POLICY ANALYSIS SERIES

ISSUES RELATED TO WELSCH v. LEVINE / NO. 19

AN UPDATE TO POLICY ANALYSIS SERIES NO. 4 AND 15

COST FUNCTION ANALYSIS OF MINNESOTA INTERMEDIATE CARE FACILITIES FOR MENTALLY RETARDED (ICF-MR) PER DIEMS: 1981

This policy analysis paper presents the findings of a study of Minnesota community-based ICF-MR per diem costs. The study used 1981 data from the departments of Health and Welfare to identify factors that could explain differences in per diem rates found among ICF-MR facilities. The current study updates the work completed in two previous analyses of 1979 and 1980 data. (*Policy Analysis Paper No. 4*, 1981 and *Policy Analysis Paper No. 15*, 1983)

Several factors underscore the importance of identifying the cost implications of community-based services for developmentally disabled people. These factors include: (1) continuing federal and state budgetary problems which mean that existing social welfare programs must be managed as effectively as possible, and (2) the *Welsch v. Levine* Consent Decree mandate to further reduce the number of mentally retarded people living in state institutions by 1987.

A Legislative Audit Commission (LAC) report, *Evaluation of Community Residential Programs for Mentally Retarded Persons* (February 11, 1983), as well as recently passed legislation emphasized the importance of analyzing ICF-MR facility costs. The LAC report criticized the state's heavy reliance on residential facilities and concluded that overreliance on the ICF-MR model has been very costly in Minnesota. Recent legislation recognized the need to control escalating costs in the field included: (1) legislation which allowed the state to pursue a Title XIX Home and Community-Based waiver to fund alternative residential and other community-based services; (2) legislation which established a construction moratorium on ICF-MR facilities and set a total licensed capacity of 7,000 beds in both state institutions and community ICF-MR facilities by 1986; and (3) legislation which required changes in improvements in Rule 52 standards as recommended by the LAC. (Laws of Minnesota 1983, Chapter 312, Article 9)

I. ICF-MR FACILITIES IN MINNESOTA

Intermediate Care Facilities-Mental Retardation (ICF-MRs) are licensed under Department of Public Welfare (DPW) Rule 34 standards. They are also licensed by the Department of Health as supervised living facilities (SLFs) to provide food, care, and lodging on a 24-hour basis. ICF-MRs are supported primarily by the federal Medicaid (Title XIX) program and are reimbursed under DPW Rule 52.

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One-third of the approximately 281 community facilities operating during 1980 were licensed to serve 6 or fewer residents. An additional 30.6 percent served 7 to 12 residents. Over one-third (N = 103; 36.7 percent) of the facilities operating in 1981 had 13 or more residents.

While the largest number of facilities had 6 residents or less, this group of facilities accounted for only 11.8 percent of the state's total community ICF-MR capacity. Conversely, the 9 largest facilities represented only 3.7 percent of the total number of facilities in 1981 but accounted for nearly 1 out of 4 community ICF-MR beds. Table 1 and Figure 1 show the distribution of ICF-MRs operating in 1981 by age categories and licensed capacity.

Table 1
Number and Licensed Capacity of Minnesota
ICF-MRs by Size Category: 1981

SIZE OF FACILITY	FACILITIES		LICENSED CAPACITY	
	Number	Percent	Total	Percent
6 or fewer residents	92	32.7%	551	11.8%
7 to 12 residents	86	30.6	832	17.8
13 to 16 residents	61	21.7	899	19.3
17 to 32 residents	10	3.6	271	5.8
33 to 64 residents	21	7.5	985	21.1
65 or more residents	11	3.9	1,131	24.2
TOTAL	281	100.0%	4,669	100.0%

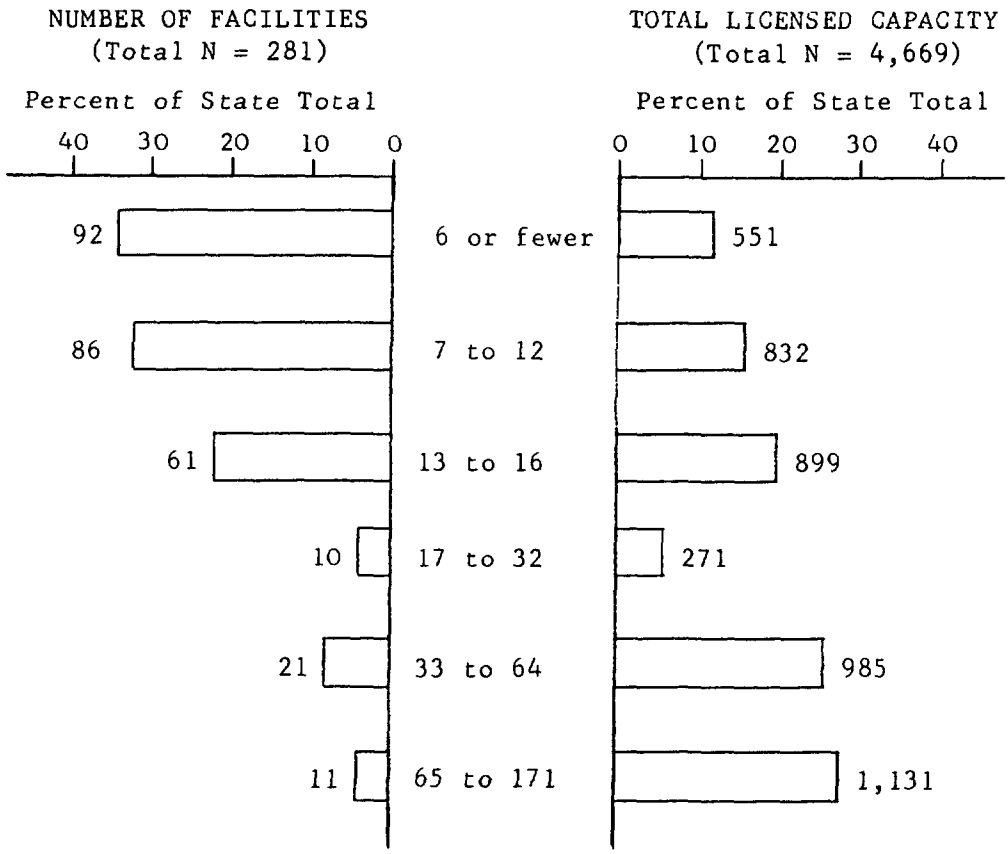

Figure 1: Facility Size

II. METHODOLOGY

The data for this study came from two primary sources: Department of Public Welfare Rule 52 cost reports on file in the Long-Term Care Rate Division; and the data files of the Quality Assurance and Review Program within the Department of Health.

DPW Rule 52 establishes the standards for determining reimbursement (per diem) rates for providers of ICF-MR residential services. Providers must submit a cost report each year. The per diem rate for each facility is based upon actual, allowable expenses incurred during the preceding year plus any allowable known cost changes which will occur during the upcoming year. For the 1982-83 state biennium, per diem rate increases were limited to 10 percent per year. The 4 percent reduction ordered by the Legislature was in effect from January 1983 through June 1983. As of July 1983, per diem rate increases are limited to 5 percent annually.

The Quality Assurance and Review (QAR) program is a federally mandated program which annually surveys facilities which are reimbursed under the

federal Medicaid program. QAR surveys report on resident dependency levels, potential for restoration, and treatment programs. They also indicate the appropriateness of current placements and the potential for movement into less restrictive living arrangements.

This analysis of per diem rates includes 261 of the 281 community ICF-MR facilities operating during 1981. Eighteen facilities were excluded from this analysis because complete QAR data for those facilities were not available, and two facilities were excluded because they are reimbursed under Rule 49.

The statistical methodology employed in this study is similar to the two previous cost studies (*Policy Analysis Paper No. 4*, 1981 and *Policy Analysis Paper No. 15*, 1983). The above analyses are a replication of the cost function analyses component of a national study on the costs of residential care (Wieck & Bruininks, 1980). That report contains a thorough review of the literature on cost studies and a discussion of the "theory" which underlines this study's treatment of cost-related variables.

Statistical techniques are not definitive. They cannot "prove" cause-effect relationships, but they can help to estimate or predict cause/effect relationships with greater confidence.

As in previous studies, cost factors were defined according to three broad categories: location, organizational structure, and resident characteristics. The study examines a number of variables and their impact upon cost using two statistical techniques: (1) analysis of variance and (2) multiple regression.

III. ANALYSIS OF VARIANCE

The first objective of this study is to test hypotheses about relationships between selected variables, such as facility size or resident characteristics, and per diem rates (cost). Through a comparison of mean values,[1] one-way analysis of variance attempts to determine to what extent facility per diem rates differ from one another; and then whether or not those differences are "significant" enough statistically to allow certain assumptions about cost-influencing variables. The hypotheses and results of these analyses are summarized below.

A. Locational Factors

H_{01}: There are no differences in the per diem rates for community ICF-MRs between Minnesota's 13 economic development regions.

[1] "Mean values" here refers to "average" per diem rates of group homes.

According to the one-way analysis of variance test, there were significant differences ($p < .01$) in the per diem rates of facilities located in the various regions of the state. The highest per diem average was found in the seven-county Minneapolis-St. Paul region at $55.90. The lowest average per diems were found in regions Six E ($33.90), One ($39.20), and Seven W (439.70). The analysis of variance and table of means and standard deviations are presented in Tables 2 and 3. This finding is similar to the two previous studies which also showed highest mean per diem in Region Eleven; the lowest in Region Six.

Table 2
Summary of Analysis of Variance of Minnesota
ICF-MR Per Diem Rates by Region: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	F Score
Between groups	12	10,899	908	5.18[a]
Within groups	248	43,518	175	
TOTAL	260	54,417		

[a] $p < .01$.

Table 3
ICF-MR Mean Per Diems by Region: 1981

Region	Mean	Standard Deviation	Number of Facilities
One	$39.20	10.90	9
Two	$47.70	10.90	6
Three (Duluth)	$44.50	8.60	28
Four (Moorhead)	$43.70	8.80	26
Five	$48.60	5.30	5
Six E	$33.90	5.60	11
Six W	$47.40	9.00	4
Seven E	$51.30	12.20	4
Seven W (St. Cloud)	$39.70	10.50	16
Eight	$49.10	15.10	12
Nine (Mankato)	$48.10	6.50	15
Ten (Rochester)	$52.70	17.00	32
Eleven (Mpls.-St. Paul)	$55.90	15.90	93

Pooled standard deviation = 13.20.

H_{02}: There is no relationship between per diem rates of facilities and their location in an urban or nonurban area.

A second locational variable examined was urban versus nonurban/rural location. An urban area was defined as, according to the Census Bureau (1982), ". . . comprises an incorporated place and densely settled surrounding area that together have a minimum population of 50,000." There are seven urban areas in Minnesota: Duluth, Moorhead, East Grand Forks, LaCrescent, Rochester, St. Cloud, and the Minneapolis-St. Paul metropolitan area.

Both *Policy Analysis Papers No. 4* and *15* indicated that there was a statistical difference between per diems of facilities in urban and nonurban locations. The current study indicates that for 1981 data there was also a statistical difference ($p < .01$) between facilities located in urban areas and those outside urban settings. The average per diem for facilities in urban areas was $54.30, and the average per diem for facilities in nonurban or rural areas was $45.20. The average per diem in urban areas was 20 percent higher than that of nonurban settings. Part of these differences may be attributed to the higher cost of goods and services in urban areas when compared to nonurban areas. This analysis did not make any adjustments for these differences. Tables 4 and 5 present the summary of analysis of variance test and the table of means and standard deviations.

Table 4
Summary of Analysis of Variance of Minnesota ICF-MR Per Diem Rates by Urban/Nonurban Location: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	1	5,325	5,325	28.10[a]
Within groups	259	49,092	190	
TOTAL	260	54,417		

[a] $p < .01$.

Table 5
ICF-MR Mean Per Diems by Urban/Nonurban Location: 1981

Location	Mean	Standard Deviation	Number of Facilities
Urban	$54.30	15.70	117
Nonurban	$45.20	11.90	144

Pooled standard deviation = 13.80.

B. Organizational Factors

Eight organizational factors were examined in this study for their probable impact upon per diem rates: (1) facility size, (2) licensed capacity, (3) occupancy rate, (4) staff-resident ratios, (5) profit/nonprofit status, (6) system affiliation, (7) type of license, and (8) years of operation.

H_{0_3}: There is no relationship between per diem rates of ICF-MR residential services and facility size.

For the purpose of this study, size is the actual number of clients present in the facility over the course of the year. "Size" is very similar to "licensed capacity" because most ICF-MRs in Minnesota operate near or at capacity.

Facilities were grouped into six categories: (1) 6 or fewer residents, (2) 7 to 12 residents, (3) 13 to 16 residents, (4) 17 to 32 residents, (5) 33 to 64 residents, and (6) 65 or more residents.

There were significant differences ($p < .01$) in the per diem rates according to these size categories. The highest per diems were found among larger ICF-MRs which served 17 or more people and those facilities serving 6 or fewer residents which are typically newer facilities. The lowest per diem was found in very large facilities (more than 64 beds) which were typically older facilities. Tables 6 and 7 present the summary analysis of variance and the table of means and standard deviations.

Table 6
Summary of Analysis of Variance of Minnesota ICF-MR Per Diem Rates by Size Categories: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	5	4,206	841	4.27[a]
Within groups	255	50,211	197	
TOTAL	260	54,417		

[a] $p < .01$.

Table 7
ICF-MR Mean Per Diems by Size Categories: 1981

Size Category	Mean	Standard Deviation	Number of Facilities
6 or fewer residents	$52.50	10.80	83
7 to 12 residents	$46.30	12.40	84
13 to 16 residents	$46.00	13.50	55
17 to 32 residents	$58.50	25.70	12
33 to 64 residents	$55.80	23.50	19
65 or more residents	$43.10	11.10	8

Pooled standard deviation = 14.00.

H_{0_4}: There is no relationship between per diem rates of ICF-MR residential services and licensed capacity.

ICF-MRs in Minnesota typically operate at or near licensed capacity; the average occupancy rate for 1981 was 98 percent. The results of a one-way analysis of variance, consequently, were very similar to the results for size categories. There was a significant difference ($p < .01$) in the per diem rates according to the categories of facilities by licensed capacity. The trends again indicate higher per diem rates for smaller facilities, decreasing per diem rates in midsize facilities, and then increasing per diem rates for larger facilities except for the extremely large facilities (64 beds or larger). Tables 8 and 9 present the summary of the analysis of variance test and the table of means and standard deviations.

Table 8
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Licensed Capacity: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	5	4,319	864	4.40[a]
Within groups	255	50,098	197	
TOTAL	260	54,417		

[a] $p < .01$.

Table 9
ICF-MR Mean Per Diems by Licensed Capacity: 1981

Licensed Capacity	Mean	Standard Deviation	Number of Facilities
6 or fewer residents	$52.40	10.70	82
7 to 12 residents	$46.40	12.40	83
13 to 16 residents	$45.80	13.40	57
17 to 32 residents	$57.90	28.20	10
33 to 64 residents	$56.40	22.40	21
65 or more residents	$43.10	11.10	8

Pooled standard deviation = 14.00.

H_{05}: There is no relationship between per diem rates of ICF-MR residential services and occupancy rate.

A one-way analysis of variance test did not reveal any significant statistical difference among facility per diem rates when facilities were compared by occupancy rate. Statewide, community ICF-MRs operated at 98 percent of their licensed capacity in 1981. The lowest occupancy rate was 46 percent; the highest was 100 percent. Only 11 ICF-MRs operated at less than 90 percent.

H_{06}: There is no relationship between facility per diem rates and the direct care staff-resident ratio.

The staff-resident ratio is calculated by dividing the number of direct care staff(full-time equivalent) by the number of residents (size).

Previous national studies and the previous two policy papers indicated that per diem rates are greatly influenced by personnel costs. The number and type of staff are, in turn, influenced by client characteristics and needs. These factors such as level of functioning, staffing patterns required by regulatory standards, and behavior characteristics are difficult to analyze due to the influence of other variables. The staff-resident ratio picks up influence of the other variables; therefore, exact cause-effect relationship measurement is difficult.

In this study, facilities were grouped according to five categories based upon staff-resident ratios: (1) less than 0.30; (2) 0.30 to 0.49; (3) 0.50 to 0.69; (4) 0.70 to 0.99; and (5) greater than 1.00. The analysis indicated that there were significant differences ($p <$ .01) among facilities when staff-resident ratios were compared. The lowest average per diem ($34.26) was found among facilities with the lowest ratios, and the highest average per diem ($74.94), which was more than double the lowest, was found among facilities with ratios greater than 1.00. As with size categories, the lowest per diem was found among the larger, older facilities. Tables 10 and 11 summarize the results of the one-way analysis of variance test.

Table 10
Summary of Analysis of Variance of Minnesota ICF-MR
Per Diems by Staff-Resident Ratios: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	4	29,486	7,371.6	75.70[a]
Within groups	256	24,931	97.4	
TOTAL	260	54,417		

[a] $p < .01$.

Table 11
Mean Per Diem Rates of Minnesota ICF-MRs
by Staff-Resident Ratio: 1981

Staff-Resident Ratio	Mean	Standard Deviation	Number of Facilities
Less than .30	$34.26	7.10	14
.30 to .49	$39.44	8.01	61
.50 to .69	$47.79	6.65	109
.70 to .99	$54.03	14.69	48
Greater than .99	$74.94	12.02	29

Pooled standard deviation = 9.87.

H_{0_7}: There is no relationship between per diem rates of ICF-MR residential services and profit/nonprofit status.

A one-way analysis of variance did not reveal any significant differences in per diem rates when facilities were compared according to profit/nonprofit status. The average per diem rate for nonprofit homes was $49.40, which was slightly higher than the average per diem rate for proprietary facilities at $49.10. Tables 12 and 13 summarize the results of the one-way analysis of variance test and table of means and standard deviations.

Table 12
Summary of Analysis of Variance of Minnesota ICF-MR
Per Diems by Profit/Nonprofit Status: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	1	5	5	0.03
Within groups	259	54,412	210	
TOTAL	260	54,417		

Table 13
Mean Per Diems of Minnesota ICF-MRs
by Profit/Nonprofit Status: 1981

Type of Status	Mean	Standard Deviation	Number of Facilities
Profit	$49.10	13.10	134
Nonprofit	$49.40	15.80	127

Pooled standard deviation = 14.50.

H_{0_8}: There is no relationship between per diem rates of ICF-MR residential services and system affiliation.

For the purpose of this study, a facility was identified as a member of a system if the organization which owned the home also owned at least one other ICF-MR facility in Minnesota. A facility which was owned by an organization with other nursing or boarding homes or out-of-state facilities was not identified as being a member of a system.

During 1981, the number of beds within individual systems ranged from a low of 12 to over 500. Over 72 percent of the 261 facilities were members of a system in 1981. All the additional facilities included in this study (N = 31) compared to the 1980 study were members of a system.

No significant differences were found between facilities which were members of a system and those which were not at the $p < .01$ range, but significant differences were identified at the $.01 < p < .05$ range. The average per diem for a nonsystem facility was $45.70, compared to $50.60 for facilities which are members of a system. Tables 14 and 15 present a summary of the results of the one-way analysis and table of means and standard deviations. The results are similar to the ICF-MR cost study on 1981 data (*Policy Analysis Paper No. 15*) and the findings of Wieck and Bruininks (1980) which also reported higher per diems for facilities which were members of a system.

Table 14
Summary of Analysis of Variance of Minnesota ICF-MR
Per Diems by System Membership: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	1	1,256	1,256	6.12[a]
Within groups	259	53,161	205	
TOTAL	260	54,417		

[a] $.01 < p < .05$.

Table 15
Mean Per Diems of Minnesota ICF-MRs
by System Membership: 1981

Type of Membership	Mean	Standard Deviation	Number of Facilities
System member	$50.60	14.40	189
Not member of system	$45.70	14.00	72

Pooled standard deviation = 14.30.

H_{0_9}: There is no relationship between per diem rates of residential services and type of license (Class A or Class B).

ICF-MRs in Minnesota are licensed either as Class A or Class B facilities depending upon the mobility and self-preservation skills of the residents (i.e., the ability to leave the building during an emergency). Class B facilities are for individuals who do not possess such skills. Consequently, Class B facilities may require special structural characteristics and/or increased staffing patterns.

The one-way analysis of variance test indicated significant differences ($p < .01$) in the per diem rates of Class B facilities when compared to per diem rates for ICF-MRs licensed as Class A facilities. The average per diem for 32 Class B facilities was $67.20, 43.6 percent higher than the Class A average per diem of $46.80. The average size of a Class B facility was 31.9 compared to the average size of a Class A of 14.0. Also, the staff-resident ratio for Class B facilities was .98, more than 62 percent larger than the Class A facilities of .602. QAR data suggest that some of the Class B facilities are serving residents with higher dependency

levels. The summary of the analysis of variance and the table of means and standard deviations are shown in Tables 16 and 17.

Table 16
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Type of License: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	1	11,694	11,694	70.89[a]
Within groups	259	42,723	165	
TOTAL	260	54,417		

[a] $p < .01$.

Table 17
Mean Per Diems of Minnesota ICF-MRs by Type of License: 1981

Type of License	Mean	Standard Deviation	Number of Facilities
Class A license	$46.80	11.40	229
Class B license	$67.20	20.60	32

Pooled standard deviation = 12.80.

H_{010}: There is no relationship between per diem rates of ICF-MR residential services and years of operation.

As previous studies in this area indicate (Piasecki et al., 1978), newer or recently opened facilities experience larger per diems due to increased start-up costs.

Years of operation were calculated by subtracting the year and month in which the facility was first licensed by the Department of Public Welfare from the year and month of the facility's 1981 fiscal year end. The years of operation were categorized into five groups: (1) less than 1.0 year; (2) 1.1 to 3.0 years; (3) 3.1 to 5.0 years; (4) 5.1 to 8.0 years; and (5) longer than 8.0 years.

The one-way analysis of variance revealed significant differences ($p < .01$) among the groups. Higher per diems were associated with more recently opened homes; and lower per diems with older facilities. However, facilities with 1.0 to 3.0 years of operation had

the highest average per diem at $55.00. Facilities with less than 1.0 year of operation had the second highest average at $53.50. Tables 18 and 19 summarize the results of the analysis of variance test and present the table of means and standard deviations.

Table 18
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Years of Operation: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	4	6,122	1,530	8.11[a]
Within groups	256	48,295	189	
TOTAL	260	54,417		

[a] $p < .01$.

Table 19
Mean Per Diems of Minnesota ICF-MRs by Years of Operation: 1981

Number of Years	Mean	Standard Deviation	Number of Facilities
Less than 1.0 year	$53.50	11.80	19
1.0 to 3.0 years	$55.00	13.20	45
3.1 to 5.0 years	$52.50	16.10	63
5.1 to 8.0 years	$47.60	13.90	88
Longer than 8.0 years	$40.70	10.90	46

Pooled standard deviation = 13.70.

C. Resident Factors

Six variables related to resident characteristics or functioning were compared against per diem rates: (1) average age of residents; (2) percentage of residents who are severely or profoundly mentally retarded; (3) percentage of residents who are completely fed; (4) percentage of residents with behavior problems; (5) percentage of residents who are not toilet trained; and (6) percentage of clients who are nonambulatory. A greater level of resident dependency suggests

a need for more direct care services, increasing staff ratios, and consequently increasing costs. According to QAR data, 14 facilities (all Class B) accounted for nearly all the residents who are reported to have higher levels of dependency in the areas of feeding and ambulation.

H_{011}: There is no relationship in the per diem rates of ICF-MR resident services and the age of residents.

A one-way analysis of variance test was run on facilities categorized by the average age of their residents. Five age groups were defined: (1) less than 16 years; (2) 16 to 25 years; (3) 26 to 35 years; (4) 36 to 45 years; and (5) greater than 45 years of age. Significant differences ($p < .01$) were revealed by the analysis. As with previous studies, an inverse relationship was found between resident age and per diem. Facilities serving children had the highest average per diem rate at $72.60; facilities whose residents averaged more than 45 years of age had the lowest average per diem rates at $42.60. The results of the one-way analysis and the table of means and standard deviations are shown in Tables 20 and 21.

Table 20
Summary of Analysis of Variance in Minnesota ICF-MR
Per Diems by Average Age of Residents: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	4	13,519	3,380	21.15[a]
Within groups	256	40,898	160	
TOTAL	260	54,417		

[a] $p < .01$.

Table 21
Mean Per Diems of Minnesota ICF-MRs
by Average Age of Residents: 1981

Average Age	Mean	Standard Deviation	Number of Facilities
Less than 16 years	$72.60	19.60	16
16 to 25 years	$54.50	15.10	50
26 to 35 years	$49.00	11.80	86
36 to 45 years	$44.10	10.30	79
Greater than 45 years	$42.60	11.40	30

Pooled standard deviation = 12.60.

H_{012}: There is no relationship between per diem rates of ICF-MR residential services and the proportion of residents who are severely or profoundly mentally retarded.

The proportion of residents who were classified as severely or profoundly mentally retarded was calculated for each facility using QAR data. Significant differences ($p < .01$) were indicated by the results of the one-way analysis of variance test. The 45 facilities which reported that 75 percent to 100 percent of their residents were severely or profoundly mentally retarded had the highest average per diem of any group at $57.40. Tables 22 and 23 present the analysis of variance summary and table of means and standard deviations.

Table 22
Summary of Analysis of Variance of Minnesota ICF-MR
Per Diems by Proportion of Residents Severely
or Profoundly Mentally Retarded: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	6	4,720	787	4.02[a]
Within groups	254	49,697	196	
TOTAL	260	54,417		

[a] $p < .01$.

Table 23
Mean Per Diems of Minnesota ICF-MRs
by Proportion of Residents Severely
or Profoundly Mentally Retarded: 1981

Proportion	Mean	Standard Deviation	Number of Facilities
Less than 6 percent	$49.60	14.40	49
6 to 9 percent	$44.10	5.10	10
10 to 19 percent	$52.60	10.00	16
20 to 39 percent	$46.50	14.30	68
40 to 49 percent	$44.50	10.30	31
50 to 74 percent	$48.20	12.60	42
75 to 100 percent	$57.40	18.30	45

Pooled standard deviation = 14.00.

H_{013}: There is no relationship between per diem rates of ICF-MR residential services and the proportion of residents who must be completely fed.

Resident dependency levels were again provided by QAR data from the Department of Health. As stated earlier, increased resident dependency levels suggest greater staffing ratios and higher costs. Facilities were categorized according to the proportion of residents who must be completely fed. Most facilities (N = 247; 95 percent) reported that 6 percent or fewer of the residents required complete feeding. The results of the one-way analysis indicated significant differences ($p < .01$). The five facilities with dependency levels of 40 percent or more had the highest average per diem at $92.90. The results of the analysis of variance and the table of means and standard deviations are reported in Tables 24 and 25.

Table 24
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Proportion of Residents Completely Fed: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	3	15,983	5,328	35.62[a]
Within groups	257	38,434	150	
TOTAL	260	54,417		

[a] $p < .01$.

Table 25
Mean Per Diems of Minnesota ICF-MRs by Proportion of Residents Completely Fed: 1981

Proportion	Mean	Standard Deviation	Number of Facilities
Less than 6 percent	$47.50	11.90	247
6 to 19 percent	$73.30	14.40	4
20 to 39 percent	$75.10	22.70	5
More than 39 percent	$92.90	15.00	5

Pooled standard deviation: 12.20.

H_{014}: There is no relationship between per diem rates of ICF-MR residential services and the proportion of residents who have severe behavior problems.

Facilities were classified into five groups according to the proportion of residents who were reported to have severe behavior problems.[1] Significant differences ($p < .01$) were indicated by the one-way analysis of variance test. Facilities reporting that more than 50 percent of the residents had severe behavior problems had the highest per diems. Tables 26 and 27 summarize the results of the one-way analysis of variance.

[1] Severe behavior problems were defined as ". . . disturbs others/runs away, aggressive verbally, threatens, steals, destructive, assaultive/self-injurious behaviors."

Table 26
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Proportion of Residents with Severe Behavior Problems: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	4	3,463	866	4.35[a]
within groups	256	50,954	199	
TOTAL	260	54,417		

[a] $p < .01$.

Table 27
Mean Per Diems of Minnesota ICF-MRs by Proportion of Residents with Severe Behavior Problems: 1981

Proportion	Mean	Standard Deviation	Number of Facilities
Less than 6 percent	$47.00	9.80	66
6 to 19 percent	$48.10	14.90	75
20 to 34 percent	$48.90	13.70	69
35 to 49 percent	$48.00	20.50	22
More than 49 percent	$59.40	15.30	29

Pooled standard deviation = 14.10.

H_{o15}: There is no relationship between per diem rates of ICF-MR residential services and the proportion of residents who are not toilet trained.

Facilities were categorized according to the proportion of residents who were not toilet trained. Of the 261 facilities, 239 had less than 3 percent of their residents not toilet trained. Of the remaining 22 facilities, the highest average per diem was associated with those facilities in which more than 25 percent of the residents were not toilet trained. The results of the one-way analysis which reported significant differences ($p < .01$) are reported in Tables 28 and 29.

Table 28
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Proportion of Residents Not Toilet Trained: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	3	14,211	4,737	30.28[a]
Within groups	257	40,206	156	
TOTAL	260	54,417		

[a] $p < .01$.

Table 29
Mean Per Diems of Minnesota ICF-MRs by Proportion of Residents Not Toilet Trained: 1981

Proportion	Mean	Standard Deviation	Number of Facilities
Less than 3 percent	$47.10	11.70	239
3 to 12 percent	$65.60	20.30	9
13 to 25 percent	$70.80	19.30	3
More than 26 percent	$79.80	19.60	10

Pooled standard deviation = 12.50.

H_{016}: There is no relationship between per diem rates of ICF-MR residential services and the proportion of residents who are nonambulatory.

Department of Health QAR data were used to group facilities according to the proportion of residents who were nonambulatory: (1) less than 10 percent; (2) 10 percent to 19 percent; (3) 20 percent to 39 percent; and (4) more than 39 percent. Over 95 percent (N = 241) of the facilities reported low proportions of nonambulatory residents. The results of the one-way analysis test indicated significant differences ($p < .01$) and are reported in Tables 30 and 31.

Table 30
Summary of Analysis of Variance of Minnesota ICF-MR Per Diems by Proportion of Residents Who are Nonambulatory: 1981

Source of Variance	Degrees of Freedom	Sum of Squares	Mean Squares	*F* Score
Between groups	3	17,739	5,913	41.43[a]
Within groups	257	36,678	143	
TOTAL	260	54,417		

[a] $p < .01$.

Table 31
Mean Per Diems of Minnesota ICF-MRs by Proportion of Residents Who Are Nonambulatory: 1981

Proportion	Mean	Standard Deviation	Number of Facilities
Less than 10 percent	$47.10	11.50	241
10 to 19 percent	$60.10	17.20	6
20 to 39 percent	$66.10	11.20	4
More than 39 percent	$87.70	18.00	10

Pooled standard deviation = 11.90.

V. COST-FUNCTION ANALYSIS

The first portion of this study involved the use of a statistical technique called one-way analysis of variance which defined groups of facilities according to selected variables, and compared mean per diems of groups based only upon those single factors. Cost factors, however, are often interrelated; and two or more variables acting together may influence the cost of residential care services.

The second objective of this study will be to develop an explanation of cost relationships using a cost-function approach. A cost-function is the testing of statistical relationships between inputs (independent variables such as facility location or staff-resident ratios) and cost (the dependent variable) using multiple regression techniques. Multiple regression makes it possible to evaluate the influence specific variables may have upon cost while at the same time accounting for the possible impact of several other variables.

The dependent variable in this analysis was per diem rate. Twenty-five independent variables were utilized as predictors of cost:

1. Region;
2. Urban/Nonurban Location;
3. Profit-Nonprofit Status;
4. Membership in a System;
5. Total Licensed Capacity of a System;
6. Management Compensation--"top management" compensation as a proportion of total operating expenses;
7. Current Ratio--the ratio defined by dividing a facility's current assets by current liabilities;
8. Facility Size--numbers of residents;
9. Occupancy Rate;
10. Number of Direct Care Staff--full-time equivalents;
11. Staff-Resident Ratio;
12. Transportation Expense--resident-related transportation costs as a proportion of total operating expenses;
13. Interest Expense on Working Capital Loans--as a proportion of total operating expenses;
14. Property and Related Cost--total per diem dollars allowed for property and related expenses;
15. General and Administrative Cost--total per diem dollars allowed for general and administrative expenses;
16. Earnings Allowance Cost--total per diem dollars allowed for earnings allowance or minimum cost of capital;
17. Fixed Cost Ratio--fixed costs such as administrative, property, and earnings allowance as a proportion of total operating expenses;
18. Return on Investment Ratio--the costs calculated by dividing earnings allowance for proprietary facilities by gross investment minus average capital indebtedness;
19. Consultant/Contract Expenses--resident-related consultant contracts and in-service training for staff as a proportion of total operating expenses;
20. Years of Operation;
21. Average Age of Residents;
22. Percentage of Residents Severely or Profoundly Retarded;
23. Percentage of Residents with Behavior Problems;
24. Percentage of Residents Not Toilet Trained;
25. Class A or Class B Licensure.

Three variables from the one-way analysis of variance were omitted because of their high degree of correlation with other variables. The three factors which were omitted from this portion of the study were: licensed capacity (correlated with size) and percentage of residents completely fed or nonambulatory (which were correlated with other resident dependency variables).

Several variables were added to the regression analysis because they are related to cost. While they may not show significance in a one-way

analysis of variance, taken together they may help to explain more of the variation in per diem rates.[1] The variables added were management compensation; current ratio; transportation expense; interest expense on working capital loans; property and related cost; general and administrative cost; earnings allowance cost; fixed cost ratio; return on investment ratio; and consultant contract expenses.

The regression analysis indicated that 15 of the 25 variables were statistically significant predictors of per diem cost. Thirteen variables were significant at $p < .01$ level: location; number of direct care staff (full-time equivalent); staff-resident ratio; property and related costs; general and administrative cost; earnings allowance; resident behavior problems; percentage of residents not toilet trained; Class A or Class B licensure; size (inversely related); fixed cost ratio (inversely related); return on investment ratio (inversely related); and years of operation (inversely related). The variables proprietary status and average age of residents (inversely related) were significant at $p < .10$ level. The overall regression equation accounted for 92.2 percent of the variance in per diems.

In a second analysis, facilities were divided into two groups: (1) facilities serving 12 or fewer residents and (2) facilities serving more than 12 residents. A regression analysis was then performed on each of these groups.

The regression equation for facilities serving 12 or fewer clients (N = 167) indicated that 10 of the 25 variables were statistically significant predictors of per diem costs. Seven variables were statistically significant at the $p < .01$ level: location; proprietary status; number of direct care staff (full-time equivalent); property and related costs; general and administrative costs; earnings allowance; and fixed cost ratio (inversely related). One variable was significant at the $p < .05$ level and two variables at the $p < .10$ level. These variables, respectively, were average age of residents (inversely related), occupancy rate, and years of operation (inversely related). This regression equation explained 91.5 percent of the variance in per diems.

In the regression analysis for facilities serving more than 12 residents (ranging from 13 to 171 residents with N = 94), the equation explained 95.2 percent of the variance in per diems. Fourteen of the twenty-five variables were statistically significant. Ten variables were significant at the $p < .01$ level: size (inversely related); direct care staff (full-time equivalent); staff-resident ratio; interest expense on working capital loans (inversely related); property and related costs; general and administrative costs; earnings allowance; fixed cost ratio

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[1] An example would be higher start-up costs which may indicate more per diem dollars spent for property and related costs as well as a larger fixed cost ratio.

(inversely related); consultant/contract expenses; and years of operation (inversely related). Three variables were statistically significant at the $p < .05$ level: location; percentage of residents not toilet trained; and Class A or Class B licensure. One variable was statistically significant at $p < .10$ level: resident behavior problems.

Table 32 summarizes the significant variables identified by the regression analyses and their relationship with per diem ratio.

Table 32
Summary of Regression Results: Significant Variables

Regression Analysis	Significant Variable	p Level	Relationship to Per Diem
Overall:	Location	.01	positive
	Proprietary Status	.10	positive
N = 261	Size	.01	inverse
R^2 = 92.2	Direct Care Staff (FTE)[a]	.01	positive
	Staff-Resident Ratio	.01	positive
	Property and Related Costs	.01	positive
	General and Administrative Costs	.01	positive
	Earnings Allowance	.01	positive
	Fixed Cost Ratio	.01	inverse
	Return on Investment Ratio	.01	inverse
	Years of Operation	.01	inverse
	Average Age of Residents	.10	inverse
	Behavior Problems	.01	positive
	Percentage of Residents Not Toilet Trained	.01	positive
	Class A or Class B Licensure	.01	positive
Facilities Serving 12 or Fewer Residents:	Location	.01	positive
	Proprietary Status	.01	positive
	Occupancy Rate	.10	positive
N = 167	Direct Care Staff (FTE)	.01	positive
R^2 = 91.5	Property and Related Costs	.01	positive
	General and Administrative Costs	.01	positive
	Earnings Allowance	.01	positive
	Fixed Cost Ratio	.01	inverse
	Years of Operation	.10	inverse
	Average Age of Residents	.05	inverse
Facilities Serving 13 or More Residents:	Location	.05	positive
	Size	.01	inverse
	Direct Care Staff (FTE)	.01	positive
N = 94	Staff-Resident Ratio	.01	positive
R^2 = 95.2	Interest on Working Capital Loans	.01	inverse
	Property and Related Costs	.01	positive
	General and Administrative Costs	.01	positive
	Earnings Allowance	.01	positive
	Fixed Cost Ratio	.01	inverse
	Consultant/Contract Expenses	.01	positive
	Years of Operation	.01	inverse
	Behavior Problems	.10	positive
	Percentage of Residents Not Toilet Trained	.05	positive
	Class A or Class B Licensure	.05	positive

[a]FTE = Full-Time Equivalent.

VI. SUMMARY OF FINDINGS

The one-way analysis of variance tests revealed the following results when per diem rates were examined according to several facility and resident characteristics:

A. Region

There were significant differences ($p < .01$) in the per diems of ICF-MRs located in Minnesota's 13 economic development regions. The highest average per diem was found in the Minneapolis-St. Paul region ($55.90). The lowest average per diem rates were found in regions Six E ($33.90), One ($39.20), and Seven W ($39.70).

B. Urban/Nonurban Location

According to data provided by the Census Bureau for 1982, there were seven major "urban" areas in Minnesota: Duluth, Moorhead, East Grand Forks, LaCrescent, Rochester, St. Cloud, and Minneapolis-St. Paul. Facilities operating in these areas had an average per diem of $54.30, which was 20 percent higher than the average per diem for nonurban locations of $45.20.

C. Size

As in previous studies in this area, a U-shaped relationship between size and per diem costs was found. There was a significant difference ($p < .01$) in per diems by size categories. The highest average per diems were associated with facilities serving 17 to 32 residents in size ($58.50), 33 to 64 residents in size ($55.80), and fewer than 6 residents ($52.20). The lowest average per diem was found in those facilities serving 65 or more residents in size ($43.10).

The higher costs for facilities between 17 and 64 resident size may be attributed in part to increasing staff requirements and, hence, direct care staff (FTE). The higher costs for facilities serving fewer than 6 residents in size may be in part due to their newer opening and higher start-up costs.

D. Licensed Capacity

Since ICF-MRs typically operate at or near licensed capacity (98 percent occupancy), the results of the one-way analysis of variance were similar to the results when categorized by size (number of residents). The highest average per diems were found in the 17 to 32 category, 32 to 64 category, and fewer than 6 category. Lower average per diems were associated with categories between 6 and 17 and greater than 65.

E. Occupancy Rate

The one-way analysis of variance did not reveal any significant differences when groups of facilities were compared by occupancy rate, primarily because in Minnesota ICF-MRs operate at similar rates of resident occupancy--98 percent, statewide average.

F. Staff-Resident Ratio

There were significant differences ($p < .01$) when facilities were compared by categories of staff-resident ratios. Facilities with the lowest staff-resident ratio (less than .30) had the lowest average per diem ($34.26). As staff-resident ratios increased, average per diems increased. The highest average per diem ($74.94) was associated with facilities having a staff-resident ratio greater than .99.

G. Proprietary Status

The analyses did not reveal any significant differences between facilities when compared by profit/nonprofit status. The mean average per diem for nonprofit facilities ($49.90) was slightly higher than for profit facilities ($49.10).

H. Membership in a System

No significant differences were found when comparing per diem rates of facilities which were members of a system and those that were not at the $p < .01$ level. However, at the $.01 < p < .05$ level, facilities which were members of a system were statistically different than those facilities which were not. Facilities which were system members had an average per diem of $50.60. The average per diem for nonsystem facilities was $45.70. Over 72 percent of all facilities were members of a system. The number of beds within an individual system ranged from 12 to 506.

I. Class A/Class B Licensure

The results of one-way analysis of variance indicated statistically significant differences ($p < .01$) for Class A versus Class B facilities. Class B facilities had an average per diem of $67.20, nearly 44 percent higher than the Class A facilities' average of $46.80. Further analysis indicated that this difference may be due in part to client characteristics, staffing patterns, and regulations regarding building structure.

J. Years of Operation

The one-way analysis of variance indicated statistically significant differences ($p < .01$) for facility per diem rates by years of operation. The relationship between per diem rates and years of operation was inverse. The highest average per diem was associated with

those facilities opened recently (less than 1.0 year) at $53.50 and fairly recently (1.0 to 3.0 years ago) at $55.00. The lowest average per diem was found in facilities operating for more than 8 years at $40.70.

K. Age of Residents

Statistically significant differences ($p < .01$) occurred when facilities were compared by the average age of the residents served. An inverse relationship was present between average age of residents and per diem rates. The highest average per diems ($72.60) were associated with those facilities serving residents less than 16 years of age. The lowest average per diem ($42.60) was found at those facilities serving residents who averaged 45 years of age or older.

L. Proportion of Residents Severely or Profoundly Mentally Retarded

The one-way analysis of variance indicated statistically significant differences ($p < .01$) when facility per diems were compared according to the proportion of residents classified as severely or profoundly mentally retarded. The highest average per diem ($57.40) was reported by those facilities (N = 45) serving more than 75 percent residents who were severely or profoundly retarded. Facilities which had 6 to 9 percent of their residents with severe or profound mental retardation had the lowest average per diem ($44.10).

M. Resident Dependency Levels

The majority of facilities did not serve clients who were not toilet trained, who have to be completely fed, or who were nonambulatory. The residents who had these characteristics were served primarily in Class B facilities which, as noted earlier, had higher staffing patterns and larger sized facilities. The differences in average per diem rates of facilities compared by these variables were statistically significant ($p < .01$).

Mean per diem rates by proportion of residents not toilet trained ranged from $47.10 (2 percent or less) to $79.80 (more than 26 percent). By proportion of residents who are completely fed, the range was from $47.50 (5 percent or less) to $92.90 (more than 39 percent). The highest mean per diem rate according to proportion of nonambulatory residents was $87.70 (more than 39 percent) and the lowest mean per diem was $47.10 (9 percent or less). For facilities serving residents with severe behavior problems, the highest average per diem ($59.40) was for those facilities with more than 50 percent of their residents with severe behavior problems, and the lowest ($47.00) was for those facilities having 5 percent or less of their residents with severe behavior problems.

N. Multiple Factors

Twenty-five variables were examined using multiple regression techniques to estimate their impact upon ICF-MR per diem rates. Fifteen variables were identified as statistically significant predictors of ICF-MR costs: (1) location; (2) proprietary status; (3) size (inversely related); (4) direct care staff (full-time equivalent); (5) property and related costs; (6) general and administrative costs; (7) earnings allowance; (8) fixed cost ratio (inversely related); (9) return on investment ratio (inversely related); (10) years of operation (inversely related); (11) average age of residents (inversely related); (12) behavior problems; (13) proportion of residents not toilet trained; (14) staff-resident ratio; and (15) Class A or Class B licensure.

A regression analysis using the same 25 variables for facilities with 12 or fewer residents revealed 10 statistically significant cost predictors: (1) location; (2) proprietary status; (3) direct care staff (full-time equivalent); (4) property and related costs; (5) general and administrative costs; (6) earnings allowance; (7) fixed cost ratio (inversely related); (8) years of operation (inversely related); (9) average age of residents (inversely related); and (10) occupancy rate. The regression equation for facilities serving more than 12 residents yielded 14 significant predictors: (1) location; (2) size (inversely related); (3) direct care staff (full-time equivalent); (4) property and related costs; (5) general and administrative costs; (6) earnings allowance; (7) fixed cost ratio (inversely related); (8) years of operation (inversely related); (9) behavior problems; (10) proportion of residents not toilet trained; (11) staff-resident ratio; (12) Class A or Class B licensure; (13) interest on working capital loans; and (14) consultant/contract service.

VII. SUMMARY

The data presented in this study are not definitive but statistical presentations of information derived from ICF-MR cost reports and Health Department records. The data presented are to help define problems, clarify trends, and outline some basic issues regarding community residential care services. Although cost remains a major consideration as both the state and federal governments struggle with substantial budget deficits, it is not the only consideration. Normalization, appropriateness of services, and the movement of developmentally disabled people into less restrictive living environments must also remain high priorities.

A comparison of this study of 1981 ICF-MR data with the study of 1980 data (*Policy Analysis Paper No. 15*) reveals a number of important trends.

In the analysis of variance tests involving individual factors which influence cost, many of the *F* scores increased between 1980 and 1981. This

means that the difference between groups was more statistically significant, suggesting that cost differences based on these factors are increasing rather than decreasing. For example, the average per diem for Class B facilities went from 36 percent higher than the Class A average in 1980 to 44 percent higher in 1981. For policy makers, the increasing cost differences between types of ICF-MR facilities may indicate areas that deserve further attention in rate setting procedures.

In the cost function analysis area, the 1981 regression equation explained a higher percentage of the variation in per diems than the 1980 one did. (R^2 increased from 77.4 to 91.5.) This increase was due in part to the inclusion of additional variables. The three statistically significant variables which had the largest impact were property and related costs, general and administrative costs, and earnings allowance; all were positively related to per diem rates. One variable which was not statistically significant in the 1980 analysis was in 1981 (location); one variable (region) was not as significant in 1981 as it had been in 1980. Several variables which were statistically significant in the 1980 analysis also had a statistically significant impact on costs in the 1981 study. For the purposes of cost savings and effective use of resources, both recurring and new variables which have strong influences on costs should be examined in further analyses.

Finally, the reader is urged to refer to *Policy Analysis Paper No. 15* (pages 31 through 34) for a discussion of policy issues related to ICF-MR residential services. The policy issues which were raised in that paper are still relevant; they may be even more important given recent state legislation aimed at changing the funding and structure of programs for developmentally disabled people.

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