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A prognosis
for hospitals

The effects of population change on
the need for hospital space

1967-2031

L.A. Lefebvre, Z. Zsigmond, M.S. Devereaux

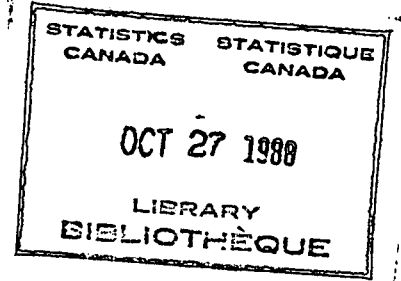**I✻** Statistics Canada   Statistique Canada

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The responsibility for the analysis and
interpretation of the data is that of the
authors and not of Statistics Canada

SYMBOLS

The following standard symbols are used in Statistics Canada publications:

.. figures not available.

... figures not appropriate or not applicable.

- nil or zero.

-- amount too small to be expressed.

p preliminary figures.

r revised figures.

x confidential to meet secrecy requirements of the Statistics Act.

PREFACE

A major concern in Canada today is the rising public expenditure on health care. Hospitals are the most costly sector in the health care delivery system, representing just under 50% of total health expenditures in 1975. In the mid-1970's, the respective capital (excluding land) and operating costs were $50,000 per bed and $125 per patient-day. Furthermore, with more than four million hospital admissions each year, at an average stay of almost 11 days, hospital services in 1975 amounted to $5.3 billion or 3.3% of G.N.P. It is important, therefore, to gain some appreciation of how these costs might change in the future.

In this study, projections are made of the demand for hospital space from the year 1976 to 2031. Statistics Canada fully recognizes that projections of any variable more than 50 years into the future are tenuous, no matter how reasonable the historical trends on which they are based. Although it is possible that unexpected developments in health care or new cures for disease may reduce the need for hospitalization, it will be seen that demand for hospitalization is in a large measure dependent upon the age structure of the population and the health status of the population reflected by that age distribution.

The extent of this demand for hospital resources depends primarily upon the number of people who are ill enough to require institutional care. While the number of times people are admitted to and their length of stay in, a hospital vary, it is a fact that the frequency of admission and the number of days patients spend in hospital increase with age. (In 1975, the 65 and over age group represented 8.6% of the population, but utilized almost 38% of total hospital bed capacity) Since population forecasts indicate that the proportion of people in the age group 65 and over will climb from 8.7% (1976) to about 20% by 2031, there is certain to be a significant increase in the demand for institutional care. Furthermore, if medical technology results in the discovery of several major cures in the next few decades, thus increasing life expectancy and lowering death rates, the elderly may represent an even larger proportion of the total population than present forecasts suggest.

In addition to the expected increase in the number of elderly people requiring hospital care, current life styles and environment factors may result in an increase in the occurrence of illness which specifically requires hospital care, both generally and with respect to the elderly. While the requirements for hospitalization have increased, the reasons for debilitation have changed. Improvements in living conditions, e.g., better housing and sanitation, and the development of antibiotics and immunization, have virtually eliminated infectious disease as a major health problem in Canada.

Yet, the economic growth that facilitated technological breakthroughs in both preventive medicine and primary care, has produced heightened levels of stress, and consequently, has threatened health. In our efforts to reach new levels of affluence and achieve more economic growth, we subject ourselves to the pressures of a highly urbanized society: we eat, drink and smoke too much, and we destroy and maim

with our automobiles. Even the eradication of a single cause of death may give rise to another, unless the general level of health improves. This observation may be complicated by iatrogenic disease, whereby the cure for one disease becomes the cause of another, a tragic example of which has been the deformed children born to women who took the drug thalidomide.

These phenomena, the expected geriatric boom and the inevitable increase in episodes of illness associated with aging, have profound effects on the future demand for hospital services and the concomitant costs.

The purpose of this study is to determine these demands and costs, insofar as this is feasible given our existing knowledge. This monograph also shares an objective stated in a recent publication of the Hudson Institute, Canada Has a Future: namely, to "create reasonable and useful images of the future, images which will be helpful in the planning process".

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MAJOR FINDINGS

Population

- Despite low fertility, the Canadian population is projected to grow from 23 million in 1976 to 31 million in 2031.

- The age composition is shifting rapidly because the postwar baby boom was followed by a steep decline in births, and because of increased life expectancy.

- Since the end of the Second World War, Canada's population has been "young". The 0-24 age group dominated, reaching a peak of almost 50% of the total during the last decade. But at the turn of the century it will constitute less than one-third, and by 2031, only 28%. Thus, the population is "aging".

Older People

- Between 1976 and 2031 the total population will increase 35%, while the 65+ component will triple from two million to six million.

- The 65+ age group, which comprised less than 7% of the population in the early forties, had risen to only 8.7% by 1976. By 2001 it could make up 12%, and in 2031 when the bulk of the baby boom has retired, 20% or every fifth person will be in the elderly component, if current low birth rates and fertility trends persist.

- At 1979's rate of growth tomorrow at this time there will be 178 more older people, and by 2021 the daily increase will be 365.

- In the future the 75+ age group will grow even faster than those 65+.

- Because female life expectancy is more than seven years longer than male, in 1976 women 65+ outnumbered men by 251,000. This figure is anticipated to more than double to 685,000 in 2001, and by 2031 will be in excess of one million.

Hospitalization

- In 1975 about 18 in every 100 persons were institutionalized in general and allied special hospitals (excluding mental and tuberculosis), hereinafter referred to as "hospitals". This rate is expected to fall somewhat in the next two decades, but rise again (around 10%) during the first 30 years of the next century.

- About one-third more females than males require institutional care, a ratio that may be weighted more heavily toward women in the future, because of the projected growth of the female population and their longer life expectancy.

- Hospitalization increases with age: children 5-14 are relatively infrequent patients, but at 75+ the need increases six- to sevenfold over the 5-14. Almost half of the 75+ men and more than one-third of the women are hospitalized each year.

- In 1975 males who were hospitalized stayed about 11 days, and females about 10 days. Average stays increased with age from one week for children to six weeks for the 75+ group. Up to 75, the length of time for males and females differed little. But over that age males averaged 27 days in contrast to 35 for their female contemporaries - a disparity of more than a week.

- Periods of hospitalization in acute care institutions were longer in the past, but with medical advances there has been a decline for almost every age group, a trend that is expected to continue but at a decreasing rate.

- Annual patient-days increased between 1967 and 1975 from 36.9 million to 43.1 million (one and a half times the rate of population growth).

Older People in Hospital

- Older people have always needed a large share of hospital space and time. In 1975 they made up only 8.6% of the population but accounted for 38% of all patient-days.

- From 1976 to 2031 the population of people 65+ is expected to more than triple, and their demand for patient-days is expected to rise accordingly.

- If 1975 participation rates persist, by the second decade of the next century it would require all of today's capacity to take care of older people alone.

How Long Will 1975 Capacity Last?

- Immediate expansion of hospital facilities may not be necessary if present capacity were more fully used. Utilization (patient-days related to capacity) dropped from 81.3% in 1971 to 76.8% in 1975. For reasons of economic conditions and the necessity to use existing capacity more fully, a return to the 80% level that prevailed throughout the sixties could forestall the opening of new beds for several years.

- Furthermore, if enough less-acute care facilities like nursing homes or non-institutional care were made available, present hospital capacity would likely be sufficient until the mid-1990s.

Projected Requirements

- Requirements for hospital care are expected to grow before the turn of the century beyond what present facilities can accommodate, and after 2000 the demand likely will accelerate.

- Planning will have to be initiated in the next decade to meet the anticipated increase in the demand for hospital space at the beginning of the next century as a result of a substantially larger proportion of the population in the older age groups.

- By 2031 total hospital patient-days are projected to rise to 84 million - not quite double the present 43 million. But those occupied by elderly people could more than triple from 16 million to 55 million, representing 38% and 65%, respectively, of all patient-days.

Cost

- Expenditures in constant (1976) dollars could rise from $5.4 billion to over $11 billion by 2031. This 109% increase is due to overall population growth, but most notably, to the increasing number of older people.

Option

- The current scarcity of secondary health facilities compels many patients, particularly elderly women, to stay in hospital for extended periods simply because they have nowhere else to go. This expenditure could be gradually reduced if patients whose condition does not dictate full hospital services were transferred to less sophisticated facilities or provided with home care.

Savings

- Establishment of less-acute level care implies a potential saving on hospital operating costs of $27 billion over the next 50 years.

- For instance, if from the early 1980s efforts to build nursing homes were intensified, perhaps 30% of projected patient-days could be spent in nursing homes rather than in hospital. A nursing home patient-day is about one-fifth as expensive as one in a hospital ($25 versus $125).

- Not only are nursing homes cheaper to operate, but they are also less expensive to construct. In the mid-seventies the capital cost per bed of a general hospital ranged from $40,000 to $80,000 (excluding land). Available data suggest that the 1975 average was well over $50,000. To build nursing homes, the capital investment per bed is about 60% of that for hospitals.

INTRODUCTION

Background

When I get older, losing my hair
Many years from now,
Will you still be sending me a Valentine,
Birthday greetings, bottle of wine?
If I'd been out till quarter to three,
Would you lock the door?
Will you still need me, will you still feed me,
When I'm sixty-four.(1)

These are questions that an ever-larger proportion of Canada's population will be asking in the next 50 years. The baby boom generation, who gave rise to a "youth revolution" in the sixties, may create a "geriatric revolution" after the turn of the century. Between now and then, they are going to pass through all the intermediate stages from young adulthood to late middle age. The size of this cohort accentuates the concerns, needs and problems of whatever age group they happen to occupy.

An unprecedented expansion of obstetric services was necessary from the late 1940s to the early 1960s to bring the baby boom into the world. Shortly thereafter, educational facilities had to grow to accommodate them. The baby boom is now leaving school, and their entry into the labour force is contributing to the highest levels of unemployment in forty years. Inevitably, this generation will reach retirement, and when they do, more and more will require hospitalization. Just as the educational enterprise had to increase in the middle of the twentieth century, so will health care facilities in the early decades of the twenty-first.

Chart 1 encapsulates the situation. In 1975 people 65 and older made up 8.6% of the population, but accounted for 38% of hospital occupancy. At the current rate of utilization, and as the age group grows, by 2022 every hospital bed now available to the total population would be filled by an elderly person. In 2031 they alone would take up 127% of the facilities currently occupied.

The emerging divergence between the supply and demand for hospital space prompted this study. Statistics for 1975 show that after age 65, people are twice as likely to be hospitalized, and their average length of stay rises from around two weeks to about a month.

The composition of the population will shift progressively toward the older extremity. A decline in fertility that began in 1960 has resulted in fewer young people to replace the baby boom generation. Because this is a demographic fact, it

(1) The Beatles. When I'm Sixty-Four. England: Northern Songs Ltd., 1967.

Chart — 1

Patient-days Required by Elderly, 1975 to 2031

Patient-days (millions)

Patient-days (millions)

127%

If 1975 hospital capacity and utilization were to remain unchanged till 2031, the percentages shown below indicate the portion of that capacity that would be required by the elderly alone.

99%

1975 patient-days

80%

71%

59%

45%

38%

75+ Males

75+ Females

65-74 Males

65-74 Females

1975 1981 1991 2001 2011 2021 2031
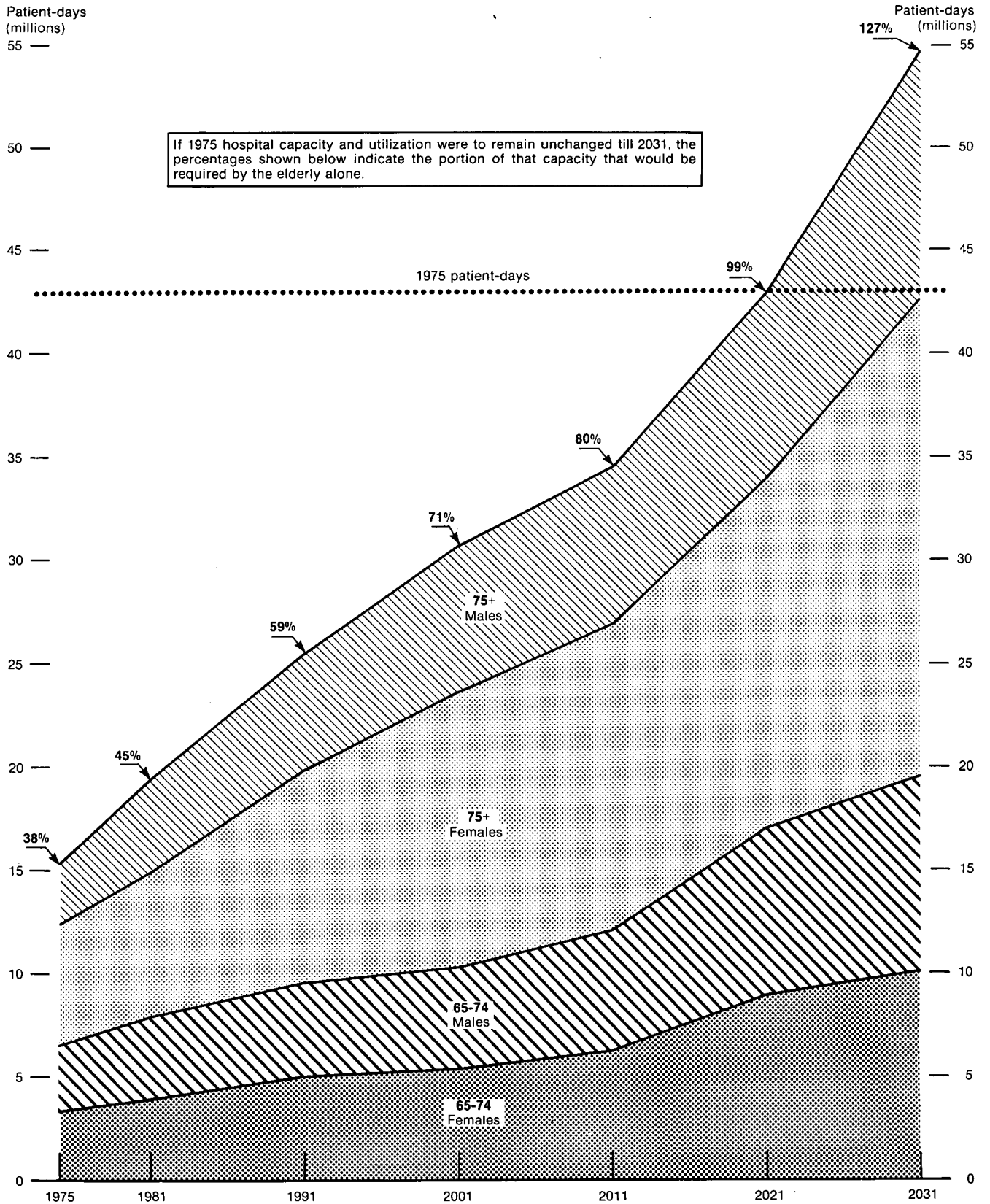
is possible to project some of its consequences, a squeeze on hospital resources being a prime example. An aging population creates a demand that grows in two ways: more people require admission to hospital, and they stay there longer.

Hospital services are expensive, amounting to an estimated 3.34% of the 1975 Gross National Product.(2) Furthermore, hospital costs are the single largest component of the total amount spent for health care - an estimated $125 per patient-day in 1976.(3) Recent efforts to restrain the rise of these costs have made it important to demonstrate how demographic developments will affect future needs.

Patient-day expenditures tend to be concentrated on older age groups. The problem is unavoidable when the baby boom generation reaches old age, more elderly people than ever before will require health services, and expenditures will rise. Notwithstanding the fact that we may live longer by 2020 and that we may die of different causes, the growing pressure on hospitals can be foreseen, and this lends itself to long-range planning.

Purpose and Scope

The report has two major purposes:

(1) To show how population could affect Canada's need for hospital services to 2031 if present trends (low fertility, increasing life expectancy) persist, and medical technology does not radically curb hospitalization. The intention is not to calculate exact numbers, but rather to suggest relative magnitudes. By assuming that authorities could adopt different means of handling the effects of changes in population distribution, four projections of hospital patient-days have been produced.

(2) To demonstrate in constant (1976) dollars the cost implications of these alternatives.

The topic - the effect of Canada's increasing elderly population on the need for hospital space - has been explored before by Health and Welfare Canada.(4) This report updates and extends the findings of those earlier studies.

The period examined extends from 1967 to 2031. Historical data up to 1975 were reviewed to establish patterns of supply and demand on which the projections were based. The projections cover more than 50 years - a long time considering the detail and specificity of some calculations.

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(2) Estimate from Health Economics and Statistics Division, Health and Welfare Canada.

(3) After this study was completed, actual data became available. The average cost per hospital day in 1976 was $124.30.

(4) J.A. Clark and N.E. Collishaw, Canada's Older Population, Staff Papers, Long Range Health Planning, Health and Welfare Canada, Ottawa, 1975, and Mary K. Rombout, Hospitals and the Elderly: Present and Future Trends, Staff Papers, Long Range Planning, Health and Welfare Canada, Ottawa, 1975.

Definitions and concepts

- Rates:

    - crude birth - birth rates per 1,000 population.

    - age-specific fertility - birth rate per 1,000 women in the respective age period.

    - total fertility - sum of female age-specific fertility rates multiplied by five.

    - general fertility - birth rate per 1,000 women 15-49.

    - crude death - death rates per 1,000 population.

- A hospital is an institution operated for the medical, surgical and/or obstetrical care of inpatients, and which is licensed or approved as a hospital by the federal and/or provincial government, or by a municipality duly authorized under the laws of the province. Specifically excluded are institutions primarily for tuberculosis or psychiatric disorders.

- Nursing homes are homes in which nursing care is the predominant function. Establishments that provide only living quarters and meals are excluded.

- Length of stay is the number of days a patient spends in hospital.

- A separation is the discharge or death of an inpatient. The frequency counts show individual cases separated, not persons separated.

- The participation rate expresses the number of separations as a rate per 100 population in each age group.

- A newborn is an infant inpatient born alive in the hospital or postnatal newborn admitted with mother for maternal care.

- Patient-days are the number of separations, including newborns, during a calendar year multiplied by their length of stay.

- Utilization is the ratio between theoretical hospital bed capacity and patient-days. All levels of utilization cited in this report exclude bassinets and newborns.

- The elderly and older people are used synonymously to refer to everyone 65 and older.

Limitations

One of the limitations of this report is that it uses only one population projection. Nevertheless, the people who will make the greatest claims on hospital services early in the next century - the aging baby boom generation - have already been born. Thus, to a significant extent, the magnitude of future demand is predetermined. A comparison with high and low growth population projections of the Economic

Council of Canada(5) and an earlier projection(6) that incorporated a very low fertility rate (1.5) reveals little difference in the numbers of elderly people in 2001 and 2031, although their proportion of the total varies (Table 1):

TABLE 1. Alternative Population Projections, Total and 65+ Age Group, Canada, 2001 and 2031

	2001			2031		
	Total popu- lation	65+	% 65+	Total popu- lation	65+	% 65+
	'000			'000		
Social Security - National Programs, 1978:	28,250.7	3,358.1	11.9	28,838.6	6,406.0	22.2
Economic Council of Canada:						
- low growth	28,346.0	3,390.3	12.0	30,757.6	6,501.0	21.1
- high growth	31,634.0	3,451.8	10.9	40,618.3	6,894.8	17.0
A Prognosis for Hospitals	28,793.0	3,425.0	11.9	30,935.0	6,240.1	20.2

A potential influence on the outcome of these projections which could not be incorporated in the assumptions, is medical advances. It is impossible to evaluate the impact of technological developments in the next five years, let alone fifty. A breakthrough tomorrow or several decades from now could reduce the need for hospitalization and/or the length of stay for particular illnesses. Notwithstanding this inevitable limitation, it has been judged important to carry out this study for reasons discussed in the Foreword.

Similarly, a shift in societal attitudes could reduce hospitalization of the elderly. If values revert so that the extended family rather than the nuclear family becomes the typical household unit, older people may be cared for, to a greater extent, by their family instead of public institutions. But again, while such a change in lifestyle is possible, it was not feasible to include it in the Projections.

(5) Jac-André Boulet and Gilles Grenier, Health Expenditures in Canada and the Impact of Demographic Changes on Future Government Health Insurance Program Expenditures, Economic Council of Canada Discussion Paper No. 123 (Ottawa, 1978), 40.
(6) Statistics Canada, Institutions and Public Finance Branch, Social Security - National Programs, 1978, Catalogue number 86-201 annual (Ottawa, 1978), 7-8.

Another limitation of this report is that calculations of future hospital demand incorporate only three variables: population, participation rate and length of stay. National averages of the last two from 1972 to 1975 are used, although they may be affected by unique conditions. Participation and length of stay vary between teaching and non-teaching institutions, between urban and rural areas, and from province to province. Government can apply pressure to reduce admissions and length of stay; contrariwise, universal medical coverage may incline those who pay premiums to make greater use of facilities. Hospitals with sophisticated technology or staff specializing in certain kinds of care may draw patients from outside the immediate vicinity, while those with lower levels of technology and less specialized staff may primarily serve people within their own area. These intervening variables can have a strong local influence, and may even affect national trends.

Perhaps a more important shortcoming is that the nursing home is the sole alternative to hospitalization that is explored here. This is counter to recent moves to avoid institutionalization and expand home care. The authors are aware of these trends and use nursing homes merely to demonstrate possible savings.

The data contain some technical deficiencies as well:

- Projections refer to general and allied special hospitals, but the historical statistics from 1967 include a small number of private and mental hospitals that could not be isolated.

- When the research was conducted (1977-78), 1975 hospital morbidity data were the latest available by age and sex.

Nonetheless, the extent and strength of the change in demographic trends override the effect these minor limitations in the historical data would have on the overall results.

To reiterate the message in the Foreword, projections are not predictions. They indicate the direction and magnitude of future developments, based on past and present circumstances. They must be evaluated in the light of when they were made and conditions at that time. Every projection must be updated as trends change. Its value lies not in its predicative ability, but in its usefulness in helping us to understand forces which are shaping the future.

Layout

The report proper is divided into five sections:

Population. An explanation of the components of population change, a review of past developments, and a projection for the future with special attention to the elderly.

Hospital Retrospective. An examination of trends in participation, length of stay, patient-days, and utilization.

Projections. Four Projections of the number of patient-days that will be needed in the future and the operating cost of each.

Options. A comparison of participation rates, length of stay and patient-days in each Projection, and an assessment of relative costs.

Conclusion

Several appendices at the end of the report contain detailed tables and charts and a bibliography.

Health Services in Canada

Canada's health care sector does not operate by the rules of the marketplace. The supply of medical services is regulated not only by demand and government policy, but also by many other factors. Supply and demand are difficult, therefore, to project.

Today virtually all residents of Canada are covered by hospital and medical insurance programs. Major government involvement in the provision of health services dates back at least a generation. In 1946 Saskatchewan introduced a universal, compulsory hospital insurance plan. However, not until 1957 did the government of Canada pass the Hospital Insurance and Diagnostic Services Act. Under this Act the federal and provincial governments share the cost of providing specified hospital services - some mandatory across the country, others supplied at the discretion of particular provinces. By 1961 all provinces and territories had entered into the cost-sharing scheme.

Meanwhile, in 1966 the Medical Care Act was passed, empowering the federal government to contribute to provinces that ran medical care insurance programs in accord with certain criteria. By 1972 all provinces and territories were participating.

POPULATION

Introduction

To estimate future demand for hospital patient-days, it is first necessary to project the size of the population. No one is safe from accident and disease. Hence, all are potential patients, and demand for hospital services is closely related to their numbers. However, everyone is not equally likely to require such services.

Although individual states of health differ, patterns of hospitalization vary predictably with the patient's age and sex. Consequently, the size and age structure of the population allow some speculation to be made about the number of patient-days required.

Future demand has been calculated on the basis of projections made by the Population Estimates and Projections Division of Statistics Canada(7) incorporating results of the 1976 quinquennial Census. Of many projections available, the one selected for this study starts with 1977, assumes a drop in the fertility rate from 1.83 in 1976 to 1.7 by 1991, constant annual net migration of 75,000, and a small reduction in mortality. These assumptions were selected arbitrarily to demonstrate the growing number of older people and changes that will occur in age distribution if current population trends continue. Figures after 2001 are merely mechanical extensions, not official population projections.

The purpose is not to predict exact numbers but to show the impact of the baby boom generation as they advance through the life cycle to constitute the bulk of the 65+ age group early in the twenty-first century.

Any long-range projection cannot be more than a "ball park" estimate, even for that part of the population living during the 1976 Census. And of course, different demographic assumptions, particularly about fertility, would change future numbers and age structure.

As it has for at least two decades, and will into the twenty-first century, the postwar baby boom dominates Canadian demography. The baby boom children "inflate" whatever age group they happen to occupy, and demands for the goods and services appropriate to that phase of life increase as never before. This has happened with obstetricians, toys, schools, rock music and university professors. The current clamour is for jobs and apartment space. When the baby boom reaches middle age, plastic surgeons may be hard-pressed to keep up with requests for face-lifts and hair transplants.

In the future a new term may have to be devised. It is somewhat incongruous to think of the "baby boom children" requiring geriatic care, but that is the shape of things to come. When this generation reaches retirement early in the next century, an unprecedented strain may be placed on facilities and services for the elderly, many of which have traditionally been furnished by hospitals.

(7)Statistics Canada, Census and Household Surveys Field, Population Estimates and Projections Division, Population Projections for Canada and the Provinces 1976-2001, Catalogue 91520 occasional (Ottawa, 1979).

Planning for the health needs of a large number of older people is a relatively recent issue. But it is one that will remain and intensify in the foreseeable future.

Components of Population Change

A population projection indicates what would result if the underlying assumptions were correct. The objective is always to select the most reasonable assumptions about the components of population change: fertility (births), net migration, and mortality.

Fertility

Simply stated, the total fertility rate is the number of children each woman is expected to have.

Projecting the fertility rate and the annual number of births, even in the short run, is difficult because the social, economic and other factors that contribute to it are neither fully understood nor easily predicted. In order to grasp how the age profile of the population could change if fertility remains at its current low level, it is necessary to examine past developments, especially since the end of the Second World War.

Chart 2 shows the fertility rate and annual births from 1921 to 1976, and projections to the turn of the century. From 3.54 in 1921, fertility dropped gradually to a low of 2.65 in 1937 (about midway through the Depression), and did not exceed 3.0 until 1943. Subsequently, it rose to a high of 3.94 in 1959. In 1960 the rate began a steep, continuous drop, hitting 1.83 in 1976, well below the 2.1 replacement level.

Annual births reflected these fertility trends. From 264,879 in 1921 the number fell to 227,869 in 1937 - a 14% loss. Births then rose almost every year to a high of 479,275 in 1959 - a 110% gain in just over two decades. The ensuing fertility turnaround produced a decline almost as precipitous as the rise. Births fell to 343,373 in 1973 - the lowest total since 1945 (300,587). The next three years saw a slight gain to an estimated 360,340 in 1977. Meanwhile, the fertility rate has continued to slide.

The projection of annual births to 2001 shows a 10% rise to 396,600 in 1985, and then a drop to 338,400 at the turn of the century. An unexpected upturn in fertility could increase young age groups, but it can have no major effect on the number of elderly people before the middle of the next century. It would, however, reduce their percentage of the total population. On the other hand, a further decline in the fertility rate would skew the future population distribution even more toward the older ages.

Migration

Because the primary focus of this study is the size of the older population after the turn of the century, migration in the 1980s and 1990s may be as significant a

Chart — 2

Total Fertility Rate[1], 1921 to 1975, and Projected to 2001,
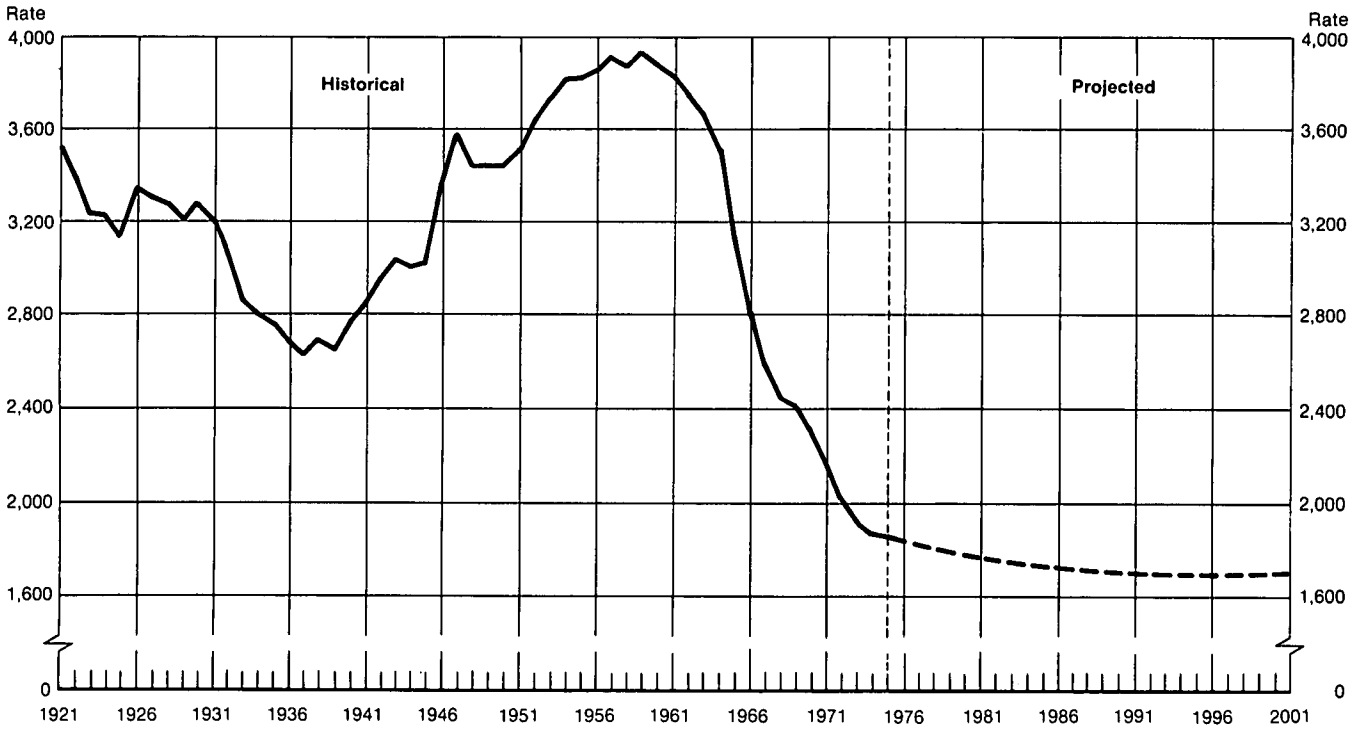
(1) Average number of children per 1,000 women born through the childbearing ages (15-49).

Live Births, 1921 to 1976, and Projected to 2001,
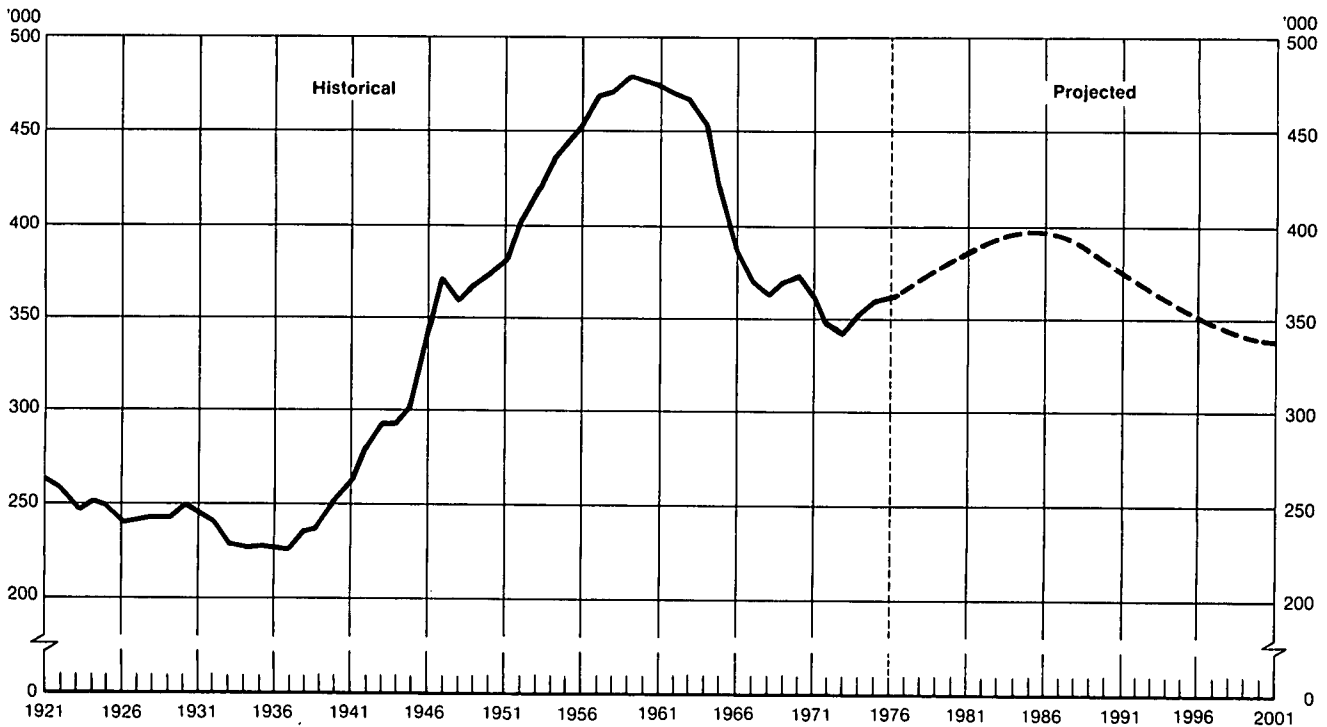
variable as fertility. About two-thirds of all immigrants to Canada are younger than 30. Thus, most of those who may come in the next few years would be part of the elderly population in the twenty-first century.

A leading influence on immigration, aside from government policy, has been the Canadian economy. Immigration has tended to be negatively correlated with the unemployment rate: when unemployment rose, immigration dropped, and vice versa. However, predicting economic conditions, even in the short term, is very difficult; decades ahead, foolhardy. Hence, variations between actual future net migration and what is assumed here could affect not only Canada's total population, but also the 65+ age group.

The migration assumptions for the projection are: entering, 150,000; leaving, 75,000; net, 75,000.

Mortality

Canada's crude death rate was 7.3 per 1,000 in 1977. It has declined gradually but continuously over the past hundred years, but will rise as the population ages. Average male life expectancy at birth rose from 66.3 in 1951 to 69.6 in 1976, and is projected to be 70.2 in 1986. Female life expectancy is greater, and the gap is projected to widen: the corresponding figures are 70.8 in 1951, 76.9 in 1976 and 78.3 in 1986.

However, a breakthrough in the control of major causes of death (i.e., cardio-vascular disease and cancer) could lead to reductions in mortality rates at the older ages. This would result in longer life expectancy, and hence, a larger, older population than projected here.

Possible improvement is suggested by the experience of other countries, principally in Northwestern Europe. For instance, Sweden's 1976 life expectancy at birth for females was almost 78; for males, more than 72. Implicit in these figures is the prospect that the male-female gap will remain, as differences are substantial even in countries with long life expectancy.

Population Projections(8)

Total

Despite a low total fertility assumption of 1.7 and annual net migration of only 75,000, the projection indicates that Canada's population will increase. However, the rate of growth will decline.

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(8) The population projections presented here are based on the general assumption that there will be no large-scale war, widespread epidemic, or other major catastrophe.

Between 1961 and 1971 the population went from 18,238,247 to 21,568,311 - an 18.2% gain. Projected totals and ten-year growth rates are:

Year	Population	Percentage increase over previous decade
1981	24,338,200	12.8%
1991	26,974,600	10.8%
2001	28,793,300	6.8%
2011	30,068,000	4.4%
2021	30,876,700	2.7%
2031	30,935,000	0.2%

Age Composition

This consistent, if slow, growth projected for the total population hides significant shifts in the relative proportions of various age groups. Primarily because of past fluctuations in the annual number of births, the rates of change of different ages will not be the same as the total. Chart 3 and Table 2 show the projected age composition to 2031.

The postwar rise in births and the succeeding drop produced a population bulge that will eventually work its way through all ages. This bulge is followed by a cohort diminished in size by the fertility turnaround. Thus, the rate of change for each age group is different. In any decade the group that contains the baby boom generation will be inflated. As a proportion of the population in 2001, persons aged 0-24 will have declined to 33% compared with 45% in 1976. Adults 25-44 and 45-64 will have increased from 27% and 19% to 31% and 24%. Persons 65+ will constitute nearly 12%, compared with 8.7% in 1976.

After the turn of the century the proportion of young people will likely continue to fall. Young adults also begin to decline, but the middle-aged and elderly increase in absolute and relative numbers.

In 2011 the first baby boom children (born in 1946) will turn 65. That year the 65+ age group will make up 13% (3.9 million) of the population. A decade later they will comprise 17% (5.1 million), and by 2031, 20% (6.2 million); meanwhile, the number under 65 will actually drop from 26.2 million to 24.7 million.

The Elderly Population

Numbers and Growth Rate

A large elderly population is a phenomenon new to this century. In 1921 there were 420,000 older persons, every twentieth Canadian; in 1976, 2,002,400 - nearly every eleventh. The elderly are now 4.8 times as numerous as in 1921; the under 65's, only 2.5 times. If the previously outlined population assumptions materialize, by 2001 every eighth Canadian will be 65 or older; by 2031, every fifth.

Chart — 3

Total Population and Percentage Distribution in Censal Years, by Selected Age Groups, 1941 to 1976, and Projected to 2031

Millions

Key assumptions:

1 — Total fertility rate: 1.7 by 1991

2 — Net annual migration: 75,000(+)

65+ age group

25-64 age group

0-24 age group

Projected

Historical

Millions

16.5%

13.0%

20.2%

11.9%

11.1%

9.5%

8.7%

8.1%

7.6%

7.8%

6.7%

46.2%

53.0%

54.6%

56.2%

54.5%

51.4%

48.4%

43.8%

44.1%

46.4%

46.8%

45.1%

48.1%

42.1%

35.9%

33.5%

30.8%

29.0%

28.4%

48.3%

45.8%

46.5%

1941 1951 1961 1971 1981 1991 2001 2011 2021 2031
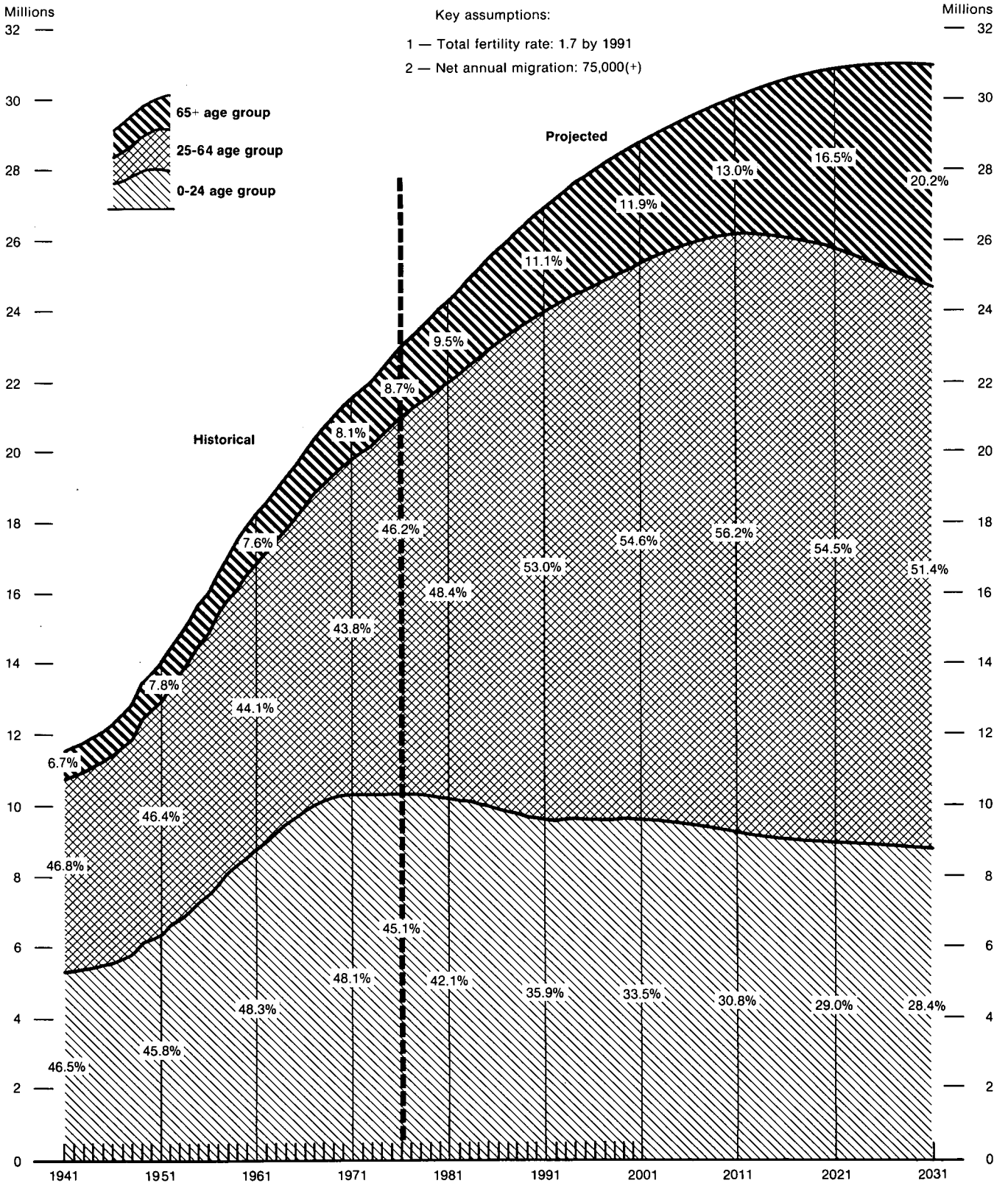
TABLE 2. Percentage Distribution of Population, by Age Group, Canada, 1921-2031

	Historical						Projected								
	1921	1931	1941	1951	1961	1971	1976	1981	1986	1991	1996	2001	2011	2021	2031
number in millions															
All ages	8.8	10.4	11.4	14.0	18.2	21.5	23.0	24.3	25.7	27.0	28.0	28.8	30.1	30.9	31.0
per cent															
All ages	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Less than 1	2.4	1.9	1.9	2.5	2.5	1.6	1.5	1.6	1.5	1.4	1.2	1.2	1.2	1.1	1.0
1- 4	9.6	8.5	7.2	9.8	9.9	6.8	6.0	6.1	6.1	5.8	5.2	4.8	4.6	4.4	4.2
5-14	22.3	21.3	18.7	18.0	21.6	21.2	18.1	15.2	14.4	14.6	14.3	13.4	11.7	11.7	11.2
15-24	17.3	18.8	18.7	15.3	14.3	18.6	19.5	19.3	16.7	14.2	13.7	14.1	13.3	11.9	12.0
Sub total (0-24)	51.6	50.4	46.5	45.8	48.3	48.1	45.1	42.1	38.7	35.9	34.5	33.5	30.8	29.0	28.4
25-44	28.5	27.3	28.2	28.8	26.7	25.1	27.0	29.5	32.4	33.9	32.8	31.0	27.7	27.5	26.2
45-64	15.0	16.7	18.6	17.7	17.4	18.7	19.1	18.9	18.7	19.2	21.1	23.6	28.5	27.0	25.3
Sub total (25-64)	43.5	44.0	46.8	46.4	44.1	43.8	46.2	48.4	51.1	53.0	53.9	54.6	56.2	54.5	51.4
65-74	3.3	3.9	4.6	5.3	4.9	5.0	5.5	6.0	6.2	6.6	6.8	6.6	7.4	10.2	11.7
75+	1.5	1.7	2.1	2.4	2.8	3.1	3.3	3.5	3.9	4.4	4.8	5.3	5.6	6.2	8.5
Sub total (65+)	4.8	5.6	6.7	7.8	7.6	8.1	8.7	9.5	10.2	11.1	11.6	11.9	13.0	16.5	20.2

Assumptions: 1.7 total fertility rate by 1991, constant thereafter; +75,000 annual net migration.

The elderly increased rapidly in the 1961-71 period (25%), much faster than the population as a whole (18%). Their growth is projected to accelerate slightly in the seventies (32%), but then fall off in the eighties (29%) and nineties (15%) as the small cohort born during the Depression reaches 65.

However, the births of the postwar baby boom will ultimately have an impact. In the first part of the twenty-first century (2001 to 2031), the 65+ age group will rise from 3,425,000 to 6,240,100 - an increase of 2,815,100 or 82%.

After about 2040 their ranks may be expected to fall, primarily as a result of the diminishing birth cohorts of the 1960s and 1970s.

The probability that numbers of older people will be as projected is greater than for young people because the former are unaffected by future fertility. The people who will be over 65 in the year 2001 or even 2031 are now all living. Mortality and immigration, however, might alter the size of the elderly population, deaths reducing the initial cohorts and immigration typically increasing them. Future reductions in death rates could mean a somewhat larger elderly population than projected. The high immigration of the fifties and early sixties will add to the number of older people in the first decades of the twenty-first century. But the drop in the late sixties and seventies, which coincided with falling annual births, will accentuate the decline in the growth rate of the elderly after 2040.

Proportion

Older people have made up a steady increasing share of the total population. From 1921 to 1976 the proportion 65+ nearly doubled from 4.6% to 8.7%. The low fertility rate used for this projection means that by 2001 about 12% of the population will be 65+; by 2031, 20%.

A rise in the 75+ component is even more probable, because the elderly population itself has been aging. In 1921 the percentage of the 65+ age group who were 75+ was 31%; by 1976 this proportion had risen to 37% and will be about 44% in 2001. After the turn of the century the trend should reverse, (43% in 2011; 38% in 2021) reflecting the low fertility levels of the Depression years. But the group will "age" again as the baby boom generation advances into this part of their life cycle. About 42% of 2031's elderly will be 75+; around 2040 the proportion will rise above 50%. Greater concentration of the elderly at the higher ages has important implications for planning for their medical needs because of the different health conditions that characterize various segments of the older population. Chronic diseases and impairments increase rapidly with age.

Compared with some other industrial countries, the proportion 65+ in Canada, as in the United States, is relatively small. The 12% level projected for Canada in 2001 was reached in 1965 by Austria, Belgium, Sweden, France and the United Kingdom. By 1970 several other countries contained this percentage of elderly people: Denmark, West Germany, Luxembourg, and Norway. Today the proportion 65+ in some of these nations exceeds 15%.

Sex Composition

A large majority of older persons are women, whereas at younger ages there is an excess of males or only a small excess of females. There are now 78 males for every 100 females 65+. Only 20 years ago their numbers were almost equal, a result of the heavy, predominantly male immigration before World War I. It is anticipated that the proportion of men will continue to fall, reaching 67 males per 100 females in 2001, and then remain around that level throughtout the projection period.

The sex ratio of older people in 1976 corresponded to an excess of a quarter million women. By 2001 the excess is expected to more than double to 685,000, and by 2031 it will be more than one million.

The cumulative effect of higher death rates for males over the entire age range explains the sex ratio of the older population. In explanation of the drop in this ratio over time, males have benefited less than females from declines in death rates in recent years. Female life expectancy is now about seven years greater; the gap is projected to widen to about eight years by 1986. The progressive imbalance in the number of elderly men and women has obvious implications for health care planners: there will be many more older women than men in need of service, and this entails an increase in patient-days attributable to disease in which females predominate.

HOSPITAL RETROSPECTIVE

Introduction

To lay the groundwork for the Projections in the study, historical patterns are given for the following variables:

- separations
- participation rate
- length of stay
- patient-days
- utilization

All historical hospital data were taken from published and unpublished material collected by the Health Division of Statistics Canada.

Separations

Every patient discharged from hospital is a "separation". Of course, the same person may be hospitalized several times in one year, each instance being counted as a separation.

Table 3 and Chart 4 show separations by sex for selected age groups from 1967 to 1975. The total rose steadily from 3,342,700 in 1967 to 4,070,300 in 1974, a 22% increase. Then for the first time, the number declined, to 4,036,400 in 1975.

Overall, more women than men were hospitalized, their share of the total hovering around 57%. In only two age groups, 0-14 and 65-74, did males outnumber females. Some drop over the nine years occurred for the younger ages; by contrast, there was a significant rise in separations among those 45 and older.

Admittedly, the number of separations alone is not very meaningful. To put the number in context, it must be related to the corresponding population. The resultant proportion is the "participation rate".

Participation Rate

Participation rates from 1967 to 1975 are shown by sex in Chart 5. The rates are quite consistent. Female participation always exceeded male by five to six percentage points. An upward trend climaxed in 1973 and was succeeded by a moderate but definite decline. Nonetheless, 1975 participation was still higher than in any year from 1967 to 1969.

Table 4 gives the breakdown of participation rates by age group and sex. Rates for everyone but the 5-14 age group peaked between 1971 and 1974, and have since fallen.

Chart — 4
Number of Separations, by Age Group and Sex,1967 to 1975
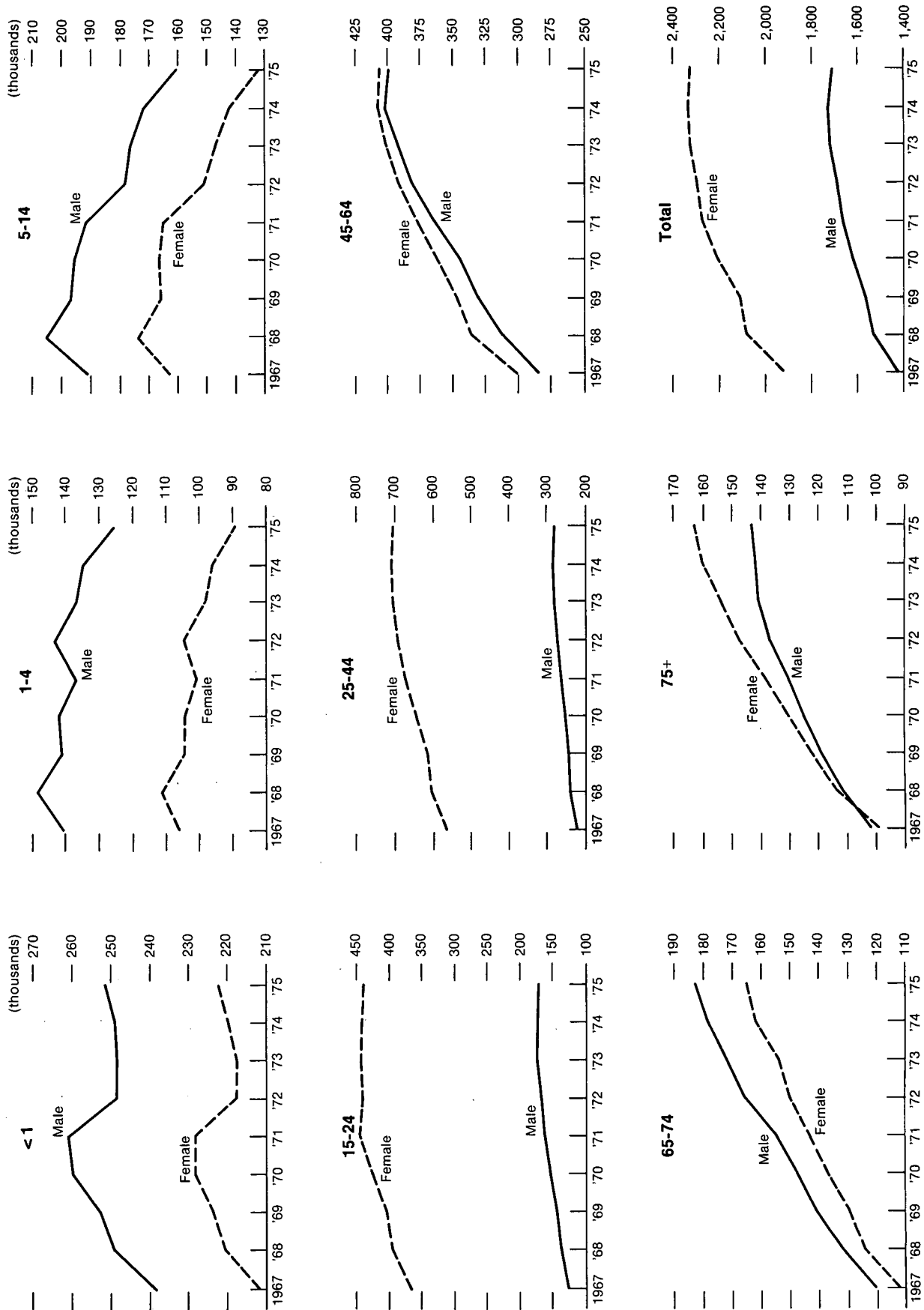
TABLE 3. Number of Hospital Separations, by Age Group and Sex, 1967-75

		1967	1968	1969	1970	1971	1972	1973	1974	1975
		thousands								
<1	M	238.4	249.4	252.9	259.9	261.0	248.8	248.7	249.1	251.8
	F	211.7	220.4	223.8	228.4	228.3	217.8	217.6	219.8	222.1
	T	450.1	469.8	476.7	488.3	489.3	466.6	466.3	468.9	473.9
1- 4	M	140.4	148.6	140.6	141.7	136.6	142.8	136.5	134.4	125..8
	F	105.7	111.0	104.7	104.5	100.8	104.6	98.2	96.4	89.6
	T	246.1	259.6	245.3	246.2	237.4	247.4	234.7	230.8	215.4
5-14	M	190.8	205.4	197.0	195.8	191.5	178.2	176.5	172.0	160.3
	F	162.6	173.8	166.1	166.5	165.2	151.0	147.1	142.2	132.2
	T	353.4	379.2	363.1	362.3	356.7	329.2	323.6	314.2	292.5
15-24	M	124.9	138.0	141.4	151.7	160.7	165.7	174.0	173.4	170.8
	F	362.7	394.7	402.2	427.0	446.1	439.9	444.0	441.5	440.0
	T	487.6	532.7	543.6	578.7	606.5	605.6	618.0	614.9	610.8
25-44	M	220.9	239.7	242.5	252.7	263.0	272.6	281.6	284.7	279.6
	F	567.2	609.3	618.1	648.7	677.6	692.3	705.4	706.7	705.2
	T	788.1	849.0	860.6	901.4	940.6	964.9	987.0	991.4	984.8
45-64	M	284.1	312.4	330.0	345.0	364.9	380.7	393.2	401.0	399.4
	F	300.3	336.4	348.6	363.1	376.3	391.8	401.1	405.9	404.9
	T	584.4	648.8	678.6	708.1	741.2	772.5	794.3	806.9	804.3
65-74	M	120.4	131.7	140.8	148.0	154.6	166.4	172.3	179.3	183.2
	F	111.7	123.9	129.9	137.3	142.5	150.2	154.1	161.8	165.2
	T	232.1	255.6	270.7	285.3	297.1	316.6	326.4	341.1	348.4
75+	M	101.5	111.7	119.4	125.5	130.6	137.7	140.7	141.9	143.1
	F	99.4	113.3	122.4	130.9	138.8	148.2	154.6	160.2	163.2
	T	200.9	225.0	241.8	256.4	269.4	285.9	295.3	302.1	306.3
Total	M	1,421.4	1,536.9	1,564.5	1,620.2	1,662.6	1,692.8	1,723.8	1,735.8	1,714.0
	F	1,921.3	2,082.8	2,115.7	2,206.3	2,275.5	2,295.8	2,322.2	2,334.5	2,322.4
	T	3,342.7	3,619.7	3,680.2	3,826.5	3,938.1	3,988.6	4,046.0	4,070.3	4,036.4

Chart — 5

Total Hospital Participation Rate, by Sex, 1967 to 1975
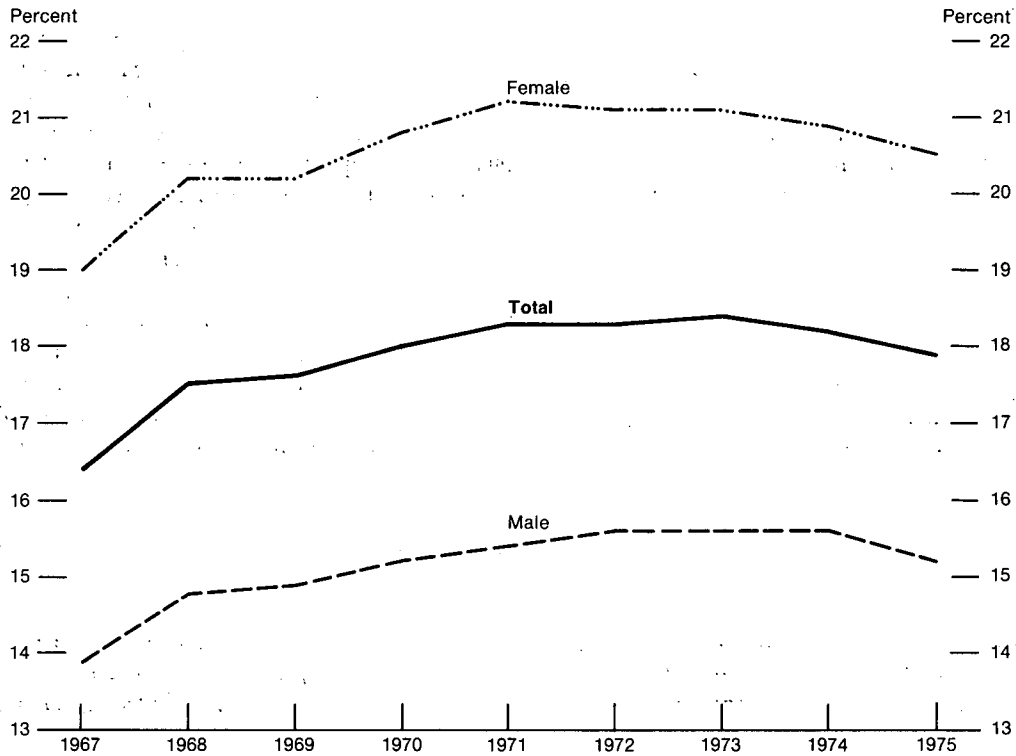
TABLE 4. Hospital Participation Rates, by Age Group and Sex, 1967-75

		1967	1968	1969	1970	1971	1972	1973	1974	1975
		per cent								
<1	M	125.1	135.5	139.4	141.6	143.9	139.6	142.8	145.2	141.9
	F	116.3	126.2	129.2	130.1	132.0	129.6	132.4	134.6	131.8
1- 4	M	15.7	17.4	17.3	18.3	18.4	19.5	18.7	18.5	17.5
	F	12.4	13.6	13.5	14.1	14.2	15.0	14.2	14.0	13.2
5-14	M	8.4	8.9	8.5	8.4	8.2	7.8	7.8	7.8	7.4
	F	7.5	7.9	7.5	7.5	7.4	6.9	6.8	6.8	6.4
15-24	M	7.2	7.6	7.5	7.8	8.0	8.1	8.3	8.1	7.8
	F	21.1	22.0	21.7	22.2	22.5	21.9	21.7	21.0	20.4
25-44	M	8.6	9.2	9.2	9.4	9.6	9.7	9.8	9.6	9.2
	F	22.4	23.9	23.9	24.8	25.4	25.3	25.1	24.4	23.6
45-64	M	15.6	16.8	17.3	17.7	18.4	18.9	19.2	19.2	18.9
	F	16.4	17.9	18.0	18.2	18.5	18.9	18.9	18.8	18.4
65-74	M	26.2	28.3	29.6	30.4	30.8	32.3	32.5	32.9	32.6
	F	21.6	23.5	24.0	24.6	24.8	25.5	25.3	25.6	25.4
75+	M	38.0	41.3	43.6	45.3	46.6	48.8	49.7	49.8	49.4
	F	29.9	32.3	34.0	35.0	35.9	37.1	37.7	37.9	37.5
Total	M	13.9	14.8	14.9	15.2	15.4	15.6	15.7	15.6	15.2
	F	19.0	20.2	20.2	20.8	21.2	21.1	21.1	20.9	20.4
	T	16.4	17.5	17.6	18.0	18.3	18.3	18.4	18.2	17.8

Infants' participation always exceeds 100% because most births now occur in hospital. Rates decline to the early teens, but then begin to rise. Although participation increases with age, the trend among females is not apparent from statistics alone. Fifteen-44-year-old women have a rate higher than 45-64-year-old women -almost as high as that of the 65-74 age group. The reason for this seeming anomaly is that 15-44 covers the prime child-bearing years. Thus, many of the women in this age range are hospitalized to give birth. As a result, the largest gap between male and female participation has been, is now, and will remain among 15-44-year-olds. Child-bearing inevitably raises the female rate far above that of men. By contrast, male participation in the 0-14 and 65+ age groups has always surpassed female. Sex differences in participation by 45-64 year-olds are not significant.

Chart 6 displays the rates by age group and sex for 1975. The patterns accord with earlier trends. Such consistency over nearly a decade suggests that trends in participation rates, applied to the projected population, may be an acceptable indicator of the number of cases (separations) hospitals will have to handle in the future. Yet this alone does not establish demand, which also depends on the length of time patients are hospitalized.

Length of Stay

Length of stay is the number of days patients spend in hospital. Like participation, it is related to age and sex. Table 5 shows that patterns in the average length of stay for the various age-sex groups have also been consistent from 1967 to 1975.

Overall, length of stay has gradually fallen, particularly during the seventies. Steady improvements in medical technology may have contributed to this decline. The 1967 average was 11.0 days; by 1975, 10.7, although a high of 11.4 had been reached in 1969.

Stays increase with age: children averaged less than a week; people 75+, around five weeks. In fact, the oldest age group (75+) was the only one to experience an increase since 1967.

Men generally stayed longer than women, but the difference (about one day) owes more to the causes of hospitalization than sex per se. The time spent by boys and girls 0-14 is almost the same. Between the ages of 15 and 44, women have a noticeably shorter average stay. This is because a large proportion of the hospitalized women are having children - a standardized procedure that takes a relatively short time. On the other hand, accidents, which usually mean an average stay of close to two weeks, are the leading cause of hospitalization for men of these ages. From 45-64, with the effect of maternity removed, lengths of stay equalize. However, after 65, and especially after 75, women spend considerably more time in hospital. A major reason is that women have a longer life expectancy, so at advanced ages there are many widows. With no one at home to assist them during convalescence, they may have to remain in hospital longer than necessary for medical reasons.

The 1975 data in Chart 7 indicate variations that prevail between the groups.

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Chart — 6
Hospital Participation Rates, by Sex and Age Group, 1975
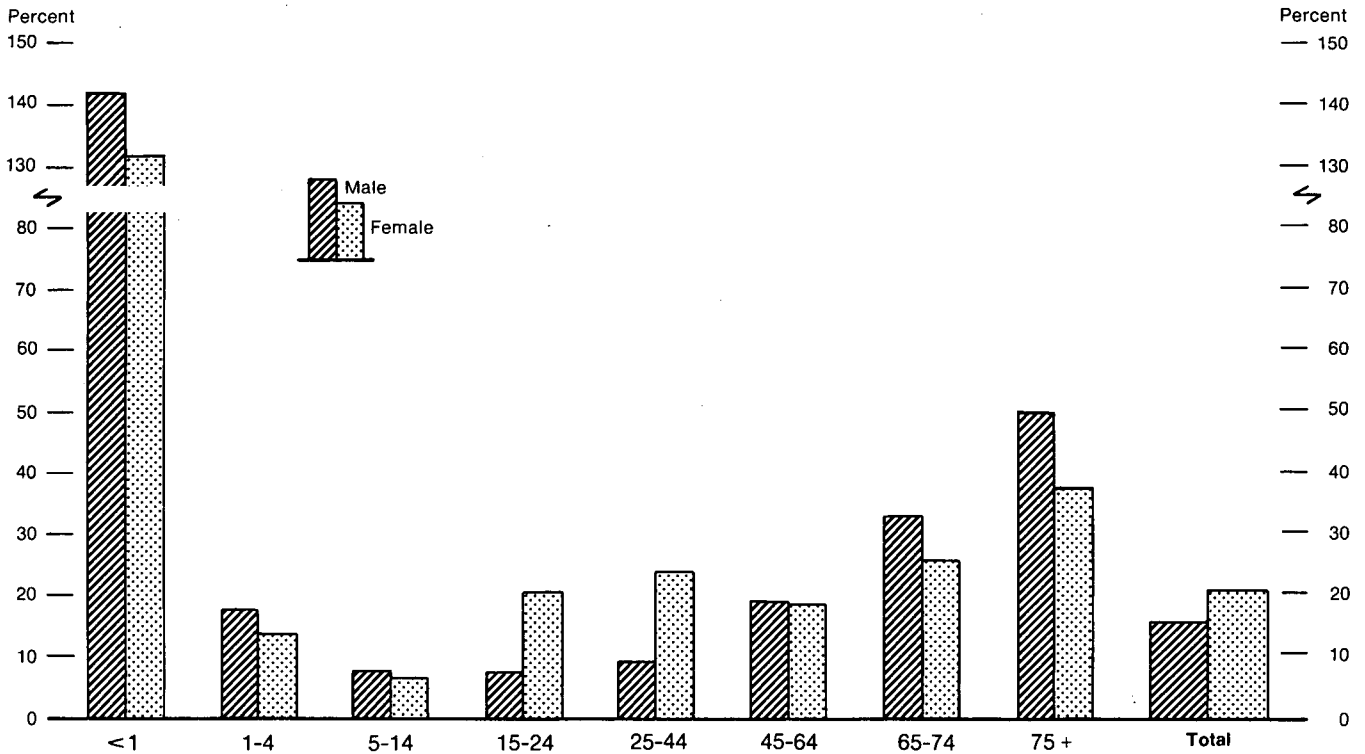
Chart — 7
Average Length of Stay in Hospital, by Sex and Age Group, 1975
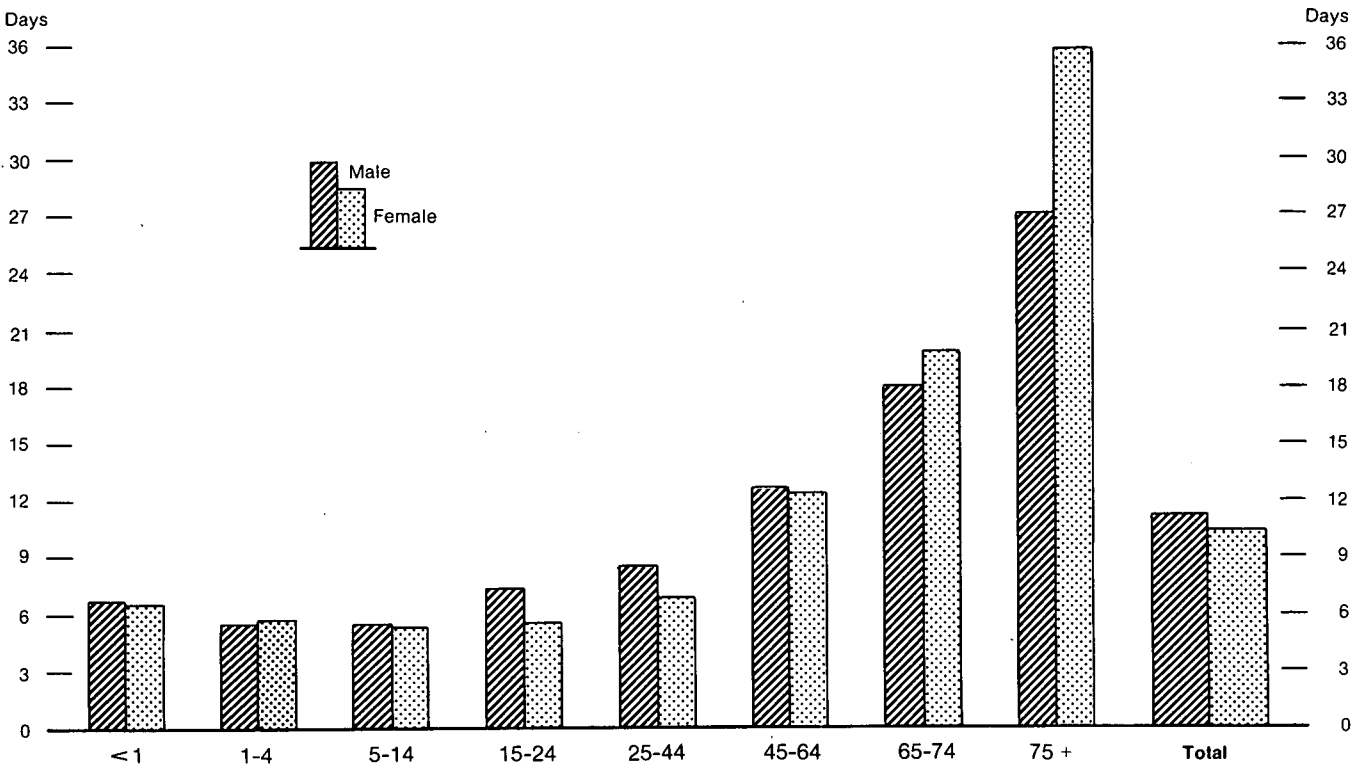
TABLE 5. Length of Stay in Hospital, by Age Group and Sex, 1967-75

	<1		1-4		5-14		15-24		25-44		45-64		65-74		75+		Total		
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
	days																		
1967	8.5	8.2	6.8	7.0	6.1	5.8	8.2	6.4	10.1	8.1	14.6	14.3	20.0	21.8	26.4	32.1	11.7	10.5	11.0
1968	7.8	7.6	7.0	7.1	6.0	5.7	8.2	6.4	10.1	8.2	14.5	14.1	20.2	21.4	26.4	32.0	11.6	10.6	11.0
1969	8.1	8.2	6.6	6.9	6.0	5.8	8.1	6.4	9.9	8.1	14.6	14.2	20.5	22.2	27.2	35.2	11.9	11.0	11.4
1970	7.6	7.5	6.6	6.8	5.9	5.7	8.1	6.2	9.7	8.0	14.2	14.0	20.1	22.2	27.4	35.0	11.8	10.8	11.2
1971	7.5	7.4	6.6	6.7	5.9	5.8	8.0	6.1	9.4	7.8	14.0	13.7	19.9	21.5	26.9	34.3	11.7	10.7	11.1
1972	7.3	7.1	6.5	6.8	6.0	5.6	7.8	6.0	9.3	7.4	13.7	13.4	19.0	21.6	27.2	34.9	11.7	10.7	11.1
1973	7.0	6.9	6.0	6.4	5.8	5.6	7.7	5.8	8.9	7.2	13.2	12.8	18.6	20.6	26.9	34.3	11.4	10.4	10.8
1974	6.9	6.8	5.8	6.0	5.6	5.7	7.5	5.6	8.8	7.0	13.0	12.5	18.4	20.6	27.1	35.8	11.3	10.5	10.8
1975	6.6	6.5	5.5	5.7	5.5	5.4	7.3	5.6	8.5	6.8	12.6	12.3	18.0	19.9	27.0	35.8	11.1	10.3	10.7

TABLE 6. Hospital Patient-Days, by Age Group and Sex, 1967-75

	0-24			25-44			45-64			65-74			75+			Sub-total 65+			Total		
	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T	M	F	T
millions																					
1967	5.2	5.7	10.9	2.2	4.6	6.8	4.2	4.3	8.4	2.4	2.4	4.8	2.7	3.2	5.9	5.1	5.6	10.7	16.6	20.3	36.9
1968	5.4	6.0	11.3	2.4	5.0	7.4	4.5	4.7	9.2	2.7	2.7	5.3	3.0	3.6	6.6	5.6	6.3	11.9	17.9	22.0	39.9
1969	5.3	6.1	11.4	2.4	5.0	7.4	4.8	4.9	9.8	2.9	2.9	5.8	3.2	4.3	7.6	6.1	7.2	13.3	18.7	23.2	41.9
1970	5.3	6.0	11.3	2.5	5.2	7.7	4.9	5.1	10.0	3.0	3.1	6.0	3.4	4.6	8.0	6.4	7.6	14.0	19.1	23.9	42.9
1971	5.3	6.0	11.3	2.5	5.2	7.7	5.1	5.2	10.3	3.1	3.1	6.1	3.5	4.8	8.3	6.6	7.8	14.4	19.4	24.3	43.7
1972	5.1	5.8	10.8	2.5	5.1	7.6	5.2	5.3	10.5	3.2	3.2	6.4	3.8	5.2	8.9	6.9	8.4	15.3	19.8	24.6	44.3
1973	4.9	5.6	10.5	2.5	5.1	7.6	5.2	5.1	10.3	3.2	3.2	6.4	3.8	5.3	9.1	7.0	8.5	15.5	19.6	24.2	43.8
1974	4.8	5.4	10.1	2.5	5.0	7.5	5.2	5.1	10.3	3.3	3.3	6.6	3.8	5.7	9.6	7.1	9.1	16.2	19.6	24.5	44.1
1975	4.5	5.1	9.6	2.4	4.8	7.2	5.0	5.0	10.0	3.3	3.3	6.6	3.9	5.8	9.7	7.2	9.1	16.3	19.1	24.0	43.1
per cent																					
1967	31.0	28.3	29.5	13.5	22.8	18.6	24.9	21.1	22.8	14.4	12.0	13.1	16.1	15.8	15.9	30.5	27.8	29.0	←	100.0	→
1968	29.9	27.2	28.4	13.4	22.6	18.5	25.3	21.5	23.2	14.9	12.1	13.3	16.5	16.5	16.5	31.4	28.6	29.8	←	100.0	→
1969	28.4	26.2	27.2	12.9	21.5	17.7	25.9	21.3	23.3	15.4	12.4	13.8	17.4	18.6	18.1	32.8	31.0	31.9	←	100.0	→
1970	27.8	25.2	26.4	12.8	21.6	17.7	25.7	21.2	23.2	15.6	12.8	14.0	18.0	19.2	18.7	33.6	32.0	32.7	←	100.0	→
1971	27.1	24.9	25.9	12.7	21.6	17.7	26.2	21.2	23.5	15.8	12.6	14.0	18.1	19.6	18.9	33.9	32.2	32.9	←	100.0	→
1972	25.8	23.4	24.5	12.8	20.9	17.3	26.4	21.4	23.7	16.0	13.2	14.4	19.0	21.0	20.1	35.0	34.2	34.5	←	100.0	→
1973	25.1	22.9	23.9	12.8	20.9	17.3	26.4	21.2	23.5	16.4	13.1	14.6	19.3	21.9	20.7	35.7	35.0	35.3	←	100.0	→
1974	24.4	21.9	23.0	12.7	20.3	16.9	26.5	20.8	23.3	16.8	13.6	15.0	19.6	23.4	21.7	36.4	37.0	36.7	←	100.0	→
1975	23.6	21.3	22.3	12.5	20.0	16.7	26.3	20.7	23.2	17.3	13.7	15.3	20.3	24.3	22.5	37.6	38.0	37.8	←	100.0	→

Note: Detail may not add to totals because of rounding.

Patient-Days

If the number of separations in any year is multiplied by the length of stay, the result is patient-days, a measure of hospital occupancy. Although many elements come into play, patient-days are basic in determining the need for facilities. Naturally, because patient-days are a product of separations and length of stay, trends since 1967 reflect patterns of the two latter variables. The total rose consistently from 36.9 million in 1967 to 44.3 million in 1972, but then fluctuated. In 1975 the number was 43.1 million (Table 6).

The percentage taken by young age groups (0-24) dropped steadily from 30% to 22%, illustrating the decline in births that followed the baby boom. Twenty-five-44-year-olds also accounted for a diminishing share: 17% in 1975 as opposed to 19% in 1967. Patients in the 45-64 age range maintained a nearly constant level of 23%.

In contrast, older people comprised an ever-growing share. Those 65-74 occupied 13% of 1967's patient-days; 15% of 1975's. The proportion allotted to the 75+ age group went from 16% to 23%. Thus, patient-days taken by everyone 65+ increased about nine percentage points from 29% to 38%. Much of this gain was attributable to the 75+. Of the 10.7 million patient-days assigned to persons 65+ in 1967, the 75+ segment accounted for 55%; by 1975 their portion had risen to 60%.

Overall, females occupied about 55% of patient-days in any of the nine years. Yet there was some variation by age. Females 0-24 were only slightly overrepresented, while about two-thirds of all patient-days allotted to 25-44-year-olds were taken by women, undoubtedly because of child-bearing. Contrariwise, patient-days were distributed almost equally between 45-64 and 65-74-year-old men and women. However, females constituted the majority of the 75+ patient-days, and their share grew from 54% in 1967 to 60% in 1975.

Utilization

Although the number of patient-days rose between 1953 and 1975 from 22.6 million to 43.1 million, this increase was not as steep as that of hospital capacity. Consequently, the percentage utilization of hospital beds declined, most notably in the last few years (Table 7).(9)

(9) Lefebvre, Louis A., Public General and Allied Special Hospitals in Canada - Historical Summary of Inputs and Utilization of Facilities 1953-1973, Research Paper. Statistics Canada. Health Division, Ottawa, 1976.

TABLE 7. Hospital Utilization, 1953-75*

per cent			
1953 - 81.2	1959 - 80.4	1965 - 82.3	1971 - 81.3
1954 - 79.2	1960 - 82.0	1966 - 81.4	1972 - 78.7
1955 - 78.7	1961 - 83.2	1967 - 80.2	1973 - 78.8
1956 - 78.9	1962 - 82.3	1968 - 81.2	1974 - 77.5
1957 - 80.2	1963 - 81.8	1969 - 80.7	1975 - 76.8
1958 - 80.1	1964 - 81.1	1970 - 80.9	

* Excludes newborns.

Chart — 8
Hospital Utilization , 1953 to 1975

Bed-days
(millions)

60 —

Bed-days
(millions)
— 60

Capacity

Unoccupied

Occupied

55 —
— 55

50 —
— 50

45 —
— 45

40 —
— 40

35 —
— 35

30 —
— 30

25 —
— 25

20 —
— 20

15 —
— 15

10 —
— 10

5 —
— 5

0
0

18.8%
18.0%
18.6%
21.3%
23.2%
81.2%
82.0%
81.4%
78.7%
76.8%

1953 1955 1957 1959 1961 1963 1965 1967 1969 1971 1973 1975
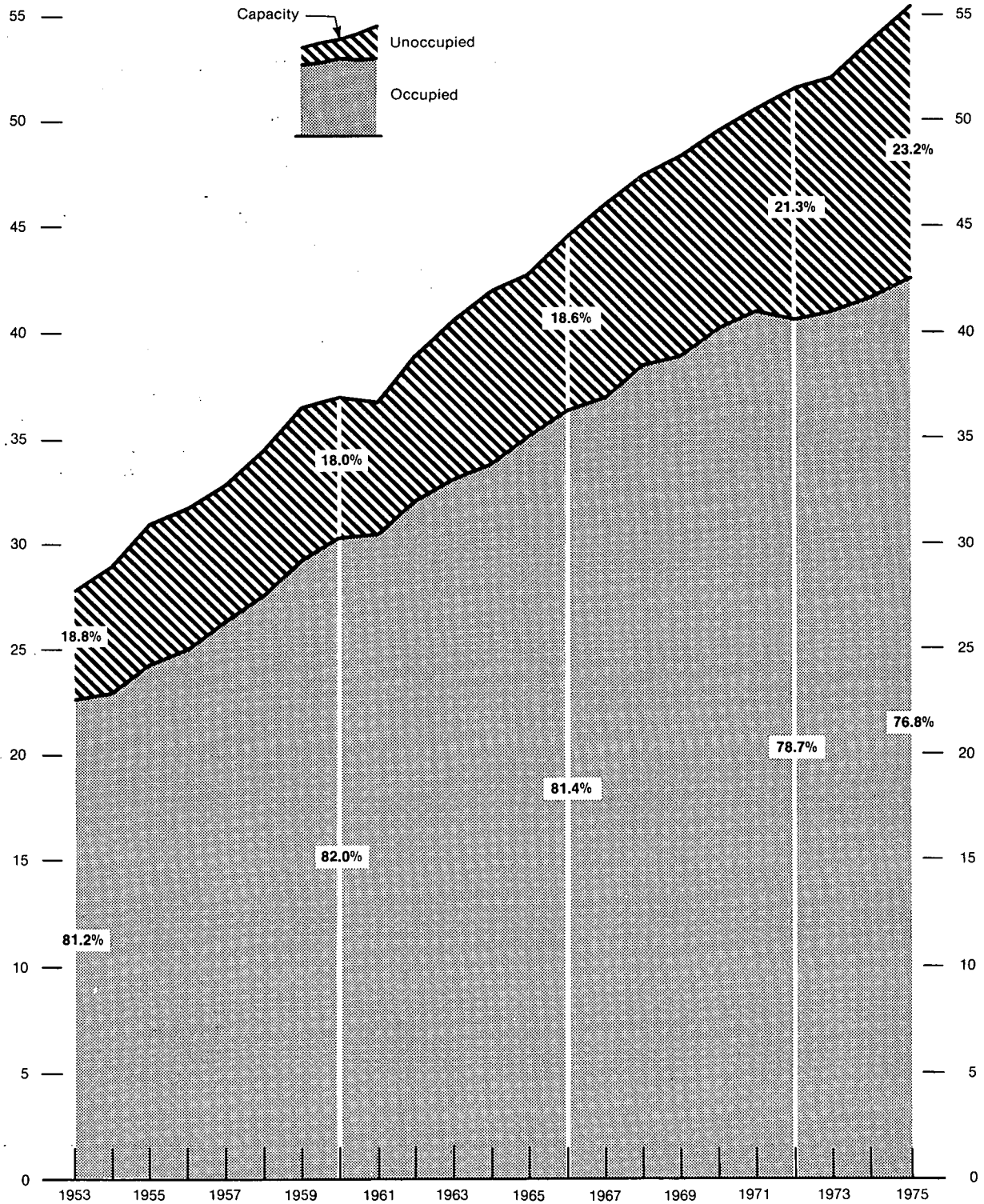
Chart 8 illustrates how utilization fluctuates. For nearly 20 years it hovered around 80%. But since the early seventies it has fallen almost steadily: from 81.3% in 1971 to 76.8% in 1975, a clear downward trend. Preliminary 1976 data suggest that the trend may now be changing and that the utilization rate is now on the increase.

Nonetheless, utilization is essential for planning future hospital requirements, as it can relieve or add to the pressure on space, independent of the size of the population at risk.

Conclusion

Analysis of historical data shows consistent trends in hospital participation and length of stay, both varying predictably by age and sex. Thus, these variables can be applied to a population projection to estimate the potential number of patient-days in the future. Impending changes in the age distribution mean that requirements must be calculated separately for each age group. Higher participation and longer stays are characteristic of the elderly, who now occupy a proportionately large share of hospital space than younger age groups. As the population's age profile shifts toward the older end, this imbalance is projected to become more pronounced.

PROJECTIONS

Introduction

     Population, participation, and length of stay were examined historically and
projected to 2031. Different assumptions about these three variables resulted in a
range of possible patient-day demands and concomitant costs.

     Participation and length of stay implicitly encompass a number of elements such
as medical technology, general health of the population, supply of medical personnel
and facilities, preventive health programs, public propensity to use medical ser-
vices, "third party" (government) payment of costs, judgement of individual physi-
cians, and availability of alternative kinds of health care. Significant changes in
one or any combination of these factors could reduce or increase length of stay and
participation. Without attempting to specify the exact implications of such
changes, a "band" (or range) of alternative projections is presented.

     At the "upper end" of the range of projected patient-days, length of stay and
participation rates for the various age-sex groups are maintained at the 1975 level,
with the result that population change alone determines demand. The "lower end" of
the range results from the following assumptions: (a) on the basis of the 1972-75
interval, trends in length of stay and participation rates of age groups up to 64
are continued until 1985, and held constant thereafter; (b) the length of stay of
age groups over 65 undergoes a gradual 40% decrease of the 1980 value between 1981
and 2001, and (c) the participation rate of the 65+ group declines 10% of the 1980
value, starting in 1981 and ending in 2001. The latter two assumptions are based
upon two suppositions: i.e., some elderly people do not require hospital-level of
care, but are there because they have nowhere else to go, and alternatives to hospi-
talization for older people will be developed soon.

     Customarily, long-range projections stem from trends that extend back more than
four years. However, the pattern in hospital participation rates and average length
of stay that emerged in the early 1970s may mark a turning point and the beginning
of a decline. Although one cause of less hospitalization may be decreased morbidity,
further reductions can be induced by decisions of policy makers, as well as related
developments such as greater utilization of out-patient care. Such developments
reflect public concern over government expenditures in times of economic
uncertainty.

     The range of projections shows that population growth and shifts in age structure
will increase the need for hospitalization, and demonstrates the significant savings
that could be made if alternatives were provided. Operating costs are calculated
using 1976 constant dollars so that the different alternatives can be compared. For
convenience, the cost per hospital patient-day was rounded to $125 from the $124.30
reported in 1976.

Upper Boundary of the Projection Range

     By 2031 at the upper extremity of the projection range, where length of stay and
participation rates remain the same, the population's overall growth and changing
age composition have raised the patient-day requirement to about 91 million, more
than double the 1975 figure. Table 8 indicates how the distribution of patient-days
would shift among the age groups.

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TABLE 8. Hospital Patient-Days, Upper Boundary, by Age Group, Selected Years, 1975-2031

	1975	1986	2001	2016	2031
percentage distribution					
75+	22.5	25.5	30.8	30.2	38.6
65-74	15.3	16.2	15.6	19.3	21.6
Sub total (65+)	37.8	41.7	46.4	49.5	60.2
45-64	23.2	20.9	23.8	25.9	19.9
25-44	16.7	18.7	16.1	13.0	10.6
0-24	22.3	18.6	13.7	11.5	9.3
Total	100.0	100.0	100.0	100.0	100.0
Total number ('000)	43,096	53,219	66,112	76,715	90,801
Index of growth	100	123	153	178	211

Generally, younger groups claim a decreasing proportion of total patient-days, whereas the relative need of the elderly rises steadily. By the end of the projection period, the overall increase would be around 48 million patient-days, of which 80% are attributable to older people.

On the basis of the 1976 cost per patient-day of $125, expenditures would more than double from $5.4 billion in 1976 to about $11 billion in 2031. The significant change, however, is a proportionate one among the age groups. There is a net decline in the percentage of expenditures devoted to patients younger than 65. Yet the elderly, who in 1976 accounted for 38% of costs ($2.1 billion), are projected to require 60% ($7 billion) by 2031 - an increase of over 200% (Table 9).

TABLE 9. Estimated Hospital Patient-day Costs, Upper Boundary, by Age Group,
Selected Years, 1976-2031

Age Group		1976	1981	1986	1991	2001	2011	2021	2031
		1976 constant dollars - millions							
<1	$	391	426	443	422	378	391	373	356
	%	7.1	7.0	6.7	5.8	4.6	4.3	3.7	3.1
1-4	$	149	159	169	168	148	150	147	138
	%	2.7	2.6	2.5	2.3	1.8	1.6	1.5	1.2
5-14	$	196	174	175	185	182	166	170	165
	%	3.6	2.9	2.6	2.6	2.2	1.8	1.7	1.5
15-24	$	474	494	452	403	428	420	386	393
	%	8.6	8.1	6.8	5.6	5.2	4.6	3.8	3.5
25-44	$	926	1,071	1,242	1,360	1,328	1,237	1,260	1,201
	%	16.8	17.6	18.7	18.8	16.1	13.5	12.5	10.6
45-64	$	1,271	1,332	1,391	1,494	1,965	2,477	2,408	2,258
	%	23.1	21.9	20.9	20.6	23.8	27.0	23.8	19.9
65-74	$	852	982	1,082	1,207	1,289	1,509	2,141	2,453
	%	15.5	16.2	16.2	16.7	15.6	16.5	21.2	21.6
75+	$	1,252	1,440	1,700	2,000	2,548	2,810	3,227	4,381
	%	22.6	23.7	25.6	27.6	30.7	30.7	31.8	38.6
65+	$	2,104	2,422	2,782	3,207	3,837	4,319	5,368	6,834
	%	38.1	39.9	41.8	44.3	46.3	47.2	53.0	60.2
Total	$	5,511	6,079	6,653	7,240	8,264	9,160	10,113	11,350
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Lower Boundary of the Projection Range

While participation rates and length of stay at the top of the range were held
constant throughout the projection period, at the lower boundary these variables
were allowed to fall to levels that according to some members of the medical profes-
sion, seem reasonable, given present knowledge and expected changes in technology.

The purpose of setting this limit on the projection band is to illustrate how
costs may be reduced if certain proportions of elderly hospital patients were placed
in nursing homes. From the individual's perspective this may not be a happy out-
come. Less expensive, indeed, than a hospital ($25 per patient-day), the nursing
home is still an institution. Lengthy or permanent stays in one or the other may be
contrary to both the desires and needs of the elderly. The intention is not to
recommend a wholesale transfer from one type of institution to another, but simply

to show savings that might accrue to a less expensive mode of care. The costs stated for nursing homes are greater than those that would be incurred by a home care program.(10) Hence, demonstrated savings might be even greater if large-scale home health services were established.

Nonetheless, home care has limitations. Its advocates " ... should not expect this service to radically reduce the proportions of elderly in long-term care facilities".(11) As the population projection indicates, Canada's elderly are increasing, both numerically and proportionately, and the 75+ cohort is growing even faster. When people reach such an advanced age, illness and disability, often necessitating institutional care, are inevitable. "No country has yet discovered a magic formula which will enable people to live to their eighties, nineties, and hundreds without their growing old."(12)

For elderly patients, the lower projection limit assumes that length of stay will undergo a gradual 40% (of the 1980 value) drop between 1981 and 2001 and remain constant thereafter; their participation rate is assumed to decrease 10% (of the 1980 value) between 1981 and 2001, and then stay at that level to 2031. This translates into fewer hospital patient-days, but requires more nursing home beds for those who otherwise would have been treated in hospitals.

In 2031 the projected hospital patient-day total is almost 59 million, about one-third more than in 1975 (Table 10). The noticeable decline in elderly patient-days results in a less lopsided distribution among the various age-sex groups.

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(10) Preliminary analysis of home care in Manitoba, conducted by Carol Motuz of Health and Welfare Canada, suggests that daily costs average about $5.00.
(11) Ethel Shanas, "Health status of older people: cross-national implications", American Journal of Public Health, LXIV (March 1974), 263.
(12) Ibid.

TABLE 10. Hospital Patient-days, Lower Boundary, by Age Group, Selected Years, 1975-2031

	1975	1986	2001	2016	2031
	percentage distribution				
75+	22.6	27.4	25.5	25.3	33.8
65-74	15.3	15.0	11.0	13.9	16.2
Sub total (65+)	37.9	42.4	36.5	39.2	50.0
45-64	23.2	21.4	29.0	32.0	25.7
25-44	16.7	17.9	18.4	15.1	12.8
0-24	22.3	18.4	16.2	13.7	11.6
Total	100.0	100.0	100.0	100.0	100.0
Total number ('000)	43,096	43,371	46,131	51,689	58,563
Index of growth	100	101	105	120	136

TABLE 11. Estimated Patient-Day Costs of Hospitals and Additional Nursing Homes,
Lower Boundary, by Age Group, Selected Years, 1976-2031

Age Group		1976	1981	1986	1991	2001	2011	2021	2031
		1976 constant dollars - millions							
<1	$	382	371	386	369	330	342	318	312
	%	7.1	7.0	7.0	6.5	5.5	5.1	4.4	3.9
1- 4	$	137	116	117	117	103	104	102	96
	%	2.6	2.2	2.1	2.0	1.7	1.6	1.4	1.2
5-14	$	192	146	140	149	146	133	136	130
	%	3.6	2.7	2.6	2.6	2.4	2.0	1.9	1.6
15-24	$	455	399	352	308	332	328	301	307
	%	8.5	7.5	6.4	5.4	5.5	4.9	4.2	3.9
25-44	$	888	856	969	1,062	1,036	965	984	937
	%	16.5	16.1	17.6	18.6	17.3	14.5	13.6	11.8
45-64	$	1,225	1,113	1,157	1,243	1,635	2,062	2,005	1,880
	%	22.8	20.9	21.0	21.7	27.4	31.0	27.8	23.6
65-74	$	835	856	834	831	717	840	1,192	1,366
	%	15.5	16.1	15.1	14.5	12.0	12.6	16.5	17.2
75+	$	1,262	1,467	1,555	1,641	1,701	1,877	2,178	2,927
	%	23.4	27.6	28.2	28.7	28.3	28.2	30.2	36.8
65+	$	2,097	2,323	2,389	2,472	2,418	2,717	3,370	4,293
	%	38.9	43.7	43.3	43.2	40.3	40.8	46.7	54.0
Total	$	5,374	5,323	5,513	5,719	6,001	6,651	7,215	7,956
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Total costs for both hospitals and new nursing homes are projected to increase from $5.4 billion to $8 billion. Patient-day costs for the elderly rise from 39% of the 1976 total to 44% in 1986, and then decline to 40% at the turn of the century. Thereafter, the rise is gradual, to about 54% of all spending in 2031 (Table 11). Overall, expenditures for older people alone, in both hospitals and additional nursing homes, are projected to grow from about $2 billion to a little more than $4 billion.

Selected Mid-Range Outcomes

In the previous two sections the upper and lower bounds of the range of possible outcomes to 2031 were delineated. Within this range a number of estimates could be presented. However, only two have been chosen for comment here.

Projection I

In addition to structural population change, Projection I incorporates 1972-1975 trends in length of stay and participation rates for each age-sex group. Specifically, the net direction (up or down) of the length of stay of each age-sex group was extended until it reached ±15% of the 1975 value, an acceptable allowance for variability, according to some members of the medical profession. This level was then maintained throughout the projection period.

The four-year trend in participation of each age-sex group was extended to 1985, and then held constant. The increase or decline from 1976 to 1980 amounts to one-half the percentage change between 1972 and 1975; from 1981 to 1985, one-quarter of the 1972-1975 percentage change. These estimates, too, appeared reasonable to some medical personnel who were consulted.

Projection I is considered a "likely" estimate of future demand, for it permits some variation suggested by recent trends. By the end of the projection period the total patient-day requirement would be about 84 million, not quite double the 1975 figure (Table 12). The relative number of patient-days needed by younger people would decline, while those for the elderly would rise. The overall increase to 2031 is some 41 million patient-days, of which the elderly would account for 93%.

TABLE 12. Hospital Patient-Days, Projection I, by Age Group, Selected Years,
1975-2031

	1975	1986	2001	2016	2031
percentage distribution
75+	22.6	31.3	37.1	36.3	45.3
65-74	15.3	15.7	14.7	18.2	20.0
Sub total (65+)	37.9	47.0	51.8	54.5	65.3
45-64	23.2	19.7	22.0	23.9	17.9
25-44	16.7	16.5	13.9	11.3	8.9
0-24	22.3	17.0	12.3	10.3	8.1
Total	100.0	100.0	100.0	100.0	100.0
Total number ('000)	43,096	47,033	59,507	69,189	83,985
Index of growth	100	109	138	161	195

Costs, of course, reflect rising numbers, but more important, the skewed distribution of patient-days. From $5.4 billion in 1976 the total nearly doubles to $11 billion in 2031. In 1976, $2.1 billion (38% of the total) were spent to hospitalize the elderly. By 2001 older people would require more than half of the projected total of more than $7 billion. In 2031 their hospitalization bill is projected to be about two-thirds of the $11 billion total (Table 13).

Projection II

In Projection II, older people's hospital participation rate and length of stay decrease between 1981 and 2001, the rates of decline being 5% and 20%, respectively. As in the case of the lower boundary of the range, this projection assumes that alternatives to hospitalization could soon be developed. The ultimate effect is to lower the elderly's demand for hospital patient-days, so that by 2031 they would take about 58% of the total compared with some 65% in Projection I (Table 14).

TABLE 13. Estimated Hospital Patient-Day Costs, Projection I, by Age Group, Selected Years, 1976-2031

Age		1976	1981	1986	1991	2001	2011	2021	2031
		1976 constant dollars - millions							
<1	$	382	371	387	369	330	342	318	312
	%	7.1	6.9	6.6	5.7	4.4	4.1	3.5	3.0
1- 4	$	137	116	117	117	103	104	102	96
	%	2.6	2.2	2.0	1.8	1.4	1.3	1.1	1.0
5-14	$	192	146	140	149	146	133	136	130
	%	3.6	2.7	2.4	2.3	2.0	1.6	1.5	1.2
15-24	$	455	399	352	308	332	328	301	307
	%	8.5	7.4	6.0	4.8	4.5	4.0	3.3	2.9
25-44	$	888	856	969	1,062	1,036	965	984	937
	%	16.5	16.0	16.5	17.0	13.9	11.7	10.7	8.9
45-64	$	1,225	1,113	1,157	1,243	1,635	2,062	2,005	1,880
	%	22.8	20.7	19.6	19.3	22.0	25.0	21.8	17.9
65-74	$	835	859	920	1,025	1,095	1,282	1,820	2,085
	%	15.5	16.0	15.7	15.9	14.7	15.5	19.8	19.9
75+	$	1,262	1,510	1,836	2,163	2,761	3,047	3,547	4,750
	%	23.4	28.1	31.2	33.2	37.1	36.8	38.3	45.2
65+	$	2,097	2,369	2,756	3,188	3,856	4,329	5,367	6,835
	%	38.9	44.1	46.9	49.1	51.8	52.3	58.1	65.1
Total	$	5,374	5,369	5,879	6,436	7,439	8,264	9,212	10,498
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 14. Hospital Patient-days, Projection II, by Age Group, Selected Years, 1975-2031

	1975	1986	2001	2016	2031
	percentage distribution				
75+	22.6	28.9	31.2	30.7	39.5
65-74	15.3	15.8	13.5	16.9	19.0
Sub total (65+)	37.9	44.7	44.7	47.6	58.5
45-64	23.2	20.5	25.2	27.6	21.3
25-44	16.7	17.1	16.0	13.0	10.6
0-24	22.3	17.6	14.1	11.9	9.6
Total	100.0	100.0	100.0	100.0	100.0
Total number ('000)	43,096	45,256	51,842	59,937	70,483
Index of growth	100	105	120	139	164

As well, overall demand is reduced. About 70 million hospital patient-days would be required by 2031, as opposed to the 90 million in Projection I. At $125 and $25 per day in hospitals and nursing homes, respectively, costs rise from $5.4 billion in 1976 to an estimated $9 billion in 2031 (Table 15), which is about $1 billion less than in Projection I.

Discussion

The elderly now account for close to 40% of all hospital patient-days and concomitant costs. At one end of the projection range (upper boundary and Projection I), on the basis of trends in population distribution and hospitalization, the percentage could rise to about 60%.

Many health problems of older people are multiple chronic conditions and functional impairments, yet they are locked into a system designed to provide acute care. The medical effort on their behalf is strongly oriented towards diagnosis, treatment and recovery (or death) in a crisis. Nearly a decade ago a task force appointed by the Committee on Costs of Health Services reported that "there are in acute general hospital beds a significant number of patients who could be handled at other levels of care, thereby reducing the cost to the community in the long run".(13)

As mentioned earlier, within the range of possible outcomes, Projection I is considered a "likely" approximation of future requirements. The financial implication is that even in constant (1976) dollars, costs would double by the end of the period. Is there an alternative to this escalation of expenditures?

(13) Department of National Health and Welfare, Task Force Reports on the Cost of Health Services in Canada - Summary (Ottawa: 1969), p. 34.

TABLE 15. Estimated Patient-day Costs of Hosqitals and Additional Nursing Homes,
Projection II, by Age Group, Selected Years, 1976-2031

Age Group		1976	1981	1986	1991	2001	2011	2021	2031
		1976 constant dollars - millions							
<1	$	382	371	387	369	330	342	318	312
	%	7.1	6.9	6.8	6.1	5.0	4.6	3.9	3.4
1- 4	$	137	116	117	117	103	104	102	96
	%	2.6	2.2	2.0	1.9	1.5	1.4	1.3	1.0
5-14	$	192	146	140	149	146	133	136	130
	%	3.6	2.7	2.5	2.4	2.2	1.8	1.7	1.4
15-24	$	455	399	352	308	332	328	301	307
	%	8.5	7.4	6.2	5.1	5.0	4.4	3.7	3.4
25-44	$	888	856	969	1,062	1,036	965	984	937
	%	16.5	16.0	17.0	17.5	15.5	13.0	12.1	10.2
45-64	$	1,225	1,113	1,157	1,243	1,635	2,062	2,005	1,880
	%	22.8	20.8	20.3	20.5	24.5	27.8	24.7	20.6
65-74	$	835	871	901	953	921	1,078	1,530	1,753
	%	15.5	16.3	15.8	15.7	13.8	14.6	18.8	19.2
75+	$	1,262	1,486	1,677	1,877	2,169	2,394	2,757	3,732
	%	23.4	27.7	29.4	30.8	32.5	32.4	33.8	40.8
65+	$	2,097	2,357	2,578	2,830	3,090	3,472	4,287	5,485
	%	38.9	44.0	45.2	46.5	46.3	47.0	52.6	60.0
Total	$	5,374	5,357	5,701	6,079	6,672	7,406	8,132	9,147
	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

One potential solution is to treat patients who do not require the highly sophisticated technology of modern hospitals in lower level care facilities. A patient-day in a nursing home, for example, is about one-fifth as expensive as in a hospital: $25 versus $125. It is reasonable, then, to surmise that transferring greater porportions of older people from hospitals to nursing homes could result in significant savings.

The Canadian health care delivery system is centred on institutional care. Compared with other countries, a large segment of Canada's older population, about 9%,(14) lives in institutions. This is high relative to the United States, where the proportion is 5%(15). In both countries there is a shortage of home care. According to current estimates, Canada has one home-help (homemaker) for every 4,300 persons; in the United States there is one for every 5,000 people. Sweden has the highest ratio with approximately one aide for each 121 persons; Norway has one to 173; the Netherlands, one to 247, and the United Kingdom, one to 726.(16)

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(14) Cope W. Schwenger, "Health Care for Aging Canadians" Canadian Welfare (January-February 1977), p. 11. It should be noted that agreement on this figure is not universal.

(15) United States, Department of Health, Education and Welfare, Health Resources Administration, Health U.S. 1976-77, (Washington, D.C. 1977).

(16) Anne R. Somers and Florence M. Moore, "Homemaker Services. Essential Option for the Elderly", Public Health Reports, XCI (July-August 1976), 355.

The extent of the difference within the range of projections becomes apparent when the upper and lower boundaries and the two mid-range estimates are compared. The general trend is an upturn with ever-widening divergences.

Participation Rate

Chart 9 shows, within the projection range, the proportion of the population that can expect to be hospitalized. The participation rate is highest at the upper limit because 1975 rates were held constant throughout, and because the population is "aging", i.e., the average Canadian is getting older, and consequently, is more likely to be hospitalized. Projection II and the lower limit of the range assume that the overall participation rate could be reduced by transferring some elderly patients from acute care hospitals to less expensive facilities. In Projection I, considered "most likely", participation decreases slightly in the mid-eighties, and then, rises gradually (about two percentage points) by 2031. Participation increases after the turn of the century because of the "aging" of the population. Future rates could hover between 17% and 20%.

Length of Stay

Because 1975 values were held constant at the upper boundary of the Projections, average stay is longest there (Chart 10). In the rest of the range, average stays decline until the 1980s and then level off. From the early eighties to 2001, the overall average is projected to decrease to nine days and eventually rise to 10 or 11.

After the turn of the century each Projection indicates an increase, especially in the second and third decades when the baby boom generation reaches old age. By the end of the projection period, the average could range between 10 and 14 days, which suggests that some prolongation of hospital stays may be inevitable.

The projection range of length of stay is wide. The assumed decrease of the elderly's length of stay has a particularly strong effect on the patient-day projections. Since people 65+ account for a proportionately larger share of patient-days, a 20% or 40% reduction in their hospital stays lowers overall averages.

Patient-Days

Chart 11 shows the projection range for patient-days. The pattern, not unexpectedly, resembles those of participation rate and length of stay. By the end of the period some 30 million hospital patient-days separate the upper and lower boundaries.

It is estimated that, eventually, a substantial number of patient-days will have to be added to the present 43 million. By 2031 all the surviving baby boom generation will be over 65. At the lower limit of the projection range, about 58 million hospital patient-days would be needed, representing an increase of about 15 million. The eventual total at the upper limit is 90 million days, more than double the 1975 figure.

Chart — 9
Total Hospital Participation Rate, Projection Range , 1967 to 2031
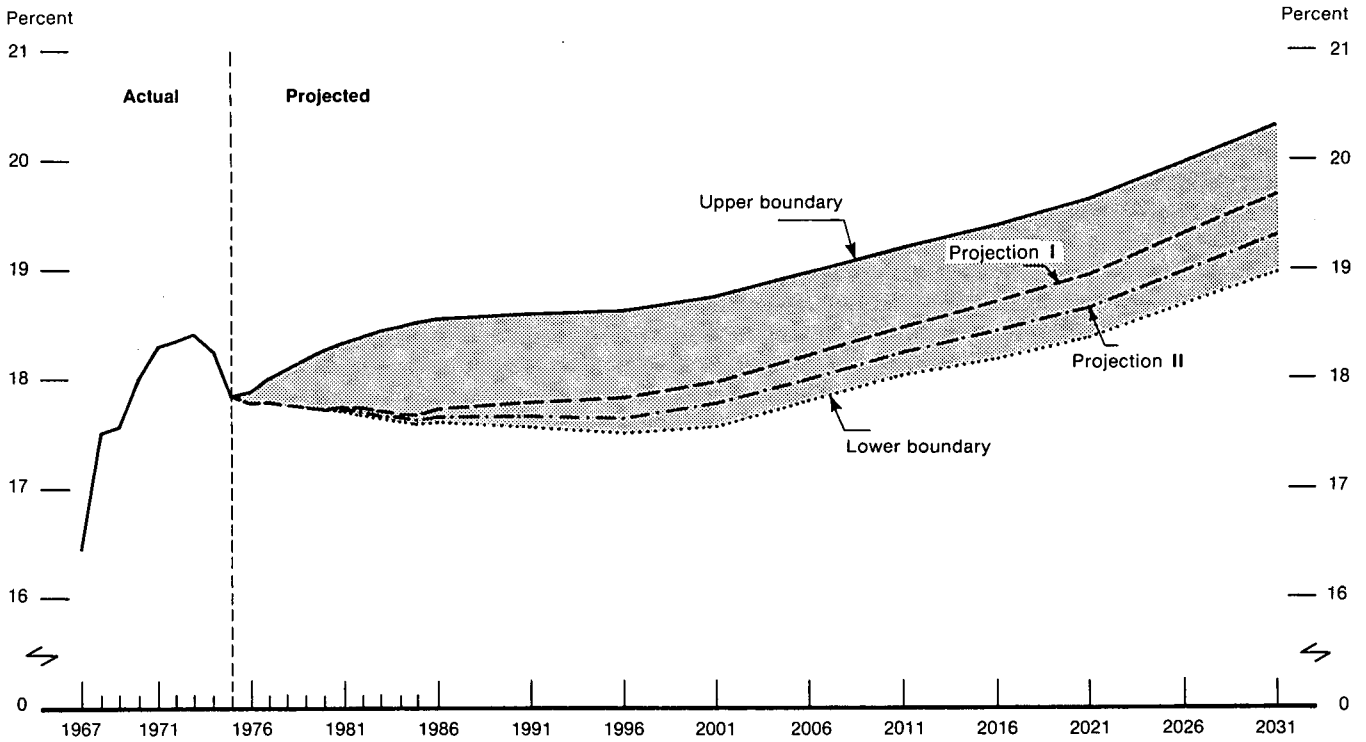
Chart — 10
Average Length of Stay in Hospital, Projection Range , 1967 to 2031
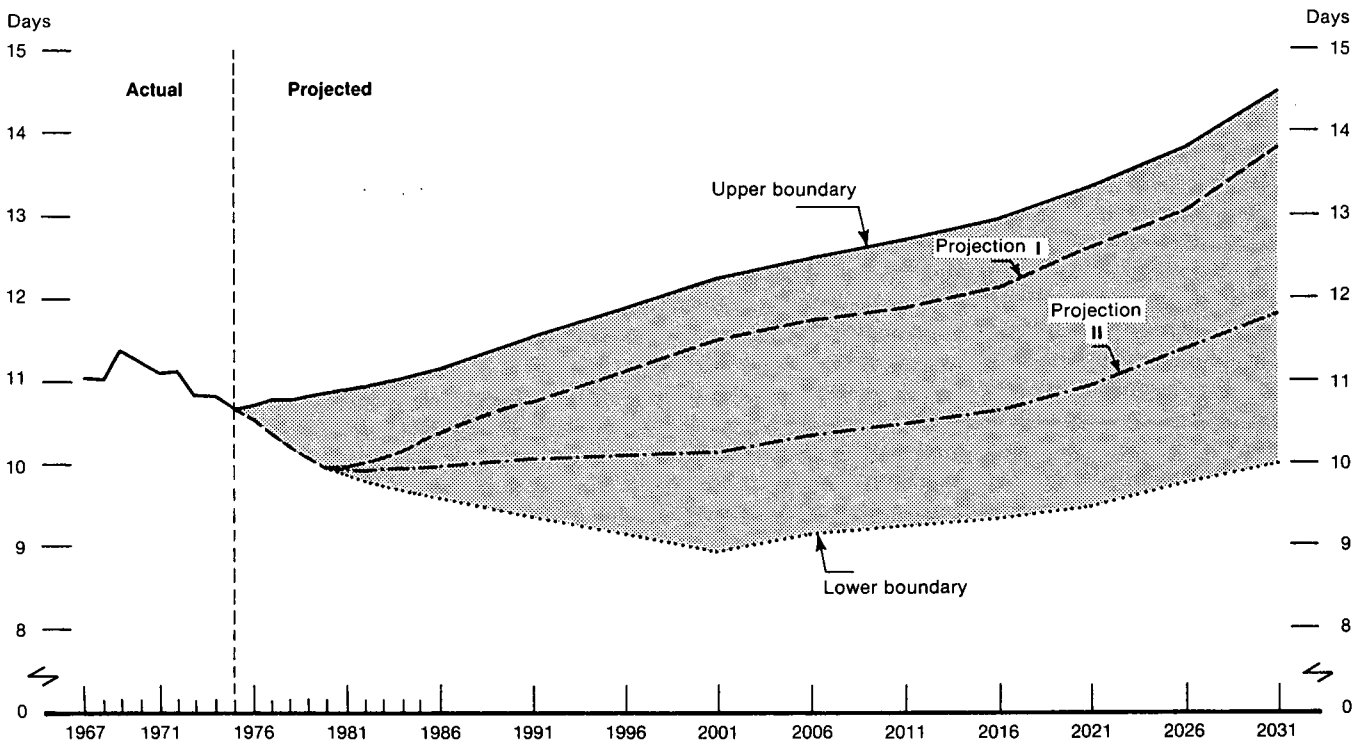
Patient-Days and the Elderly

As mentioned earlier, in 1975 the 65+ age group constituted 8.6% of the population but accounted for 37.8% of all patient-days.

Taking Projection I as an illustration, the situation in Table 16 might be expected to develop. By 2031 elderly people alone are projected to occupy more hospital patient-days than the 1975 total (55 million versus 43 million). Equally significant is the possibility that their share would rise to 65%, although even by then they would comprise only about 20% of the total population.

Table 17 shows the effect of transfers from acute care hospitals to chronic care facilities, on which the lower boundary and Projection II are based. Under Projection II, by 2001 nearly one-quarter of the patient-days taken by the 65+ age group in Projection I would be spent in facilities other than acute care hospitals. At the lower boundary of the range the proportion rises to almost one-half.

Utilization

Speculation about when facilities have to be increased depends, in the first instance, on utilization. To illustrate its potential significance, Chart 12 relates 1975 capacity to the anticipated demand. The left side of the chart represents the projected range of patient-days, and the right, levels of utilization. Between 1971 and 1975 utilization declined from 81.3% to 76.8%. The supply of hospital patient-days is determined by the number of beds available and their utilization. Therefore a greater demand for hospital patient-days and a further overall decline in utilization would call for an increase in the number of beds. At the upper boundary of the range, a substantial addition would be necessary even before 1980. Yet if utilization were raised to only 80%, the current number would be adequate until the early 1980s. At the lower boundary of the projection range, existing of hospital beds would suffice for more than a decade.

It would, however, be difficult to raise the national level of utilization to 80% overnight. Many hospitals have long waiting lists, while some in other areas may have empty beds. Even if distance were not a factor, a patient's physician may not have admitting privileges with the under-used hospital. It appears that the level of utilization likely will rise in the future, particularly as governments and administrators face greater financial constraints brought about by economic uncertainty.

Chart — 11
Total Hospital Patient-days, Projection Range , 1967 to 2031
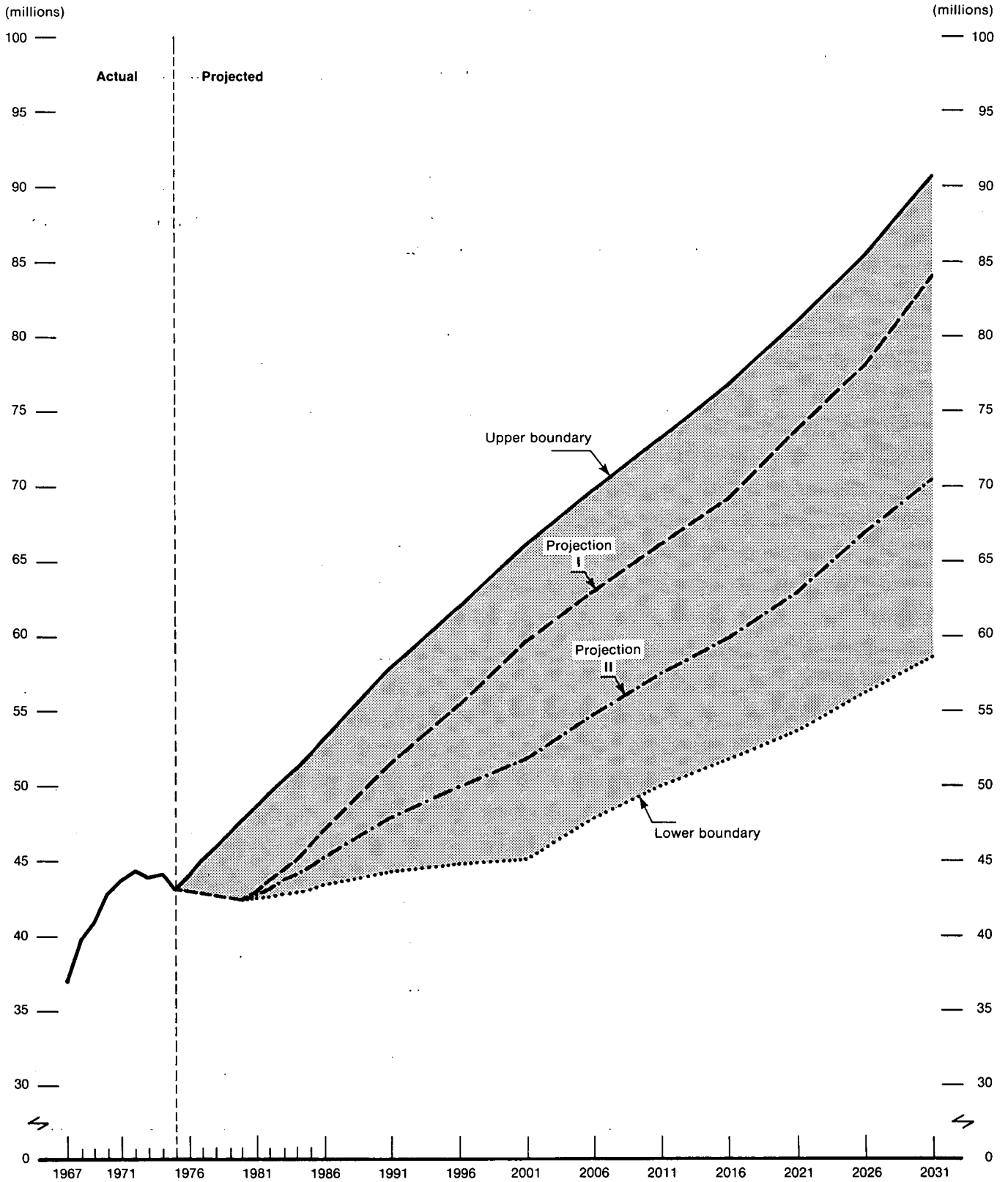
TABLE 16. The 65+ Age Group's Share of Hospital Patient-Days, Projection I, by Sex, Selected Years, 1975-2031

	1975	1986	2001	2031
	thousands			
Total patient-days:				
Males	19,087	19,840	· 24,304	33,909
Females	24,009	27,193	35,203	50,076
Total	43,096	47,033	59,507	83,985
Total 65+ patient-days:				
Males	7,170	8,633	11,254	20,266
Females	9,126	13,410	19,595	34,414
Total	16,296	22,043	30,849	54,680
Percentage of total patient-days required by elderly:	per cent			
Males	37.6%	43.5%	46.3%	59.8%
Females	38.0%	49.3%	55.7%	68.7%
Total	37.8%	46.9%	51.8%	65.1%

TABLE 17. Patient-Days Transferred from Acute Care Hospitals to Nursing Homes, Projection II and Lower Boundary, by Sex, Selected Years, 1968, 2001 and 2031

	Projection II		
	1986	2001	2031
	thousands		
Number transferred:			
Males	379	3,432	4,352
Females	1,398	5,233	9,150
Total	1,777	7,665	13,502
Transferrals related to number of elderly patient-days in Projection I:	per cent		
Males	4.4	21.6	21.5
Females	10.4	26.7	26.6
Total	8.1	24.8	24.7
	Lower Boundary		
	thousands		
Males	1,147	4,986	8,959
Females	2,515	9,390	16,463
Total	3,662	14,376	25,422
Transferrals related to number of elderly patient-days in Projection I:	per cent		
Males	13.3	44.3	44.2
Females	18.8	47.9	47.8
Total	16.6	46.6	46.5

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Chart — 12
How Long Will 1975 Hospital Capacity Last?
(by Level of Utilization)

Patient-days
excluding newborns
(millions)

Utilization
of 1975
Capacity
(percent)

Upper boundary

Projection I

Projection II

Lower boundary

1975 (actual)

100.0

85.0

80.0

76.8

75.0

66
64
62
60
58
56
54
52
50
48
46
44
42
40
0

1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001

0
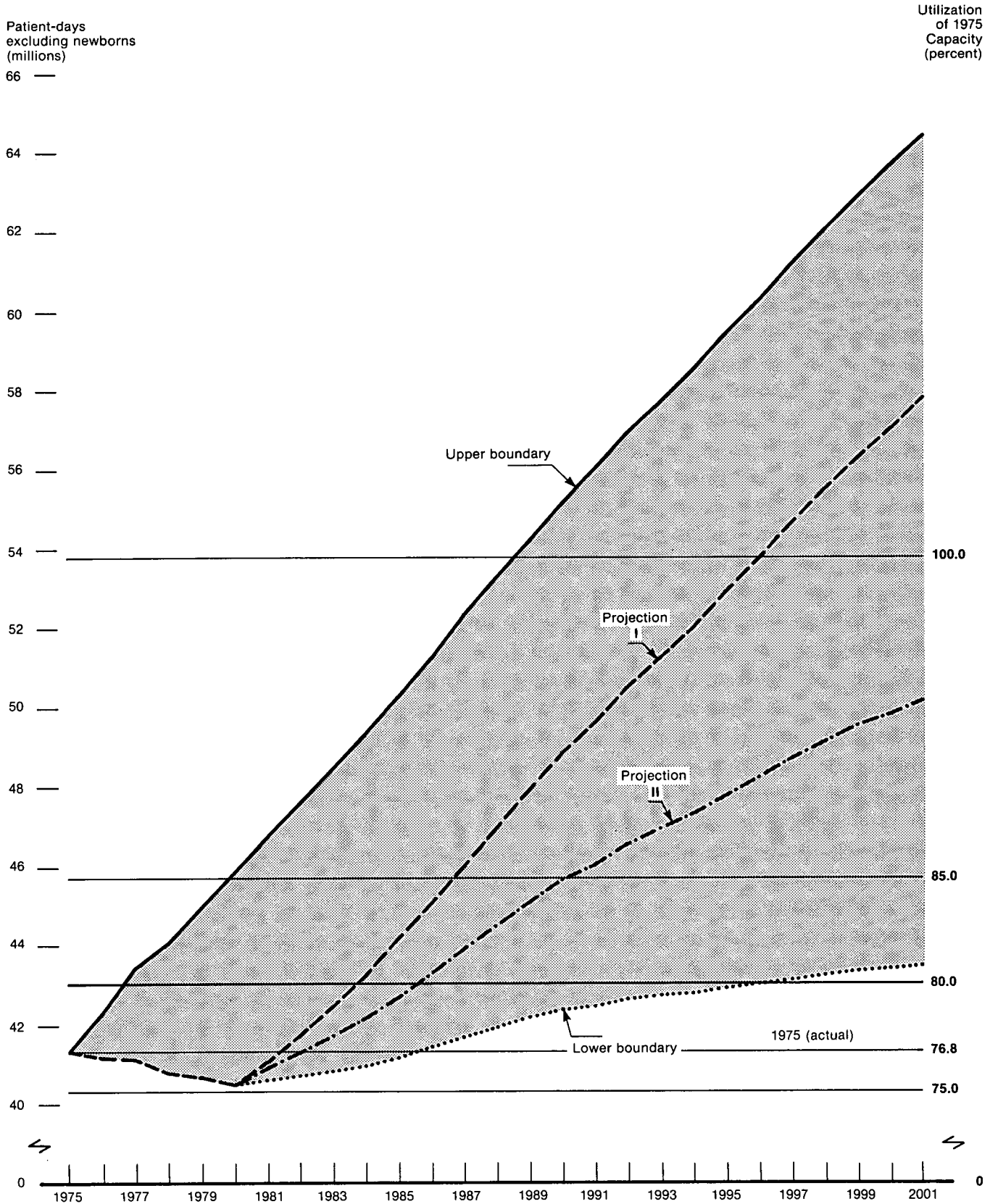
Financial Considerations

If the supply of resources were adequate, this study would be useful merely as a demonstration of how demography could affect the need for hospital services. However, should current tight financial conditions persist, it is likely that alternatives will have to be developed. If the estimates near the bottom of the projection range are feasible, then this report may have more than academic value.

An average hospital patient-day cost about $125 in 1976. With this amount as a constant for hospitals, and $25 for a day in a nursing home, Chart 13 compares operating costs in constant (1976) dollars(17) of the estimates in the projection range.

The top of the projection band shows the effect that structural population changes alone could have on annual patient-day expenditures: they more than double from about $5 billion to $11 billion. Similarly, under Projection I costs nearly double by the end of the period. Yet by 1980, because of the projected decrease in patient-days, the annual cost in this projection would decline slightly from $5.4 billion in 1976. It then would rise steadily to over $10 billion by 2031.

The two lower estimates include nursing home costs as well as acute care hospital expenditures, a breakdown of which is given in Table 18. While total patient-day costs, as estimated in Projection II, would rise above $9 billion, most of this would be accounted for by hospitals alone (96%). The costs associated with nursing homes would be about $300 million.

At the lower boundary, overall costs are projected to be about $8 billion, 92% of which would be incurred by hospitals. Total expenditures are about 13% less than in Projection II. Of course, with the assumption of greater use of nursing homes, costs of these facilities would be about $600 million, some $300 million more than estimated in the previous projection.

Theoretically then, an alternate mode of responding to anticipated patient-day needs could result in annual savings of $2 to $3 billion by 2031, i.e., the difference between Projection I (one of the mid-range estimates) and the lower boundary of the range. If hospital expenditures alone are considered, the difference would be more than $3 billion.

Table 19 displays the total annual and aggregate savings that could be made if the conditions characterizing the lower end of the projection range prevailed instead of those in Projection I. For instance, in 2031 the potential difference between Projections I and II is more than $1 billion, and by then aggregate savings would total about $14 billion. Between Projection I and the lower boundary of the range, the annual saving in 2031 would be more than $2 billion, and over the whole period this translates into an aggregate of about $27 billion.

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(17) The method of estimating current dollar costs is explained in Appendix B.

Chart — 13
Total Patient-day Costs in 1976 Constant Dollars, Projection Range, 1976 to 2031
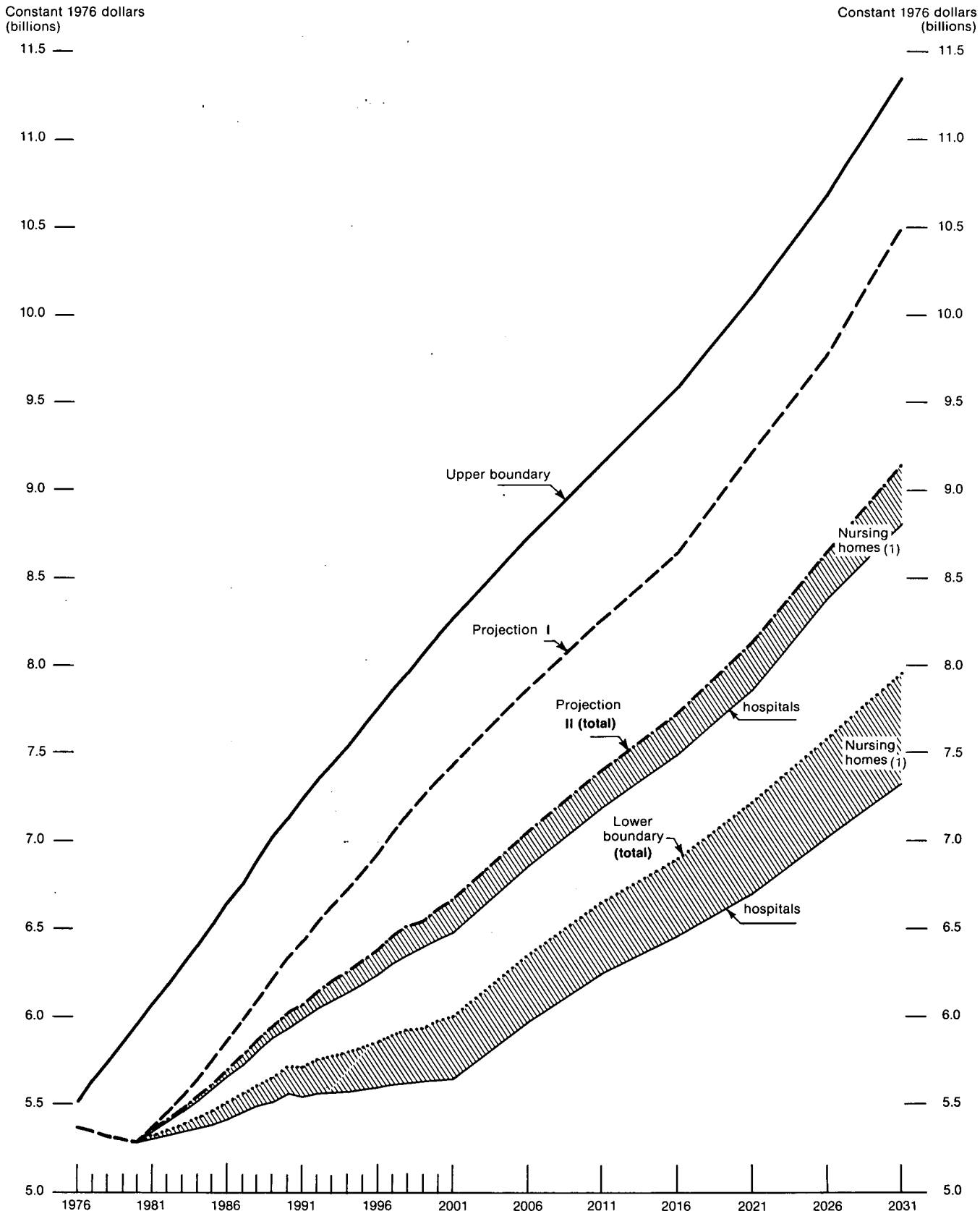
(1) This represents only transferees from hospitals. It should not be interpreted as total nursing home costs since transferees could stay longer in the nursing home than they would have in the hospital.

TABLE 18. Patient-Day Costs in Hospitals and Nursing Homes, Projection II and Lower
Boundary, Selected Years, 1976-2031

Year	Projection II			Lower Boundary		
	Hospi-tals	Nursing Homes	Total	Hospi-tals	Nursing Homes	Total
	1976 constant dollars - millions					
1976	$5,374	-	$5,374	$5,374	-	$5,374
1977	5,354	-	5,354	5,354	-	5,354
1978	5,329	-	5,329	5,329	-	5,329
1979	5,313	-	5,313	5,313	-	5,313
1980	5,294	-	5,294	5,294	-	5,294
1981	5,349	8	5,357	5,311	12	5,323
1982	5,403	14	5,417	5,327	26	5,353
1983	5,460	20	5,480	5,345	41	5,386
1984	5,517	27	5,544	5,363	57	5,420
1985	5,579	36	5,616	5,385	75	5,460
1986	5,657	44	5,701	5,421	92	5,513
1987	5,734	53	5,787	5,456	109	5,565
1988	5,806	62	5,868	5,485	126	5,611
1989	5,877	71	5,947	5,511	144	5,655
1990	5,941	80	6,021	5,532	161	5,695
1991	5,989	89	6,078	5,540	179	5,719
1992	6,050	90	6,140	5,560	197	5,757
1993	6,096	108	6,204	5,566	214	5,780
1994	6,139	117	6,256	5,570	231	5,801
1995	6,193	128	6,321	5,583	250	5,832
1996	6,245	138	6,383	5,594	268	5,863
1997	6,301	149	6,450	5,611	288	5,898
1998	6,351	160	6,511	5,619	307	5,926
1999	6,396	171	6,567	5,627	324	5,951
2000	6,438	181	6,619	5,634	342	5,975
2001	6,480	192	6,672	5,641	359	6,001
2006	6,851	203	7,054	5,965	380	6,345
2011	7,191	214	7,406	6,248	403	6,651
2016	7,492	231	7,724	6,461	438	6,899
2021	7,862	270	8,132	6,699	516	7,215
2026	8,376	279	8,654	7,034	547	7,581
2031	8,810	338	9,147	7,320	636	7,956

These sums, however, do not represent outright "savings", since an initial capital investment is necessary to construct nursing homes. It is possible that if secondary facilities are not built, significantly more resources will have to be allocated toward construction of new hospitals. The lack of "hard" data makes it difficult (but not impossible) to compare capital costs of hospitals and nursing homes. In 1975 the cost per hospital bed ranged between $40,000 and $80,000 (excluding land); the average was about $50,000. No information has been systematically assembled about nursing homes, but sources(18) estimate that construction costs per bed are about 60% of those for hospitals. Nursing homes do not require the myriad of facilities and equipment essential to modern acute care hospitals. If capital costs were included in the overall financial considerations, the savings illustrated might be much greater.

(18) Personal communication from an official of the Central Mortgage and Housing Corporation.

TABLE 19. Patient-Day Costs and Savings, Projections II and Lower Boundary Versus Projection I, Selected Years, 1976-2031

Year	Projection I total cost	Projection II			Lower Boundary		
		Total cost (including nursing homes)	Savings		Total cost (including nursing homes)	Savings	
			In same year	Aggregate		In same year	Aggregate
	1976 constant dollars - millions						
1976	$ 5,374	$5,374	-	-	$5,374	-	-
1977	5,354	5,354	-	-	5,354	-	-
1978	5,329	5,329	-	-	5,329	-	-
1979	5,313	5,313	-	-	5,313	-	-
1980	5,294	5,294	-	-	5,294	-	-
1981	5,369	5,357	12	12	5,323	46	46
1982	5,459	5,417	42	54	5,354	105	151
1983	5,552	5,480	72	126	5,387	165	316
1984	5,648	5,544	104	230	5,420	228	544
1985	5,761	5,616	145	375	5,460	301	845
1986	5,879	5,701	178	553	5,513	366	1,211
1987	5,998	5,787	211	764	5,564	434	1,645
1988	6,114	5,868	246	1,010	5,611	503	2,148
1989	6,229	5,947	282	1,292	5,655	574	2,722
1990	6,341	6,021	320	1,612	5,720	621	3,343
1991	6,436	6,079	357	1,969	5,719	717	4,060
1992	6,543	6,148	395	2,364	5,756	787	4,847
1993	6,635	6,204	431	2,795	5,780	855	5,702
1994	6,725	6,256	469	3,264	5,801	924	6,626
1995	6,831	6,321	510	3,774	5,832	999	7,625
1996	6,936	6,383	553	4,327	5,863	1,073	8,698
1997	7,047	6,450	597	4,924	5,898	1,149	9,847
1998	7,152	6,511	641	5,565	5,926	1,226	11,073
1999	7,249	6,541	708	6,273	5,926	1,323	12,396
2000	7,344	6,619	725	6,998	5,976	1,368	13,764
2001	7,439	6,672	767	7,765	6,001	1,438	15,202
2006	7,866	7,054	812	8,577	6,345	1,521	16,723
2011	8,264	7,406	858	9,435	6,651	1,613	18,336
2016	8,649	7,724	925	10,360	6,899	1,750	20,086
2021	9,212	8,132	1,080	11,440	7,215	1,997	22,083
2026	9,768	8,654	1,114	12,554	7,581	2,187	24,270
2031	10,498	9,147	1,351	13,905	7,956	2,542	26,812

CONCLUSION AND DISCUSSION

This study starts with demography and ends with dollars. The goals have been to examine the impact of population growth and changing age distribution on future hospital needs, and to suggest the financial considerations.(19) By 2031 the total population is projected to have increased only 34%, but the elderly, who are the predominant users of hospitals, would more than triple. They now make up nearly 9% of the population; in 2031 they could account for more than 20%, and consequently, place a greater demand on hospitals.

Several points about hospital patient-days have emerged:

1. The total could be expanded without adding beds if utilization were to rise.

2. The need for patient-days will likely grow continuously. By 2001 the minimum requirement could be more than 45 million, the maximum 66 million. By 2031 the total could vary between 58 and 91 million.

3. Establishment of secondary facilities would make current hospital space adequate for years to come.

4. Not all patients now in hospital need that level of service. A number of chronic cases, specifically older people, could be treated elsewhere.

5. Hospitals are the most expensive health care facilities to build and operate.

A final word of caution is necessary. It appears probable that between now and 2031 health care facilities will have to be extended. However, before a massive building program is undertaken, some lessons could be learned from other sectors of society that have tried to accommodate the baby boom generation. Such endeavours must be tempered with restraint because the baby boom is a demographic trap for the unwary. As the education system has belatedly discovered, the boom was followed by a bust. Now that enrolment is declining, the problem of what to do with empty schools left over from the era of expansion looms ever larger.

Fifty years hence, when the baby boom generation starts to die, hospitals and nursing homes could face similar difficulties. It would not be economical to close hundreds of beds in either type of institution.

This is an added reason for encouraging home care or day care rather than going the institutional route and overbuilding. Furthermore, one might consider attempting to design new facilities which could be converted easily to other uses. Decisions, then, should involve not only health authorities and social planners, but also architects, engineers, and contractors.

A statistical increase in the demand on hospitals has been illustrated along with a concomitant rise of costs. A more economical alternative has been discussed, but that is as far as this report can go. Governments and hospital administrators, seeking ways to reduce expenditures, may be able to use these findings. However, the ultimate policy decisions are theirs to make.

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(19) Financial implications for the entire health sector are considered by Jac-André Boulet and Gilles Grenier in the Economic Council of Canada discussion paper Health Expenditures in Canada and the Impact of Demographic Changes on Future Government Health Insurance Program Expenditures (1978).

APPENDIX A

POPULATION AND PATIENT-DAYS

   The following five tables contain detailed population and patient-day data. The
first shows the population by age group and sex from 1967 to 2031. The next four
tables give the same breakdown for each patient-day projection.

TABLE A-1 Historical and Projected* Population, by Age Group and Sex, Canada, 1967 to 2031

Years	<1 year M	<1 year F	1-4 years M	1-4 years F	5-14 years M	5-14 years F	15-24 years M	15-24 years F	25-44 years M	25-44 years F	45-64 years M	45-64 years F	65-74 years M	65-74 years F	75+ M	75+ F	Total Male	Total Female	Total
in thousands																			
Historical:																			
1967	190	182	896	849	2,275	2,177	1,741	1,718	2,558	2,526	1,823	1,826	459	516	267	332	10,208	10,125	20,333
1968	184	175	856	814	2,306	2,205	1,821	1,791	2,597	2,553	1,864	1,881	465	528	270	346	10,364	10,292	20,656
1969	181	173	814	775	2,327	2,222	1,891	1,856	2,636	2,583	1,907	1,937	475	542	274	360	10,506	10,448	20,953
1970	183	176	774	739	2,332	2,229	1,956	1,922	2,685	2,618	1,948	1,990	486	558	277	373	10,642	10,604	21,246
1971	181	173	744	710	2,327	2,224	2,011	1,983	2,739	2,662	1,983	2,034	501	575	280	387	10,767	10,748	21,514
1972	178	168	731	699	2,296	2,192	2,046	2,008	2,805	2,739	2,017	2,077	514	588	282	399	10,871	10,874	21,745
1973	174	164	730	694	2,250	2,148	2,089	2,049	2,873	2,810	2,050	2,118	530	610	283	410	10,979	11,004	21,983
1974	172	163	727	691	2,207	2,106	2,147	2,105	2,960	2,898	2,083	2,161	545	631	285	422	11,127	11,177	22,304
1975	178	168	717	681	2,168	2,069	2,202	2,160	3,046	2,986	2,118	2,204	561	650	289	436	11,281	11,354	22,635
1976	178	169	711	675	2,131	2,033	2,262	2,217	3,138	3,079	2,154	2,243	580	675	296	452	11,450	11,543	22,993
Projected:																			
1977	184	175	709	674	2,080	1,982	2,308	2,254	3,217	3,163	2,179	2,269	597	700	301	465	11,575	11,682	23,257
1978	186	177	718	683	2,023	1,925	2,352	2,287	3,299	3,251	2,204	2,298	612	722	308	479	11,702	11,822	23,524
1979	189	179	733	697	1,965	1,870	2,383	2,308	3,395	3,350	2,221	2,317	629	747	315	495	11,830	11,963	23,793
1980	191	182	744	707	1,923	1,828	2,394	2,312	3,503	3,459	2,236	2,334	645	771	323	512	11,959	12,105	24,064
1981	194	184	757	721	1,895	1,801	2,387	2,301	3,612	3,566	2,255	2,356	658	791	331	529	12,089	12,249	24,338
1982	196	186	767	730	1,884	1,790	2,365	2,276	3,728	3,678	2,274	2,376	667	809	339	548	12,220	12,393	24,613
1983	198	188	777	740	1,887	1,791	2,327	2,238	3,845	3,791	2,295	2,398	674	824	349	568	12,352	12,538	24,890
1984	200	190	786	748	1,894	1,798	2,282	2,195	3,963	3,902	2,319	2,422	681	840	358	589	12,483	12,684	25,167
1985	201	191	795	756	1,897	1,801	2,236	2,151	4,085	4,017	2,335	2,438	696	865	369	610	12,614	12,829	25,443
1986	201	191	802	763	1,902	1,806	2,187	2,103	4,204	4,129	2,358	2,457	709	889	380	635	12,743	12,973	25,716
1991	192	182	798	759	2,017	1,917	1,954	1,873	4,616	4,518	2,546	2,625	779	1,005	435	759	13,337	13,638	26,975
1996	178	170	748	712	2,055	1,953	1,961	1,878	4,659	4,532	2,902	2,997	835	1,067	475	870	13,813	14,179	27,992
2001	171	163	704	670	1,979	1,881	2,075	1,988	4,551	4,386	3,335	3,465	844	1,059	526	996	14,185	14,608	28,793
2006	174	165	696	662	1,866	1,773	2,112	2,025	4,365	4,196	3,861	3,998	863	1,085	560	1,067	14,497	14,971	29,468
2011	178	169	712	678	1,809	1,719	2,037	1,953	4,252	4,079	4,216	4,360	989	1,238	576	1,103	14,769	15,299	30,068
2016	176	167	717	683	1,824	1,733	1,925	1,845	4,297	4,121	4,234	4,364	1,214	1,526	594	1,137	14,981	15,576	30,557
2021	170	161	700	666	1,847	1,755	1,868	1,791	4,332	4,159	4,118	4,218	1,392	1,772	670	1,258	15,097	15,780	30,877
2026	164	156	674	641	1,826	1,735	1,883	1,805	4,258	4,087	3,957	4,040	1,550	1,945	796	1,480	15,108	15,889	30,997
2031	162	154	659	627	1,771	1,682	1,906	1,827	4,130	3,962	3,876	3,939	1,615	2,006	911	1,708	15,030	15,905	30,935

Note: Figures may not add due to rounding.
* Projection 3 in Statistics Canada, Census and Household Surveys Field, Population Estimates and Projections Division, Population Projections for Canada and the Provinces 1976-2001, Catalogue 91-520 occasional (Ottawa, 1979). See text page 23.

TABLE A-2 Historical and Projected Patient-Days, by Age Group and Sex, Upper Boundary, Canada, 1967 to 2031

Years	< 1 year M	< 1 year F	1-4 years M	1-4 years F	5-14 years M	5-14 years F	15-24 years M	15-24 years F	25-44 years M	25-44 years F	45-64 years M	45-64 years F	65-74 years M	65-74 years F	75+ M	75+ F	Total Male	Total Female	Total
in thousands																			
Historical:																			
1967	2,027	1,726	950	739	1,158	944	1,030	2,323	2,240	4,618	4,150	4,281	2,403	2,432	2,684	3,191	16,644	20,254	36,898
1968	1,940	1,678	1,040	786	1,240	996	1,133	2,553	2,408	4,980	4,529	4,738	2,665	2,655	2,952	3,628	17,908	21,994	39,902
1969	2,042	1,835	934	726	1,183	966	1,143	2,553	2,398	5,000	4,832	4,941	2,882	2,881	3,245	4,314	18,659	23,215	41,874
1970	1,977	1,706	942	709	1,152	944	1,224	2,660	2,445	5,159	4,899	5,068	2,977	3,050	3,435	4,580	19,050	23,875	42,925
1971	1,968	1,684	905	678	1,128	953	1,276	2,728	2,475	5,252	5,099	5,153	3,074	3,064	3,519	4,758	19,444	24,269	43,713
1972	1,805	1,554	934	710	1,060	847	1,292	2,640	2,529	5,147	5,223	5,265	3,163	3,244	3,751	5,175	19,756	24,583	44,339
1973	1,739	1,510	823	634	1,017	826	1,334	2,588	2,512	5,068	5,175	5,142	3,215	3,170	3,784	5,303	19,600	24,240	43,840
1974	1,725	1,485	787	582	966	808	1,298	2,480	2,495	4,957	5,192	5,091	3,296	3,331	3,843	5,732	19,603	24,465	44,068
1975	1,675	1,447	692	513	889	709	1,253	2,441	2,383	4,809	5,024	4,964	3,303	3,283	3,867	5,843	19,087	24,009	43.096
Projected:																			
1976	1,677	1,451	686	508	873	695	1,285	2,505	2,452	4,960	5,112	5,052	3,413	3,404	3,949	6,066	19,447	24,641	44,088
1977	1,734	1,500	684	507	852	678	1,311	2,547	2,513	5,256	5,171	5,110	3,513	3,530	4,021	6,231	19,799	25,359	45,158
1978	1,759	1,522	692	514	828	658	1,336	2,584	2,578	5,236	5,230	5,175	3,603	3,644	4,113	6,425	20,139	25,758	45,897
1979	1,784	1,543	707	525	805	640	1,354	2,608	2,652	5,396	5,272	5,219	3,699	3,767	4,214	6,636	20,487	26,334	46,821
1980	1,806	1,563	718	533	787	625	1,360	2,612	2,737	5,572	5,306	5,257	3,797	3,890	4,314	6,862	20,825	26,914	47,739
1981	1,829	1,582	731	543	776	616	1,356	2,600	2,822	5,744	5,351	5,305	3,869	3,991	4,421	7,100	21,155	27,481	48,636
1982	1,850	1,601	740	550	771	612	1,343	2,572	2,912	5,925	5,395	5,351	3,928	4,082	4,530	7,349	21,469	28,042	49,511
1983	1,870	1,618	750	557	764	612	1,322	2,529	3,004	6,107	5,446	5,401	3,966	4,158	4,659	7,620	21,781	28,602	50,383
1984	1,886	1,633	759	563	775	615	1,296	2,480	3,096	6,286	5,503	5,454	4,007	4,238	4,786	7,900	22,108	29,169	51,277
1985	1,895	1,640	767	569	777	616	1,270	2,430	3,191	6,470	5,542	5,491	4,093	4,365	4,926	8,186	22,461	29,767	52,228
1986	1,898	1,642	774	575	779	617	1,242	2,376	3,284	6,651	5,594	5,533	4,174	4,484	5,078	8,518	22,823	30,396	53,219
1991	1,810	1,567	769	571	826	655	1,110	2,116	3,606	7,277	6,042	5,912	4,586	5,069	5,817	10,184	24,566	33,351	57,917
1996	1,683	1,458	722	536	841	668	1,114	2,122	3,639	7,300	6,887	6,749	4,913	5,385	6,342	11,663	26,141	35,881	62,022
2001	1,619	1,401	679	504	810	643	1,179	2,247	3,555	7,065	7,914	7,804	4,967	5,343	7,028	13,354	27,751	38,361	66,112
2006	1,642	1,420	671	499	764	606	1,200	2,288	3,410	6,759	9,156	9,004	5,079	5,473	7,484	14,313	29,406	40,362	69,768
2011	1,677	1,451	687	510	741	588	1,157	2,207	3,322	6,571	9,997	9,819	5,823	6,246	7,696	14,791	31,100	42,183	73,283
2016	1,661	1,437	692	514	747	593	1,093	2,085	3,357	6,638	10,042	9,829	7,142	7,700	7,934	15,251	32,668	44,047	76,715
2021	1,600	1,384	675	501	756	600	1,061	2,024	3,385	6,698	9,766	9,500	8,194	8,939	8,947	16,872	34,384	46,518	80,902
2026	1,548	1,339	650	483	748	600	1,070	2,040	3,326	6,583	9,383	9,099	9,124	9,811	10,632	19,050	36,481	49,005	85,486
2031	1,531	1,324	635	472	743	575	1,083	2,064	3,226	6,382	9,192	8,872	9,507	10,122	12,173	22,900	38,090	52,711	90,801

Note: Figures may not add due to rounding.

TABLE A-3 Historical and Projected Patient-Days, by Age Group and Sex, Projection I, Canada, 1967 to 2031

| Years | Age Groups | | | | | | | | | | | | | | | | Total | | |
| | <1 year | | 1-4 years | | 5-14 years | | 15-24 years | | 25-44 years | | 45-64 years | | 65-74 years | | 75+ | | | | |
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Male	Female	Total
in thousands																			
Historical:																			
1967	2,027	1,726	950	739	1,158	944	1,030	2,323	2,240	4,618	4,150	4,281	2,403	2,432	2,684	3,191	16,644	20,254	36,898
1968	1,940	1,678	1,040	786	1,240	996	1,133	2,533	2,408	4,980	4,529	4,738	2,665	2,655	2,952	3,628	17,908	21,994	39,902
1969	2,042	1,835	934	726	1,183	966	1,143	2,553	2,398	5,000	4,832	4,941	2,882	2,881	3,245	4,314	18,659	23,215	41,874
1970	1,977	1,706	942	709	1,152	944	1,224	2,660	2,445	5,159	4,899	5,068	2,977	3,050	3,435	4,580	19,050	23,875	42,925
1971	1,968	1,684	905	678	1,128	953	1,276	2,728	2,475	5,252	5,099	5,153	3,074	3,064	3,519	4,758	19,444	24,269	43,713
1972	1,805	1,554	934	710	1,060	847	1,292	2,640	2,529	5,147	5,223	5,265	3,163	3,244	3,751	5,175	19,756	24,583	44,339
1973	1,739	1,510	823	634	1,017	826	1,334	2,588	2,512	5,068	5,175	5,142	3,215	3,170	3,784	5,303	19,600	24,240	43,840
1974	1,725	1,485	787	582	966	808	1,298	2,480	2,495	4,957	5,192	5,091	3,296	3,331	3,843	5,732	19,603	24,465	44,068
1975	1,675	1,447	692	513	889	709	1,253	2,441	2,383	4,809	5,024	4,964	3,303	3,283	3,867	5,843	19,087	24,009	43,096
Projected:																			
1976	1,642	1,414	632	464	841	692	1,249	2,388	2,354	4,748	4,954	4,845	3,360	3,318	3,946	6,148	18,978	24,017	42,995
1977	1,654	1,420	580	423	792	657	1,235	2,324	2,319	4,674	4,859	4,723	3,404	3,349	4,019	6,397	18,862	23,967	42,829
1978	1,632	1,396	537	388	745	622	1,220	2,259	2,282	4,596	4,766	4,603	3,433	3,364	4,112	6,683	18,727	23,911	42,638
1979	1,609	1,376	537	387	698	588	1,196	2,178	2,252	4,528	4,652	4,459	3,468	3,378	4,214	6,990	18,626	23,884	42,510
1980	1,582	1,343	536	384	659	560	1,164	2,085	2,224	4,461	4,526	4,310	3,498	3,389	4,316	7,319	18,505	23,851	42,356
1981	1,604	1,361	540	386	629	537	1,127	2,061	2,280	4,571	4,565	4,340	3,499	3,374	4,421	7,660	18,665	24,290	42,955
1982	1,625	1,380	542	386	622	527	1,084	2,024	2,342	4,685	4,603	4,367	3,484	3,451	4,527	8,021	18,829	24,841	43,670
1983	1,646	1,398	543	387	620	516	1,061	1,977	2,402	4,795	4,643	4,398	3,451	3,515	4,652	8,411	19,018	25,397	44,415
1984	1,662	1,412	544	386	620	507	1,036	1,924	2,464	4,904	4,695	4,432	3,420	3,583	4,778	8,819	19,219	25,967	45,186
1985	1,673	1,420	545	386	619	498	1,011	1,873	2,525	5,015	4,728	4,451	3,497	3,691	4,914	9,243	19,512	26,577	46,089
1986	1,675	1,423	550	389	621	499	989	1,831	2,599	5,155	4,773	4,486	3,567	3,792	5,066	9,618	19,840	27,193	47,033
1991	1,598	1,357	547	387	658	530	833	1,631	2,853	5,641	5,154	4,793	3,918	4,286	5,804	11,499	21,365	30,124	51,489
1996	1,486	1,263	513	363	671	540	887	1,635	2,880	5,659	5,875	5,471	4,197	4,553	6,328	13,169	22,837	32,653	55,490
2001	1,430	1,213	482	342	646	520	928	1,731	2,813	5,476	6,751	6,326	4,243	4,517	7,011	15,078	24,304	35,203	59,507
2006	1,450	1,231	477	338	609	490	955	1,763	2,698	5,239	7,817	7,299	4,339	4,627	7,466	16,161	25,811	37,148	62,959
2011	1,481	1,257	488	346	591	475	921	1,700	2,628	5,094	8,535	7,960	4,974	5,281	7,678	16,700	27,296	38,813	66,109
2016	1,466	1,245	492	348	595	479	870	1,606	2,656	5,145	8,573	7,968	6,102	6,510	7,915	17,219	28,669	40,520	69,189
2021	1,342	1,199	480	340	603	485	845	1,560	2,678	5,192	8,338	7,701	7,000	7,558	9,326	19,050	30,612	43,085	73,697
2026	1,366	1,160	462	327	596	485	852	1,572	2,632	5,103	8,011	7,376	7,795	8,296	10,607	21,509	32,321	45,828	78,149
2031	1,351	1,147	451	320	578	465	862	1,591	2,553	4,947	7,848	7,192	8,122	8,558	12,144	25,856	33,909	50,076	83,985

Note: Figures may not add due to rounding.

TABLE A-4 Historical and Projected Patient-Days, by Age Group and Sex, Projection II, Canada, 1967 to 2031

Years	Age Groups < 1 year M	F	1-4 years M	F	5-14 years M	F	15-24 years M	F	25-44 years M	F	45-64 years M	F	65-74 years M	F	75+ M	F	Total Male	Female	Total
	in thousands																		
Historical:																			
1967	2,027	1,726	950	739	1,158	944	1,030	2,323	2,240	4,618	4,150	4,281	2,403	2,432	2,684	3,191	16,644	20,254	36,898
1968	1,940	1,678	1,040	786	1,240	996	1,133	2,533	2,408	4,980	4,529	4,738	2,665	2,655	2,952	3,628	17,908	21,994	39,902
1969	2,042	1,835	934	726	1,183	966	1,143	2,553	2,398	5,000	4,832	4,941	2,882	2,881	3,245	4,314	18,659	23,215	41,874
1970	1,977	1,706	942	709	1,152	944	1,224	2,660	2,445	5,159	4,899	5,068	2,977	3,050	3,435	4,580	19,050	23,875	42,925
1971	1,968	1,684	905	678	1,128	953	1,276	2,728	2,475	5,252	5,099	5,153	3,074	3,064	3,519	4,758	19,444	24,269	43,713
1972	1,805	1,554	934	710	1,060	847	1,292	2,640	2,529	5,147	5,223	5,265	3,163	3,244	3,751	5,175	19,756	24,583	44,339
1973	1,739	1,510	823	634	1,017	826	1,334	2,588	2,512	5,068	5,175	5,142	3,215	3,170	3,784	5,303	19,600	24,240	43,840
1974	1,725	1,485	787	582	966	808	1,298	2,480	2,495	4,957	5,192	5,091	3,296	3,331	3,843	5,732	19,603	24,465	44,068
1975	1,675	1,447	692	513	889	709	1,253	2,441	2,383	4,809	5,024	4,964	3,303	3,283	3,867	5,843	19,087	24,009	43,096
Projected:																			
1976	1,642	1,414	632	464	841	692	1,249	2,388	2,354	4,748	4,954	4,845	3,360	3,318	3,946	6,148	18,978	24,017	42,995
1977	1,654	1,420	580	423	792	657	1,235	2,324	2,319	4,674	4,859	4,723	3,404	3,349	4,019	6,397	18,862	23,967	42,829
1978	1,632	1,396	537	388	745	622	1,220	2,259	2,282	4,596	4,766	4,603	3,433	3,364	4,112	6,683	18,727	23,911	42,638
1979	1,609	1,376	537	387	698	588	1,196	2,178	2,252	4,528	4,652	4,459	3,468	3,378	4,214	6,990	18,626	23,884	42,510
1980	1,582	1,343	536	384	659	560	1,164	2,085	2,224	4,461	4,526	4,310	3,498	3,389	4,316	7,319	18,505	23,851	42,356
1981	1,604	1,361	540	386	629	537	1,127	2,061	2,280	4,571	4,565	4,340	3,519	3,431	4,366	7,474	18,630	24,161	42,791
1982	1,625	1,380	542	386	622	527	1,084	2,024	2,342	4,685	4,603	4,367	3,525	3,464	4,416	7,636	18,759	24,469	43,228
1983	1,646	1,398	543	387	620	516	1,061	1,977	2,402	4,795	4,643	4,398	3,513	3,483	4,482	7,815	18,910	24,769	43,679
1984	1,662	1,412	544	386	620	507	1,036	1,924	2,464	4,904	4,695	4,432	3,504	3,504	4,544	7,997	19,069	25,066	44,135
1985	1,673	1,420	545	386	619	498	1,011	1,873	2,525	5,015	4,728	4,451	3,532	3,562	4,617	8,179	19,250	25,384	44,634
1986	1,675	1,423	550	389	621	499	989	1,831	2,599	5,155	4,773	4,486	3,556	3,612	4,698	8,400	19,461	25,795	45,256
1991	1,598	1,357	547	387	658	530	833	1,631	2,853	5,641	5,154	4,793	3,659	3,824	5,041	9,408	20,343	27,571	47,914
1996	1,486	1,263	513	363	671	540	887	1,635	2,880	5,659	5,875	5,471	3,672	3,807	5,149	10,093	21,133	28,831	49,964
2001	1,430	1,213	482	342	646	520	928	1,731	2,813	5,476	6,751	6,326	3,478	3,537	5,344	10,825	21,872	29,970	51,842
2006	1,450	1,231	477	338	609	490	955	1,763	2,698	5,239	7,817	7,299	3,557	3,623	5,691	11,602	23,254	31,585	54,839
2011	1,481	1,257	488	346	591	475	921	1,700	2,628	5,094	7,960	8,535	4,077	4,136	5,852	11,989	24,573	32,957	57,530
2016	1,466	1,245	492	348	595	479	870	1,606	2,656	5,145	8,573	7,968	5,001	5,098	6,033	12,362	25,686	34,251	59,937
2021	1,342	1,199	480	340	603	485	845	1,560	2,678	5,192	8,338	7,701	5,737	5,918	6,803	13,676	26,826	36,071	62,897
2026	1,366	1,160	462	327	596	485	852	1,572	2,632	5,103	8,011	7,376	6,389	6,496	8,085	16,094	28,393	38,613	67,006
2031	1,351	1,147	451	320	578	465	862	1,591	2,553	4,947	7,848	7,192	6,657	6,701	9,257	18,563	29,557	40,926	70,483

Note: Figures may not add due to rounding.

TABLE A-5 Historical and Projected Patient-Days, by Age Group and Sex, Lower Boundary, Canada, 1967 to 2031

Years	Age Groups																Total		
	< 1 year		1-4 years		5-14 years		15-24 years		25-44 years		45-64 years		65-74 years		75+				
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Male	Female	Total
	in thousands																		
Historical:																			
1967	2,027	1,726	950	739	1,158	944	1,030	2,323	2,240	4,618	4,150	4,281	2,403	2,432	2,684	3,191	16,644	20,254	36,898
1968	1,940	1,678	1,040	786	1,240	996	1,133	2,533	2,408	4,980	4,529	4,738	2,665	2,655	2,952	3,628	17,908	21,994	39,902
1969	2,042	1,835	934	726	1,183	966	1,143	2,553	2,398	5,000	4,832	4,941	2,882	2,881	3,245	4,314	18,659	23,215	41,874
1970	1,977	1,706	942	709	1,152	944	1,224	2,660	2,445	5,159	4,899	5,068	2,977	3,050	3,435	4,580	19,050	23,875	42,925
1971	1,968	1,684	905	678	1,128	953	1,276	2,728	2,475	5,252	5,099	5,153	3,074	3,064	3,519	4,758	19,444	24,269	43,713
1972	1,805	1,554	934	710	1,060	847	1,292	2,640	2,529	5,147	5,223	5,265	3,163	3,244	3,751	5,175	19,756	24,583	44,339
1973	1,739	1,510	823	634	1,017	826	1,334	2,588	2,512	5,068	5,175	5,142	3,215	3,170	3,784	5,303	19,600	24,240	43,840
1974	1,725	1,485	787	582	966	808	1,298	2,480	2,495	4,957	5,192	5,091	3,296	3,331	3,843	5,732	19,603	24,465	44,068
1975	1,675	1,447	692	513	889	709	1,253	2,441	2,383	4,809	5,024	4,964	3,303	3,283	3,867	5,843	19,087	24,009	43,096
Projected:																			
1976	1,642	1,414	632	464	841	692	1,249	2,388	2,354	4,748	4,954	4,845	3,360	3,318	3,946	6,148	18,978	24,017	42,995
1977	1,654	1,420	580	423	792	657	1,235	2,324	2,319	4,674	4,859	4,723	3,404	3,349	4,019	6,397	18,862	23,967	42,829
1978	1,632	1,396	537	388	745	622	1,220	2,259	2,282	4,596	4,766	4,603	3,433	3,364	4,112	6,683	18,727	23,911	42,638
1979	1,609	1,376	537	387	698	588	1,196	2,178	2,252	4,528	4,652	4,459	3,468	3,378	4,214	6,990	18,626	23,884	42,510
1980	1,582	1,343	536	384	659	560	1,164	2,085	2,224	4,461	4,526	4,310	3,498	3,389	4,316	7,319	18,505	23,851	42,356
1981	1,604	1,361	540	386	629	537	1,127	2,061	2,280	4,571	4,565	4,340	3,462	3,376	4,295	7,353	18,502	23,985	42,487
1982	1,625	1,380	542	386	622	527	1,084	2,024	2,342	4,685	4,603	4,367	3,412	3,353	4,274	7,392	18,504	24,114	42,618
1983	1,646	1,398	543	387	620	516	1,061	1,977	2,402	4,795	4,643	4,398	3,346	3,317	4,268	7,442	18,529	24,230	42,759
1984	1,662	1,412	544	386	620	507	1,036	1,924	2,464	4,904	4,695	4,432	3,283	3,283	4,258	7,493	18,562	24,341	42,903
1985	1,673	1,420	545	386	619	498	1,011	1,873	2,525	5,015	4,728	4,451	3,256	3,284	4,256	7,540	18,613	24,467	43,080
1986	1,675	1,423	550	389	621	499	989	1,831	2,599	5,155	4,773	4,486	3,225	3,276	4,261	7,619	18,693	24,678	43,371
1991	1,598	1,357	547	387	658	530	833	1,631	2,853	5,641	5,154	4,793	3,059	3,198	4,215	7,866	18,917	25,403	44,320
1996	1,486	1,263	513	363	671	540	887	1,635	2,880	5,659	5,875	5,471	2,830	2,934	3,968	7,779	19,110	25,644	44,754
2001	1,430	1,213	482	342	646	520	928	1,731	2,813	5,476	6,751	6,326	2,471	2,513	3,797	7,692	19,318	25,813	45,131
2006	1,450	1,231	477	338	609	490	955	1,763	2,698	5,239	7,817	7,299	2,527	2,575	4,043	8,244	20,576	27,179	47,755
2011	1,481	1,257	488	346	591	475	921	1,700	2,628	5,094	8,535	7,960	2,897	2,938	4,158	8,519	21,699	28,289	49,988
2016	1,466	1,245	492	348	595	479	870	1,606	2,656	5,145	8,573	7,968	3,553	3,622	4,287	8,784	22,492	29,197	51,689
2021	1,342	1,199	480	340	603	485	845	1,560	2,678	5,192	8,338	7,701	4,076	4,205	4,834	9,717	23,196	30,399	53,595
2026	1,366	1,160	462	327	596	485	852	1,572	2,632	5,103	8,011	7,376	4,539	4,616	5,745	11,435	24,203	32,074	56,277
2031	1,351	1,147	451	320	578	465	862	1,591	2,553	4,947	7,848	7,192	4,730	4,762	6,577	13,189	24,950	33,613	58,563

Note: Figures may not add due to rounding.

APPENDIX B

PATIENT-DAY COSTS IN CURRENT DOLLARS

The advantage of showing constant dollars is that it is a comparable year-to-year measurement, which clearly illustrates magnitudes and trends. Nonetheless, it is not an entirely satisfactory indicator. Some inflation is inevitable, so projected costs in constant dollars are almost certainly too low. Therefore, it is useful to indicate total amounts in current dollars. Because the extent of inflation is in question, readers interested in current dollars costs in a particular year must make an assumption about the future rate of inflation. An inflation table is provided for this purpose.

For example, a determination of the current dollar cost of Projection I in 1986 involves the following steps:

- average annual inflation is assumed to be 8% (row 8 on the table)

- between 1976 and 1986 there are 10 years (column 10 on the table)

- the inflation factor is the cell on the table where row 8 and column 11 intersect

- the value of this cell is 2.159

- the constant dollar cost of Projection I in 1986 ($5.9 billion) multiplied by 2.159 yields the cost in current dollars ($12.7 billion)

TABLE B-1 Inflation Factors

Inflation Rate (%)	Years														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.010	1.020	1.030	1.041	1.051	1.062	1.072	1.083	1.094	1.105	1.116	1.127	1.138	1.149	1.161
2	1.020	1.040	1.061	1.082	1.104	1.126	1.149	1.172	1.195	1.219	1.243	1.268	1.294	1.319	1.346
3	1.030	1.061	1.093	1.126	1.159	1.194	1.230	1.267	1.305	1.344	1.384	1.426	1.469	1.513	1.558
4	1.040	1.082	1.125	1.170	1.217	1.265	1.316	1.369	1.423	1.480	1.539	1.601	1.665	1.732	1.801
5	1.050	1.102	1.158	1.216	1.276	1.340	1.407	1.477	1.551	1.629	1.710	1.796	1.886	1.980	2.079
6	1.060	1.124	1.191	1.262	1.338	1.419	1.504	1.594	1.689	1.791	1.898	2.012	2.133	2.261	2.397
7	1.070	1.145	1.225	1.311	1.403	1.501	1.606	1.718	1.838	1.967	2.105	2.252	2.410	2.579	2.759
8	1.080	1.166	1.260	1.360	1.469	1.587	1.714	1.851	1.999	2.159	2.332	2.518	2.720	2.937	3.172
9	1.090	1.188	1.295	1.412	1.539	1.677	1.828	1.993	2.172	2.367	2.580	2.813	3.066	3.342	3.642
10	1.100	1.210	1.331	1.464	1.611	1.772	1.949	2.144	2.358	2.594	2.853	3.138	3.452	3.797	4.177
11	1.110	1.232	1.368	1.518	1.685	1.870	2.076	2.305	2.558	2.839	3.152	3.498	3.883	4.310	4.785
12	1.120	1.254	1.405	1.574	1.762	1.974	2.211	2.476	2.773	3.106	3.479	3.896	4.363	4.887	5.474
13	1.130	1.277	1.443	1.630	1.842	2.082	2.353	2.658	3.004	3.395	3.836	4.335	4.898	5.535	6.254
14	1.140	1.300	1.482	1.689	1.925	2.195	2.502	2.853	3.252	3.707	4.226	4.818	5.492	6.261	7.138
15	1.150	1.322	1.521	1.749	2.011	2.313	2.660	3.059	3.518	4.046	4.652	5.350	6.153	7.076	8.137
16	1.160	1.346	1.561	1.811	2.100	2.436	2.826	3.278	3.803	4.411	5.117	5.936	6.886	7.988	9.266
17	1.170	1.369	1.602	1.874	2.192	2.565	3.001	3.511	4.108	4.807	5.624	6.580	7.699	9.007	10.539
18	1.180	1.392	1.643	1.939	2.288	2.700	3.185	3.759	4.435	5.234	6.176	7.288	8.599	10.147	11.974
19	1.190	1.416	1.685	2.005	2.386	2.840	3.379	4.021	4.785	5.695	6.777	8.064	9.596	11.420	13.590
20	1.200	1.440	1.728	2.074	2.488	2.986	3.583	4.300	5.160	6.192	7.430	8.916	10.699	12.839	15.407

APPENDIX C

AVERAGE LENGTHS OF STAY AND PARTICIPATION RATES, PROJECTIONS I, II, AND LOWER
BOUNDARY

   The following charts show how average length of hospital stay and participation
rates were allowed to change for each age-sex group in Projections I, II, and the
lower boundary.

Chart — C-1
Average Length of Stay in Hospital, by Age Group and Sex, Projection I, 1967 to 2031
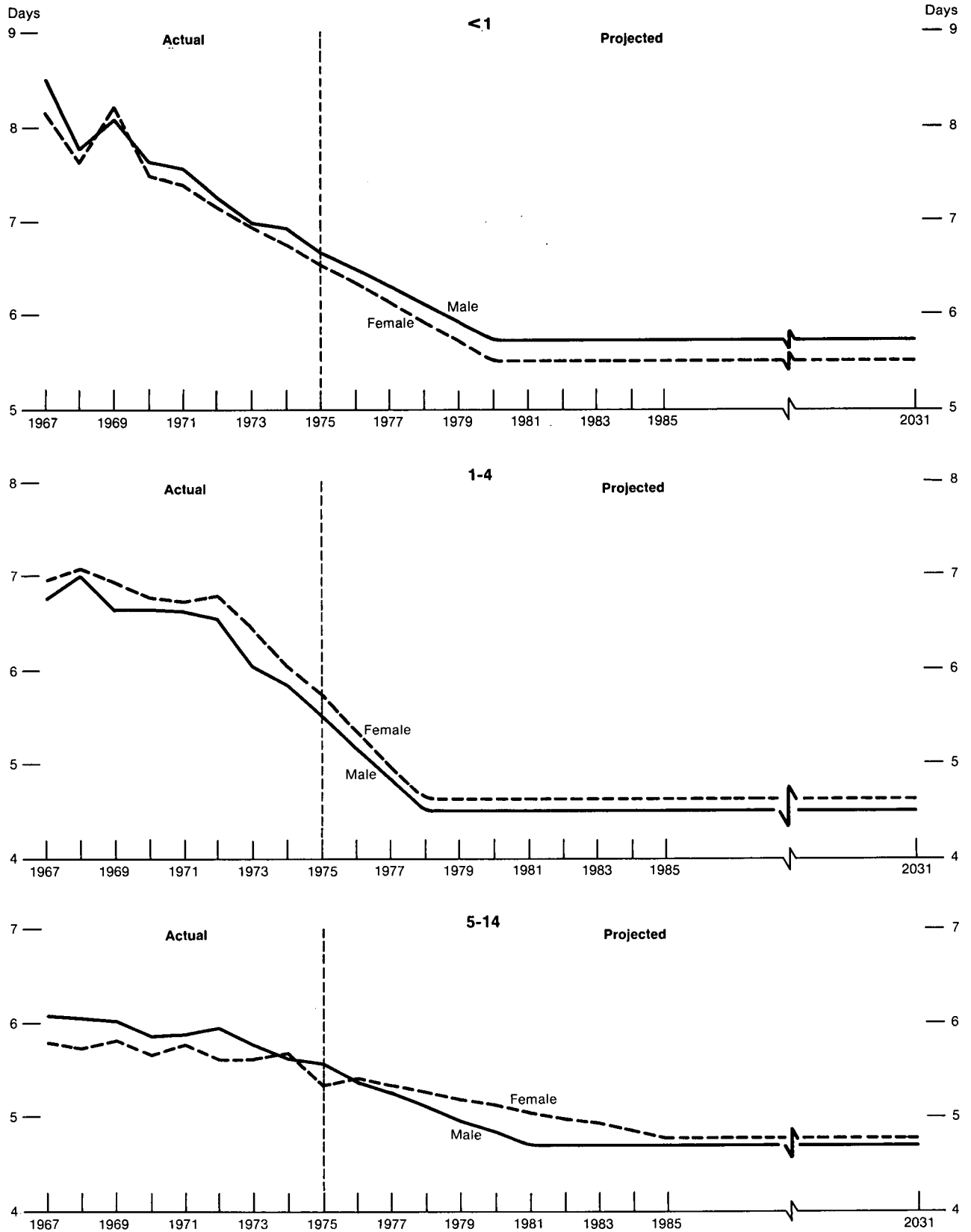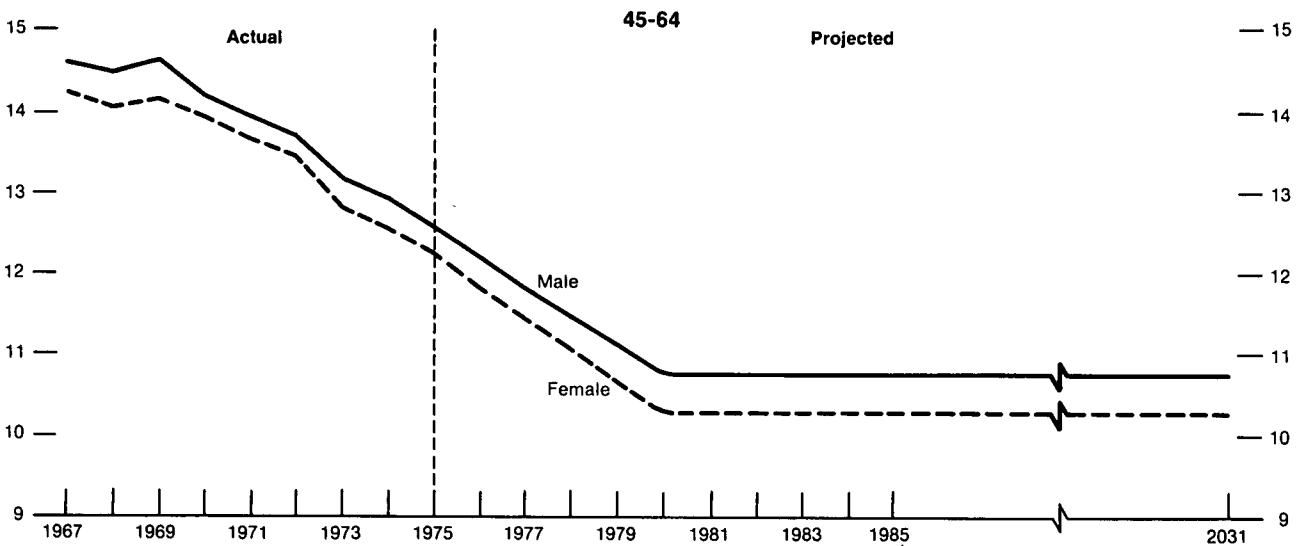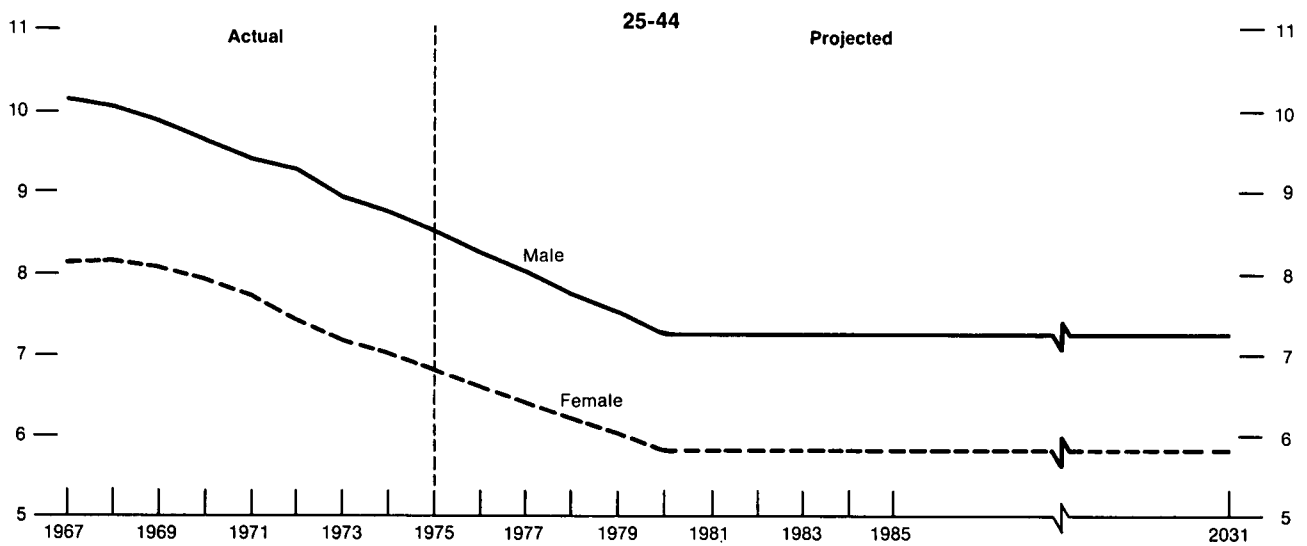
Chart — C-1
Average Length of Stay in Hospital, by Age Group and Sex, Projection I, 1967 to 2031

Days
9 —   Actual   **15-24**   Projected   Days
                                                                                                     — 9

8 —

                                                                                                     — 8
7 —
                                                    Male   — 7

6 —
                                                                                                     — 6
                                                 Female
5 —   — 5

4 — 1967   1969   1971   1973   1975   1977   1979   1981   1983   1985   2031   — 4

11 —   Actual   **25-44**   Projected   — 11

10 —   — 10

9 —   — 9

                                                    Male   — 8
8 —

7 —   — 7
                                                 Female
6 —   — 6

5 — 1967   1969   1971   1973   1975   1977   1979   1981   1983   1985   2031   — 5

15 —   Actual   **45-64**   Projected   — 15

14 —   — 14

13 —   — 13

12 —   Male   — 12

11 —   — 11
                                                 Female
10 —   — 10

9 — 1967   1969   1971   1973   1975   1977   1979   1981   1983   1985   2031   — 9
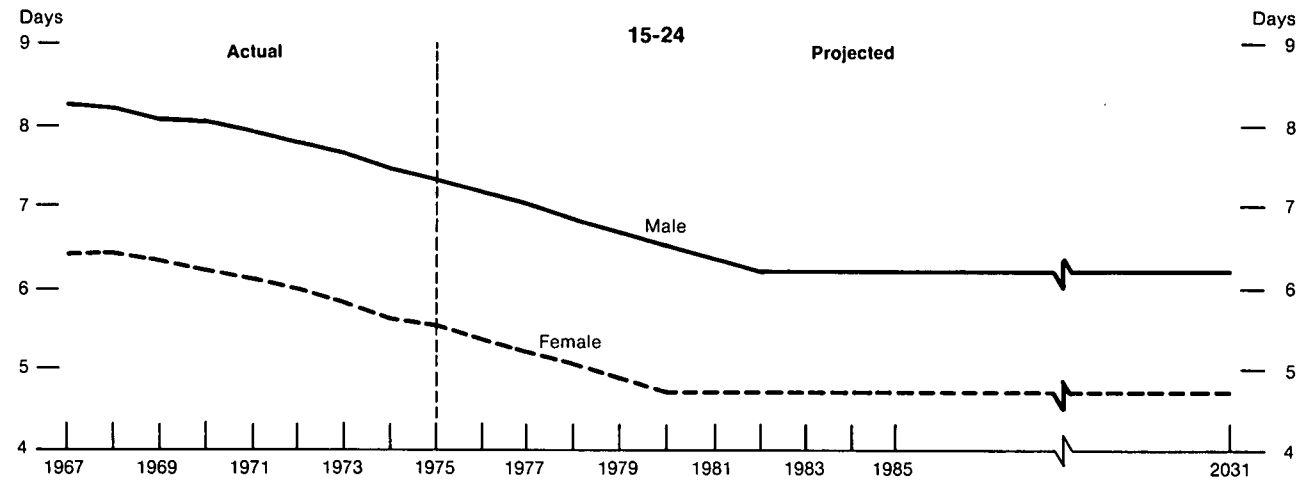
Chart — C-1
Average Length of Stay in Hospital, by Age Group and Sex, Projection I, 1967 to 2031

Chart — C-2
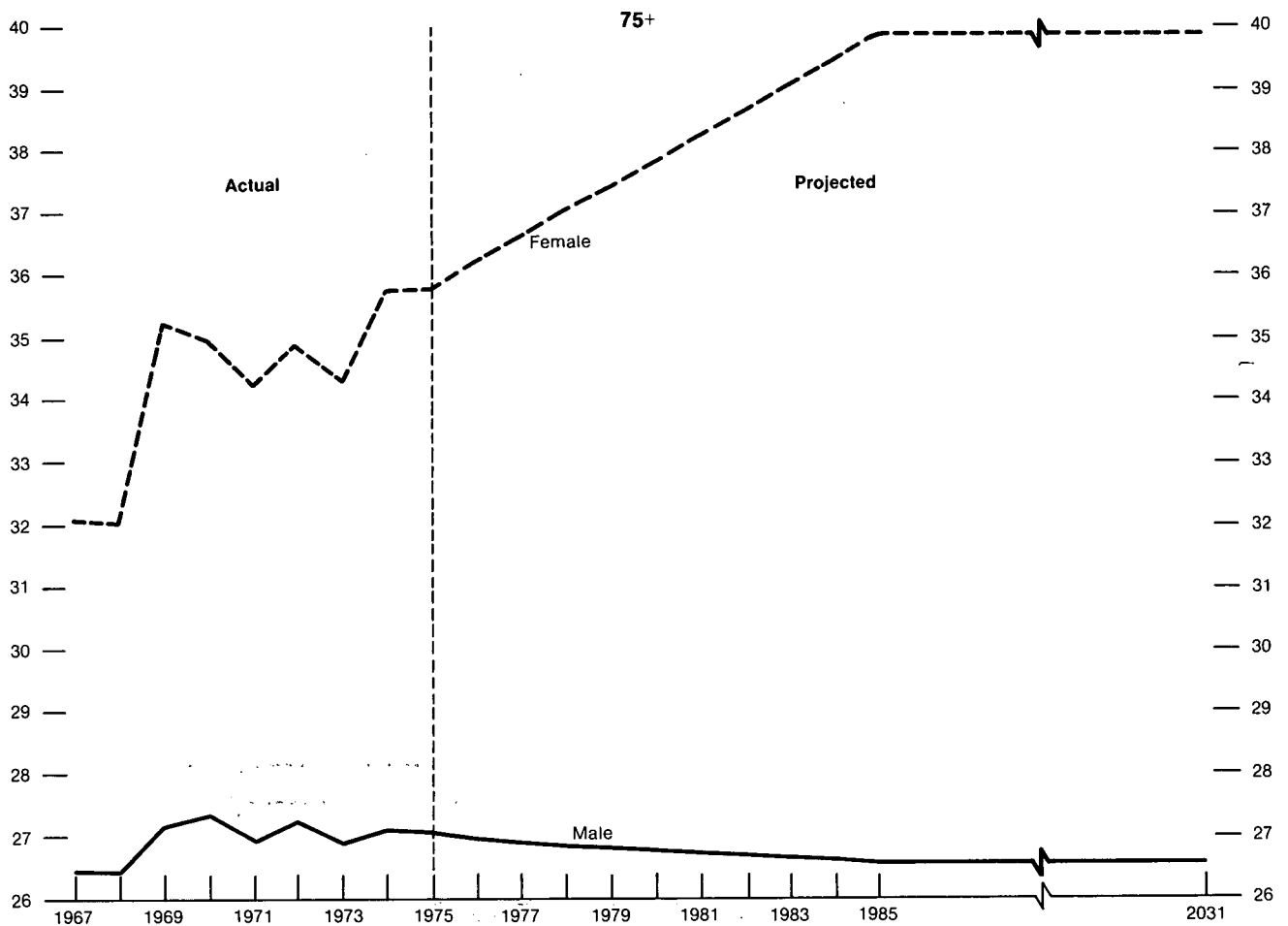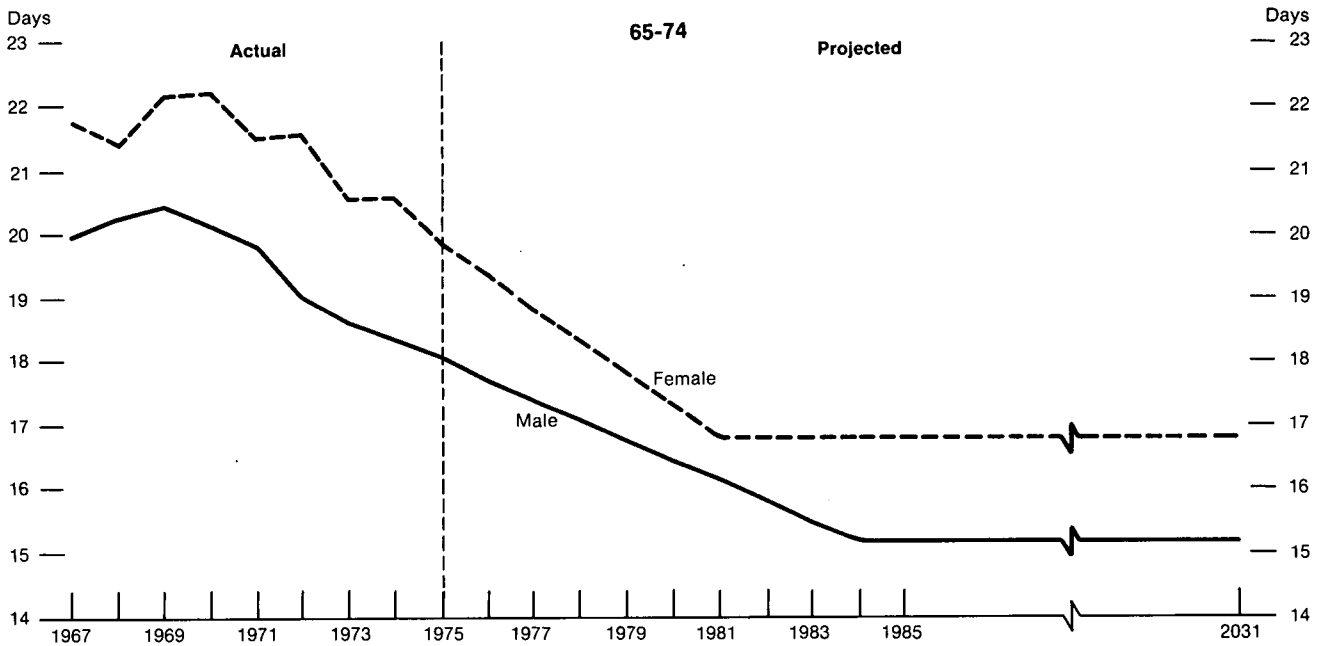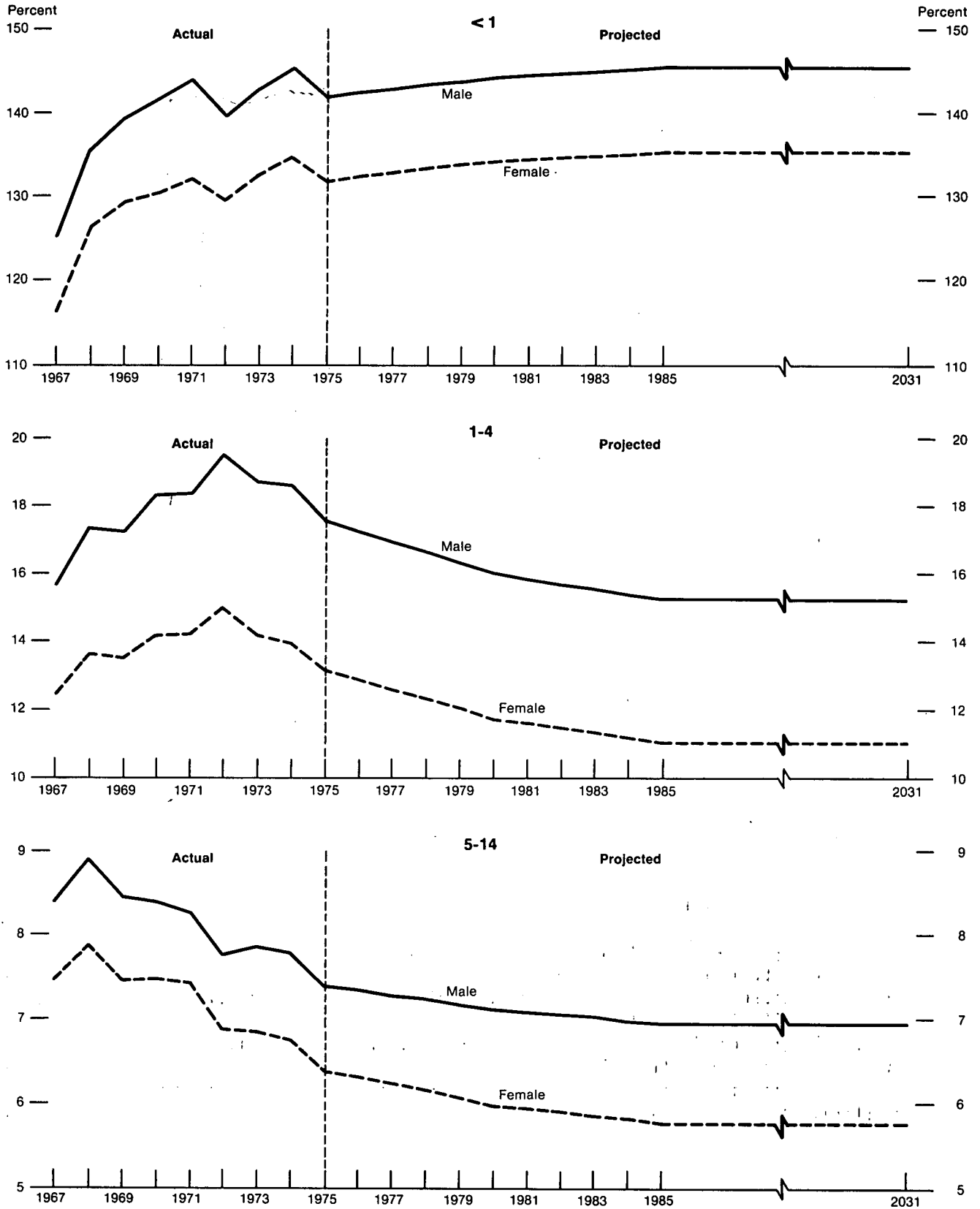**Hospital Participation Rate, by Age Group and Sex, Projection I, 1967 to 2031**

Chart — C-2
Hospital Participation Rate, by Age Group and Sex, Projection I, 1967 to 2031

Chart — C-2
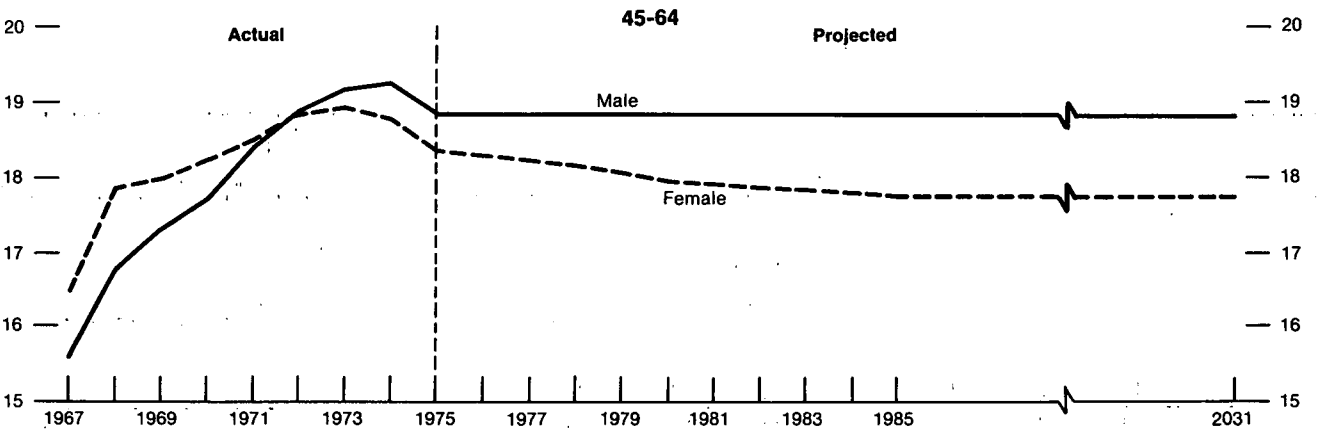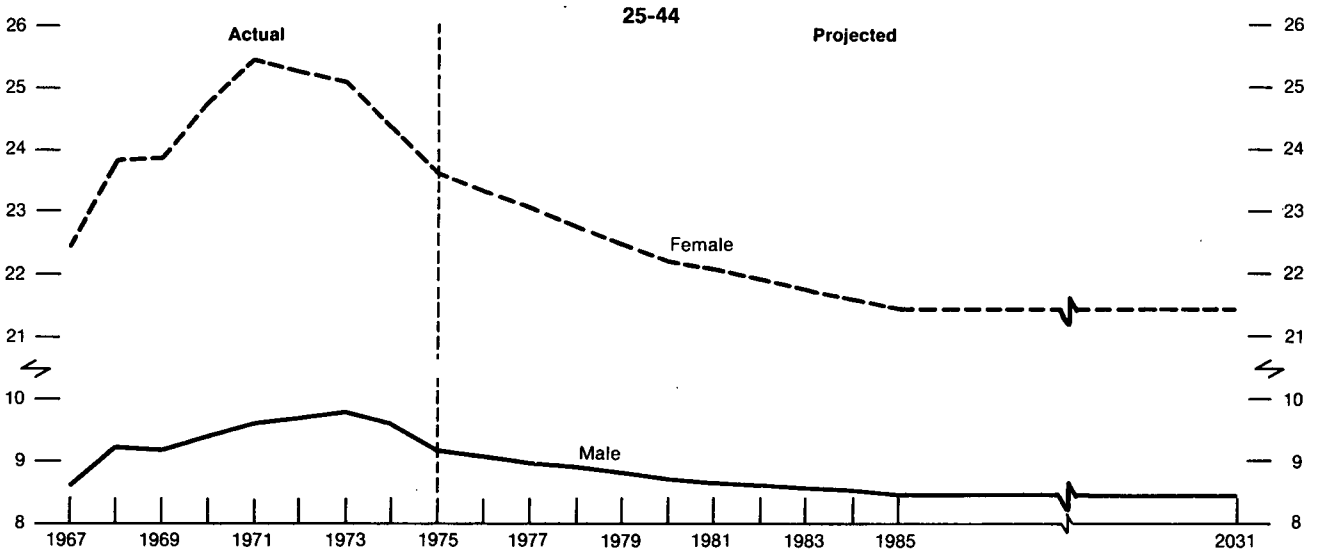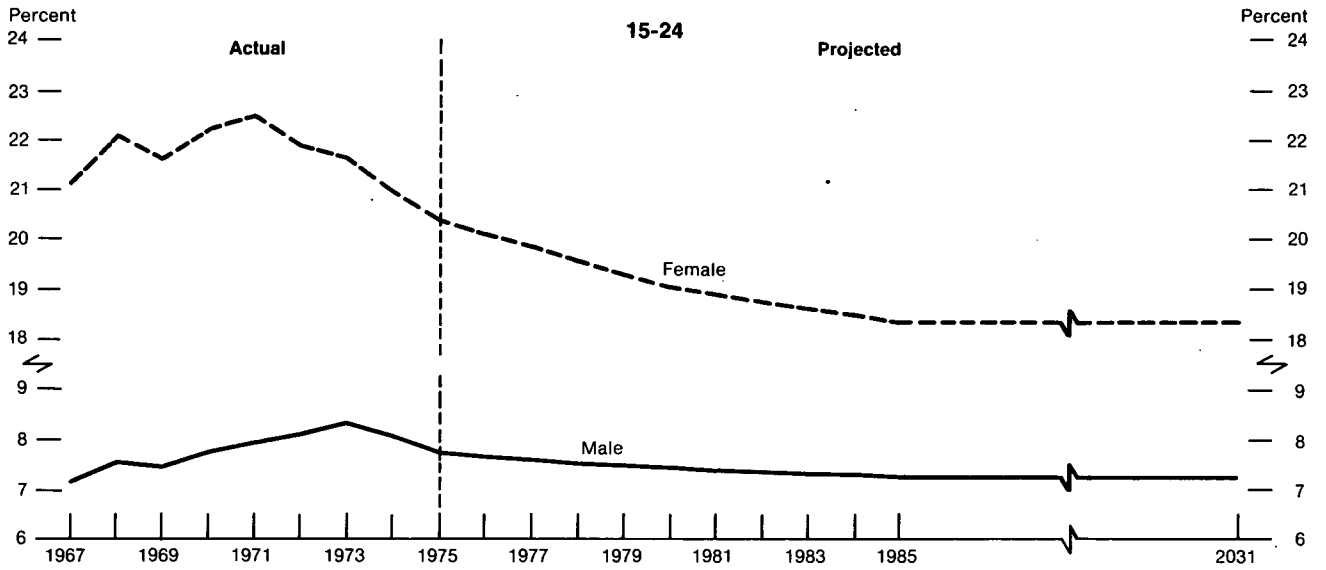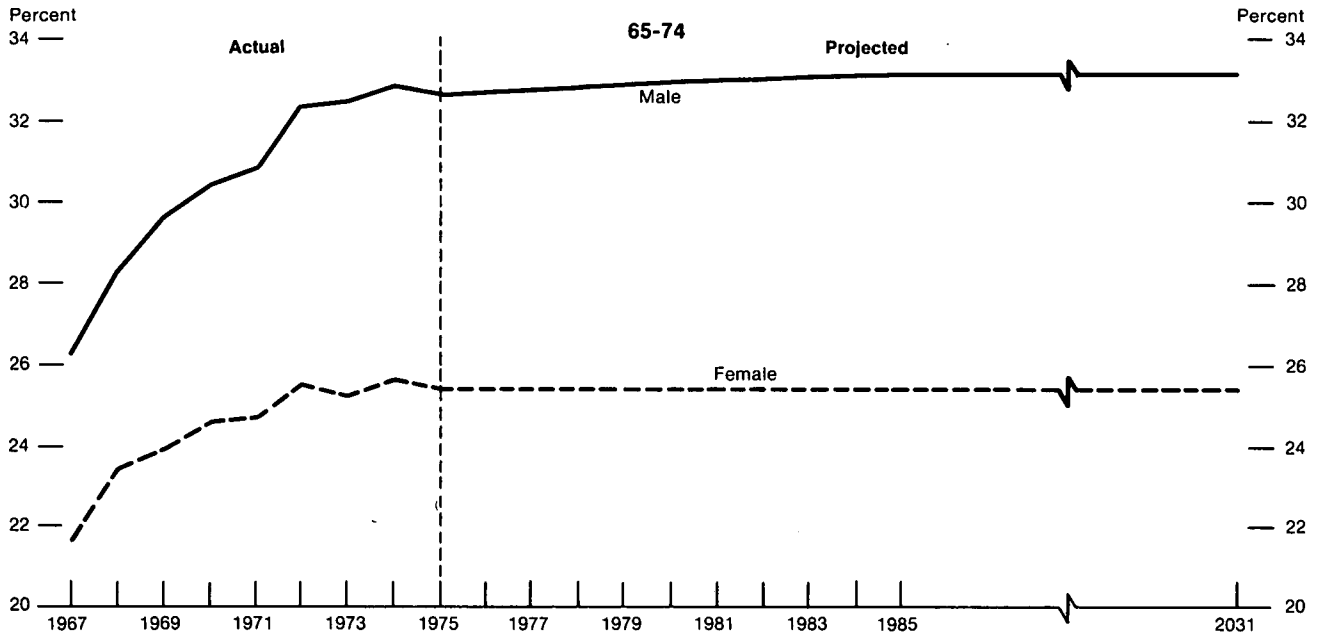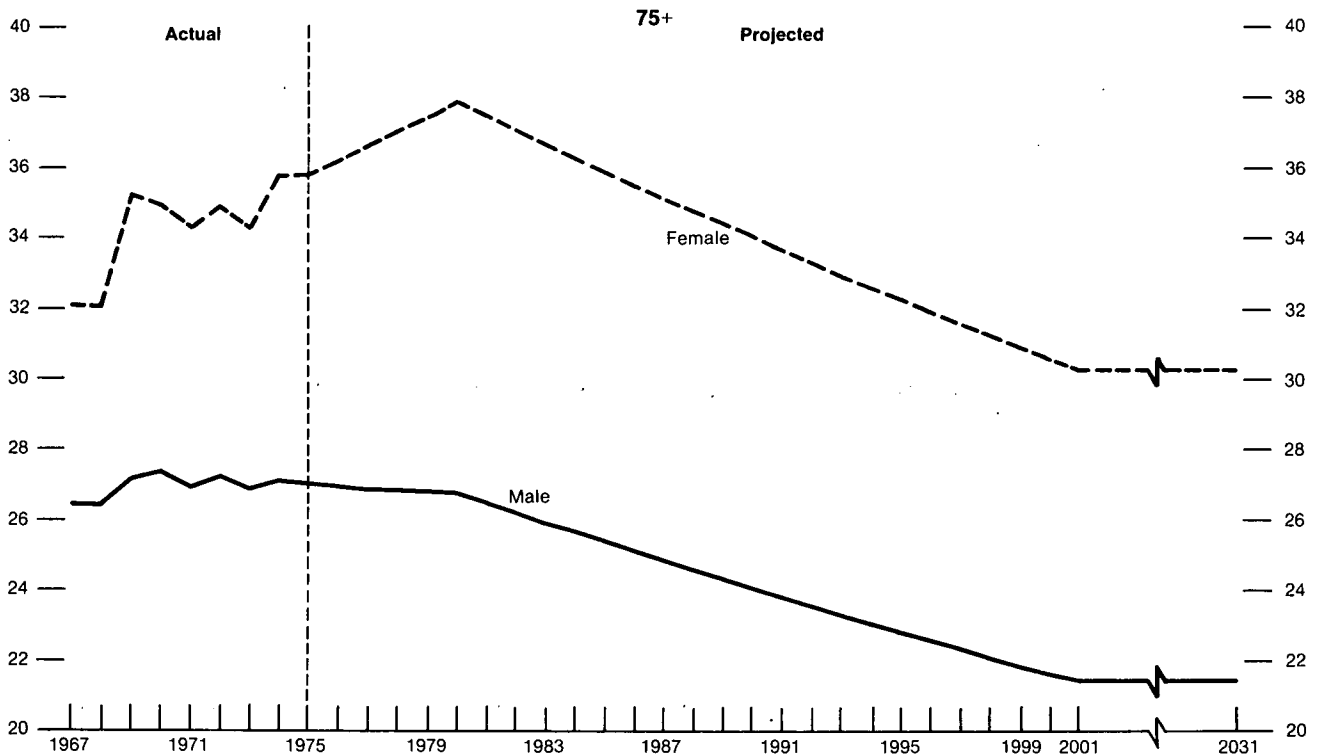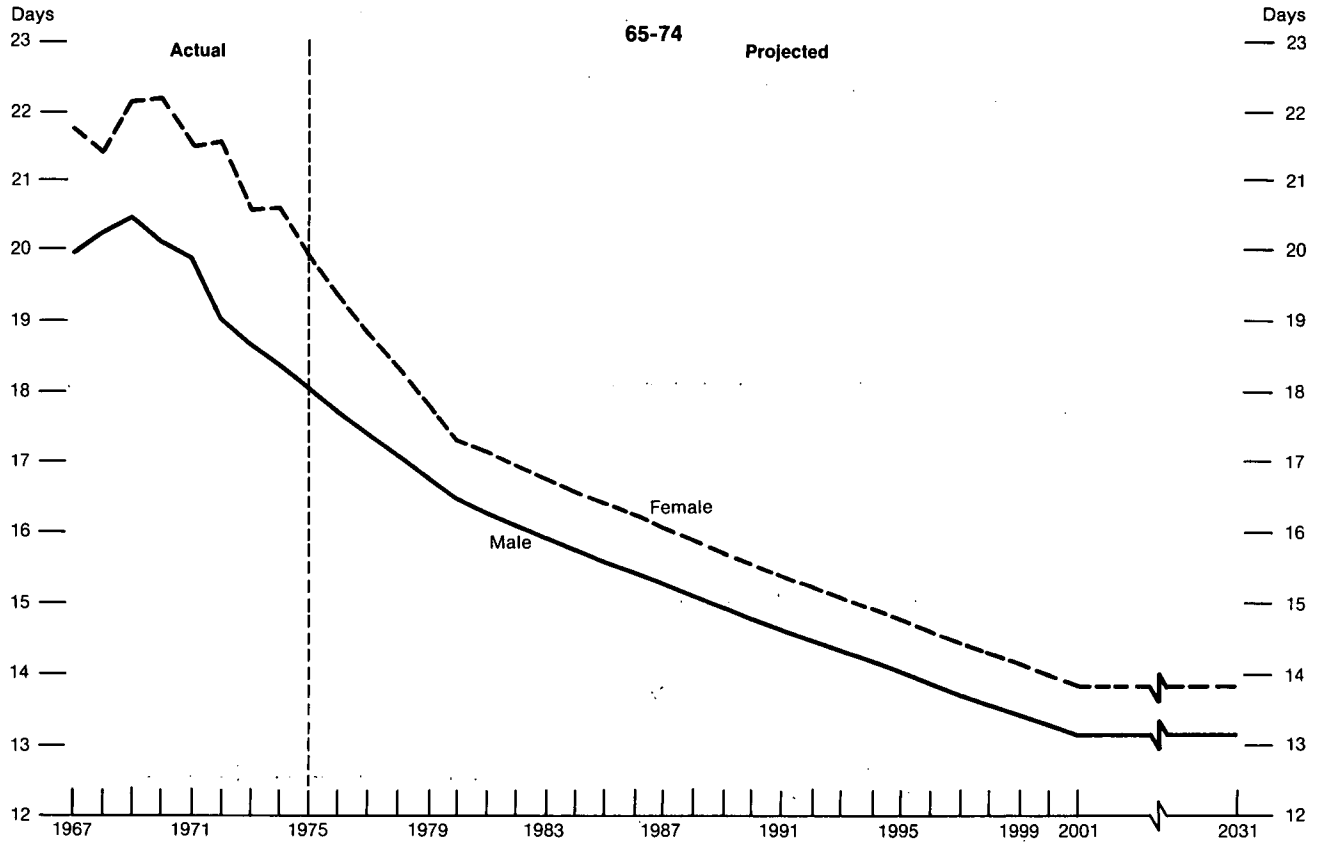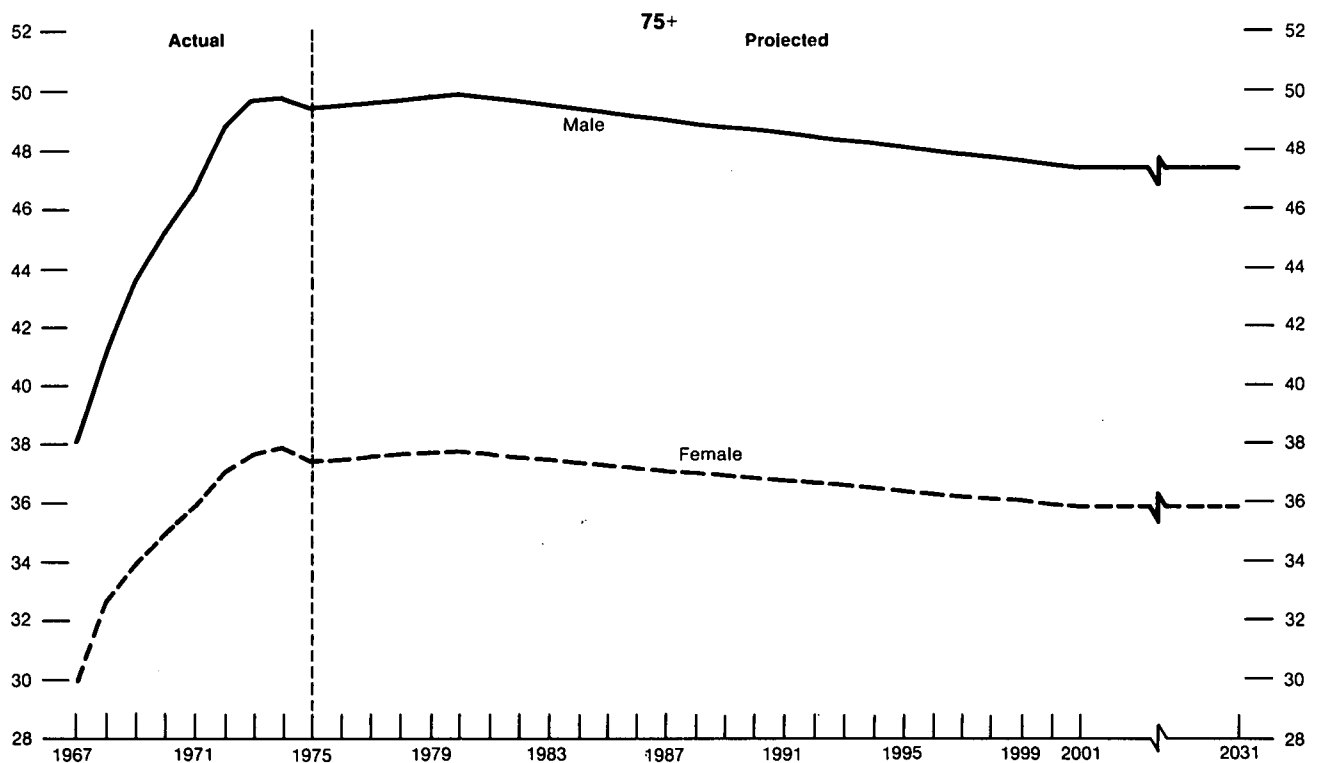## Hospital Participation Rate, by Age Group and Sex, Projection I , 1967 to 2031
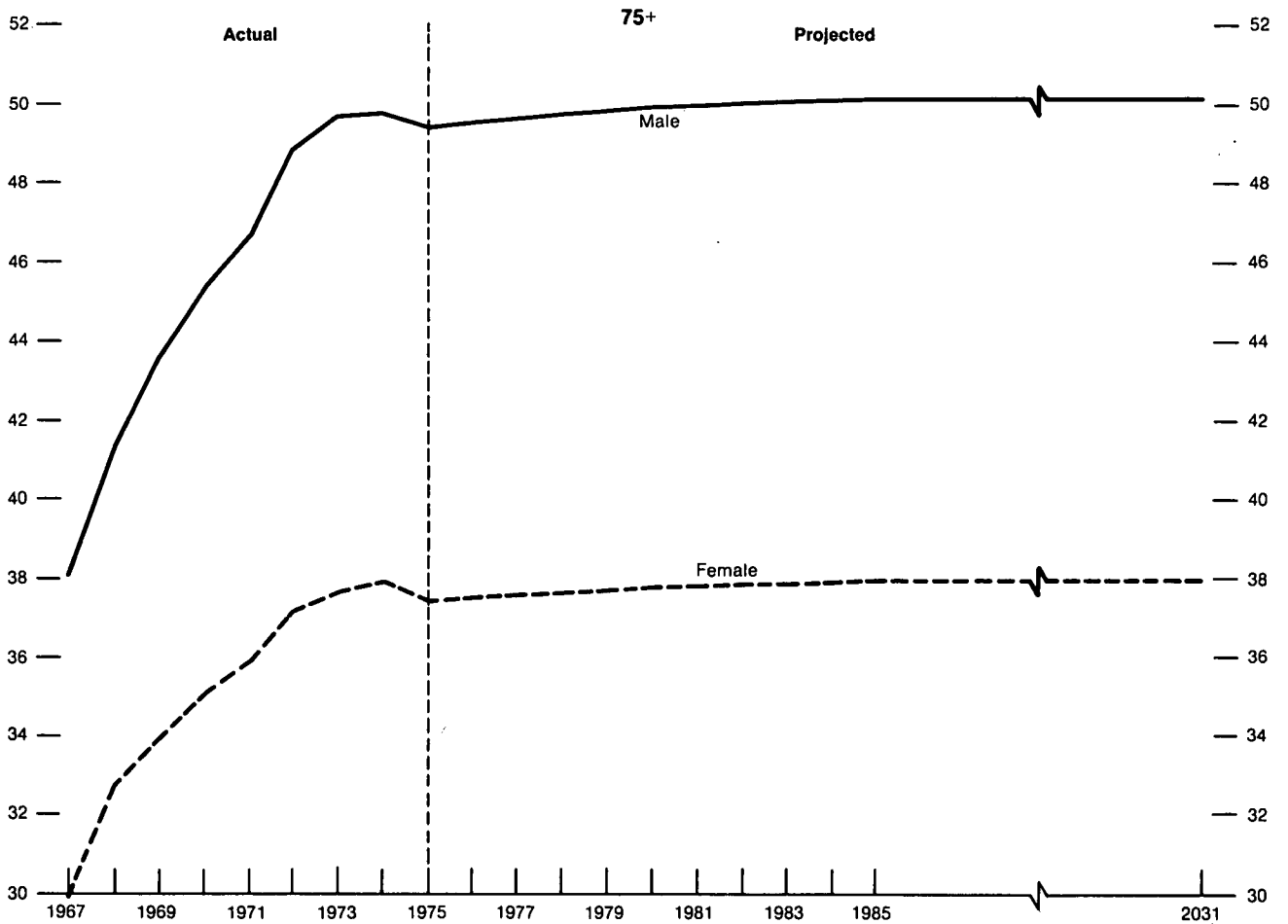
Chart — C-3

Average Length of Stay in Hospital, 65-74 and 75+ Age Groups, by Sex, Projection II, 1967 to 2031

Days

65-74

Days

Actual   Projected

(line chart for 65-74 age group showing Female and Male average length of stay, Days axis from 12 to 23, years 1967 to 2031, with dashed vertical line at 1975 dividing Actual and Projected)

75+

Actual   Projected

(line chart for 75+ age group showing Female and Male average length of stay, Days axis from 20 to 40, years 1967 to 2031, with dashed vertical line at 1975 dividing Actual and Projected)

Chart — C-4
Hospital Participation Rate, 65-74 and 75+ Age Groups, by Sex, Projection II, 1967 to 2031
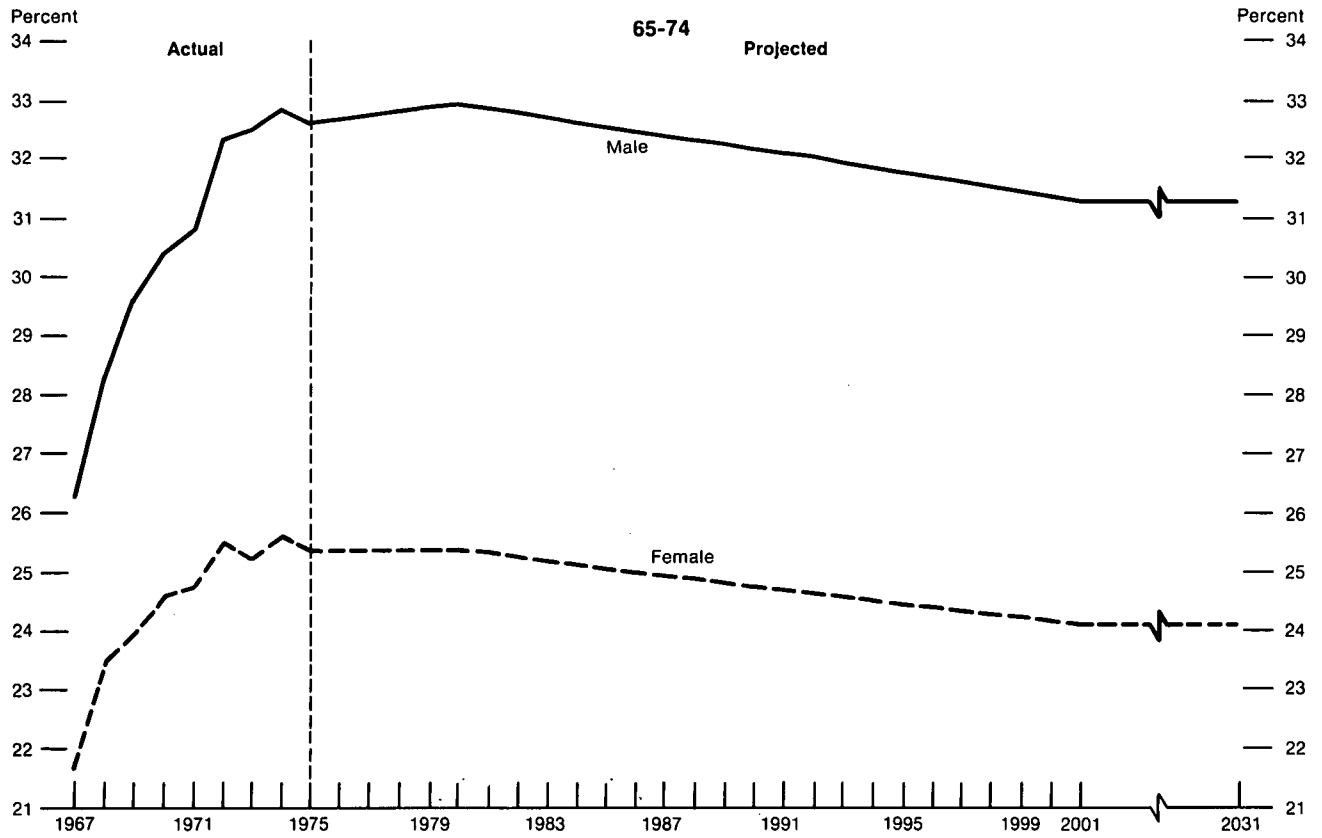
Chart — C-5
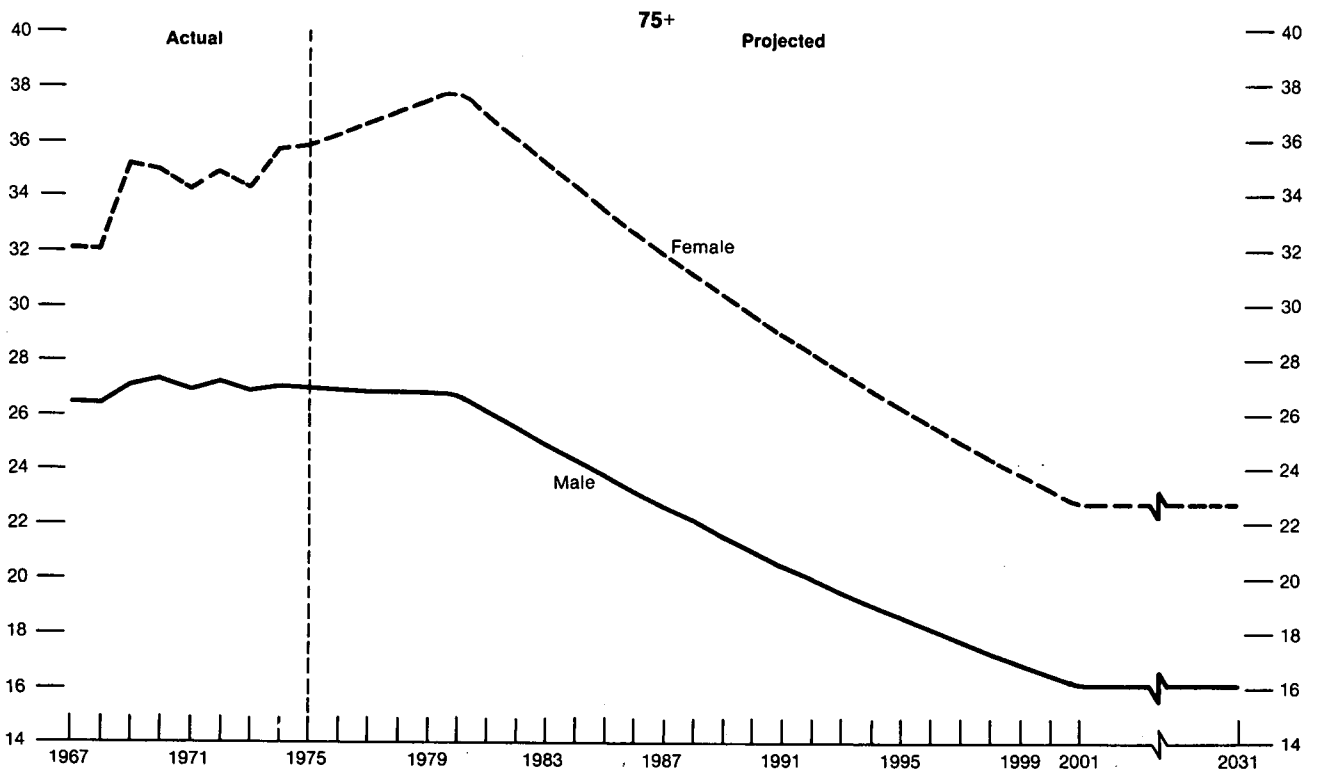**Average Length of Stay in Hospital, 65-74 and 75+ Age Groups, by Sex, Lower Boundary , 1967 to 2031**
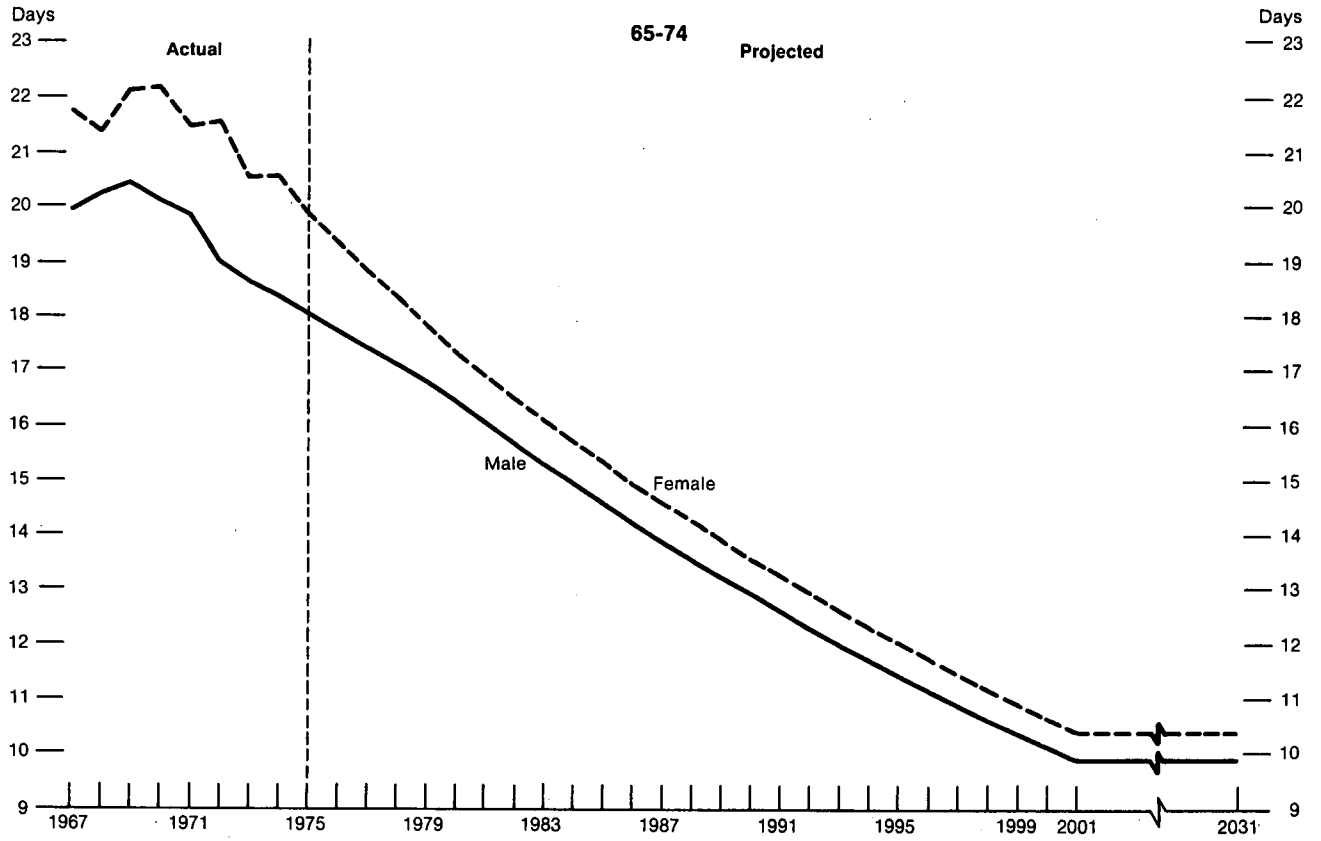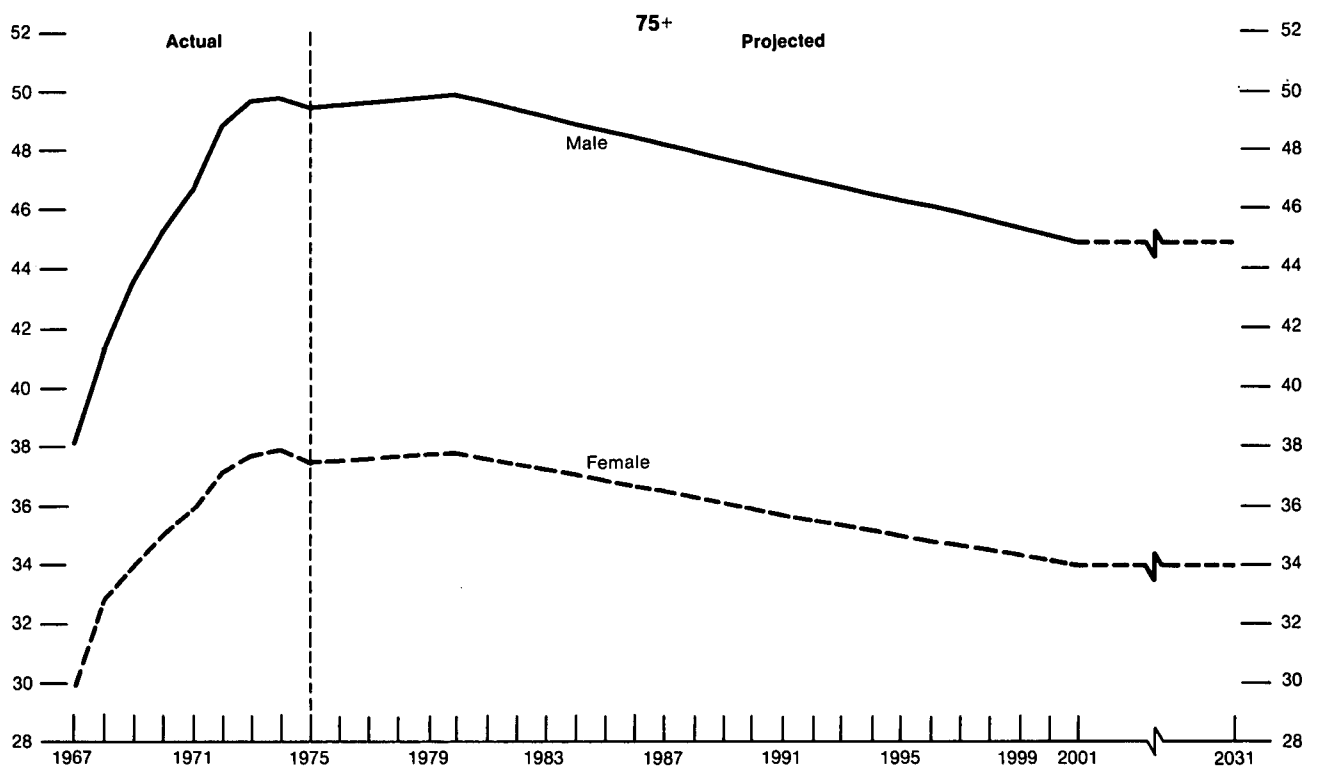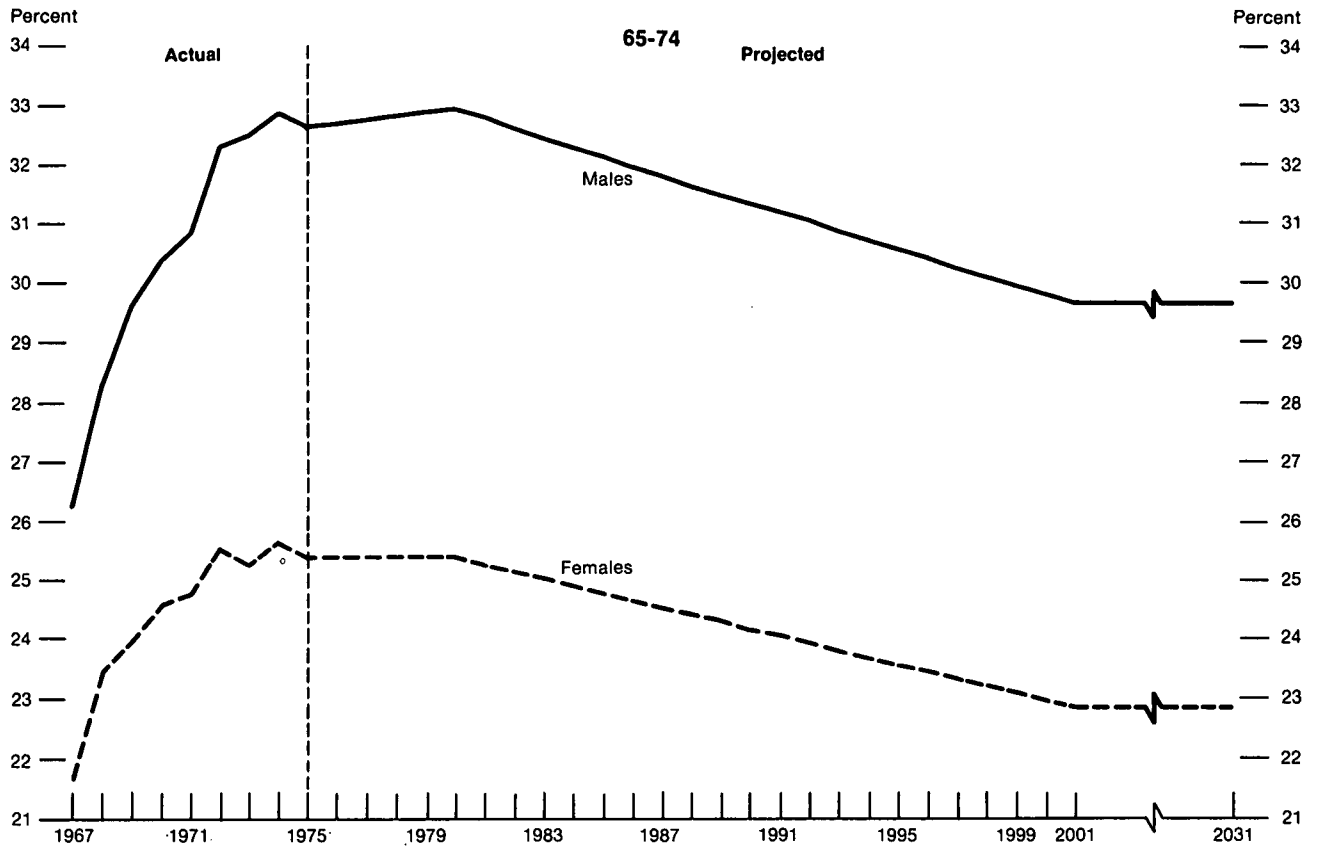
Chart — C-6
Hospital Participation Rate, 65-74 and 75+ Age Groups, by Sex, Lower Boundary , 1967 to 2031

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