Statistical cost analysis of long-terrm care facilities in Montana with policy implications
by Bernard Nicholas Ries

A thesis submitted in partial fulfillment of the requirements for the degree of MASTER OF SCIENCE
in Applied Economics
Montana State University

Abstract:
The objective of this research is to determine the effects selected facility characteristics have on cost per patient day for long-term care in Montana. The main hypotheses test the relationships between cost and ownership, location, size, quality and occupancy rate. The final results are used to project added expenses incurred from subsidizing small relatively costly long-term care facilities.

Ordinary least squares regression analysis is the main statistical tool used in this study. The selected characteristics are defined as the explanatory (independent) variables and relevant cost categories are used as the dependent variables. The estimated regression coefficients indicate the change in the average cost per patient day given a change in explanatory variables.

The final estimated average cost model is used to estimate average cost per patient day given location, ownership, size, occupancy rate and quality level. A least cost facility is also determined and the average cost per patient day is estimated. This estimated cost is compared with the current actual cost of long-term care in Montana and savings to the State are determined for funding only least cost facilities.

The final conclusions indicate location has no significant effect on average cost. Economies of scale are indicated as inverse relationships between cost and size. A similar5 relationship exists between cost and occupancy rate and suggests economies of full utilization. The least cost facility size is 122 beds. The estimated potential cost saving to the State for funding only least cost facilities ranges from one to four million dollars. These savings may be totally offset by added costs of developing least cost facilities.

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Date Mar. 2, 1977

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March, 1977

ADKNOWLEDGEMENT

I wish to express my deepest gratitude to the head of my thesis committee, Dr. Jon Christianson, for his time and effort in the preparation of this study. I would also like to thank the remaining members on my reading committee, Dr. Steve Stauber and Dr. Verne House, for their support.

I would like to express my appreciation to Mr. Dan Crowley of the SRS for his assistance in collection of the data and to my sister Joan for her help in proofreading the final copy.

I would also like to thank Evelyn Richard for her extra help in getting the thesis in final form.

To my parents I owe a great deal for the support they have given me during my years in college.

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ABSTRACT

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Chapter 1

INTRODUCTION TO THE STUDY

Objectives

This research studies the nursing home industry in Montana. Certain objectives are used as guidelines to limit the scope of the research. They are:

1) Review of a general economic model which relates costs to operational characteristics, location (relative to the population of the community in which the facilities exist), and type of ownership.
2) Estimation and application of this model to determine the change in costs relative to changes in characteristics, the services provided and the ownership structures.
3) Use of the estimated results to determine if economies of scale have been reached in the industry in Montana.
4) Projection of added expenses to the State incurred from subsidizing small relatively costly nursing home facilities.

The ownership structure is tested to determine how it affects costs. The Montana industry is composed of proprietary, government (county) and charitable facilities. The costs differences are determined for the two categories of profit (proprietary) and non-profit (church, government) facilities. The main emphasis is placed on the

test of the hypothesis that costs differ because of the different incentives for provision of care that exist between the two types of facilities.

This study also examines the influences of facility location on cost of operation. In particular, potential cost differences between rural and non rural areas are analyzed. The hypothesis that higher costs are found in rural areas is tested. It is believed that in the smaller communities the awareness of the conditions in the home and the personal acquaintances that exist between the employees, patients and families do affect the cost structure.

Finally, the research analyzes the relationship between costs and size. An analysis is conducted to determine if economies of scale have been reached in such categories as salaries, operation expenses, nursing services and total costs.

Demand for Long-Term Care

In 1972, for the first time, Medicaid expenditures for nursing home care exceeded payments for surgical and general hospitals in the United States. This amounts to $2 out of every $3 of revenue received by nursing homes.[1] The demand for public support is expected to

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[1]"Nursing Home Care in the United States: Failure in Public Policy", Introductory Report. Subcommittee on Long-Term Care of the Special Committee on Aging, United States Senate, U. S. Government Printing Office, November 1974, pp. 1-7.

continue to increase because the fastest growing population group in the U. S. is the age group of 75 years and over.

In the past half century the percentage of older citizens in the U.S. has more than doubled with the present population of people 65 and older approaching the ratio of 1 to 10. Life expectancy has increased from 43 years in 1900 to 73 years at the present. By the end of this century it is expected that the number of Americans age 65 and over will approach 32 million.[2]

In recent years the population in the age group of 65 to 74 has ranged from 12.5 million in 1970 to 13.2 million in 1973, a 1.9 percent increase. In the age group of 75 and over the population ranges from 7.6 million in 1970 to 8.1 million in 1973, a 2.2 percent increase. Over the past ten years (1960-1970 the last census period) these age groups increased 1.2 percent and 3.1 percent respectively. The age group of 65 to 74 made up approximately 6.1 percent of the population in 1960 and also in 1970 (approximately 11 million in 1960 to 12.5 million in 1970). The 75 and over age group made up 3.1 percent of the population in 1960 and increased by 3.8 percent by 1970 (approximately 5.5 million in 1960 to 7.6 million in 1970).[3]

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[2]Simmons, Leo W. The Aged Ill. Appleton-Century-Crofts, Educational Division/Meredith Corp., New York, 1970, pp. 3.

[3]U.S. Bureau of the Census, Statistical Abstract of the U.S., 1974, pp. 31-33.

All of these statistics show that the older citizen in the U.S. is indeed a growing force. This force requires and demands services and aids of a special character which society has not been accustomed to providing. These services are in such areas as transportation, housing, financial aid and health care. To aid the reader in understanding the problems of providing long-term health care, a brief history of the nursing home industry follows.

History of the Industry

Facilities built to take care of the elderly have been discovered as far back in history as the pre-Renaissance period. As the Church became the main overseer of health care, hospitals and facilities for health care could always be found in cities where the large cathedrals were located. It was in the Renaissance period that the first institution that would later become the nursing home was developed -- the almshouse.[4]

The almshouse -- also called the poor farm, the county infirmary or the workhouse -- acted as a catch-all institution, housing orphans, diseased prostitutes, the blind, and other moral deviant and mentally distressed persons as well as the aged. The common denominator of the inhabitants was their dependence on the state for support

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[4] Schneeweiss, Stephen, Nursing Home Administration. University Park Press, Baltimore, 1974, p. 1.

and their rejection by society. The passage of the English poor law enhanced the poor conditions in the almshouse even more (although it placed the responsibility on society to maintain the homes) by using the institution as a warning to everyone that idleness and lack of control in financial matters would not be tolerated by the state.[5]

These same general ideas were carried across the sea with the founders of our nation. The settlers established the almshouse to care for the undesirable, unwanted, and unfortunate of the early pioneer society. But one interesting fact that came about in the young society was the treatment settlers received when they suffered economic loss from Indian raids. Instead of having to go to the almshouse, they were given financial help by the community. This charitable deviation from the norm proved to be a significant step in reversing the errors of the almshouse.[6]

By the 1800's there was an increasing growing concern to improve the conditions which the poor faced. One of the main actions was to provide special care for particular groups which were previously confined to the almshouse. The objective was to develop a variety of institutions. Beginning in 1832 special attention was

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[5] McArthur, Ray F. "The Historical Evolution From Almshouse to ECF". Nursing Homes, Vol. 19, No. 4, 1970. p. 27.

[6] Schneeweiss, op. cit., p. 2.

given to the young blind. They were removed from the stifling atmosphere of the almshouse and placed in an institution of their own, receiving special training and aid. This led to the establishment of other facilities which could provide special treatment and specialized aid and training for such groups as the orphans, widows, veterans and other groups who were previously outcasts of the community. The discovery of the causes and cures for many communicable diseases also decreased the population of the almshouses by giving people who were once considered a deadly entity to the community a new start. All these changes had the effect of "skimming off" the people who had relatively solvable problems, leaving only the individuals for which society had no answers.[7]

The shift of the almshouse's population from a variety of aged and disadvantaged people to one of a highly concentrated type continued up into the 1930's. The almshouse became more and more a place where only old people were sent when their care became troublesome. But the almshouse, as it existed, had a short life left. In 1932, the Federal Government took the responsibility of providing for the poor, relieving much of the burden that was placed on the local governments. It was this shifting of responsibility, along with the

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[7] McArthur, op. cit., p. 26-27.

Social Security Act of 1935, which signalled the demise of the almshouse.[8]

With the creation of the Social Security Act, people were removed from the public institutions and brought back into the private sector--exactly opposite of the previous community goals. This shift was caused by the sudden awareness that local tax money could be saved by such action. To the surprise of the official agencies trying to place the people, unexpected aid was located in the private sector.[9]

A large proportion of the private aid was created by the economic conditions of the country. It was in the middle of the depression, with jobs and money both scarce. Many of the people affected were the ones who had large amounts of capital locked up in the ownership of their large homes. To protect themselves from further losses or even sale of their property, many individuals opened up their homes to the almshouse residents realizing the opportunity for increased income. The residents who were eligible for the Federal aid welcomed the chance to get out of the almshouse and into a more socially accepted existence. Finally, many of the almshouses closed down as

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[8]Ibid, p. 27.

[9]Ibid, p. 27.

this initial start of the nursing home industry started to flourish across the country.[10]

As the industry grew, so did the problems that existed with it. The difference between the initial homes that were established and the homes that came into existence in the late 30's and early 40's was marked. The investors in the later homes soon realized that the method of payment not only provided no incentive to provide proper care, but also discouraged any aid beyond the minimal requirements to exist.[11] As the industry continued to grow, the government finally stepped in with regulations intended to increase quality of care.

The first count of nursing homes was conducted in 1939 by the Bureau of the Census. It revealed that there were approximately 1200 nursing, convalescent and rest homes with approximately 25,000 beds.[12] By 1954, there were 25,000 homes with more than 450,000 beds. These homes provided all types of care, ranging from boarding home care to intensive nursing care.[13]

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[10] Ibid, p. 27.

[11] Ibid, p. 27.

[12] Block, L. "Hospital and Other Institutional Facilities and Services, 1939." Vital Statistics - Special Report, Vol. 13, Nos. 1-57, U.W. Bureau of the Census, Washington, D.C. 1942.

[13] Division of Hospital and Medical Facilities: The Nation's Health Facilities, Ten Years of the Hill-Burton Hospital and Medical Facilities Program, 1946-56. PHS Pub. No. 616, U.S. Dept. of HEW, Washington, D.C., 1958.

Today there are more than 22,000 nursing and related homes in the U.S. There are approximately 12,800 nursing care homes (a facility in which over 50 percent of the residents receive nursing services and at least one R.N. or L.P.N. is employed more than 35 hours a week), 3,560 personal care homes without nursing care (a facility in which 3 or more personal services - eating, walking, bathing, etc. - are provided but not nursing services), and 190 domiciliary care homes (a facility in which less than 3 personal services are provided and no nursing care).[14]

There are more than 917,700 beds in nursing care and related homes today. This accounts for more than 3/4 of the total number of beds of all kinds for the care of the chronically ill and aged. There are also more than 283,890 beds available in other types of nursing care and related homes.[15]

A look at the ownership structure reveals that an estimated 75 percent of the nursing homes are operated under proprietary control with the rest under control of the government or some other non-profit entity. It is also estimated that proprietary homes have approximately 71 percent of the beds and 70 percent of the residents with an average

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[14] "Nursing Care and Related Homes" Health Resource Statistics. Health Services and Mental Health Administration, U.S. Dept. of HEW, Washington, D.C., 1974, p. 382.

[15] Ibid.

size home having 70 beds. The non-profit homes have the balance of the beds with an average size of 88 beds.[16] The services and costs vary, depending on the home, location, and type of ownership. The national expenditures for nursing home care rose from 1.1 percent of national health expenditures in 1950 to over 4.2 percent in 1969. Expenditures for nursing home care in actual dollars increased from $142 million to $2.84 billion, a 1,902 percent increase.[17]

The industry hires over 567,710 persons full-time. A breakdown analysis shows that there is approximately one full-time employee for every two patients. They consist of R.N.'s, L.P.N.'s, aids and orderlies, housekeepers, bookkeepers, and administrators.[18]

The number of homes in Montana has kept pace with national trends. In 1967 there were approximately 82 nursing homes in Montana. This number consisted of 45 nursing care homes, 20 personal care homes with nursing care, 15 personal care homes without nursing care and 2 domiciliary care homes. The number of residents in the facilities was 2,838. The facilities employed a total of 1,380 full-time employees.[19]

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[17] Rice, Dorothy P., and Barbara Cooper, "National Health Expenditures, 1929-1970", Social Security Bulletin, Vol. 34, January, 1971.

[18] "Nursing Care and Related Homes" Health Resources Statistics. p. 382.

[19] Ibid, 1969. pp. 269-281.

By 1971, the industry had grown to 103 homes, a 26 percent increase. This total consisted of 61 nursing care homes (36 percent increase), 27 personal care homes with nursing care (35 percent increase), 13 personal care homes without nursing care (13 percent decrease), and 2 domiciliary care homes (no change). The total number of residents in the facilities rose from 2,838 to 4,145, a 46 percent increase. The number of full-time employees increased 60 percent, from 1,380 to 2,201.[20]

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[20] Ibid, pp. 281-400.

Chapter 2

ECONOMIC THEORY OF COST

It is important to understand the economic concepts behind total, average and marginal costs in order to interpret any analysis of nursing home costs in Montana. These concepts are presented at the beginning of this chapter. Related studies are discussed in the second part of the chapter in an attempt to clarify the estimation techniques and economic theory used for this study.

Total Cost Curves

The starting point of a facility's cost structure is its total cost function. This function states the total cost of producing a given number of patient days of care in a certain time period. The function takes the following form:

$$TC(q) = f(q) + b$$

TC = Total Cost

q = number of patient days of care

b = fixed costs

The total cost function (TC) consists of costs incurred from producing "q" patient days of care plus total fixed cost "b".

The fixed cost is defined as the total cost incurred when "q" equals zero. It remains constant over all ranges of "q". The total variable cost is defined as the difference between total cost and

total fixed cost.

$$TVC\ (q) = TC\ (q) - TFC\ (q)$$

In other words total variable cost is the portion of total cost which changes with changes in the number of patient days of care "q". Curves representing total cost, total variable cost and total fixed cost are shown in Figure 1.

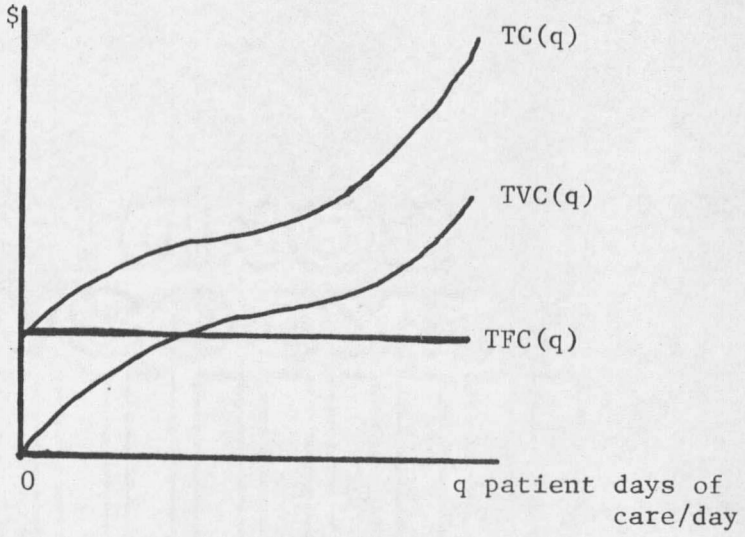

Figure 1. Total Cost Curves

Average Cost

Average cost can be broken down into two components, average variable cost and average fixed cost. Average variable cost is defined as total variable cost divided by the number of patient days of care "q".

$$AVC(q) = \frac{TVC(q)}{q}$$