

Table 13. Rodent Contamination and Insect Infestation in Wheat Samples Taken by Trade, P.M.A., and F.F.A. Groups from Farm Bins

Sample groups	Number samples	Rodent contamination		Insect infestation		Total bushels represented
		Number	Per cent	Number	Per cent	
Grain trade	671	140	20.9	58	8.6	397,508
P.M.A.	542	88	16.2	46	8.4	332,019
F.F.A.	579	154	26.6	45	7.8	204,081

creases the possibilities of increased infestation.

2. The greater the volume of wheat as related to total exposed surface area, the lower the level of rodent contamination and the higher the level of insect infestation.

When no attempt is made at sanitation, the above generalization is most likely to be observed. Grain in the Northwest that has maximum surface to volume will in most cases cool sufficiently during the winter to kill the insect forms; however, maximum surface provides a favorable habitat for larger mouse populations. Grain in large storage provide little surface for mouse populations but adequate insulation for the development of insect populations.

#### SAMPLING ADEQUACY

The adequacy of sampling was of primary concern throughout the study. Apparently it was, for the most part, adequate. The following supports this conclusion:

1. The month to month sampling showed consistently the same differences in contamination from farm to terminal.

2. The rather consistent seasonal trends in insect infestation within the smaller types of storage (farm bins and government grain) and the agreement of insect trends in seven out of eight lines during the summer-fall-winter would indicate that sampling for seasonal changes in levels of insect infes-

tation at these respective points has been adequate.

3. No expected change in contamination was noted with change in Food and Drug Administration regulations.

4. A county replication of farm bins sampled by three different groups provided comparable levels on insect infestation and high levels of rodent contamination (table 13).

#### ADEQUACY OF ANALYSES

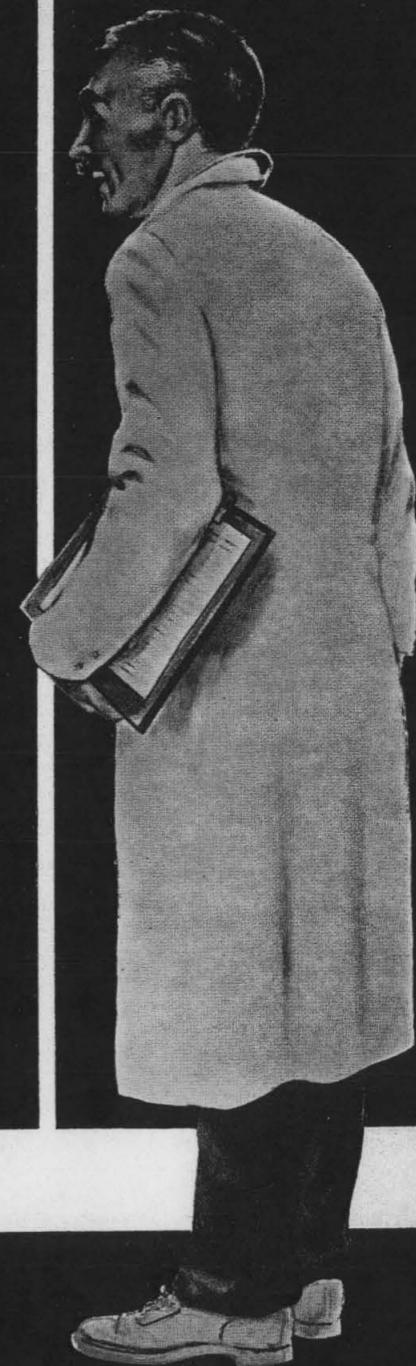
No definitive statement can be made with regard to adequacy of analysis. Without having experimentally designed controls against which to measure achievement, the conclusion can only be a matter of judgment. Undoubtedly some rodent contamination was missed, but a greater proportion of hidden infestors was not recovered. The recovery techniques employed by the grain industry are subject to these same limitations. Time required for complete recovery of all contaminants is prohibitive under most circumstances. However, certain refinements can be made similar to the work on hidden infestation as demonstrated in the recovery of the grain beetle, *Laemophloeus* sp.

It is doubtful that the recovery of all insect forms would have changed significantly the results of the study. The very nature of sample size from each large storage receptacle leaves any method for determining the exact extent of contamination in doubt. However, the Northwest can expect to find levels of contamination at least as high as found in the present study, not less

## Rural-Urban Distribution of Hospital Facilities and Physicians in Minnesota



Agricultural Experiment Station



## CONTENTS

	Page
Introduction .....	3
Trends in hospital facilities .....	5
Distribution of general hospitals .....	5
Hospital beds in use .....	5
Hospital size .....	7
Veterans' Administration hospitals .....	7
All hospitals .....	8
Summary .....	8
Trends in distribution of physicians in Minnesota .....	10
Size of community .....	10
Population per physician in 1949 .....	12
Factors related to population per physician .....	17
Summary and conclusions .....	17
Acceptance of medical facilities .....	18
The hospital survey and construction program .....	19

# Trends in Rural-Urban Distribution of Hospital Facilities and Physicians in Minnesota

Lowry Nelson and Roy G. Francis<sup>1</sup>

**F**ROM pioneer days until the recent past, the farm population has been at considerable disadvantage in obtaining needed medical care. The reasons are obvious. Perhaps the greatest single impediment has been distance. Scattered patterns of land settlement imposed a major handicap to social intercourse, a handicap which prevailed until the development of the automobile. The automobile called for good, all-weather roads. The cars themselves were constantly improved. Road construction and maintenance has achieved a level of effectiveness and now provides easy and rapid access of all but a small proportion of farm homes to the services of one or more trade centers.

Another obstacle to achieving health services has been the low average income of farmers up to the outbreak of World War II. Even since that time, however, there has always been a segment of the farm population with a level of income insufficient to provide itself with adequate health care.

This report deals with trends over a period of years in the rural-urban distribution of hospitals and physicians. In the case of hospitals, the period covered is from 1930 to 1950.<sup>2</sup> In the case of physicians the period dates from 1912 to 1950. There have been three reports on the hospitals based upon

work done before, during, and after World War II. The study of physician distribution and characteristics was inaugurated in 1938 as a WPA project. The source of information was the Directory of the American Medical Association, publication of which was suspended during the war. The reappearance of this directory for the year 1950 made it possible to obtain the information necessary to provide comparison with the earlier years back to 1912. During the 1940's the number of physicians in the state was obtained from the annual *State of Minnesota Directory of Licensed Physicians*.

<sup>1</sup> Professor and assistant professor, respectively, in Rural Sociology, Minnesota Agricultural Experiment Station.

Acknowledgments: Over the years many individuals have contributed to the preparation of data, some of which is presented in this summary. Among those who deserve special mention are John D. Kelley, Robert E. Forman, James Copp, Mary Bonwell, and John Fletcher.

<sup>2</sup> The main source of information regarding hospitals is the annual report on hospitals published in the "hospital number" of the *Journal of the American Medical Association*. The hospitals listed are those which meet the "essentials of a registered hospital" as defined by the Council on Medical Education and Hospitals of the American Medical Association. In the use of the data supplied from this source, it has been necessary to make certain classifications which should be explained at this point. (1) Because the hospitals are reported only by the name of the town in which they are located, and since, for our purposes, it was desired to have a rural-urban distribution the following procedure was followed: first, the hospitals were tabulated by counties according to the location of the hospital center; second, the counties were placed in three groups, (a) those including St. Paul, Minneapolis, Duluth, and Rochester, labeled "four counties"; (b) those containing no center with as many as 2,500 population and labeled "rural"; and (c) the remaining counties, which are labeled "other urban." (2) Since our major interest has been the general hospital facilities, the question arose as to how to classify the veterans hospitals. The one located at Minneapolis has been included in general hospitals, while the one at St. Cloud has been classed as mental hospital and included in the total facilities in the state.

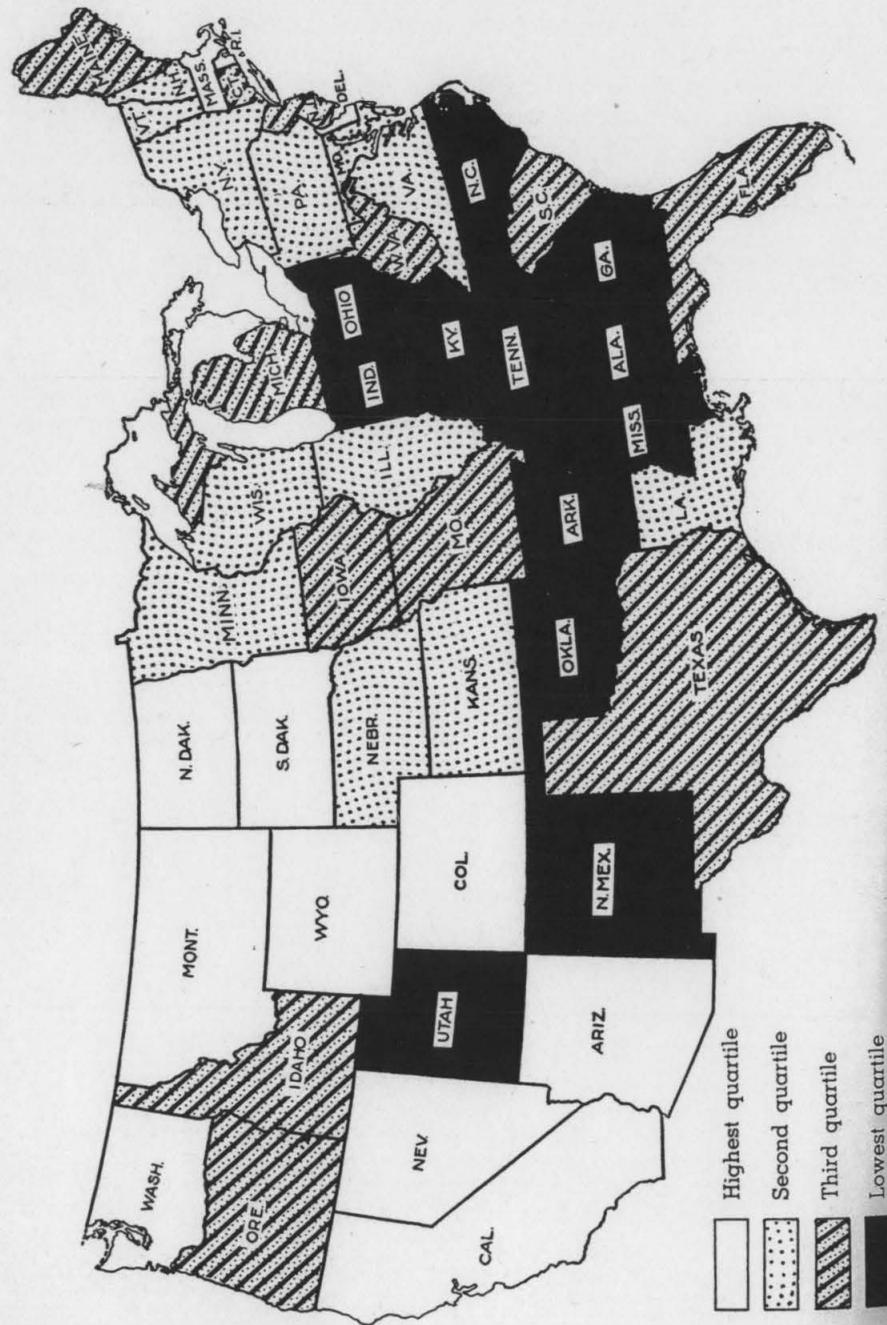


Fig. 1. Rank of states according to hospital beds per 1,000 population, 1950.

# Trends in Hospital Facilities

Minnesota has ranked reasonably well among the states in the supply of hospital beds in relation to the population (see figure 1). This favorable position is partly the result of the presence within the state of the Mayo Clinic at Rochester and the University of Minnesota Medical School. Both of these institutions serve large numbers of people from other states, and indeed, from other nations.

The following conclusions are warranted from the data:

1. Hospital beds have been increasing more rapidly than the population. The number of general hospital beds increased by 28.5 per cent between 1930 and 1950, while the population increased by only 16.3 per cent.

2. The proportion of hospital beds in use (based on reported average census) has increased. In 1930, the percentage of available beds in use was 61.7, and in 1950, 78.4. The increased utilization has been general, both rural and urban.

3. The percentage of general hospital beds located in the "four counties" has declined from 70.4 in 1930 to 64.2 in 1950. The tendency has been to increase the proportion in the "other urban" counties.

4. The average size of general hospitals in number of beds has shown a tendency to increase since 1930.

## DISTRIBUTION OF GENERAL HOSPITALS

How the general hospitals are distributed throughout the state can be seen from figure 2 and table 1. From this it may be seen that there are only a few small areas in the southern portion of the state that are not located within a 20-mile radius of a general hospital. In the northern section of the state, however, there are large areas beyond 20 miles from such a hospital.

The four counties contained 64.2 per cent of all general hospital beds in 1950 as compared to 70.4 per cent in 1930, showing that those in the rest of the state have increased somewhat, particularly in the "urban" counties.

## HOSPITAL BEDS IN USE

By grouping the counties according to the percentage of the population of each county which was rural farm, one is able to see the tendency for hospitals to be located in the urban areas. A slight tendency towards improvement in relative position of the rural areas may be noted, however. The shortage or absence of hospitals in rural areas does not mean that farm people do not have access to those located in urban centers. All-weather roads and the automobile go far towards overcoming the handicaps of distance which rural

Table 1. Distribution of General Hospital Beds by Rural and Urban Counties for Specified Years for Minnesota\*

Year	State		Rural		Urban		Four counties	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1950	13,592	100	744	5.5	4,122	30.3	8,726	64.2
1946	12,362	100	980	7.9	3,321	26.9	8,061	65.2
1943	12,110	100	965	8.0	3,051	25.2	8,094	66.8
1939	11,155	100	876	7.9	2,862	25.7	7,417	66.5
1936	10,283	100	717	7.0	2,565	24.9	7,001	68.1
1930	10,579	100	718	6.8	2,415	22.8	7,446	70.4

\* Data compiled from the "Hospital Numbers" of the Journal of the American Medical Association for the respective years.

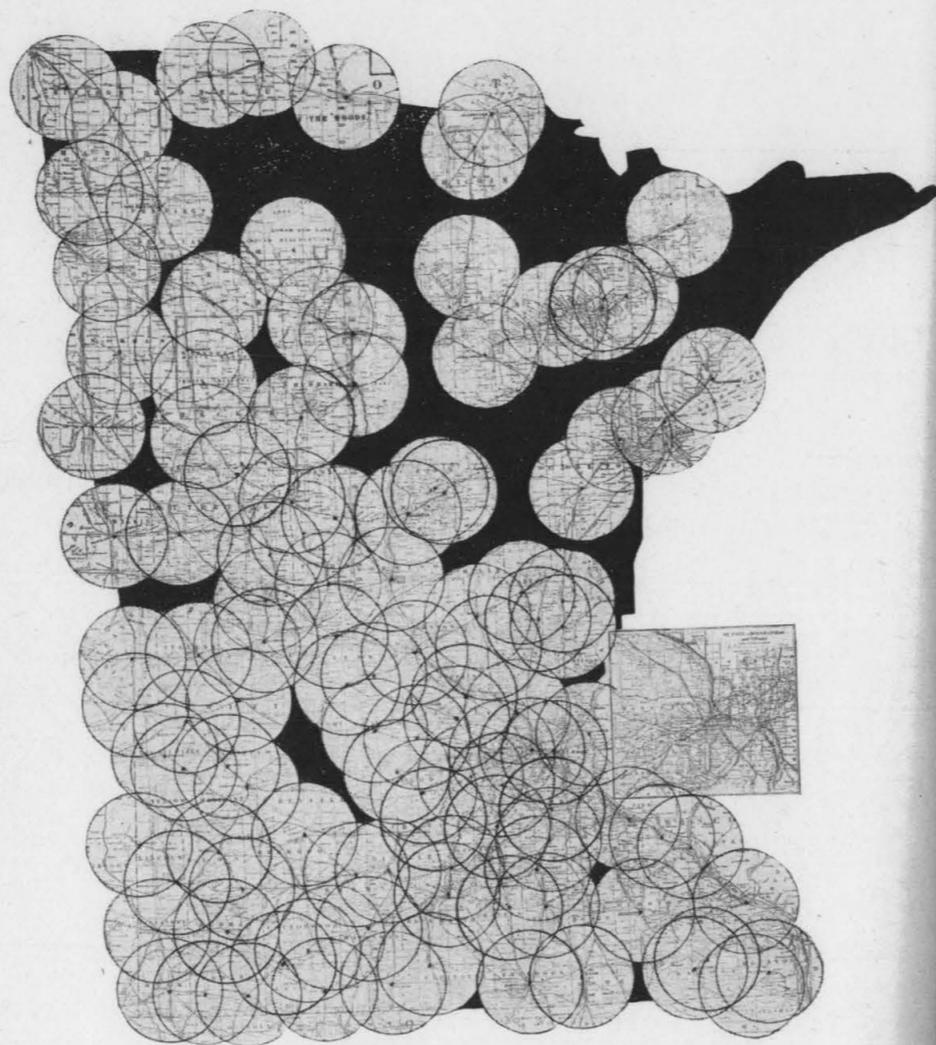


Fig. 2. Location of general hospitals showing areas outside 20-mile radius, 1950.  
Source: *Journal of the AMA*, 1951.

people suffered in an earlier day. Yet time and distance may still be of vital importance in emergencies, and is an economic impediment to better medical care for many people.

While the long-range trend since 1930 has been towards a higher proportion of beds in use, there has been some decrease since 1946. There are two possible explanations for this recent decline in percentage of beds in use. In the first place, there has been a program of hospital construction in the state since 1946, stimulated by the Federal grants-in-aid made available under the Hill-Burton Act. In the second place, the patients are not being kept in hospitals for as long periods as was formerly the practice, so that more persons now may be served by the same facilities. (See table 3.)

### HOSPITAL SIZE

The greatest change with regard to hospital size is the drop in the number of hospitals with 15 beds or less—a decline of more than 50 per cent between 1930 and 1950. (See table 4.) Such hospitals, because of their small size, are unable to render adequate service, and tend to be relatively inefficient economically. No other size category showed a decline in numbers. The greatest increase was in the category

Table 2. General Hospital Beds per 1,000 Population Grouped by Percentage of Population of County That Is Rural Farm, 1940-1950

	Per cent rural farm			
	0-20	20-40	40-60	60-85
1940 .....	6.1	5.2	2.8	2.1
1950 .....	5.7	5.0	2.8	2.5

51-75 beds, followed by the 26-25 bed class. Twenty-eight of the state's 34 hospitals with 100 beds or over are located in the four counties.

Comparisons between the rural and the urban categories should be made with caution as the number of rural counties decreased drastically with the 1950 census. For example, the 1948 report of this study showed 21 rural hospitals with 51 beds or over. The 1950 census showed that all of the counties containing these hospitals had grown so that they moved into the urban category. Thus, for 1950 this report shows no rural hospitals with 51 beds or over.

### Veterans' Administration Hospitals

As was pointed out earlier, the Veterans' Administration Hospitals have been included in the tabulations. However, it is both interesting and important to study them separately. The Veterans' Hospital in St. Cloud (Stearns

Table 3. Percentage of Beds in Use, Increase or Decrease from Previous Report in Percentage of Beds in Use, for Minnesota, 1930, 1936, 1939, 1943, 1946, 1950\*

	1930	1936	1939	1943	1946	1950
State	per cent					
Beds in use .....	61.7	64.3	69.0	69.0	82.6	78.4
Increase or decrease .....	—	+2.6	+4.7	0.0	+13.6	-4.2
Rural	per cent					
Beds in use .....	50.3	46.6	51.8	59.7	74.4	73.4
Increase or decrease .....	—	-3.7	+5.2	+7.9	+14.7	-1.0
Urban	per cent					
Beds in use .....	53.5	53.4	55.5	63.6	76.6	67.9
Increase or decrease .....	—	-0.1	+2.1	+8.1	+13.0	-8.7
Four counties	per cent					
Beds in use .....	68.3	69.7	76.5	74.8	86.2	83.8
Increase or decrease .....	—	+1.4	+6.8	-1.7	+11.4	-2.4

\* Data compiled from the "Hospital Numbers" of the *Journal of the American Medical Association* for the respective years. Counties not reporting or those listing incomplete data are not included in any of the tabulations. Note that for this reason the number of beds in this table is usually less than that given in previous tables.

Table 4. Classification of General Hospitals According to Number of Beds by Rural and Urban Counties for 1930, 1946, 1950, in Minnesota\*

Number of beds	State			Rural			Urban			Four counties		
	1930	1946	1950	1930	1946	1950	1930	1946	1950	1930	1946	1950
Total	155	158	161	38	41	29	74	79	96	43	38	36
15 and under	46	21	20	18	7	7	25	13	11	3	1	2
16-25	33	37	38	14	18	11	15	17	27	4	2	0
26-50	32	47	44	4	15	11	23	29	31	5	3	2
51-75	12	14	20	2	1	0	8	11	18	2	2	2
76-100	5	8	5	0	0	0	0	5	3	5	3	2
100 and over	27	31	34	0	0	0	3	4	6	24	27	28
50 and under	111	105	102	36	40	29	63	59	69	12	6	4

\* Data compiled from the "Hospital Numbers" of the *Journal of the American Medical Association* for the respective years.

County) Minnesota, is predominantly for mental patients. The hospital in Hennepin County is of the general type. Veterans are tested for service-connected illness, for emergency care, or in the event that the veteran is unable to afford private hospital care. The percentage of beds in use at the St. Cloud hospital has risen from 82.7 per cent in 1946 to 97.8 per cent in 1948. (See table 5.) The percentage of beds in use at the Hennepin County hospital has decreased slightly since 1946. The number of beds in these two hospitals collectively has increased greatly from 897 in 1930 to 2,433 in 1948. (See table 6.)

ALL HOSPITALS

Minnesota's total number of hospitals has decreased from 223 in 1930 to 202 in 1948, but the total number of hospital beds has increased from 24,974 in 1930 to 32,588 in 1948. (See table 7.) There were more beds per 1,000 population in 1948 (11.2) than in 1930 (9.7). In 1930 the population was 2,563,953<sup>3</sup> and by 1948 there were 2,940,000<sup>4</sup> persons in the state. Also, the percentage of beds in use has risen from 81.5 in 1930 to 87.6 in 1948.

The number of general hospitals has remained almost constant since 1930. Mental and nervous hospitals have de-

creased by 1, tuberculosis hospitals by 3, and "others" by 17. The greatest decrease is shown in the classification of others, which includes the following categories of patients treated: cardiac; children; chronic; convalescent and rest; drug and alcoholic; epileptic; eye, ear, nose, and throat; incurable; industrial; institutional; isolation; maternity and children; orthopedic; skin and cancer; venereal.

SUMMARY

In conclusion, the following points seem to be of particular significance:

1. General hospital beds in Minnesota

Table 5. Number of Patients, Percentage of Beds in Use, Average Patients and Service of Veterans' Hospitals in Minnesota, 1946-1948\*

Service	St. Cloud (Mental)	Hennepin (General)	Total
1948			
Number of beds	1,387	1,046	2,433
Average patients	1,357	971	2,328
Percentage of beds in use	97.8	92.8	95.7
1946			
Number of beds	1,532	804	2,336
Average patients	1,267	760	2,027
Percentage of beds in use	82.7	94.5	86.8

\* Data compiled from the "Hospital Numbers" of the *Journal of the American Medical Association* for respective years.

<sup>3</sup> Lowry Nelson, *The Number and Distribution of Hospital Facilities and Physicians in Minnesota, 1930-1946*, University of Minnesota Agricultural Experiment Station, Miscellaneous Series, Paper No. 598, September, 1947.  
<sup>4</sup> Estimate used by State Division of Vital Statistics.

Table 6. Percentage of Beds in Use, Average Patients, and Number of Hospitals, for Veterans' Hospitals in Minnesota, 1930, 1948\*

	1930	1948
Number of hospitals	2	2
Number of beds	897	2,433
Average patients	872	2,328
Percentage of beds in use	97.2	95.7
Increase or decrease		-1.5

\* Data compiled from "Hospital Numbers" of the *Journal of the American Medical Association*, for respective years.

are concentrated in the urban areas, with 30.3 per cent in the counties containing a center of 2,500 or more persons, and 64.2 per cent located in the four counties of Hennepin, Ramsey, Olmsted, and St. Louis. The urban areas contain 94.5 per cent of all general hospital beds. Over one-fourth of these are outside the four counties. In 1950, the rural counties had 5.5 per cent of the total general hospital beds, and 13 counties had no hospital at all.

2. Small hospitals declined in number during the period but there were still 20 in 1950 having 15 beds or less. According to accepted standards, hospitals ought to have from 50 to 75 beds to be efficient units.
3. The Veterans' Administration Hospitals have increased in both number of beds and average patients since 1930. The percentage of beds

in use at the Veterans' Administration Hospital located in St. Cloud (mental type service) has increased from 82.7 per cent in 1946 to 97.8 per cent in 1948.

4. Over half (52.6 per cent) of the hospital beds of the state are being used by patients suffering from mental and nervous disorders, and from tuberculosis. In terms of beds per 1,000 population, the ratio for tuberculosis declined while that for mental and nervous disorders increased since 1930.
5. The number of general hospitals has remained about the same between 1930 and 1950, but the average hospital is larger, has more beds, and these beds are more fully used than earlier. The increase in both number of beds and percentage of beds in use is almost twice as great as the increase in population of the state over this period, showing a real increase in availability and utilization of hospital care.
6. Hospitals are more completely used now than they were earlier. The increase in percentage of beds in use in the rural areas is significant because it reveals that farm people have accepted more readily the use of available hospital facilities, other than as a last resort. This increase also reflects the growth of hospitalization insurance plans among the farm people.

Table 7. Number of Hospitals, Beds, Beds per 1,000 Population, and Percentage of Beds in Use; By Type of Hospital, 1948 and 1930

	Total	General	Mental	Tuberculosis	Others
1948					
Number of hospitals	202	155	12	14	21
Number of beds	32,588	12,830	15,234	1,919	2,605
Beds per 1,000 population	11.2	4.4	5.2	.6	.9
Percentage of beds in use	87.6	80.0	95.7	80.2	83.3
1930					
Number of hospitals	223	155	13	17	38
Number of beds	24,974	10,579	10,590	1,996	1,809
Beds per 1,000 population	9.7	4.1	4.1	.8	.7
Percentage of beds in use	81.5	61.7	96.9	83.3	66.5

\* Data compiled from the "Hospital Numbers" of the *Journal of the American Medical Association* for the respective years.

## Trends in the Distribution of Physicians in Minnesota<sup>5</sup>

The trend over the years has been toward a decrease in number of physicians in rural areas and a concentration in the urban centers, so that today the medical profession is largely urban. In 1912 there were 1,406 physicians (61.9 per cent of all) in centers with more than 2,500 population; in 1949 there were 3,255 physicians (83.9 per cent) in centers with more than 2,500 population in 1940. Furthermore, 2,523, or 65 per cent of the 3,883 physicians in Minnesota in 1949 were practicing in the four cities of Minneapolis, St. Paul, Duluth, and Rochester. In the entire state there was one physician for every 745 persons in 1949, but for the counties this figure varied from 65 persons per physician in Olmsted County to 3,730 persons per physician in Red Lake County.

It should be pointed out that the statistics presented in the following pages are for **all physicians**, not for general practitioners only. Doctors in mental hospitals, Veterans' hospitals, sanitariums, etc., although not generally available for service to the public, are included in the tabulations.

### SIZE OF COMMUNITY

Table 8 shows how Minnesota physicians have been distributed by size of community from 1912 to 1950. The following observations can be made: (1) The total number of physicians in Minnesota has been steadily increasing through the years. (2) The number of physicians in places under 1,000 population has shown a sharp decrease in the last 13 years. (3) There has been a

marked over-all decrease in percentage of physicians in communities under 5,000. In 1912, 43.5 per cent of the physicians in the state were in communities with less than 5,000 people, in 1949 only 20.7 per cent. (4) Since 1921 the percentage of physicians in communities with 5,000 to 10,000 population has remained relatively constant. (5) The number and percentage of physicians in communities with population between 10,000 and 25,000 has increased greatly in the past 13 years, probably due to growth in the number of physicians in Rochester, which is included in this group. (6) Although in every successive period there have been more physicians in the Twin Cities and Duluth, the percentage change has been slight. Briefly, the percentage of physicians in communities under 5,000 has decreased, the percentage in communities 5,000 to 10,000 has remained about constant, while the percentage in communities with more than 10,000 people has increased and accounts for the over-all state increase in the number of physicians.

The steady decline in the number of small-town doctors is shown in table 9 which indicates the trend since 1912. The number of towns with only one doctor has continually declined and the number of incorporated towns without doctors has increased faster than the increase in the number of incorporated places in the state.

Table 10 and the accompanying map, figure 3, show where the physicians of Minnesota are now concentrated. In these 33 centers with more than 10

<sup>5</sup> The data used in this section of the paper were obtained mainly from two sources, namely, the directories of the American Medical Association from 1912 to 1936 (which were used in a study of the distribution and mobility of physicians in Minnesota; Lowry Nelson, "Distribution, Age, and Mobility of Minnesota Physicians, 1912-1936." *American Sociological Review*, 7 (1942): 800-801, 1942).

Table 8. Distribution by Size of Community of Minnesota Physicians, 1912-1950

Size of place	1912		1921		1931		1934		1936		1950	
	Number	Per cent										
Total	2,270	100.0	2,630	100.0	3,074	100.0	3,173	100.0	3,279	100.0	3,984	100.0
Under 500	301	13.2	230	8.7	186	6.0	220	6.9	210	6.4	89	2.2
500-999	232	10.2	220	8.4	230	7.5	250	7.9	255	7.8	159	4.0
1,000-2,499	331	14.6	305	11.6	304	9.9	306	9.7	313	9.6	302	7.6
2,500-4,999	122	5.4	182	6.9	189	6.2	200	6.3	204	6.2	154	3.9
5,000-9,999	234	10.3	203	7.7	173	5.6	191	6.0	198	6.0	258	6.5
10,000-24,999	91	4.0	330	12.6	568	18.5	488	15.4	566	17.3	260	6.5
Twin Cities and Duluth	959	42.2	1,160	44.1	1,424	46.3	1,518	47.8	1,533	46.7	2,762*	69.3*

\* Includes Rochester and St. Cloud.  
Source: Directory of the American Medical Association for year shown.

**Table 9. Number of Towns with One, Two, and No Physicians for Specified Years**

	1912	1921	1931	1950
1-Doctor towns .....	243	235	185	129
2-Doctor towns .....	104	102	102	85
Incorporated towns with no doctor .....	177	241	306	378
Total incorporated places reported in census 1912, 1920, 1930, and 1950 .....	633	682	728	782
Percentage of incorporated places with no doctor .....	28	35	42	48

physicians, there are a total of 3,054 physicians. This is 78.6 per cent of all of the physicians in the state. In figure 3 it should be noted that 16 of these 33 cities are in the southeastern

**Table 10. Cities in Minnesota Having 10 or More Physicians, 1949\***

City	Number of physicians	Rank
Minneapolis .....	1,154	1
Rochester .....	695	2
St. Paul .....	516	3
Duluth .....	158	4
Mankato .....	41	5
St. Cloud .....	36	6
Winona .....	30	7
Albert Lea .....	26	8
Fergus Falls .....	25	9
Austin .....	23	10
Red Wing .....	21	12
Virginia .....	21	12
Willmar .....	21	12
Faribault .....	20	14
Crookston .....	19	15.5
Thief River Falls .....	19	15.5
Brainerd .....	18	17.5
Hibbing .....	18	17.5
New Ulm .....	17	19.5
Worthington .....	17	19.5
Owatonna .....	16	21.5
St. Peter .....	16	21.5
Northfield .....	14	23
Cloquet .....	13	24
Anoka .....	12	26
Bemidji .....	12	26
Grand Rapids .....	12	26
Alexandria .....	11	29.5
Hastings .....	11	29.5
Hopkins .....	11	29.5
Stillwater .....	11	29.5
Detroit Lakes .....	10	32.5
Fairmont .....	10	32.5

\* From State of Minnesota Directory of Licensed Physicians, 1949.

portion of the state. Thus we can say not only that the medical profession is concentrated in certain places, but we can say also that these places tend to be in one corner of the state.

If the counties of the state are divided into three groups, (1) rural—those counties which contain no center of 2,500 or more people in 1940, (2) urban—those counties which contained one or more centers of 2,500 or more population in 1940, and (3) four counties—the large city counties, Hennepin, Ramsey, St. Louis, and Olmsted (in which Rochester is located), the distribution shown in table 11 results.

Table 11 shows that although the number of people per physician has constantly decreased for the state as a whole, there has been a continuous increase in the number of people per physician in the rural counties. The population per physician ratio has shown little change for the urban counties, while the real decrease in population per physician for the state is almost entirely due to the tremendous increase of doctors in the four large city counties.

**POPULATION PER PHYSICIAN IN 1949**

As shown in table 12 there are 15 counties with over 2,000 people per physician and 2 counties with more

**Table 11. Population per Physician in Rural, Urban, and Large City Counties of Minnesota, 1910, 1920, 1930, 1950\***

Area	1910	1920	1930	1950
State .....	914	908	834	748.5
Rural counties† .....	1,194	1,433	1,444	1,920
Urban counties‡ .....	1,123	1,216	1,259	1,382
Four counties§ .....	665	606	544	454.5

\* Population was not estimated for counties the years 1912, 1921, and 1931, when the medical directories appeared. This time lay between census years and the directories should not seriously distort the picture, however.

† Containing no center of 2,500 or more people.  
‡ Containing one or more centers with 2,500 or more people.  
§ Hennepin, Ramsey, St. Louis, Olmsted (containing Rochester).



Fig. 3. Centers in which one or more physicians are located and the area outside a 10-mile radius from the centers. Source: Minnesota Directory of Licensed Physicians and Surgeons, 1950.

Table 12. Population and Number of Physicians in Minnesota, by Counties, Ranked According to Population-Physician Ratio, 1949\*

Rank	County	Population per physician	Physicians	Population
1	Olmsted	65	697	45,426
2	Hennepin	527	1,204	635,075
3	Ramsey	644	520	334,680
4	Pennington	663	19	12,604
5	Blue Earth	741	49	36,295
6	Big Stone	813	12	9,755
7	Rice	884	37	32,714
8	St. Louis	889	231	205,438
9	Goodhue	891	36	32,058
10	Cottonwood	947	15	14,200
11	Cook	1,035	3	3,106
12	McLeod	1,043	21	21,913
13	Nicollet	1,047	17	17,799
14	Nobles	1,073	21	22,529
15	Brown	1,079	24	25,898
16	Crow Wing	1,086	29	31,506
17	Winona	1,088	35	38,090
18	Carlton	1,091	21	22,902
19	Steele	1,093	19	20,763
20	Wadena	1,097	12	13,158
21	Grant	1,115	9	10,036
22	Kandiyohi	1,124	25	28,094
23	Wabasha	1,153	15	17,300
24	Stearns	1,169	55	64,289
25	Freeborn	1,186	30	35,575
26	Otter Tail	1,187	42	49,872
27	Lake	1,219	6	7,311
28	Polk	1,237	29	35,870
29	Scott	1,266	14	17,718
30	Yellow Medicine	1,289	13	16,759
31	Swift	1,317	12	15,799
32	Itasca	1,323	24	31,754
33	Faribault	1,324	19	25,161
34	Washington	1,335	24	32,036
35	Pipestone	1,339	11	14,730
36	Chippewa	1,349	12	16,185
37	Douglas	1,351	16	21,623
38	Wright	1,352	21	28,398
39	LeSueur	1,378	14	19,294
40	Isanti	1,394	9	12,545
41	Martin	1,426	18	25,674
42	Watsonwan	1,432	10	14,315
43	Waseca	1,440	10	14,406
44	Houston	1,441	10	14,407
45	Fillmore	1,444	17	24,547
46	Lyon	1,453	15	21,790
47	Redwood	1,456	16	23,298
48	Carver	1,472	12	17,667
49.5	Lincoln	1,477	7	10,336
49.5	Mower	1,477	29	42,844
51	Pope	1,523	9	13,706
52	Beltrami	1,550	16	24,804
53	Sibley	1,578	10	15,778
54	Sherburne	1,588	6	9,528
55	Lake of the Woods	1,623	3	4,870

Table 12. Population and Number of Physicians in Minnesota, by Counties, Ranked According to Population-Physician Ratio, 1949\*—Continued

Rank	County	Population per physician	Physicians	Population
56	Renville	1,624	15	24,364
57	Mille Lacs	1,625	10	16,251
58	Jackson	1,660	10	16,604
59	Morrison	1,666	16	26,656
60	Meeker	1,675	12	20,102
61	Cass	1,709	11	18,801
62	Norman	1,757	7	12,299
63	Todd	1,770	14	24,782
64	Clay	1,781	15	26,718
65	Dodge	1,807	7	12,647
66	Becker	1,825	14	25,554
67	Benton	1,831	9	16,481
68	Lac qui Parle	1,839	8	14,713
69	Chisago	1,851	7	12,956
70	Dakota	1,862	25	46,541
71	Kanabec	1,958	5	9,788
72	Stevens	1,996	6	11,973
73	Murray	2,116	7	14,811
74	Roseau	2,142	7	14,991
75	Koochiching	2,191	8	17,527
76	Mahnomen	2,339	3	7,016
77	Pine	2,412	8	19,298
78	Aitkin	2,456	6	14,739
79	Marshall	2,468	7	17,277
80	Anoka	2,470	12	29,638
81	Kittson	2,479	4	9,915
82	Clearwater	2,501	4	10,002
83	Rock	2,633	4	10,531
84	Traverse	2,650	3	7,951
85	Hubbard	2,830	4	11,319
86	Wilkin	3,463	3	10,388
87	Red Lake	3,731	2	7,461

\* From U. S. Census and from State of Minnesota Directory of Licensed Physicians, 1949.

than 3,000 people per physician. One should keep in mind that people in these counties have access to physicians in the next county or the next state, so the actual number of people each physician must serve is generally much lower than these figures indicate. Figure 4 shows the geographical location

of these counties. It will be noticed that the counties in the fourth quartile lie predominantly in a diagonal belt from the central eastern boundary to the northwestern corner of the state.

Counties with large population-physician ratios near the Twin Cities obviously use the facilities available there;

Table 13. Population per Physician by Degree of Urbanization

	Counties with rural farm population of			
	Under 20 per cent	20-39 per cent	40-59 per cent	60 per cent and over
Number of counties	7	22	50	8
Population	1,333,252	683,627	847,588	109,016
Number of physicians	2,005	544	609	54
Population per physician	665	1,257	1,392	2,019

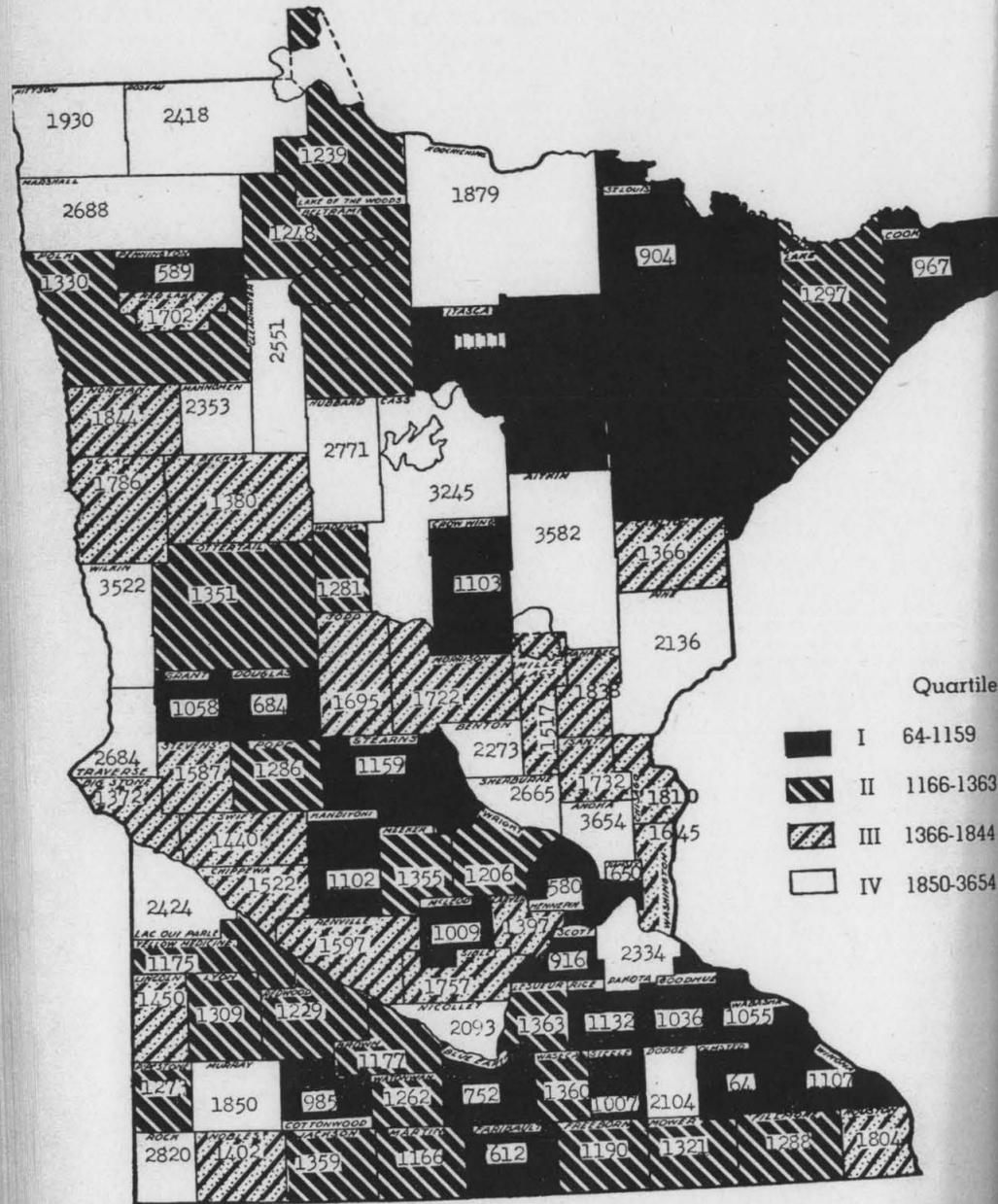


Fig. 4. Population per physicians by counties, Minnesota, 1950. Source: AMA Directory; population from 1950 Census.

Table 14. Density of Population and Farm Operator Level of Living Classified According to Population per Physician

	Population per physician, by quartiles*			
	1	2	3	4
Density of population†	216.57‡	30.83	21.77	10.30
Farm operator level of living§	175.43	161.52	146.48	121.14

\* Quartile 1 denotes least population per physician.  
 † County Data Book, Bureau of the Census, U.S. Department of Commerce, Washington, 1950. Table 12, column 6, pp. 226.  
 ‡ Op. cit., table 12, column 121, pp. 233. The value given in the quartiles is an average.  
 § If Hennepin and Ramsey counties were excluded as exceptional cases the density would be 56.45. But since these counties contain 75.2 per cent of the population in this quartile, they are included.

people of Rock County undoubtedly go to Sioux Falls, and so on. The county is not to be regarded as a suitable unit in all cases for hospital location, neither is a state for that matter.

Factors Related to Population per Physician

If the counties of Minnesota are divided into four groups according to the percentage of rural farm population in the total county population in 1950, the population per physician ratios of table 13 result.

If the counties are divided into quartiles according to population per physician, as they are in figure 4, and the average density and Rural Level of Living Index is computed, the data of table 14 results.

From this table it can be seen that those counties with the greatest number of people for each physician also have the lowest density. This means that the physicians in these counties not only must serve more people, but

they must serve these people over a larger area.

Contrary to expectations the Rural Level of Living Index failed to differentiate between the quartiles except between the first three and the fourth. Thus, it would appear that factors other than the level of living of the rural people, as measured by the index, are related to the uneven distribution of physicians through the state, except in the counties with the lowest level of living.

Additional statistical analysis has shown that population per physician, although associated with population per hospital bed, is more closely associated with the business activity of a county.<sup>6</sup> This means that a county must contain sizable trade centers in addition to providing adequate hospital facilities if it is going to be attractive to physicians.

It should be pointed out that not all towns can furnish adequate hospital facilities and support the specialists of today. The automobile and good roads mean that a doctor does not have to be so close to his patients as formerly. But, when people in several contiguous counties have to share a few physicians and have to travel long distances to get a doctor, medical facilities in those places can hardly be considered adequate.

SUMMARY AND CONCLUSIONS

In conclusion, these observations seem most significant:

1. There were 3,883 licensed physicians in Minnesota in 1949, which represents a steady increase since 1912, but the percentage in small towns had decreased while the percentage of physicians in cities has increased.

<sup>6</sup> Rank order correlations were computed for the counties between population per physician and (a) population per hospital bed in 1948 and (b) per capita retail sales in 1939 (most recent data available, 1940 census). The coefficients were respectively for (a) .48; and for (b) -.64. These correlations may be read as follows: (a) The larger the population per hospital bed, the larger the population per physician. In other words, where the hospitals are, there the physicians are also. (b) The lower the retail sales per capita, the greater the number of people per physician, or the fewer the physicians.

2. Medicine has become practically an urban profession with 83.9 per cent of the physicians in the state now practicing in places with more than 2,500 population.
3. The areas of the state which have the highest proportion of farm population show a slight tendency to have a lower level of living.
4. Those counties having more people for each physician are more sparsely settled. That is, where there are few doctors for the population, these doctors also have to serve a larger geographical area.
5. Although it is reasonable to assume that the people in the less prosperous, sparsely settled, rural

areas of the state need medical services as much as those people in other parts of the state, they are not as accessible to such services as the urban people.

6. This report does not pretend to answer the question as to the adequacy of medical care for the rural population. Such an answer can be derived—if at all—only from field studies which it is hoped may be made in the near future. In the last analysis the definition of the "adequacy" can be only relative. Field studies, however, will reveal any serious lacks or shortages of certain recognized minimum essentials.

## Acceptance of Medical Facilities

In a state and nation so used to having medical facilities, it probably seems strange to talk about the speed with which the growth of these facilities have been accepted by rural Minnesota. Yet, it is unavoidably true that the opposite side of the coin of having (or not having) medical facilities is the acceptance (or rejection) of those facilities. That the data indicate general approval of having available medical care speaks well for the Minnesota farmer.

There was time, not too long ago, when the hospital was a "death house,"

a place from which only a few miraculously cured patients returned. The idea that one had to be near "Death's Door" in order to be "eligible" for the hospital also had its reverse side. There were those who believed that unless one were dying, to go to the hospital was a frivolous waste of money. This is something like the old miser who accused his wife of "spending money on herself" by going to the dentist. Indeed, it was an old-fashioned gentleman who bemoaned the fact that people no longer were "born at home, or die at

Table 15. Proportion of Births under Specified Conditions for Minnesota, Urban and Rural, 1942 to 1950

	Percentage of births								
	1942	1943	1944	1945	1946	1947	1948	1949	1950
In hospitals and attended by physician	91.0	95.0	96.0	97.7	98.0	98.6	99.0	98.6	99.0
Urban	66.0	76.5	83.0	88.0	92.0	94.0	95.0	96.1	96.5
Rural									
Not in hospital but attended by physician	8.2	5.0	3.4	2.1	1.6	1.3	.9	.6	.5
Urban	32.8	22.8	15.9	10.9	7.4	5.5	4.7	3.8	2.8
Rural									
Not in hospital and with other attendants*	.8	†	.6	.2	.4	.1	.1	.8	.5
Urban	1.2	.7	1.1	1.1	.6	.5	.3	.1	.1
Rural									

\* Midwives, unattended, and not reported.

home"—and he added, ruefully, they scarcely live at home.

Be that as it may, the data for the 1941-1950 decade show a steady increase in the use of hospitals. Because giving birth in no way implies illness or disease, the use of hospitals for birth is a good index of its acceptability into the community.

A comparison of urban and rural use of the hospitals for this purpose is shown in table 15. In 1942, 91 per cent of the urban births took place in the hospital; but only 66 per cent of the rural births took place there. However, in both cases birth was attended by a physician in over 98 per cent of the cases. By 1950, the urban percentage increased to 99 per cent, and the rural percentage to 96.5 per cent, with less than one per cent occurring without an attending physician. (Like shooting 18 holes of golf in 18 strokes, this is about as good a record as one could hope for.) Apparently, only accidents, and a few rare cases of impoverishment (accompanied with a refusal to be a "charity case"), prevent the attainment of 100 per cent.

The role which illegitimate births play in explaining the difference between rural and urban use of hospitals in maternity cases would be an interesting study. Due, in part, at least, to modern welfare work, almost all illegitimate births of record are born in hospitals, as far as the urban area is concerned. Whether the same is true of the rural area would be somewhat difficult to establish. Certainly, the informal controls of gossip are more important in the rural parts of the state

than in the cities. Moreover, girls from the rural areas may go to the city to give birth to an illegitimate child; for the anonymity of the city may, in this instance, be the sort of protection the unmarried mother is seeking. Because of the relatively few illegitimate births, the statistics reported previously are not likely to be changed by this kind of an analysis.

In part, these data also reflect the general "urbanization" of rural America. It is well known, and quite well documented, that, in many respects, the farmer is becoming increasingly "urbane." He is adopting scientific procedures on his farm; he is using mechanical power; he has accepted modern medical facilities and care. In some ways, farming is becoming a profession, rather than a way of life. That other data associated with the birth process would reflect this general trend should not be surprising.

## THE HOSPITAL SURVEY AND CONSTRUCTION PROGRAM

The use to which general hospitals in Minnesota have been put has been measured in various ways. Table 16 gives the total patient days, the total number of patients admitted, and the average number of days spent by each patient. We observe that there has been an increase in the number of patients, and a tendency for the average stay to decrease. In addition, there has been an increase in the average percentage of occupancy since 1948; at the same time, considerable variation is observed.

Table 16. General Hospitals in Minnesota: Patient Service Data

Year	Total patient days	Total patients admitted	Average per cent occupancy	Average days per patient	Patient days per capita
1948	3,482,201	346,930	68.45	10.04	1.24
1949	3,588,022	387,314	75.39	9.26	1.24
1950	3,547,101	414,974	76.34	8.55	1.23
1951	3,486,828	420,659	74.56	8.29	1.17

Source: Minnesota State Board of Health.

Table 17. The Status in the Various Categories of Facilities at the Time of the Third Annual Revision of the Minnesota Plan (May 15, 1951)

Category of facility	1951 Total beds needed*	1951 Existing acceptable beds	1951 Net beds to build	1951 Percentage of needs met	1948 Percentage of needs met
General	13,415	10,679	2,736	80	63
Mental	14,905	9,281	5,624	62	51
Chronic	5,962	612	5,350	10	4
Tuberculosis	1,210	1,931	0	100	100
Total	35,492	22,503	13,710	63	50.2
Public health centers	11	3	8	27	9

\* Based on Minnesota's population of 2,918,000. Tuberculosis beds based on average annual tuberculosis deaths from 1946-1950, inclusive.

It would be incorrect to think that a truly efficient hospital would have 100 per cent occupancy. This would tend to indicate a dreadful state of inadequacy—like insurance, unoccupied hospital beds “serve by waiting.” Their use in cases of emergencies more than pays for their few days in idleness. Indeed, it should be remembered that table 9 gives the average percentage of occupancy; on some days many more than the total of beds in existence could have been used.

This is true for three reasons: (1) Minnesotans, like all Americans, use hospital service much more frequently than before. In part, this is shown by the lessening average stay, implying increased efficiency in medication and increased hospital use for less serious illnesses. (2) In the case of epidemics and seasonal diseases, hospital needs change. To insure a healthy populace, preparations should be made for the worst that can be normally expected. (3) Population increase, and population shifts by migration, render regional and state hospital services inadequate or inefficient.

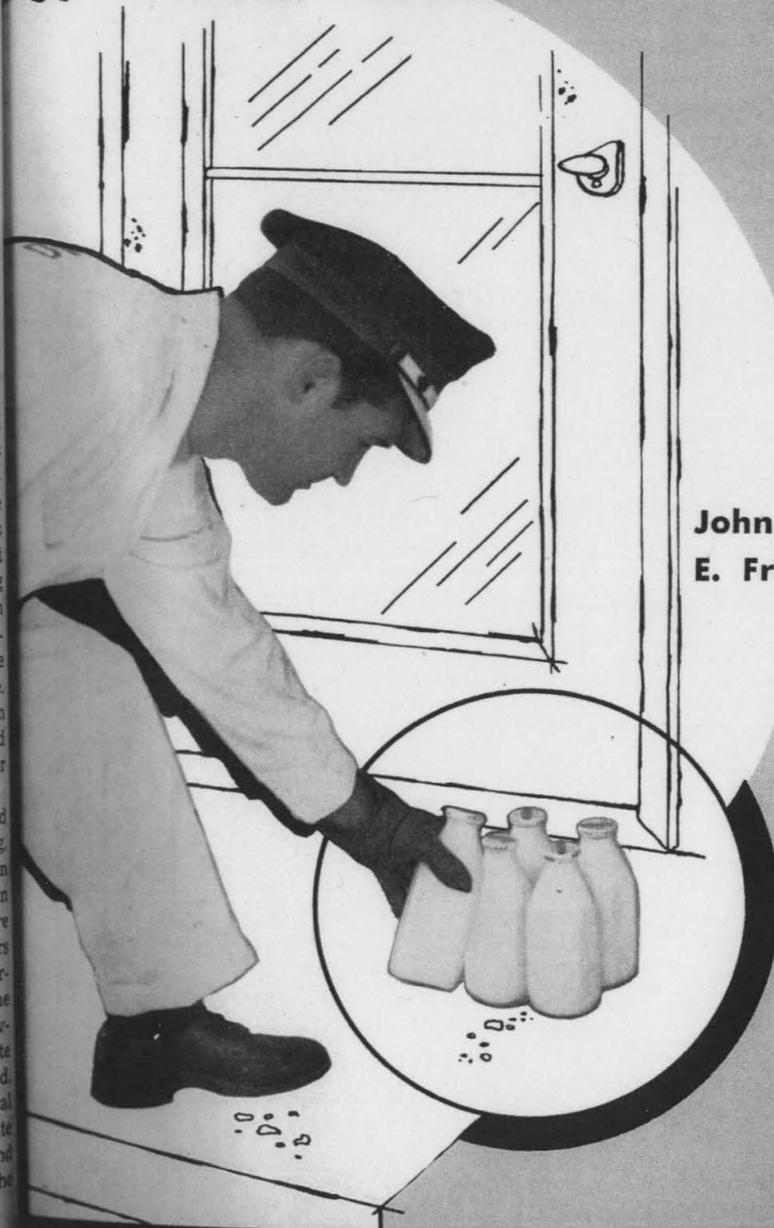
Acting under the support given by U.S. Public Law 725 (The Hospital Survey and Construction Program), the State of Minnesota charged the State Board of Health with the responsibility of studying the problem and planning ways to meet the health needs of the

state. Accordingly, they have continuously surveyed the hospital needs of the state, developed a system of priorities to speed up the construction of hospital facilities, and made substantial plans for the future.

Their assessment of hospital needs and statuses of existing facilities is given below. Only the tuberculosis hospitals can be said **now** to meet the needs of the state. All other facilities are below that which is required. It should be noted, however, that during the three years between the adoption of the original plan in 1948 and the survey reported in the above table, the deficiencies were being overcome. There was a 12.8 per cent increase in the four basic types of hospitals and an 18 per cent increase in the number of Public Health Centers.

In summary, hospital facilities and use have increased, and are increasing. Changes are occurring in population growth, there are improvements in medication, and existing facilities are wearing out. These and other factors imply the need for a continuous survey of the needs of the state. At the same time, we must note how the government, at the Federal and State levels, has responded to this need. Legislation adopted by the Federal Government has enabled the State government to create an active and efficient commission to augment the plan for increased hospital care.

## Quantity Discount Pricing of Fluid Milk ...



John D. Helmberger  
E. Fred Koller