Does a Small Minority of Elderly Account for a Majority of Health Care Expenditures?: A Sixteen-year Perspective

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IT HAS BECOME COMMON WISDOM IN BOTH CANADA (Roos and Shapiro 1981) and the United States (Garfinkel, Riley, and Iannacchione 1988) that a small minority of the population account for a large majority of health care expenditures. This pattern has been found across all age groups, including the youngest (Starfield et al. 1979) and the oldest (Roos, Shapiro, and Roos 1984). These skewed usage patterns have been reported to be consistent through time (McCall and Wai 1983; Riley et al. 1986).

This "small group, high usage" phenomenon has led to suggestions that cost-containment strategies targeting high users could have a strong impact on system-wide costs (Zook and Moore 1980; McCall and Wai 1983; Roos and Shapiro 1981). The percentage of individuals incurring high costs in a single year has been seen to be "an adequate estimate of the burden of high costs" (Garfinkel, Riley, and Iannacchione 1988). The studies on which these conclusions are based were, however, focused on usage over a relatively short period of time; a longer perspective enabling us to sort out high usage at one point in time from cumulative usage over long periods of time would clarify the high-cost issue.

Our research in Manitoba, Canada, tracks usage of hospitals and nursing homes by a representative sample of elderly persons over a 16-

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year period beginning in 1970. These two sectors dominate health care expenditures for elderly people. Thus, Birnbaum (1978) has shown the importance of including nursing home data in any definition of high-cost users, and a recent study (for which nursing home data were unavailable) found that 97 percent of "high-cost users" had at least one hospital stay (Garfinkel, Riley, and Iannacchione 1988).

This article addresses the following issues:

1. When viewed from different time perspectives, to what extent does a small minority of elderly account for a large majority of expenditures on hospitals and nursing homes?
2. To what extent do individuals who are high users at one point in time remain high users over subsequent time periods?
3. What is the risk of any elderly person becoming a high user?
4. What are the usage patterns of individuals with different expenditure levels over a 16-year period?

Methods

Data for these analyses were drawn from the Manitoba Longitudinal Study on Aging (MLSA) (Mossey et al. 1981; Roos and Shapiro 1981). A randomly selected, province-wide sample of approximately 4,803 elderly Manitobans was drawn (Manitoba Department of Health and Social Development 1973) and claims histories documenting these individuals' health care utilization over a 16-year period (1970–1985) were developed. The claims are filed routinely by hospitals with the government agency responsible for administering the universally insured provincial program. The administrative data have been described elsewhere (Roos et al. 1982; Roos, Sharp, and Wajda 1989); all tests to date suggest the data base provides a reasonably accurate, reliable, and valid representation of hospital utilization. No deductible or copayment is associated with hospitalization; Manitoba residents are reimbursed for hospitalizations which occur outside the province. In Manitoba and elsewhere in Canada, the distinction between acute and chronic care is unclear even in hospitals which deliver predominantly acute care. (Geriatric and rehabilitation units are generally located in acute hospitals.) Since this study was designed to estimate individuals' total usage of hospitals over the 16-year period, data based on all hospitalizations, whether they took place in an acute or chronic institu-

tion are reported. (Usage of chronic mental hospitals was not included.)

Since July 1973, when nursing home services in Manitoba were universally insured, claims have also been filed routinely by nursing homes. Persons in nursing homes on July 1, 1973, were covered automatically and enrolled in the program as of that date. Information on nursing home residence prior to July 1973 was obtained as follows. The MLSA included a representative sample of nursing home residents in 1971. Residents who were interviewed ($N = 569$) were asked how long they had been in that accommodation, and this information was used to determine duration of nursing home residence prior to 1971. If an individual was not interviewed in a nursing home but was a resident in a nursing home at the time the provincial insurance program went into effect ($N = 99$), he/she was assumed to have entered on a day halfway between the interview and July 1973. (Nursing home usage by this cohort is probably slightly underestimated. Between the interview and beginning of the provincial insurance program, 281 individuals who were community residents at the time of interview died. No information on their possible use of nursing homes between 1971 and death was available.)

Manitoba nursing homes are not used for short-term convalescence or long-term rehabilitation. Ninety-five percent of residents once admitted to Manitoba nursing homes remain there until death (Shapiro and Webster 1984). All residents in nursing homes at the time the universal insurance program was implemented were automatically covered as of that date. After July 1, 1973, individuals could enter only if: (1) assessed as requiring such care by their personal physician and by a nurse or social worker (or both); and (2) this assessment was upheld by a panel consisting of a geriatrician, a senior provincial nurse, and a senior provincial social worker. All levels of long-term institutional care, from relatively light to heavy care are included in this coverage. Although by far the largest proportion of nursing home residents would be classified as requiring skilled nursing facilities or intermediate care in the United States, some elderly admissions to the lightest care level might be accommodated in the United State in residential care.

The MLSA sample was selected as follows: 10 percent of nursing home residents in urban areas and 20 percent of those in rural areas, 2.5 percent of the elderly living outside nursing homes in urban areas, and 5 percent of non-nursing home residents in the rest of the prov-

ince. All analyses have been reweighted by the sampling proportions within strata to reflect population usage figures. Where appropriate, differences in usage were tested using analysis of variance with appropriate control for the factors used to stratify the sample.

Comparisons with population data suggest that the sample accurately reflects several characteristics (age, sex, and marital status) of Manitoba's elderly population. The sample somewhat underrepresented the more educated elderly (33 percent of the sample as compared with 40 percent of the province's elderly reported nine or more years of education) and underestimated the rate of hospitalization by approximately 15 percent.

Because elderly in acute care hospitals were not interviewed, and because reasons related to ill health (death, too ill to interview, moved to a facility although part of the general population sample) contributed to the need for the replacement sample, it was expected that the rate of hospitalization of those interviewed underestimated that of the elderly population. In 1971 and 1972, the Manitoba elderly averaged 7.7 days in acute and chronic institutions while the sample averaged 6.7 days in the year after the interview. During the year before the interview, the sample's utilization was somewhat lower (Roos and Shapiro 1981). This bias, even in a study using proxy interviews, multiple callbacks, and an all-inclusive sampling design, suggests the difficulty of accurately identifying a "representative" elderly sample.

Manitoba hospitals and nursing homes (as elsewhere in Canada) are funded on the basis of global budgets (Detsky, Stacey, and Bombardier 1983; Evans et al. 1989). To identify high-cost users, an estimate of mean costs per day in hospital ($322) and nursing home ($49) was calculated by dividing total Manitoba Health Services Commission payments (including capital repayment) in fiscal 1984 to hospitals and to nursing homes by the number of days of care produced that year by these institutions. Although per diem costs in both the hospital and nursing home sectors escalated markedly over this period, constant dollar costs were used so as not to confound effects of inflation and changes in intensity of services with usage patterns per se. High users in any given year were defined as those with usage at or above the 95th percentile level of use by individuals in 1972. That is, individuals who spent 37 days or more in hospital, 151 days or more in a nursing home, or whose combined expenditures on hospital and nursing homes were $17,885 in a calendar year, were identified as having had a year of

very high usage. Since the mean length of stay in Manitoba changed very little over the period 1975 through 1983 (Roos 1989), a constant definition of high hospital usage is appropriate. To carry out a similar study using United States data, given the reduction in length of stay following implementation of the prospective payment system in 1983, might require a changing definition of high hospital usage over time.

Use of hospitals and nursing homes for the year of death was calculated as follows. The total usage in the calendar year of death was added to the proportionate amount of usage in the previous year necessary to reflect a total of twelve months of usage prior to death. For example, if an individual died in the tenth month, two additional months of usage for this individual were estimated as 2/12 of this individual's usage in the previous calendar year and added to his usage in the calendar year of death.

Data for estimates of one year's utilization patterns are taken from 1972, a year reasonably representative of the population's usage patterns. The 16-year usage figures span the years 1970 through 1985.

Individuals ($N = 594$) were excluded if their identification was uncertain or if they were not covered in the provincial insurance system over the entire period (1970–1985) or from 1970 until death. The analysis was made from 4,209 individuals. Details on loss to follow-up are provided elsewhere (Roos, Nicol, and Cageorge 1987).

Results

Table 1 records the concentration of usage of hospital days, nursing home days, and the combined cost of hospital and nursing home care in the Manitoba elderly population over one year (1972). Thus, 5 percent of the elderly consumed 68.0 percent of the hospital days, spending on average 99.0 days in hospital that year. Nursing home usage was even more concentrated, with only 5 percent of the population accounting for 98.8 percent of nursing home days. When the combined cost of hospital and nursing home utilization is estimated, 5 percent of the elderly accounted for 65.0 percent of health care expenditures (mean expenditure $31,033). (This distribution of usage was quite representative over time. In another one-year period (1974), 5 percent of the elderly consumed 70.8 percent of the hospital days, 89.5 of the nursing home days, and 70.5 percent of all health care expenditures.)

TABLE 1
Profile of Population Usage Patterns over One Year (1972) for Manitoba Elderly ($N = 4,209$)

	Percentage of days in hospital, days in nursing home, and combined cost of both attributable to different percentiles of the population					
	Hospital		Nursing home		Combined cost of hospital and nursing home	
Percentile*	% Use	Mean days	% Use	Mean days	% Cost	Mean cost in $
1–49	0 %	0	0 %	0	0 %	0
50–74	0	0	0	0	0.5	$695.7
75–89	14.5	8.3	0	0	20.9	4,487.3
90–94	17.5	26.1	1.3	60.8	13.6	13,235.2
95+	68.0	99.0	98.8	269.0	65.0	31,033.2

* Population percentiles are specified in ascending order. For example, the 4th row indicates the percentage of hospital days (17.5) incurred by the 5 percent of the population between the 90th and 94th percentile of the distribution of hospital days used by individuals in the sample. This group spent an average of 26.1 days in hospital. Similarly, 1.3 percent of the nursing home days were incurred by the 5 percent of the population between the 90th and 94th percentile of the distribution of nursing home days. The distribution of hospital days, nursing home days, and combined costs are derived independently and, therefore, comparisons across rows have no meaning.

Concentration of Health Care Usage over Time

Following the hospital and nursing home usage of this cohort of 4,209 individuals through time dilutes the concentration of health care usage and expenditures in a small minority of the elderly. Thus, while over one year (1972), 5 percent of the elderly used 68.0 percent of hospital days, over 16 years, the top 5 percent of users accounted for only 33.3 percent of all hospital days consumed (table 2). Similarly, while in 1972 5 percent of the elderly used almost all of the days spent in nursing home (98.8 percent), over 16 years, concentration of usage also dropped by about one-half: 5 percent accounted for 46.3 percent of nursing home days consumed. The same pattern is seen when the combined cost estimate of days in hospital and nursing home is followed through time. (At points between one and 16 years, intermediate levels of concentration were observed. For example, over five years, 5 percent of the population accounted for 46.7 percent of hospital days consumed, and at 10 years, 39.4 percent.)

TABLE 2
Profile of Population Usage Patterns over One- and Sixteen-year Periods

Percentile of elderly persons	Population's usage calculated for*: One Year	Sixteen Years
	% of total days used	
Hospital usage		
1–49th percentile	0.0%	8.0%
50–89	14.5	43.2
90–94	17.5	15.6
95th + higher	68.0	33.3
Nursing home usage		
1–49th percentile	0.0	0.0
50–89	0.0	29.2
90–94	1.2	24.5
95th + higher	98.8	46.3
	% of total cost	
Estimated combined cost		
1–49th percentile	0.0	7.5
50–89	21.4	48.4
90–94	13.6	16.4
95th + higher	65.0	27.7

* The entire sample is used for calculating percentages at each interval: $N = 4,209$.

The dilution of usage patterns over long periods of time might be caused by deaths in an early time period; high users in early years who die may eventually be counted as low users (relative to the rest of users). If one examines not total usage over the 16-year period but mean annual expenditures on hospitals and nursing homes per year alive, however, an almost identical dilution of usage occurs. The top 5 percent of the population accounts for 27.1 percent of the expenditures on hospitals and nursing homes.

Repetition of High Usage

These data suggest the need to examine closely the question: Do individuals who make heavy demands on the system at one point in time continue to be heavy users over longer periods? Could interventions di-

rected toward high users have a "strong impact on overall medical costs"?

Table 3 presents data on the high hospital user group in four separate years (1972, 1973, etc.); this table illustrates the proportion of each group which had been high users of hospitals at least one year in each of three prior periods (one year before, two years before, and four years before). From 20 to 24 percent of the high users each year repeated usage patterns from the previous year. Going back farther increased the pool of repeat high users somewhat, but still less than one-half of the high users in 1974 and 1975 (31.4 and 35.5 percent respectively) had been high users in one of the four prior years.

Table 4 prospectively follows one cohort of high users (those among the top 5 percent of hospital users in 1972) and nonhigh users (all other individuals in the sample alive in 1972) through time. The first two lines of table 4 show the high mortality rate among high users. Only 73.5 percent of this group was alive at the beginning of 1973, and only 57.7 percent at the beginning of 1974. In contrast, 92.2 percent of the 1972 nonhigh users were alive at the beginning of 1974. Among those surviving until December 1973, fully 27.9 percent followed their high usage in 1972 with another year of high usage in 1973. Thus, they are 9.3 times as likely to be high users the following year than were those who were not high users in 1972. Those 1972 high users surviving through 1974 had a much reduced risk of being in

TABLE 3
Proportion of High Hospital Users in a Given Year Who Were High Hospital Users in Previous Years

	Proportion Who Were		
	High users in prior year	High users in one of two prior years	High users in at least one of four prior years
1972 high users*	20.3%	24.4%	--
1973 high users	25.9	32.3	--
1974 high users	22.8	26.6	31.4
1975 high users	24.0	30.1	35.5

* Numbers of high users each year from the sample were as follows: 1972 - 272, 1973 - 221, 1974 - 220, 1975 - 228.

the high-user group (11.3 percent), although still somewhat higher than those who had not been high users in 1972 (3.9 percent).

Regardless of prior usage, impending mortality greatly increases the probability of an individual being a high hospital user. However, 46.0 percent of the 1972 high users dying in 1973 were high users, compared with 26.7 percent of the 1972 nonhigh users dying in 1973 (table 4). The last three rows of table 4 present data on the numbers of 1972 high user and nonhigh users who contributed to high usage groups in subsequent years. For example, of the 5,095 high users in 1972, 1,190 of them had another high-usage year in 1973, 490 had a high-usage year in 1974, and 605 had another high-usage year over the

TABLE 4
Comparison of Subsequent Usage Patterns of 1972 High Hospital Users with 1972 Nonhigh Hospital Users

	1973	1974	1975–1977
% Cohort alive at end of year			
1972 high users	73.5%	57.7%	31.9%
1972 nonhigh users	96.4	92.2	76.5
% Survivors with high usage			
1972 high users	27.9	11.3	19.4
1972 nonhigh users	3.0	3.9	9.6
% Decedents in each year with high usage			
1972 high users	46.0	34.1	39.5
1972 nonhigh users	26.7	23.4	38.2
Population estimates of the number of 1972 cohort with high hospital costs in each subsequent year(s)			
1972 high users (N = 5,095)	1,190	490	605
1972 non-high users (N = 89,045)	3,410	4,030	11,095
Percent 1972 high users in high-usage group	25.9%	10.8%	5.2%

* All groups and percentages presented here are weighted to reflect relative usage by the two groups in the population. All calculations are based on the sample of 272 1972 high users and 3,937 nonhigh users. The cell size for each calculation was 100 or more except for the following: 73 of the 1972 high-user cohort were alive at the end of 1977, there were 41 decedents from the high-user cohort in 1973, 30 in 1974 and 52 in 1975–1977. The final two rows used the appropriate population weights to estimate the relative usage by the two groups in the total population over the various time periods. The estimated total size of the elderly population (after exclusions for coverage) was 94,140.

three-year period of 1975 to 1977. Similarly, 3,410 of the 89,045 individuals who were not high users in 1972 were high users in 1973. Thus, the 1972 high users made a significant contribution to the high-user group in 1973 (25.9 percent). By 1974, however, they contributed only 10.8 percent to the high-user group and over the next three years, only 5.2 percent.

High hospital users are also at higher risk of entering a nursing home: 21.3 percent of the 1972 high users entered a nursing home between 1972 and 1977, compared with 8.3 percent of the other elderly. Table 5 shows the mean combined hospital and nursing home expenditures incurred by 1972 high users and 1972 nonhigh users in 1973, 1974, and 1975–1977 by age and sex. Clearly, much higher costs were incurred by 1972 high users in 1973. For calculating 1973 mean expenditures, the entire 1972 group was used as the denominator. This seemed appropriate for purposes of estimating short-term future costs of 1972 high users since predicting who will die over the next twelve months is impossible. When only individuals alive at the beginning of 1973 were used, male high users aged 75 to 84 and those aged 85 and older both had significantly higher use in 1973 than did their nonhigh user counterparts [$p = .02$ and .01 respectively]. Only individuals alive at the beginning of 1974 and 1975 were used for calculating the 1974 and 1975–77 mean expenditures respectively. The only exception was produced by a high mortality rate among the very elderly males. (Although not presented in table 5, mean expenditures in 1973 among the 10 males surviving in that group was $19,305.) High users aged 65 to 74 incur approximately seven times the expenditures on hospitals and nursing homes of nonhigh users in the first year after a high use year. The differences over time in combined expenditures are not, however, as dramatic as was seen in the prior two tables; in the older groups, the differences are even less. Tables 3 and 4 focused on hospital usage and suggest that the risk of repeat high usage was reduced sharply after the first year. Table 5 suggests the combined elevated risk of high expenditures on hospitals and nursing homes does not drop so sharply over time. Also, although the relative risk of elevated expenditures is higher in the younger age groups, the absolute difference in dollars expended between high and low users in the older age groups are large (for example, $17,605 versus $4,933 among females aged 75 to 84 in 1974).

TABLE 5
Mean Expenditures and Ratio of Expenditures on Hospital and Nursing Homes by 1972 High Users and Nonhigh Users over the Period 1973–1977

Age and sex by 1972 usage pattern	Mean expenditures in $ on hospitals and nursing homes@ 1973–1977			Ratio of expenditures high/nonhigh		
	1973	1974	1975–1977	1973	1974	1975–1977
65–74 years						
Male high users	$14,800**	$ 6,579**	$23,659*	7.8	2.9	3.0
Male nonhigh users	1,898	2,232	7,773			
Female high users	12,355**	11,540**	30,637**	7.1	5.3	3.7
Female nonhigh users	1,735	2,192	8,271			
75–84 years						
Male high users	10,738	6,285	28,907	3.4	1.4	1.9
Male nonhigh users	3,169	4,400	14,950			
Female high users	14,885**	17,605**	46,155**	3.9	3.6	2.3
Female nonhigh users	3,854	4,933	19,675			
85 years and older						
Male high users	6,370	--	--	1.0	--	--
Male nonhigh users	6,504	7,453	30,779			
Female high users	24,249**	34,738**	51,223	3.1	3.7	1.4
Female nonhigh users	7,847	9,271	35,499			

@ The mean expenditure figures are based on data weighted to reflect population usage. The actual numbers available for calculating 1973 means were as follows: age 65–74 males high vs. nonhigh 53, 1017; females 39, 1043; 75–84 males 48, 625; females 65, 766; age 85 years and older males 29, 199; females 38, 287. Only individuals alive in January 1974 were used for calculating 1974 means as follows: 34, 960; 28, 994; 24, 522; 43, 675; 8, 117; 18, 209. Individuals alive in January 1975 were used for calculating 1975 means as follows: 28, 922; 27, 967; 17, 473; 35, 626; 5, 96; 13, 167.

Statistical significance was tested comparing high users and nonhigh users within each sex and age group using analysis of variance.
* $p < .05$
** $p < .001$

The Risk of Becoming a High User and Cumulative High Usage

What is the probability of any individual becoming a high user, that is, of spending as much time in a hospital, nursing home, or of accumulating as high expenditures as the top 5 percent of the elderly popu-

lation in any given year? Almost one-half of the elderly (43.5 percent) will, during some calendar year, spend 37 days or more in a hospital, qualifying themselves that year as one of the high users (table 6). Even this figure is biased downwards since focusing on a calendar year underestimates the probability of individuals becoming high users. One 37-day episode from mid-December to mid-January or two 20-day admissions occurring in November and March would not be counted as a year of high usage. Moreover, since 28.7 percent of the elderly cohort was still alive at the end of the 16 years, the lifetime risk of high usage will be considerably higher.

The bottom half of table 6 presents the 16-year cumulative usage patterns of the elderly sample. While some individuals in every age group spent little or no time in a hospital over the entire 16-year period, 6.3 percent of the elderly accumulated a total of one year or more in hospital (Consistent with table 2, the 6.3 percent use 28.7 percent of the total hospital days consumed by the group.); 10.1 percent spent

TABLE 6
Percentage of Elderly Having at Least One Year of High Hospital Usage and Cumulative Hospital Usage over 16-year Period

		Age in 1971		
	All	65–74	75–84	85+
Number	4,209	2,152	1,504	548
16-year risk of becoming a high hospital user (1 or more years of 37+ days)	43.5%	40.6%	48.3%	43.7%
Total days spent in hospital over 16-year period				
0	10.6	11.1	8.8	15.1
1–14	14.3	14.8	13.7	13.2
15–60	31.2	31.6	30.7	29.8
61–179	27.5	28.0	27.3	24.2
180–365	10.1	8.8	12.6	9.8
366 or more	6.3	5.7	6.9	8.0
Percentage alive at end of period	28.7%	40.8%	14.8%	2.4%

180 days to 365 days. Over a 16-year period, few of the usual differences across age groups in hospital usage patterns are found. While, during 1972, Manitoba's very elderly (those aged 85 years and older) spent 3.1 times as many days in hospital as those aged 65 to 74 (16.8 days versus 5.5 days), this pattern disappears when viewed from a longer time perspective. As expected, many more of those aged 85 years died over the 16-year period, allowing fewer years for potential hospitalizations than among younger age groups.

In 1970, at the start of this study, 3.7 percent of the Manitoba elderly resided in nursing homes (table 7). By 1985, fully 27.2 percent

TABLE 7
Percentage of Elderly Entering Nursing Home and Cumulative Usage over 16-year Period

		Age in 1971		
	All	65–74	75–84	85+
Number	4,209	2,152	1,574	548
16-year risk of entering nursing home (%)				
Resident of nursing home 1970	3.7%	0.8%	4.6%	20.6%
Entered nursing home 1971–1985	23.5	16.6	33.6	28.4
Total	27.2	17.4	38.2	49.0
Total time in nursing home over 16-year period				
Never entered	72.8	82.6	61.8	51.0
1–150 days	3.0	2.1	4.4	2.8
151–365 days	3.0	2.5	3.9	2.6
2 years	4.2	2.4	6.0	9.4
3 years	4.2	3.0	5.1	8.1
4 or more years	12.8	7.4	18.8	26.1
Percentage alive at end of period (1985) by nursing home status				
Resident	5.0	5.5	5.1	1.9
Nonresident	23.7	35.3	9.7	0.5

of the sample had entered a nursing home for some period of time; this included almost one-half of those aged 85 years and over (49.0 percent). The great majority of those entering a nursing home remained for 151 days or longer, thus becoming high users.

Most elderly individuals entering nursing homes remain for several years (bottom half of table 7). During the 16 years, 18.8 percent of the 75 to 84 year olds and 26.1 percent of those aged 85 years and older spent four or more years in a nursing home. Thus, whether viewed cross-sectionally (the percentage in a nursing home in 1970) or longitudinally, the use of a nursing home is heavily age dependent with the very elderly always at highest risk. Five percent of the elderly sample was alive and resident in a nursing home at the end of the study period.

Table 8 estimates the probability of any elderly individual becoming a high-cost user (incurring $17,885 of hospital and/or nursing home care over at least a one-year period) during the years of 1970 to 1985.

TABLE 8
Percentage of Elderly Having at Least One Year of Very High Expenditures on Hospitals and Nursing Homes and Cumulative Expenditures on Hospitals and Nursing Homes over 16-year Period

		Age in 1971		
	All	65–74	75–84	85+
Number	4,209	2,152	1,504	548
Proportion having at least one year high usage* over 16-year period	42.7%	34.2%	51.9%	63.4%
Total expenditures on hospital/ nursing home over 16-year period				
$0	8.4	10.3	5.7	6.0
$1–$7,499	18.6	20.9	16.8	9.5
$7,500–$24,999	25.1	28.2	20.9	20.1
$25,000–$69,999	23.6	22.6	24.0	28.5
$70,000–$149,999	14.9	10.9	20.2	20.3
$150,000 or more	9.6	7.0	12.5	15.6

* High usage is defined as having one calendar year's expenditures on hospitals and/or nursing home of $17,885 or more.

Since the estimates of nursing home and hospital per diems are in constant dollars, the analyses represent the probability of experiencing a year of unusually high usage (the 95th percentile) independent of inflationary effects; 42.7 percent of the elderly experienced one such year of usage, ranging from 34.2 percent in the youngest group to 63.4 percent of the oldest. The 16-year cumulative expenditure patterns are described in the bottom half of table 8. A sizeable proportion of elderly incurred large expenditures on hospital and nursing home care, with 23.6 percent in the $25,000 to $69,999 range, 14.9 percent in the $70,000 to $149,999 range, and 9.6 percent with expenditures of $150,000 or more. (This latter figure represents 8.4 years in a nursing home, 1.3 years in a hospital, or some combination of the two types of usage.)

Characteristics by Levels of Expenditures

In table 9, individuals are divided into four groups, based on their expenditures over the 16-year period. The older the individual in 1971, the more likely he/she was to have accumulated expenditures of $70,000 or more by 1985 (table 9). Females were both more likely to incur very high expenditures and very low expenditures than were males. While there was little difference in mean years alive across the four expenditure groups, fully 51.9 percent of those in the lowest expenditure group were still alive at the end of the 16-year period, compared with 22 percent of those in the two higher expenditure categories. Closer examination of the lower expenditure category showed it to be comprised of two groups of individuals, both individuals more likely to be alive at the end of the 16-year period and individuals (a different set!) more likely to have died early in the period.

The overall level of expenditures was strongly related to the amount (both absolute and relative) spent on nursing homes: those with under $7,000 total expenses over the 16-year period spent on average $26 on nursing homes, compared to $2,243 on hospitals. In the highest expenditure group, however, an almost equal amount was spent on nursing homes ($63,072) as on hospitals ($90,674). One-third of the highest expenditure group's long hospital stays (90 days or longer) occurred on the occasion of transfer to a nursing home; some part of those long stays was probably associated with waiting for nursing home placement.

TABLE 9
Characteristics of Elderly Individuals in Four Quartiles of Cumulative Usage over a Sixteen-year Period, 1970–1985

	Sixteen-year expenditures on hospitals and nursing homes*			
	$6,999 or less	$7,000–$22,999	$23,000–$69,999	$70,000 or more
Age in 1971 (%)				
65–74	67.5%	64.2%	55.8%	41.9%
75–84	27.4	29.8	33.7	45.7
85 years and over	5.1	6.0	10.5	12.4
Sex: Female (%)	53.6	43.3	45.6	61.8
Survival Patterns				
Mean years alive, 1970–1985	11.9	11.1	10.4	11.8
Alive at end of period (%)	51.9%	34.3%	21.9%	22.2%
Expenditure patterns over 16 years				
Mean expenditures on:				
Hospitals ($)	$2,243	$13,563	$32,667	$90,674
Nursing homes ($)	26	520	8,460	63,072
Ratio H/N	86.3	26.1	3.9	1.4
Mean expenditure per year (before death year) ($)	$ 158	$ 1,123	$ 3,717	$12,437
Mean expenditure in year of death ($)	$1,343	$ 8,414	$21,186	$39,054

* Number of individuals in sample by quartile low to high (unweighted): 883, 926, 1097, 1303. Although the highest quartile represents 25 percent of the population, it included a larger proportion of the individuals in the sample because residents of nursing homes were twice as likely to be interviewed as nonresidents. Because expenditures in year of death were calculated as described in methods, the sum of mean expenditures on hospitals and nursing homes will be somewhat less than the combined mean expenditures per years alive plus mean expenditures in year of death.

Thus, hospital usage by the highest expenditure group is likely to be considerably overstated.

The last two rows of table 9 help to answer the question: "Do high costs in the year before death drive the expenditure patterns?" The answer would appear to be "not entirely." In every group, the highest mean costs were in the year of death. Individuals in the low expenditure group, however, had both relatively low costs in the year of death

($1,343 compared with $39,054 in the higher expenditure group) an very low costs in the prior years ($158 versus $12,437).

Discussion

The utilization data used here have several important characteristics:

1. They are population-based and include large numbers of the very elderly, a group of special interest for whom information is rarely available (Suzman and Riley 1985);
2. They represent high quality administrative data free of biases resulting from basing estimates on recall, proxies, etc. (Cohen and Burt 1985);
3. They are from a system in which hospital and medical care were insured over the whole period—nursing home stays since 1973, and home care since 1975 without deductibles or copayments. We have not included expenditures on home care in this analysis because of its relatively minor contribution to health care expenditures. In 1985, the last year covered by this analysis, total expenditures on home care in Manitoba were $32.7 million, compared with $672.4 million on the hospital sector and $155.8 on nursing homes. (A per diem charge to nursing home residents is levied as a contribution to room and board; this charge is maintained at a level at which the lowest income pensioners can pay and still have some disposable income for personal expenditures.)

Manitoba's health care delivery and bed supplies are generally similar to those of the United States. Because of their northern climate and rural character, North Dakota and Montana were the two states chosen for comparisons with Manitoba in a recent analysis of Canadian and United States hospitalization usage patterns (Newhouse, Anderson, and Roos 1988). Hospital expenditure patterns are higher in the United States than in Canada. In part, this reflects the American emphasis on intensive high-technology services (Evans et al. 1989). Despite this, Manitoba's elderly spend more days in a hospital per capita than United States elderly (Newhouse, Anderson, and Roos 1988). These two factors should be kept in mind when attempting to generalize from the Manitoba results.

Manitoba has a well-organized long-term care delivery program (Kane and Kane 1985). In many key aspects, however, the Manitoba health care system is similar to that of the United States. Physicians are paid on a fee-for-service basis and they move freely between hospital and community practice. Supplies of hospital beds (6.1 per 1,000 population) and nursing home beds (65.2 per 1,000 elderly aged 65 and older) are somewhat greater in Manitoba. This comparison uses an average bed figure for the United States, however, and many states have markedly higher or lower bed ratios than Manitoba. Somers (1985) reports that in 1980 nursing home beds ranged from 36 per 1,000 elderly in the South Atlantic region to 78 per 1,000 in the West North Central region, with a 55.5 United States national average figure.

The relevance of hospital and nursing home usage patterns of an elderly cohort identified in 1971 might be questioned. Preliminary comparisons of four-year usage patterns of a 1975 cohort with those of a 1983 cohort suggested, however, that in Manitoba utilization has changed relatively little over the period (Roos 1989). If anything, nursing home usage by the very elderly increased somewhat between 1975 and 1983.

Three precepts guide current health care planning for the elderly:

1. A small minority of elderly account for the majority of health care expenditures;
2. Expenditures during the last year of life drive health care expenditure patterns;
3. Last year's hospital usage is the best predictor of next year's usage.

Most of the studies which have led to the adoption of these precepts (including those based on the Manitoba data) were cross-sectional or used very few years of data. An examination of 16-year usage patterns suggests the need to modify these precepts.

Over a one-year period, the Manitoba data show what everybody else has reported; a small minority of elderly use the vast majority of health care resources (5 percent incur 65 percent of expenditures). Over a long period this usage pattern changes. There are still many very low users (49 percent of the population account for only 7.5 percent of expenditures) and a small group of very high users (5 percent of the population account for 27.7 percent of expenditures). Over the 16-year period,

however, 45 percent of the population incur 65 percent of the usage and this represents a considerable leveling of expenditures. Viewed somewhat differently, over a one-year period only 1 in 20 elderly is at risk of being a high hospital user. Over a 16-year period, an individual's risk of at least one year of high usage rises substantially to 1 in 2.3.

Expenditures in the year of death are substantially higher than mean expenditures in prior years. This is true for individuals in every quartile of the expenditure groupings. Expenditures in the year of death do not fully explain, however, the big differences in individuals' cumulative expenditure patterns over long periods of time. Ratios of costs in the year of death, compared to costs in prior years, range from 3 to 8 depending on the quartile. In the year of death those individuals in the highest quartile cost the health care system 29 times as much as those in the lowest quartile ($39,054/$1,343), and 79 times as much in each year they were alive ($12,437/$158).

In any given year, 20 to 25 percent of the high hospital users will be repeat high users from the previous year. The predictive power of a given year's usage, however, fades over time. After one or two years, high hospital users appear to die, enter a nursing home, or recover.

This research offers the following modified precepts based on 16 years of data to guide health care planners:

1. One-half the elderly make minimal demands on the system, while 45 percent incur large expenditures and 5 percent very large expenditures;
2. Expenditures in the year of death are three to eight times those of expenditures in other years. Levels of expenditures in the year of death, however, parallel levels in other years; on average, individuals with low expenditures have relatively inexpensive deaths and vice versa;
3. Year one hospital usage is the best predictor of year two hospital usage, but a less good predictor of year three usage, and of little help in subsequent years.

How do these modified precepts affect such often recommended policies as targeting the high hospital use by the elderly patient? They reinforce the importance of this approach and suggest a time frame for continued monitoring. Because future costs incurred by the high user group are so substantial (particularly when both future hospital and nursing home costs are considered), special interventions targeted at

high hospital users make very good sense. One simple policy would require that every elderly individual remaining a specified time in a hospital be assessed by a geriatric specialist. In Manitoba, a time period of 37 days would identify the top 5 percent of hospital users in a given year.

Preliminary findings from recent Manitoba research show that 62.9 percent of hospitalized persons who were scheduled for nursing home placement had no prior referral to a geriatrician although three of the four hospitals in the study employ salaried, full-time geriatricians. Almost all of these scheduled individuals had been in a hospital considerably longer than 37 days. Such a geriatrician-based team has been demonstrated to be effective (Rubinstein and Josephson 1989) and using a length-of-stay decision rule is a simple way to identify a small group of high-risk elderly. In Manitoba, with a population of one million people, this would mean between 5,000 and 6,000 geriatric consultations a year, if long stays at all hospitals were monitored.

High-risk individuals identified by the long-stay criteria might also be monitored following hospital discharge for approximately one year by some type of surveillance program—home care assessments, public health nurse, or whatever seemed appropriate. The Manitoba data suggest that it is over this one-year period that these individuals are at high risk of readmission to a hospital, of admission to a nursing home, and of death. A surveillance system designed to institute potentially preventive measures could be very cost effective. (Such a program might also increase costs and make a questionable contribution to quality of life if years of functionally dependent survival were added.)

The 16-year perspective highlights not only the high usage patterns of the high-risk elderly but the extraordinarily low usage patterns of many elderly individuals. Research currently underway in Manitoba will examine the predictors of successful aging, using 1971 interviews with these individuals.

Contrasting perspectives from cross-sectional and longitudinal data are seen in the relation between age and usage patterns. Thus, when viewed cross-sectionally, usage of nursing homes and hospitals appears strongly age related. The older elderly are much heavier utilizers than the younger elderly. This perspective contributes to the scenarios projecting crises for the health care system as the population ages over the next decades. When viewed from a 16-year perspective, however, the relation between age and pattern of hospital usage almost disap-

pears (table 6). A higher mortality rate in the oldest age groups leaves fewer years to accumulate additional hospitalization. When viewed longitudinally, however, usage of nursing homes continues to be highly skewed toward the very elderly. While the very elderly enter nursing homes and subsequently reduce their hospital usage (Shapiro, Tate, and Roos 1987), this does not appear to explain fully the findings. The policy implications are quite clear, however: increasing numbers of the older elderly will have a much greater impact on the nursing home sector than on the hospital sector.

Although usage of the hospital sector by the elderly appears somewhat more transitory and unpredictable than previously assumed, this is not true of the nursing home sector. Manitoba has a centrally administered, universally funded insurance system with nursing home entrance criteria based on need which cannot be met by home care services. Individuals entering this system remain for very long periods of time; 89 percent of our sample remained for 150 days or longer and 78 percent for more than one year. In the United States, it is estimated that three-quarters of elderly individuals aged 75 years and older who live alone would run the risk of spending down to impoverishment in the first year of nursing home care (Branch et al. 1988). Therefore, focusing on what places an individual at risk of nursing home entry and developing intervention strategies to help individuals stay at home longer is very appropriate. Given the major cost implications, attention to home care, sheltered housing, and other alternatives for keeping the elderly at home as long as possible could have an important impact.

Data on expenditure patterns of individuals with very high cumulative expenditures also highlight the importance of the nursing home sector. The higher the cumulative expenditures, the greater the elderly individual's usage of a nursing home, as opposed to hospital care (the ratio of expenditures on hospitals to nursing homes is 86.3 for individuals in the lowest quartile, compared to 1.4 in the highest quartile [table 9]). This suggests that, for the health care system to respond to the real needs of the elderly population, much more emphasis should be given to the long-term care sector. Enormous press coverage has been given to highly charged issues in the acute care sector, such as to what extent the elderly should have access to high-cost technology? In terms of the elderly individual's quality of life, however, attention should shift to the long-term care sector. Such care has long been a poor stepsister in the nation's social and health programs.

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