Nursing home bed capacity in the States, 1978-86

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Trends in nursing home bed supply in the States show large variations in beds per population and a gradual decline in supply per aged population. A cross-sectional time-series regression analysis was used to examine some factors associated with nursing home bed supply. Variation was accounted for by economic factors, supply of alternative services, and climate. State Medicaid reimbursement rates had negative coefficients, with supply suggesting States may be increasing rates to improve access where supply is limited. Medicaid waiver policy was not found to be significant.

Introduction

Nursing home care is the subject of intense public debate for many reasons, including the rapid growth in overall expenditures, complaints about poor quality of care, and an expanding demand for services beyond the supply of beds. The industry has grown to the point that, in 1985, the Nation spent $35 billion dollars on nursing home services, representing 9 percent of total personal health care dollars spent in the United States that year (Waldo et al., 1986). Fiscal crises in the Medicaid program at both Federal and State levels since 1981 have focused attention on nursing home expenditures (U.S. Congressional Budget Office, 1977; Health Care Financing Administration, 1981; Estes and Newcomer, 1983; Harrington et al., 1985). Even though expenditures for nursing home care continue to grow, the number of nursing home beds has begun to decline relative to the aged population. Evidence suggests that access problems for individuals whose care is paid for by public dollars has increased. Nursing homes prefer to accept private paying clients who are able to pay higher rates for care. Thus, nursing home bed capacity has become of primary concern to State and Federal officials as well as to members of the public.

In this article, we present data on trends in nursing home bed capacity (stock) in the United States, and we consider State variations and changes in beds from 1978 to 1986. Changes in relation to population trends for both skilled nursing facilities and intermediate care facilities are described. In addition, we examine some of the factors associated with State nursing home bed capacity by presenting data from a 50-State cross-sectional time-series regression analysis for the period 1978-84. Although issues of supply and undersupply are not directly addressed here, public policies, economic factors, and alternative health services that are associated with the level of nursing home beds per population in States and with short-term changes in the capacity of nursing home beds over time are considered.

Background

The nursing home industry is a multibillion dollar business in the United States, with one of the highest growth rates in expenditures among all health services. In 1980, nursing homes in the country were serving about 1.5 million residents (National Center for Health Statistics, 1983). Most of these residents are old and disabled. Although only about 5 percent of the total aged population is institutionalized at any point in time, one out of every five individuals living past the age of 65 will spend some time in a nursing home (Vladeck, 1980).

Nursing homes were a small cottage industry that began to receive a stable source of income after 1935 when the Old Age and Survivors Insurance and the Old Age Assistance programs were enacted, providing cash assistance to older people (Waldman, 1983; Birnbaum et al., 1981; Vladeck, 1980). Medicaid and Medicare programs, established in 1965, provided a steady source of income for nursing homes and thus encouraged the subsequent rapid growth in supply of beds. The growth rate in U.S. nursing home beds was 197 percent for the 1963-80 period (National Center for Health Statistics, 1965; 1983).

The primary source of nursing home financing shifted from 80 percent private funding in 1960 to 56 percent public funding in 1982, with the adoption and growth of the Medicare and Medicaid programs in 1965 (Birnbaum et al., 1981; Gibson et al., 1983). Estimates were that the proportion of Government spending for nursing home care declined by 1985 to 47 percent of the total because of restrictions in Federal payments to State Medicaid programs and other policy changes (Waldo et al., 1986). Medicaid support declined from 48 percent of all nursing home care in 1980 to 42 percent in 1985.

Four types of nursing homes have been established: skilled nursing facility (SNF), intermediate care facility (ICF), intermediate care facility for the mentally retarded (ICF-MR), and personal care. The National Center for Health Statistics (NCHS) defines a skilled nursing facility as an institution in which 50 percent or more of the residents receive nursing care during the week and that employs at least one full-time registered nurse (RN) or licensed practical nurse (LPN) (National Center for Health Statistics, 1979).

An intermediate care facility is one in which fewer than 50 percent of the residents receive some nursing care during the week, and it employs at least one full-time RN or LPN (National Center for Health Statistics, 1979). A personal care home (sometimes called boarding, domiciliary care, or residential care home) is one in which some residents receive nursing care during the week; but no full-time RN or LPN is employed. Intermediate care facilities for the mentally retarded are designed to provide care and training in activities of daily living and social skills to the mentally retarded and to those persons with related conditions.

Facilities are licensed by States, and they must be certified in order to receive Medicare and Medicaid patients and payments (Kurowski and Shaughnessy, 1983). Certification allows facilities to be reimbursed by Medicare and Medicaid after they have been surveyed and found to meet specific Federal criteria called "conditions of participation." The conditions are generally based on structural requirements intended to ensure the capacity to provide adequate care—such as the availability of certain services, educational requirements of the staff, minimal staffing patterns, and fire and safety codes (Kurowski and Shaughnessy, 1983). Recent Federal regulatory changes have focused more attention on nursing care outcome measures (Institute of Medicine, 1986). ICF care is not paid for or certified by Medicare, but it is an optional service in the Medicaid program. The ICF program was first established in 1967 for payments under the cash assistance titles of the Social Security Act. In 1971, ICF's were authorized for Medicaid coverage for the aged, blind, and disabled and for the mentally retarded (Dunlop, 1979). Medicaid established ICF standards that are similar to but lower than those for SNF, and it set ICF reimbursement not to exceed 90 percent of SNF reimbursement (Dunlop, 1979; Waldman, 1983). Both Medicare and Medicaid prohibit certification of and reimbursement to personal care homes because they do not offer professional nursing services.

The Medicare program includes provisions that allow skilled nursing, for a limited time period, for persons recently discharged from a hospital. The original term for this category of care was "extended care," limited to individuals who spent 3 days or more in a hospital, who transferred to a nursing home within 14 days after discharge from the hospital, and who received a maximum of 100 days of care. Following establishment of the Medicare program, the utilization of extended care expanded rapidly. In response, new restrictive regulations were enacted in 1969 that narrowed the definition of skilled nursing (Vladeck, 1980; Waldman, 1983). In 1972, Medicare extended care facilities were reclassified as skilled nursing facilities, and a single set of standards was developed for SNF's by Medicare and Medicaid (Vladeck, 1980; Waldman, 1983). Recent changes in Medicare legislation removed the 3-day hospitalization requirement, among other requirements. Even so, less than 2 percent of all Medicare expenditures are for skilled nursing services (Waldo et al., 1986).

The Medicaid program has the greatest effects on nursing home policies because it pays such a large proportion of the total expenditures. In 1981, the Omnibus Budget Reconciliation Act gave States greater flexibility in setting Medicaid reimbursement and eligibility policies, including those for nursing homes. After being given this greater flexibility, many States adopted policies that were designed to reduce Medicaid program costs, particularly for nursing home care (Harrington et al., 1985). These policy changes were designed to control nursing home reimbursement rates, to limit the numbers eligible for Medicaid, and the growth of new nursing home beds.

State nursing home bed supply

In this article, we examine a number of factors that affect nursing home bed capacity, considering both demand and supply factors. Supply is conventionally assumed to reflect the prices paid for nursing home services, as well as those paid to produce the services, the market structure, and the technology (Palmer, 1983). Proprietary facilities have goals of profit maximization, whereas nonprofit homes may seek to maximize quality and/or quantity while maintaining adequate revenues to achieve their goals (Palmer and Vogel, 1983). Revenues and profits are critical to the nursing home market, and they affect nursing home decisions about supply and growth. Supply generally responds to demand as the market attempts to reach an equilibrium where the quantity offered at a given price equals the demand at a given price (Palmer, 1983).

Economic factors

A number of exogenous factors affect nursing home bed stock, either by stimulating or constraining growth in supply. Factors that stimulate supply are those that encourage such investments as private bond market financing, growth of chain structure for investor-owned and tax-exempt providers, leasing and mergers by investor-owned chains, market speculation, and creative financing (Lane, 1981; 1984).

The attenuation in the rate of growth in bed stock during the last decade has been attributed to several factors related to the general economy, such as the high interest rates and high cost of new construction (Lane, 1984). For example, Lane pointed out that new facilities cost about $70 per square foot, which means that an average sized nursing home of 100 beds cost about $2 million in 1984. Lack of investor confidence in nursing homes because of the public scandals have also been considered a factor that limited growth. The recent decline in the rate of growth for nursing home beds may be, in part, the result of unfavorable financial conditions, over which public policymakers have little control. Moreover, some economic conditions should also effect the demand for nursing home beds, thus indirectly influencing supply.

Four economic variables were selected for this analysis. The national prime interest rate across years is a supply factor—higher rates reflecting greater capital costs and more attractive alternate uses of capital, so that the prime interest rate should be negatively associated with bed stock. Because of the time needed for construction, the prime interest rate will be lagged 3 years. Personal income per capita represents both demand, in the form of the ability of patients to pay for beds, and supply, insofar as providers consider personal income when evaluating the market they will serve. Higher per capita income should stimulate bed growth in States. Unemployment rates represent lower demand because they reflect the greater availability of family caregivers as substitutes for inpatient care, coupled with diminished resources to cover the costs of nursing home care, so that unemployment rate should be negatively related to growth in the bed stock. Finally, payroll per employee of extended care facilities represents input costs to providers and is therefore a factor limiting supply.

State policies

State policies to limit nursing home utilization have primarily focused on constraining nursing home bed supply. The major approaches to control utilization and costs have been through State certificate-of-need (CON) programs and the setting of State Medicaid eligibility policies and reimbursement rates. Of these, only CON is specifically directed to the control of bed stock.

The effectiveness of certificate-of-need (CON) laws, which require State approval for new construction or bed expansion, is the subject of debate (Salkever and Bice, 1979). In a study of State officials in eight large States, Feder and Scanlon (1980) found that CON has been successful in limiting the supply of nursing home beds and that States use CON primarily as a tool to limit their total expenditure for nursing home care. Many States have considered CON a valuable policy for controlling nursing home costs, but some have even imposed moratoriums on issuing new CON's for nursing home beds since the 1970's (U.S. General Accounting Office, 1983). It was found in a recent survey that a dozen States have placed moratoriums on adding new nursing home beds (Intergovernmental Health Policy Project, 1984).

Lane (1984) suggested that the CON laws have given a monopoly to existing providers and have increased the threshold costs for entry into the market for providers constructing new facilities. This franchising system may have done less to control growth than to fuel financial speculation in the market, as buyers pay higher market rates for facilities because of the difficulty in constructing new facilities. Some buyers are gambling that the controls on supply will remain, and they are thus encouraged to speculate further by investing in nursing homes. On the other hand, Cohodes et al. (1980) found little evidence that denials of CON applications had directly reduced the growth rate of new nursing homes

because States had approved the vast majority of CON requests. Unfortunately, adequate quantitative State data on CON from 1978 to 1984 were not available for a time-series analysis. Although some CON data were available for part of this period, analyses of these data are not addressed in this article.

State policies regulating Medicaid reimbursement rates aim at direct cost control by reducing reimbursement (Swan and Harrington, 1985). In a model of nursing home bed capacity, however, reimbursement rates constitute one of the key factors considered to influence supply. Increases in reimbursement rates can encourage entry into the industry and/or foster the expansion of existing services. Increases in Medicaid reimbursement rates create incentives for providers to treat Medicaid patients. Scanlon (1980a and 1980b) found that nursing homes first accept patients with sufficient funds to pay privately and then fill the remaining beds with publicly supported residents after the private demand has been met. This practice occurs because Medicaid rates, which are established by State governments, are usually lower than private rates. The difference between Medicaid rates and private prices has an important influence on provider behavior (Birnbaum et al., 1981). The Health Care Financing Administration estimates that private patients averaged an 18-percent difference between charges and reported costs in 1984 (Lane, 1984). The practice of dual pricing allows for these differentials (Scanlon, 1980a and 1980b; U.S. General Accounting Office, 1983; Vladeck, 1980; Lane, 1984). Thus, when a facility has a mix of Medicaid and private-pay patients and its costs are greater than Medicaid payment, private rates may be subsidizing the coverage of care for Medicaid patients.

The average per diem reimbursement rate for ICF care was employed in the analysis reported in this article. This measure was used because a combined weighted rate for SNF care and ICF care could not be constructed accurately. The majority of State nursing home beds were ICF beds; and when analyses were conducted using SNF rates by State, no substantial differences were found from using the ICF rates by State.

Medicaid eligibility policies may influence nursing home bed capacity by affecting the demand for care by changing the size of the pool of Medicaid-eligible individuals. Although nursing homes may accept private-pay patients in preference to Medicaid patients and although Medicaid eligibility policies may have no effect on nursing home utilization, there are a number of reasons that Medicaid eligibility may influence bed capacity. Insofar as Medicaid coverage allows facilities to profit on Medicaid patients or at least keep the bed occupancy high, increasing the pool of Medicaid eligibles demanding care may lead to some expansion of the bed stock. The existence of facilities that predominately serve Medicaid patients both suggests that some facilities can profit on Medicaid patients and that increases in Medicaid eligibles will result in increases in bed capacity.

The eligibility variable for this analysis is based on spend-down levels. State Medicaid programs may allow for spend down in two ways: spend down for medically needy programs or spend down for cash grant recipients at a special institutional level. Medically needy programs are State-optional programs for individuals or families whose medical expenses have caused them to reduce their resources below the income eligibility standard for Medicaid. Special institutional programs for the categorically eligible allow patients to become eligible for Medicaid coverage of their nursing home care when their medical expenses have reduced their resources, including incomes, below levels set by the State. Even in the absence of such spend-down programs, those whose low incomes and lack of other resources make them eligible for Supplemental Security Income or the State Supplemental Program (SSI or SSP) payments become categorically eligible for the Medicaid program. The measure for the current analysis, an income measure, was created as a continuous variable that reflects the maximum dollar amount for Medicaid nursing home eligibility. The eligibility level was the highest amount for the State's medically needy income spend-down level, if any, for a person living alone; the State's special institutional income spend-down level, if any, for one person; or the level of the State's SSI or SSP payment for a person living alone.

Medicaid spend-down policies allow patients who enter facilities under private payment to become Medicaid eligible as their resources are exhausted. A higher spend-down level in a State increases the likelihood that a nursing home patient will go onto Medicaid reimbursement and will go onto it sooner than in States where spend-down levels are lower. Because it is easier for nursing homes not to admit Medicaid patients than it is for them to discharge private-pay patients at the point that they switch to Medicaid reimbursement, higher spend-down levels should increase Medicaid utilization of existing beds. By increasing the demand for beds, the pressure should, in turn, result in increases in bed stock to accommodate private-pay patients and/or Medicaid patients.

Alternative services as substitutes

The availability of services that provide alternatives to nursing home care is an important factor that affects both supply and demand for nursing home services (Palmer, 1983). Hospitals could play a substitute role for nursing home care, especially in areas where there are excess supplies of beds. In such cases, patients might be kept longer in acute-care beds, instead of being discharged earlier to SNF beds, perhaps eliminating the need of some patients for any SNF care. Because diagnosis-related groups (DRG's) have been introduced, however, hospitals have a financial incentive for early discharge of patients, including earlier discharges to nursing homes. A

recent study of State Medicaid nursing home utilization found that alternative services may have some substitution effects on nursing home utilization (Harrington and Swan, 1987), in that hospital occupancy rates were positively associated with Medicaid nursing home utilization.

Greater numbers of hospital beds may also be complementary to greater numbers of nursing home beds, however. Greater numbers of hospital beds per population in a State may represent greater potential numbers of discharges to nursing homes, a greater tendency to institutionalize, or a State's greater propensity to allow and to construct nursing home beds. By including both the State's hospital occupancy rate and its number of beds per 1,000 population, the current analysis may detect both a substitution effect (of occupancy rate, controlling for hospital bed supply) and a complementary effect (of hospital bed supply, controlling for the occupancy rate).

Dunlop (1976) found that home health services appeared to substitute for nursing home placement. As home health services were more frequently used by Medicare beneficiaries, the use of nursing home services decreased (Dunlop, 1976). It was expected that, where home health care utilization was higher, a lower demand for nursing home care would occur and, thus, lower the nursing home bed capacity.

Numbers of office-based physicians per capita may represent an alternative to nursing home care. Greater numbers of physicians in the population may mean that physician care is more accessible care in the community, resulting in a greater ability for the aged to remain at home, with less need for nursing home care.

The Federal Government has encouraged the growth of many alternative services. A number of innovative long-term care demonstration projects have been sponsored during the past 15 years. Recently, a number of States have developed Medicaid community-based long-term care projects to prevent unnecessary institutionalization. These waiver programs were established under Section 2176 of the OBRA, 1981 (Curtis and Bartlett, 1984). Data on State waiver programs were available for 1981-85. These data were used in the analysis to determine whether substitution effects could be detected. Because these programs were small and limited in the time for which they were approved, with uncertainty about renewal, they may not have significantly lowered nursing home bed supply in the States. Any effects should have been negative. In spite of rapid increases in alternatives to nursing home care in the last few years, most estimates are that many adults continue to have unmet needs for home-based services (Vogel and Palmer, 1983). If the needs remain largely unmet, this could account for any lack of effect of alternatives on nursing home bed capacity.

During this study, the relationship of nursing home bed stock, by State, to hospital bed stock, hospital occupancy rates, office physician supply, and Medicare home health care visits was examined. Other

alternative long-term care services, such as adult day health care, homemaker, and other such services may also tend to substitute for nursing home services, but they are probably not available in large enough quantities to have any measurable effect on nursing home utilization at present. In addition, data on such services are not readily available by State.

Geography and climate

States from different regions of the country differ considerably in their bed supplies (Swan and Harrington, 1986). Preliminary analysis of the data (not shown) revealed that in the 1978-86 period the South had the lowest bed supply per capita, and the North Central Region the highest. Region variables were not employed in the analysis reported here, however, because they represent so many potential factors that their coefficients cannot be analytically interpreted. However, climate may represent an important dimension that is, in part, captured by regional differences. Elders in colder climates experience greater climate-related health risks, greater risks to independent living, and greater heating costs. These should all increase the likelihood of nursing home institutionalization. The measure employed in the current analysis was the average annual mean temperature by State at the beginning of the analysis period in 1978.

Undersupply of nursing home beds

The existence of an undersupply of nursing home beds is, in part, supported by the fact that nursing homes have uniformly high occupancy rates (U.S. General Accounting Office, 1983; National Center for Health Statistics, 1984; Lane, 1984). Although these figures vary, the national average occupancy rate in 1980 was between 91 and 93 percent (National Center for Health Statistics, 1984 and U.S. General Accounting Office, 1983). Lane (1984) estimated that the average occupancy rates had risen to 95 percent nationwide by 1982. In their eight-State study, Feder and Scanlon (1980) found reports of waiting lists for nursing home admissions and high occupancy rates, concluding that there was excess demand for nursing home services. Scanlon (1980b) found the number of unfilled nursing home beds (probability of finding a bed) was significantly related to total nursing home utilization but not to private nursing home utilization (private demand). Total utilization was positive and significantly related to unfilled beds; however, it was not related to private utilization. It was therefore concluded that excess demand existed in the nursing home market.

Although excess demand was found to occur, the findings have not been consistent across all States. ICF Incorporated (1981) designed an actuarial cost model for long-term care programs that examined the issues of supply among the States. They found that most States had a constrained nursing home supply for Medicaid and Medicare patients; however, six

States were identified as having an oversupply of beds, and two of these States had a significant oversupply. State Medicaid and health planning agencies reported that two States of eight States had an excess supply of nursing home beds (Harrington et al., 1983a and 1983b). Benjamin and associates (1982) found that only 9 out of 45 States in a telephone survey of planning agencies reported an undersupply of nursing home beds in 1982. Swan and Harrington (1986) used regression and discriminate analysis to analyze nursing home bed undersupply in the States, based on nursing home bed stock data for the period 1979-82. The number of States with a significant undersupply ranged from 18 to 20 for the years 1979-82 (Swan and Harrington, 1986). Thus, not all States may have shortages of beds and excess demand. During this study, the relationship of previously determined undersupply of nursing home beds in States with stock adjustments in a later period was tested.

Methodology

The exact number of nursing home beds available nationwide is difficult to determine because nomenclatures used by various Federal agencies and State governments differ. Moreover, reliable national statistics on the supply of nursing home beds have not been collected or reported on a regular basis since 1976 (U.S. General Accounting Office, 1983; Harrington and Swan, 1984a). Most reports on bed supply have relied on the Master Facility Inventory, collected biannually by the National Center for Health Statistics. Unfortunately, the Inventory overcounts beds because it includes residential care beds and sometimes double counts skilled nursing and intermediate care beds. During 1983, national data were collected by the General Accounting Office on the number of licensed beds certified to participate in Medicaid for the 5-year period ending in 1980. These data also appear to have included duplicate counting of skilled and intermediate care beds. More recently, the Institute for Health and Aging (IHA) (1983 and 1986) collected data directly from State governments about the number of skilled nursing facility (SNF) and intermediate care facility (ICF) beds in the 50 States during the 9-year period ending in 1986. The IHA data are considered more accurate than other sources because efforts were made to eliminate duplicate counting and to include all beds (freestanding and hospital-based).

The classification of nursing home beds has been a serious problem. The States have considerable discretion in designating which facilities will be licensed and certified as skilled care or intermediate care. After the ICF program was established, in fact, many States reclassified patients and facilities from SNF to ICF in a somewhat arbitrary fashion, principally to reduce costs to the Medicaid program (Vladeck, 1980). Intermediate care facilities now represent roughly one-half of the Nation's nursing homes.

States have been inconsistent in their classification of patients and facilities both among and within States (Community Research Applications, 1976.). Certain ICF's in some States have appeared to be more like SNF's in other States in terms of the level of care needs of residents. Thus, the percent of patients in SNF's compared with those in ICF's varied considerably among States because the definitions and standards are not uniform (Bishop et al., 1980). As a result, equivalent patients may be in SNF's in one State but in ICF's in another. These problems in misclassification or inconsistencies in patient classification were recently confirmed by the Institute of Medicine (1986) in its study of nursing home regulation.

These problems prompted the Institute to recommend changes in Federal classification to combine SNF's and ICF's into one category labeled "nursing homes" and to place the emphasis on the classification of individual residents in the facilities instead. Because of these classification problems, this analysis of nursing home bed supply combined all skilled nursing and intermediate care facility beds together.

A telephone survey of State agencies (Institute for Health and Aging, 1983) was conducted and information received on the number of beds for SNF's and ICF's for the period 1978-82 in 1982. A second telephone survey (Institute for Health and Aging, 1986) was conducted in 1986 for the 1983-86 period, using the same methodology and questions. All 50 States and the District of Columbia were called for the nursing home supply data. The data for these States were collected primarily from the following agencies: Licensing and Certification for Nursing Homes and State Health Planning. In general, the nursing home supply data have been available, although we have had some difficulty in getting both 1984 and 1986 data. Data on facilities and licensed beds were available. Data on ownership were not obtained because these were not collected routinely by the States.

A process of verification of the initial data was completed for SNF and ICF beds in 1986. To verify the telephone information, published documents, such as State directories of health facilities, were collected where possible. However, not all of the States publish a directory; and in most cases, only the most current directory could be readily obtained from a State. Further, State directories varied in terms of the scope of information that was contained. If an official directory was not available, an annual census report was used. If neither of these two documents was available, a monthly report (preferably for the month of December, so as to provide a year-end total) was used. Where possible, figures compiled through a special computer run were verified by comparing them with a published State directory or some other written document. In some States, the initial data for earlier years had to be coded from a State directory because there was no other way to reconstruct the totals without initiating a file-by-file compilation by hand of

each nursing home in that State. Because this process was contingent on the availability of appropriate documentation within each State, not all of the data could be adequately verified, although as much of these SNF and ICF data as possible were verified.

Findings

Number of licensed beds

National statistics on State nursing home beds have not been reported or collected on a regular basis since 1976. The Institute on Health and Aging collected data directly from States to examine trends in bed supply over time. The number of SNF and ICF beds licensed by State for the time period of 1978 through 1986 is shown in Table 1. These data include all hospital-based and freestanding beds and exclude personal care and ICF-MR beds. Not all licensed beds are certified for Medicare and Medicaid patients, but the total capacity of licensed beds available for use by either private or public patients is shown in Table 1.

During this period, there was an expansion of SNF and ICF beds, and almost all States reporting showed increases. The total SNF and ICF beds increased from 1.3 million to 1.5 million between 1978 and 1986, a 16-percent overall increase. In 1986, six States (California, Illinois, New York, Ohio, Pennsylvania, and Texas) accounted for 38 percent of all beds nationwide.

Percent change in licensed beds

Shown in Table 2 is the percent change in licensed SNF and ICF beds from 1979 to 1986 for each State and nationally. From 1978 through 1982, the average increase (unweighted) for all States was 8.4 percent. The average change from 1982 through 1986 was 5.9 percent. The total U.S. increases were 8.6 percent and 6.3 percent for these periods, respectively. Thus, the rate of growth was somewhat slower in the more recent period.

Nursing home beds per population

For the period 1978-86 State nursing home beds per 1,000 residents 65 years of age or over ranged from 27 to 90 (Table 3). States at the low end tend to be those with large younger retirement populations, such as Arizona and Florida. Southern States, such as North Carolina and West Virginia, also tended to have fewer beds per population. States at the high end of the range tended to be in the Midwest, and some of them had fairly high proportions of aged residents. Minnesota and Wisconsin had 90 beds and 85 beds, respectively, per 1,000 aged population. The ratio of beds per aged population thus shows regional patterns, as well as differences among States within regions.

Changes in the number of beds should be examined relative to changes in the populations served (i.e., the

Table 1
Number of skilled nursing facility and intermediate care facility beds, by State: United States, 1978-86

State	1978	1979	1980	1981	1982	1983	1984	1985	1986
					Number of beds				
Total	1,315,691	1,347,128	1,372,019	1,401,657	1,428,960	1,450,413	1,454,415	1,493,997	1,519,426
Alabama	19,954	20,200	20,522	21,135	21,306	21,476	22,244	21,592	21,970
Alaska	823	823	823	718	821	814	815	825	830
Arizona	5,354	5,534	6,197	6,904	7,148	7,834	9,274	9,915	13,734
Arkansas	18,548	18,778	19,111	19,838	19,981	20,405	20,675	20,993	21,860
California	110,826	109,329	111,556	111,305	112,922	113,612	116,069	118,107	118,430
Colorado	20,066	18,131	18,305	18,347	18,203	18,030	17,986	17,986	18,109
Connecticut	24,169	25,713	26,127	26,248	26,221	26,395	26,420	26,982	27,198
Delaware	2,997	3,305	3,646	3,787	4,034	4,269	3,241	3,919	3,906
District of Columbia	1,881	2,057	1,748	1,793	1,973	2,573	3,381	3,075	3,760
Florida	34,003	35,479	37,420	37,803	41,578	44,745	39,818	47,983	55,225
Georgia	31,496	32,881	32,881	33,753	36,427	36,689	34,462	34,693	34,742
Hawaii	2,171	2,505	2,620	2,623	2,624	2,605	2,648	2,650	2,769
Idaho	4,454	4,471	4,637	4,805	4,690	4,645	4,773	4,846	4,910
Illinois	85,888	87,674	87,284	88,095	87,193	87,918	87,991	88,365	89,333
Indiana	41,010	42,817	42,445	44,853	50,414	50,078	51,523	52,525	48,244
Iowa	32,125	32,389	32,277	32,964	33,961	34,021	32,838	32,845	33,296
Kansas	26,227	26,020	25,793	26,233	26,322	26,356	26,588	26,825	27,024
Kentucky	16,167	17,053	18,154	18,850	18,487	18,884	20,020	20,114	20,424
Louisiana	22,541	24,496	25,600	25,293	26,100	26,980	28,432	32,763	33,853
Maine	8,693	8,812	8,872	8,898	8,919	9,191	9,100	9,267	9,758
Maryland	19,322	19,529	20,582	21,603	22,259	23,056	23,284	23,555	23,934
Massachusetts	45,300	47,331	46,830	46,248	46,562	46,050	42,359	44,170	47,126
Michigan	46,026	46,517	46,477	46,348	46,128	48,275	48,555	48,750	48,857
Minnesota	44,492	44,846	45,681	45,658	45,760	44,940	44,404	44,896	47,490
Mississippi	12,399	13,417	12,245	13,455	13,793	14,051	14,223	14,184	14,454
Missouri	34,706	38,051	38,142	40,282	43,173	45,134	46,698	46,111	46,892
Montana	6,270	6,173	6,267	6,104	6,124	6,317	6,362	6,530	6,531
Nebraska	18,284	18,194	18,108	18,674	18,325	18,536	16,471	16,535	16,535
Nevada	2,009	2,130	2,170	2,243	2,256	2,470	2,381	2,629	2,659
New Hampshire	6,253	6,486	6,696	6,983	6,928	6,981	6,655	6,477	6,791
New Jersey	26,790	28,522	29,659	30,828	31,233	31,229	33,768	34,544	33,214
New Mexico	2,910	3,301	3,276	3,984	4,075	4,531	4,505	5,401	5,884
New York	90,178	91,513	92,162	93,504	94,210	95,727	96,127	97,883	98,747
North Carolina	17,424	19,259	19,652	21,166	21,869	21,880	21,493	22,894	23,540
North Dakota	5,956	6,026	6,277	6,462	6,599	6,757	6,767	6,797	6,820
Ohio	65,126	67,664	70,714	72,650	74,164	74,334	78,762	82,008	83,991
Oklahoma	28,122	27,811	28,944	29,472	29,807	29,797	29,522	32,931	31,665
Oregon	14,653	14,610	14,922	15,142	15,221	15,254	15,275	15,355	15,357
Pennsylvania	66,673	68,940	72,205	73,776	75,183	78,632	83,253	84,472	84,338
Rhode Island	8,228	8,821	8,685	8,724	8,851	9,252	9,344	9,710	9,759
South Carolina	9,875	10,200	11,362	11,795	12,462	12,899	11,123	12,829	12,981
South Dakota	7,386	7,507	7,589	7,745	7,701	7,731	7,829	7,881	7,851
Tennessee	18,505	20,510	23,003	25,218	26,206	26,596	27,330	28,543	29,708
Texas	99,000	100,687	101,101	102,788	102,724	100,986	99,719	101,781	103,423
Utah	5,758	5,797	5,548	5,423	5,406	5,600	5,425	5,728	5,728
Vermont	2,852	2,811	2,826	3,069	2,970	3,111	3,267	3,275	3,367
Virginia	16,283	17,698	19,177	20,313	21,477	22,625	22,068	22,373	22,448
Washington	28,225	26,811	26,876	27,307	27,378	27,379	25,911	26,042	26,345
West Virginia	4,789	4,774	5,086	5,668	6,316	7,038	7,033	7,284	8,365
Wisconsin	50,542	50,737	51,689	52,700	52,378	53,627	53,834	53,937	53,170
Wyoming	1,962	1,988	2,050	2,060	2,098	2,098	2,370	2,222	2,081

SOURCE: (Institute for Health and Aging, 1983 and 1986).

Table 2
Percent change in skilled nursing facility and intermediate care facility bed supply, by year: United States, 1979-86

State	1979	1980	1981	1982	1983	1984	1985	1986
Alabama	1.2	1.6	3.0	0.8	0.8	3.6	-2.9	1.8
Alaska	0.0	0.0	-12.8	14.3	-0.9	0.1	1.2	0.6
Arizona	3.4	12.0	11.4	3.5	9.6	18.4	6.9	38.5
Arkansas	1.2	1.8	3.8	0.7	2.1	1.3	1.5	4.1
California	-1.4	2.0	-0.2	1.5	0.6	2.2	1.8	0.3
Colorado	-9.6	1.0	0.2	-0.8	-1.0	-0.2	0.0	0.7
Connecticut	6.4	1.6	0.5	-0.1	0.7	0.1	2.1	0.8
Delaware	10.3	10.3	3.9	6.5	5.8	-24.1	20.9	-0.3
District of Columbia	9.4	-15.0	2.6	10.0	30.4	31.4	-9.1	22.3
Florida	4.3	5.5	1.0	10.0	7.6	-11.0	20.5	15.1
Georgia	4.4	0.0	2.7	7.9	0.7	-6.1	0.7	0.1
Hawaii	15.4	4.6	0.1	0.0	-0.7	1.7	0.1	4.5
Idaho	0.4	3.7	3.6	-2.4	-1.0	2.8	1.5	1.3
Illinois	2.1	-0.4	0.9	-1.0	0.8	0.1	0.4	1.1
Indiana	4.4	-0.9	5.7	12.4	-0.7	2.9	1.9	-8.2
Iowa	0.8	-0.3	2.1	3.0	0.2	-3.5	0.0	1.4
Kansas	-0.8	-0.9	1.7	0.3	0.1	0.9	0.9	0.7
Kentucky	5.5	6.5	3.8	-1.9	2.1	6.0	0.5	1.5
Louisiana	8.7	4.5	-1.2	3.2	3.4	5.4	15.2	3.3
Maine	1.4	0.7	0.3	0.2	3.0	-1.0	1.8	5.3
Maryland	1.1	5.4	5.0	3.0	3.6	1.0	1.2	1.6
Massachusetts	4.5	-1.1	-1.2	0.7	-1.1	-8.0	4.3	6.7
Michigan	1.1	-0.1	-0.3	-0.5	4.7	0.6	0.4	0.2
Minnesota	0.8	1.9	-0.1	0.2	-1.8	-1.2	1.1	5.8
Mississippi	8.2	-8.7	9.9	2.5	1.9	1.2	-0.3	1.9
Missouri	9.6	0.2	5.6	7.2	4.5	3.5	-1.3	1.7
Montana	-1.5	1.5	-2.6	0.3	3.2	0.7	2.6	0.0
Nebraska	-0.5	-0.5	3.1	-1.9	1.2	-11.1	0.4	0.0
Nevada	6.0	1.9	3.4	0.6	9.5	-3.6	10.4	1.1
New Hampshire	3.7	3.2	4.3	-0.8	0.8	-4.7	-2.7	4.8
New Jersey	6.5	4.0	3.9	1.3	0.0	8.1	2.3	-3.9
New Mexico	13.4	-0.8	21.6	2.3	11.2	-0.6	19.9	8.9
New York	1.5	0.7	1.5	0.8	1.6	0.4	1.8	0.9
North Carolina	10.5	2.0	7.7	3.3	0.1	-1.8	6.5	2.8
North Dakota	1.2	4.2	3.3	1.8	2.4	0.1	0.4	0.3
Ohio	3.9	4.5	2.7	2.1	0.2	6.0	4.1	2.4
Oklahoma	-1.1	4.1	1.8	1.1	0.0	-0.9	11.5	-3.8
Oregon	-0.3	2.1	1.5	0.5	0.2	0.1	0.5	0.0
Pennsylvania	3.4	4.7	2.2	1.9	4.6	5.9	1.5	-0.2
Rhode Island	7.2	-1.5	0.4	1.5	4.5	1.0	3.9	0.5
South Carolina	3.3	11.4	3.8	5.7	3.5	-13.8	15.3	1.2
South Dakota	1.6	1.1	2.1	-0.6	0.4	1.3	0.7	-0.4
Tennessee	10.8	12.2	9.6	3.9	1.5	2.8	4.4	4.1
Texas	1.7	0.4	1.7	-0.1	-1.7	-1.3	2.1	1.6
Utah	0.7	-4.3	-2.3	0.3	3.6	-3.1	5.6	0.0
Vermont	-1.4	0.5	8.6	-3.2	4.7	5.0	0.2	2.8
Virginia	8.7	8.4	5.9	5.7	5.3	-2.5	1.4	0.3
Washington	-5.0	0.2	1.6	0.3	0.0	-5.4	0.5	1.2
West Virginia	-0.3	6.5	11.4	11.4	11.4	-0.1	3.6	14.8
Wisconsin	0.4	1.9	2.0	-0.6	2.4	0.4	0.2	-1.4
Wyoming	1.3	3.1	0.5	1.8	0.0	13.0	-6.2	-6.3
U.S. average	2.4	1.8	2.2	2.0	1.5	0.3	2.7	1.7

SOURCE: (Institute for Health and Aging, 1983 and 1986).

Table 3
Number of skilled nursing facility and intermediate care facility beds per 1,000 aged population 65 years of age or over, by State: United States, 1978-86

State	1978	1979	1980	1981	1982	1983	1984	1985	1986
Total	54.7	54.6	53.7	53.4	53.3	53.0	51.9	52.4	52.1
Alabama	48.8	48.0	46.6	46.8	46.2	45.8	46.7	44.3	44.1
Alaska	82.3	82.3	71.4	55.2	63.2	58.1	54.3	48.5	45.7
Arizona	19.8	19.1	20.2	21.2	21.0	22.0	24.7	25.3	33.5
Arkansas	63.5	62.6	61.2	62.2	61.7	62.0	61.5	62.1	63.5
California	49.3	47.2	46.2	44.7	44.2	43.4	43.1	42.7	41.7
Colorado	86.5	75.9	74.0	71.7	69.2	66.8	64.2	63.1	61.9
Connecticut	69.5	72.2	71.6	69.6	67.8	66.3	64.9	65.2	64.3
Delaware	54.5	58.0	61.5	62.1	64.0	65.7	48.4	56.0	54.1
District of Columbia	26.1	28.2	23.6	24.2	26.7	34.8	45.1	40.5	49.1
Florida	22.3	22.1	22.2	21.5	22.9	24.0	20.6	24.0	26.7
Georgia	66.6	67.4	63.6	63.1	66.4	65.2	59.7	58.3	56.7
Hawaii	32.4	35.8	34.4	32.4	30.9	29.3	28.2	27.0	26.9
Idaho	51.2	49.1	49.5	49.0	46.4	44.2	44.2	44.1	43.3
Illinois	71.3	71.9	69.2	68.3	66.5	66.1	64.9	64.5	64.2
Indiana	73.1	75.1	72.5	74.6	82.2	80.3	80.8	81.4	73.5
Iowa	85.2	85.0	83.3	83.5	84.9	84.2	80.1	79.5	79.7
Kansas	88.3	86.4	84.2	84.4	83.6	82.6	82.3	82.0	81.7
Kentucky	41.8	43.4	44.3	45.1	43.5	43.8	45.7	45.4	45.3
Louisiana	60.9	64.6	63.4	61.2	62.3	63.3	65.4	74.3	75.1
Maine	65.4	65.3	63.0	61.8	60.7	61.7	59.9	60.2	62.2
Maryland	52.2	51.4	52.0	52.8	52.7	53.1	52.1	51.4	50.9
Massachusetts	64.7	66.6	64.5	62.5	61.9	60.4	54.5	56.5	59.4
Michigan	53.0	52.4	50.9	49.3	48.0	49.1	48.2	47.7	46.9
Minnesota	96.3	95.4	95.2	92.8	91.5	88.5	85.9	86.0	89.6
Mississippi	45.9	48.6	42.3	45.6	46.1	46.4	46.5	45.8	45.8
Missouri	55.4	59.9	58.8	61.2	64.8	67.0	68.5	67.1	67.5
Montana	77.4	74.4	74.1	69.4	68.0	67.9	66.3	66.6	65.1
Nebraska	90.5	89.2	88.1	89.3	86.8	87.0	76.3	76.2	75.5
Nevada	35.9	34.9	33.0	31.2	29.3	30.5	27.4	28.3	26.8
New Hampshire	65.1	66.2	65.0	65.9	63.6	62.9	58.4	55.4	56.6
New Jersey	32.5	33.8	34.5	35.0	34.6	33.9	35.8	36.2	34.2
New Mexico	28.0	30.3	28.3	32.7	32.3	34.9	33.4	38.9	40.8
New York	43.0	43.3	42.7	42.9	42.8	43.1	42.8	43.4	43.4
North Carolina	31.6	33.7	32.6	33.7	33.7	32.8	31.2	32.3	32.2
North Dakota	76.4	75.3	78.0	79.0	78.6	79.5	77.8	77.2	76.3
Ohio	57.9	59.3	60.5	60.5	60.5	59.5	61.5	63.3	63.7
Oklahoma	79.0	76.6	77.0	76.8	76.6	75.8	73.6	81.3	76.9
Oregon	51.4	49.7	49.2	48.1	47.0	45.8	44.4	43.4	42.2
Pennsylvania	45.6	46.2	47.2	47.0	46.8	48.0	49.7	49.8	48.8
Rhode Island	68.0	71.7	68.4	67.1	67.1	68.5	67.7	69.9	69.0
South Carolina	38.3	37.9	39.5	39.3	40.2	40.2	33.6	37.4	36.5
South Dakota	83.0	83.4	83.4	83.3	81.9	81.4	81.6	80.4	79.2
Tennessee	38.7	41.7	44.4	47.5	48.3	48.0	48.3	49.7	50.6
Texas	78.3	77.3	73.7	72.8	71.3	68.7	65.9	66.2	65.6
Utah	56.5	54.7	50.8	47.6	45.8	45.5	42.4	44.1	42.7
Vermont	51.9	50.2	48.6	52.0	48.7	50.2	51.9	51.2	51.6
Virginia	34.8	36.6	38.0	38.8	39.9	40.8	38.6	38.1	37.2
Washington	70.4	64.6	62.3	60.8	59.3	57.6	52.7	51.7	50.8
West Virginia	21.6	21.1	21.4	23.3	25.6	28.0	27.6	28.3	32.0
Wisconsin	92.7	91.3	91.6	91.0	88.8	89.4	88.1	87.4	84.8
Wyoming	54.5	55.2	55.1	54.2	53.8	52.4	56.4	52.9	48.6

NOTE: Aged population for 1986 estimated.

SOURCE: (Institute for Health and Aging, 1983 and 1986).

Table 4
Annual percentage change in number of skilled nursing facility and intermediate care facility beds per 1,000 aged population, by State: United States, 1978-86

State	1979	1980	1981	1982	1983	1984	1985	1986
Alabama	-1.7	-2.8	0.2	-1.2	-0.9	2.1	-5.1	-0.4
Alaska	0.0	-13.3	-22.6	14.3	-7.9	-6.6	-10.7	-5.9
Arizona	-3.1	5.4	4.9	-1.0	5.0	12.4	2.3	32.3
Arkansas	-1.5	-2.2	1.6	-0.8	0.6	-0.8	0.9	2.2
California	-4.2	-2.1	-3.3	-1.0	-1.7	-0.8	-0.9	-2.3
Colorado	-12.3	-2.4	-3.2	-3.4	-3.5	-3.8	-1.8	-1.9
Connecticut	4.0	-0.9	-2.8	-2.7	-2.1	-2.1	0.4	-1.4
Delaware	6.4	6.1	0.9	3.1	2.6	-26.3	15.7	-3.3
District of Columbia	7.9	-16.4	2.9	10.0	30.4	29.7	-10.2	21.5
Florida	-0.8	0.3	-3.0	6.5	4.4	-14.0	16.3	11.2
Georgia	1.2	-5.6	-0.8	5.2	-1.8	-8.3	-2.4	-2.7
Hawaii	10.4	-4.0	-5.8	-4.7	-5.2	-3.8	-4.0	-0.4
Idaho	-4.0	0.7	-0.9	-5.3	-4.7	-0.1	-0.3	-1.6
Illinois	0.7	-3.7	-1.3	-2.6	-0.7	-1.8	-0.5	-0.5
Indiana	2.8	-3.5	2.9	10.2	-2.4	0.6	0.8	-9.7
Iowa	-0.2	-2.0	0.2	1.7	-0.8	-4.9	-0.7	0.2
Kansas	-2.1	-2.5	0.1	-0.9	-1.1	-0.4	-0.3	-0.5
Kentucky	3.9	2.1	1.8	-3.5	0.7	4.3	-0.7	-0.2
Louisiana	6.1	-1.9	-3.4	1.7	1.7	3.2	13.7	1.1
Maine	-0.1	-3.5	-1.9	-1.8	1.7	-2.9	0.5	3.4
Maryland	-1.6	1.2	1.5	-0.1	0.7	-1.9	-1.3	-1.1
Massachusetts	2.9	-3.2	-3.0	-0.9	-2.5	-9.7	3.6	5.2
Michigan	-1.1	-2.9	-3.3	-2.6	2.4	-1.8	-1.0	-1.8
Minnesota	-0.9	-0.2	-2.5	-1.4	-3.3	-2.9	0.1	4.2
Mississippi	5.9	-12.9	7.8	1.1	0.5	0.2	-1.6	0.2
Missouri	8.3	-1.8	4.1	5.9	3.3	2.3	-2.0	0.5
Montana	-3.9	-0.3	-6.4	-1.9	-0.2	-2.4	0.5	-2.3
Nebraska	-1.5	-1.2	1.4	-2.8	0.2	-12.4	-0.1	-0.9
Nevada	-2.7	-5.5	-5.6	-6.0	4.1	-10.3	3.3	-5.1
New Hampshire	1.6	-1.7	1.3	-3.5	-1.1	-7.2	-5.2	2.3
New Jersey	4.1	2.0	1.3	-0.9	-2.2	5.8	1.0	-5.6
New Mexico	8.2	-6.5	15.3	-1.0	7.8	-4.3	16.4	5.1
New York	0.5	-1.4	0.5	-0.2	0.7	-0.7	1.6	0.0
North Carolina	6.7	-3.3	3.3	0.1	-2.8	-4.8	3.5	-0.4
North Dakota	-1.4	3.6	1.3	-0.6	1.2	-2.2	-0.7	-1.2
Ohio	2.3	2.1	0.1	0.0	-1.8	3.5	2.8	0.6
Oklahoma	-3.0	0.5	-0.3	-0.2	-1.1	-2.9	10.4	-5.4
Oregon	-3.3	-1.0	-2.3	-2.3	-2.5	-3.1	-2.3	-2.7
Pennsylvania	1.3	2.0	-0.4	-0.3	2.4	3.5	0.2	-2.0
Rhode Island	5.5	-4.6	-1.9	-0.1	2.2	-1.2	3.2	-1.2
South Carolina	-0.9	4.3	-0.6	2.2	0.0	-16.4	11.3	-2.4
South Dakota	0.5	0.0	-0.1	-1.6	-0.7	0.2	-1.4	-1.6
Tennessee	7.7	6.6	6.8	1.6	-0.5	0.6	3.0	1.7
Texas	-1.2	-4.6	-1.2	-2.1	-3.6	-4.1	0.5	-0.8
Utah	-3.1	-7.1	-6.4	-3.7	-0.6	-6.9	4.0	-3.0
Vermont	-3.2	-3.2	7.1	-6.4	3.1	3.3	-1.3	0.9
Virginia	5.3	3.6	2.3	2.8	2.3	-5.5	-1.2	-2.5
Washington	-8.2	-3.6	-2.4	-2.6	-2.7	-8.6	-1.9	-1.7
West Virginia	-2.1	1.2	9.1	9.6	9.7	-1.6	2.8	12.8
Wisconsin	-1.6	0.4	-0.6	-2.5	0.7	-1.4	-0.8	-2.9
Wyoming	1.3	-0.3	-1.6	-0.8	-2.5	7.6	-6.2	-8.1
U.S. average	-0.2	-1.7	-0.6	-0.2	-0.6	-2.1	1.0	-0.6

SOURCE: (Institute for Health and Aging, 1983 and 1986).

aged) (U.S. General Accounting Office, 1983; Lane, 1984). It is shown in Table 3 that expansion in number of beds has not kept up with increases in the aged population. The total number of beds in the United States per 1,000 aged population gradually declined from 54.7 in 1978 to 52.1 in 1986. Although most States had increases in total number of beds, they actually showed declines in their beds per aged residents.

The annual percentage change in the number of SNF and ICF beds per 1,000 aged population by State for the 1978-86 period is shown in Table 4. The percentage change by State was mixed, and it did not show a clear trend as seen previously. The State average (unweighted average) showed a small annual decline in beds per 1,000 aged population for every year except 1985.

Type of care

The type of care for which beds are available varies by State. The percents of nursing home beds licensed for skilled nursing care to total nursing home beds range from 3 percent in Oklahoma to 97 percent in Alaska (table not shown) in 1983. In some States (such as Alaska, Arizona, California, Florida, Idaho, Mississippi, and Wisconsin), SNF beds clearly predominate, and in other States (such as Iowa, Kansas, Louisiana, Maine, Nebraska, New Mexico, and Oklahoma) ICF beds greatly outnumber SNF beds. The States with available data are about evenly split in terms of whether SNF's or ICF's predominate. There was no pronounced overall pattern of change in State percentages of SNF and ICF beds over time. Those few States that shifted from SNF to ICF care tended to do so earlier in the 1978-83 period, and the shifting from ICF to SNF has continued throughout the period.

Hospital-based beds

Nursing home beds can be classified by type of facilities: freestanding facilities or hospital-based (in either chronic disease hospitals or general hospitals). Data were gathered on type of facility through 1983. Of the States reporting, nine had 10 percent or more of their nursing home beds located in hospitals, and seven had between 5 and 10 percent hospital-based beds. Eleven States had no hospital-based beds. There were few pronounced changes in the percentages of hospital-based beds among the States. These breakdowns were not available after 1983, so the total SNF and ICF beds reported in Table 1 include beds in both hospital-based and freestanding facilities.

Factors associated with bed capacity

Four analyses were conducted of factors associated with State nursing home bed supply. The first was a cross-sectional analysis of the nursing home bed capacity for the period 1978-84 using ordinary least

squares (OLS) regression analysis. The second was three cross-sectional time-series regression analyses of changes in nursing home bed capacity during the 1979-84 period. The third was the effects of previously reported undersupply of nursing home beds on bed stock adjustments for 1981-84 period using OLS cross-sectional regression analysis. And finally, the effects of the State Medicaid 2176 waiver programs were analyzed for the 1981-84 period using cross-sectional regression analysis. The time-series regression analysis used the PROC TSCSREG component of the statistical analysis system. In this article, we produce regression slopes and significance tests that account for covariance within the same unit (State) over time, but we do not test for models of autocorrelations in the data.

Factors explaining State bed capacity

In a cross-sectional OLS regression analysis of factors explaining nursing home bed supply in 50 States, several factors were found to be important. Where directional hypotheses have been stated, significance tests are one-tailed. The relationship of nursing home bed supply per 1,000 aged in each State (the dependent variable) to selected independent variables for the period 1978 through 1984 is shown in Table 5. As hypothesized, average annual temperature had a significant negative coefficient for each year. Colder climates would have more beds per capita, because of the risks to health and independent living experienced by older individuals in such climates (however, this also adds to the costs of providing care in such climates, which should have a downward influence on bed stock adjustments). The coefficient for personal income per capita was positive for each year and significant for 5 of the 7 years, suggesting a link to economic well-being. This is also suggested by the negative coefficients for State unemployment rates, significant for 4 of the 7 years.

Of the measures of alternative or complementary supply of care, hospital bed supply had significant positive coefficients for every year, giving strong support to the complementarity hypothesis and suggesting that States rich in one type of institutional bed may be rich in other types. Physician supply had a positive coefficient for 1979, opposite the hypothesized direction under the substitution hypothesis; but the effect becomes negative over the years. Nursing pay per employee, representing input costs for labor that should negatively affect bed capacity, had significant negative coefficients for the first 5 years of the period—the coefficients approached zero for the final 2 years, however.

Two State policy variables were included in the data shown in Table 5. The coefficient for Medicaid eligibility spend-down level was not significant in any year; it was positive in the first 5 years but more negative over time. Medicaid ICF average per diem rate was included only for 1979 through 1984. Higher per diem rates were expected to encourage greater

Table 5
Regression analysis of nursing home bed stock: United States, 1978-84

Coefficient and t-score for independent variable	1978	1979	1980	1981	1982	1983	1984
Intercept	27.02	27.21	62.17	83.23	82.69	[1]111.57	[1]94.75
Percent of population 65 years of age or over	-1.99 (-1.16)	-0.87 -(0.51)	0.30 (0.17)	0.49 (0.30)	-0.35 (-0.24)	0.22 (0.15)	0.56 (0.39)
Personal income per capita	3.72 (1.15)	[1]7.75 (2.54)	[1]6.80 (2.24)	4.86 (1.52)	[1]6.42 (2.09)	[1]7.12 (2.01)	[1]6.26 (2.41)
Percent unemployed	-1.61 (-0.71)	[1]-4.08 (-2.07)	-1.15 (-0.71)	[1]-2.19 (-1.78)	[1]-1.91 (-2.07)	[1]-1.71 (-1.70)	-0.38 (-0.34)
Average annual temperature	[1]-0.57 (-1.78)	[1]-0.53 (-1.90)	[1]-0.79 (-2.31)	[2]-0.77 (-2.82)	[2]-0.65 (-2.60)	[1]-0.65 (-2.31)	[1]-0.56 (-2.20)
Home health visits per 1,000 population	-106.78 (-1.58)	-61.87 (-0.92)	-53.96 (-1.02)	-30.27 (-0.62)	-41.76 (-1.21)	-5.14 (-0.17)	-19.39 (-0.78)
Physicians per 1,000 population	[1]40.95 (2.13)	14.80 (0.76)	4.19 (0.25)	10.32 (0.62)	-6.19 (-0.40)	-25.33 (-1.58)	-17.30 (-1.11)
Hospital occupancy	0.50 (0.81)	0.79 (1.29)	0.09 (0.18)	-0.33 (-0.58)	0.54 (1.11)	-0.32 (-0.70)	-0.59 (-1.45)
Hospital beds per 1,000 population	[2]12.35 (3.00)	[1]6.90 (2.06)	[1]8.23 (2.26)	[1]7.66 (2.24)	[1]4.71 (1.72)	[1]5.96 (1.93)	[2]8.08 (2.86)
Nursing pay per employee	[2]-1.35 (-3.22)	[2]-1.65 (-3.86)	[2]-1.29 (-2.59)	[2]-1.41 (-3.24)	[1]-0.86 (-2.22)	-0.31 (-0.68)	-0.04 (-0.12)
Medicaid spend down	2.68 (1.42)	2.62 (1.47)	1.35 (0.72)	1.09 (0.70)	0.28 (0.21)	-0.81 (-0.58)	-1.37 (-1.03)
Intermediate care facility per diem rate		0.55 (0.98)	0.52 (1.20)	0.17 (0.38)	-0.56 (-1.53)	-0.16 (-0.32)	-0.32 (-1.18)
N[3]	43	42	44	44	48	46	44
R^2	[2].610	[1].639	[2].522	[2].624	[2].628	[2].549	[2].604
Adjusted R^2	.488	.507	.358	.494	.515	.403	.467

[1]Significant at the .05 level, one-tailed test; except two-tailed test for effect of intermediate care facility rates.
[2]Significant at the .01 level, two-tailed test; except two-tailed test for effect of intermediate care facility rates.
[3]Arizona has no institutional Medicaid program. The District of Columbia was excluded based on its disproportionate influence, as judged by Cook's D. Rate data missing for Indiana, Mississippi, Nebraska, and Ohio for 1979; for Nebraska, New Mexico, and Ohio for 1980.

NOTE: Numbers in parentheses are t-scores.

SOURCE: (Institute for Health and Aging, 1983 and 1986).

numbers of nursing home beds. The coefficients were not significant and were positive for only the first 3 years. Similar results were obtained when the SNF rate was employed instead of the ICF rate.

Changes in the coefficients for some of the variables were of interest. The coefficients for five of the variables showed a trend toward more negative values: the two policy variables, ICF rate and spend-down level; the nursing pay variable; and two measures of alternative supply, physicians per population and hospital occupancy. Additionally, the coefficients for home health visits became more positive over time. These changes in coefficients suggest the need for an over-time analysis, that coefficients cannot be assumed to be unchanged in the over-time analysis, and that there may be a trend in the effects of specific factors over the time period considered.

Changes in bed capacity

The existence of data for a period of years allows for the pooling of the data and its analysis in a time-series framework for this study. Data on all of the variables employed in the analysis in Table 5 exist for 36 States for 6 years, 1979-84; and these were employed in the time-series cross-sectional analysis reported in Table 6. This analysis was adjusted for the correlations of State factors during the 6-year period.

In this analysis, we also introduced the national prime interest rate (constant across States but varying over time). Interest rates are important in the financing of the construction of new facilities and the purchase of beds, so higher rates should negatively influence bed supply. Such an effect, however, would be expected to be a lagged effect. Preliminary analysis suggested that a 3-year lag period had the strongest association with bed supply, so the rate in the reported analysis is lagged 3 years. A variable for year-within-period is also employed (0 for 1979 through 5 for 1984) to test for any secular trend in bed supply net the effects of the other factors in the analysis.

Three equations are presented in Table 6. The first shows the effects of the various explanatory measures on numbers of beds per population. To consider adjustments in nursing home bed stock, beds per capita were lagged 1 year and included as a predictor

Table 6
Time-series cross-sectional analysis of nursing home bed stock and change in stock: United States, 1979-84

Coefficient and t-score for independent variable	Equation 1	Equation 2	Equation 3
Intercept	[2]92.89	-12.16	-14.63
Nursing home beds per capita, lagged 1 year		[2]0.95 (43.39)	[2]0.96 (48.20)
Year in 1979-84 period	-0.91 (-1.28)	-0.71 (-1.62)	-0.15 (-0.11)
Prime interest rate, lagged 3 years	-0.02 (-0.06)	0.22 (1.26)	0.24 (1.42)
Percent of population 65 years of age or over	-0.23 (-0.31)	0.11 (0.58)	0.07 (0.41)
Personal income per capita	0.44 (0.46)	-0.06 (-0.16)	0.04 (0.11)
Percent unemployed	0.19 (1.04)	[1]0.26 (2.43)	0.19 (1.75)
Average annual temperature	-0.912 (-3.36)	0.00 (0.09)	0.02 (0.46)
Hospital beds per 1,000 population	[1]3.41 (2.38)	[1]0.95 (2.02)	[1]0.89 (2.09)
Medicaid spend-down level in $100's	[2]0.92 (2.86)	-0.00 (-0.02)	-0.18 (-0.78)
Intermediate care facility per diem rate	[1]0.19 (2.17)	0.06 (1.06)	[2]0.22 (2.92)
Nursing pay per employee	[2]-2.91 (-5.17)	-0.36 (-0.90)	[1]-1.01 (-1.65)
Home health visits per 1,000 population	7.48 (1.04)	[1]-7.94 (-1.73)	15.19 (1.70)
Physicians per 1,000 population	3.43 (0.58)	0.36 (0.18)	-2.41 (-1.02)
Hospital occupancy	0.02 (0.21)	[1]0.10 (1.80)	0.14 (1.59)
Average annual effect changes:			
In Medicaid spend-down level in $100's			0.07 (1.17)
In intermediate care facility per diem rate			[1]-0.05 (-2.12)
In nursing pay per employee			0.17 (1.15)
In home health visits per 1,000 population			[2]-5.32 (-2.98)
In physicians per population			0.78 (1.55)
In hospital occupancy			-0.02 (-0.84)
N[3]	216	216	216
Adjusted mean square error	4.51	3.51	3.33

[1]Significant at the .05 level, one-tailed test for main effect, two-tailed test for interaction.
[2]Significant at the .01 level, one-tailed test for main effect, two-tailed test for interaction.
[3]Arizona has no institutional Medicaid program. The District of Columbia was excluded based on its disproportionate influence, as judged by Cook's D in previous ordinary least squares regression (Table 5). Some data are missing for Alaska, Idaho, Indiana, Mississippi, Nebraska, New Mexico, North Dakota, Ohio, Rhode Island, Vermont, West Virginia, and Wyoming in at least 1 year, so are excluded from this analysis.

NOTE: Numbers in parentheses are t-scores.

SOURCE: (Institute for Health and Aging, 1983 and 1986).

of beds for each year (Equation 2). Because a pooled cross-sectional time-series analysis must either assume no changes in effects over time or account for such changes in effects, it was decided to consider possible changes in the effects of selected variables. To test for changes in coefficients over time, interactions were calculated between year and selected predictors (Equation 3). Coefficients for the other predictors did not appear in Table 5 to change greatly over time, so their interactions with time were not included in Equation 3. Better prediction was obtained with a model of average annual change than with one of discontinuous change during the 1979-84 period (not shown).

Equation 1 showed no evidence of a secular trend in bed supply, controlling for the other factors in the model, nor of any independent effect of the lagged prime interest rate. Average annual temperature showed a strong negative effect, as expected. Hospital bed supply had a significant positive coefficient, suggesting that States with more hospital beds have more nursing home beds. This is the opposite of what would be expected if hospital beds were simply substituting for nursing home beds; and it suggests instead that States with greater institutional health care resources of one type were also resource rich in others. As hypothesized, nursing pay per employee had a strong negative coefficient, suggesting this factor had a strong effect in constraining supply. Both of the Medicaid policy variables had significant positive coefficients, as hypothesized.

Equation 2 shows the analysis of change in bed stock during a 1-year period. Bed stock in the previous year was strongly positively related to beds in the current year. The magnitude of the coefficient, near 1.0, suggested that there was little adjustment in bed stock per capita in any one year. There was some such adjustment, nevertheless, and the coefficients for all other predictors estimated their effects on yearly changes in beds. The coefficient for average annual temperature was no longer significant, suggesting that, although this factor was associated with bed stock, it did not enter into adjustments in this stock. Among the significant effects were positive coefficients of hospital occupancy and hospital beds per population—as hypothesized, occupancy showed a substitution effect and beds per population a complementary effect of hospital bed stock with nursing home bed stock. Home health visits per capita had a significant negative coefficient, as hypothesized, suggesting that utilization of this alternative service did have a negative effect on bed stock adjustments. Percent unemployed had a strong positive coefficient, in the direction opposite that hypothesized. These interpretations should be considered carefully, however, because Equation 2 assumes no change in coefficients over time, an assumption very unlikely to hold, given the evidence in Table 5.

Equation 3 tested the hypotheses of changes in effects over the 1979-84 time period by accounting for

changes in the effects of selected factors. Coefficients for these variables represented estimates for 1979, and their interactions with year represented estimates of average annual changes in their effects. Of the variables for which coefficient changes were not considered, the effect of hospital bed stock retained its significant effect.

The 1979 coefficient for hospital occupancy is not significant, nor does it show change over time. Nursing pay has a significant negative coefficient; and although it does not change significantly over time, there is some evidence that its effect might weaken over time.

The 1979 coefficient for Medicare home health visits was not significant, but it became significantly more negative each year during the 1979-84 period, suggesting that home health utilization did not initially affect nursing home stock adjustments but increasingly did so during the 1979-84 period. This is consistent with increases in home health care in the 1980's as a result of Federal changes (under OBRA) allowing Medicare home health certification for unlicensed proprietary agencies. This Federal change greatly expanded the numbers of home health providers to the extent that this sector may have become large enough to influence nursing home bed stock. Home health services may have begun to substitute for nursing home services and to have lowered the demand for beds. Home health utilization may also have been affected by the implementation of Medicare DRG hospital reimbursement in 1983, resulting in greater need for care for hospital early discharges. This created a large pool of older persons in need of home health care, which may also have substituted for nursing home care.

The ICF reimbursement rate had a significant positive effect, as hypothesized, for 1979, but this effect weakened significantly over time. This suggests that the rate is less important over time. State Medicaid nursing home per diem reimbursement rates have increasingly failed to keep up with private charges, or even with nursing home costs, so that Medicaid has most likely had declining influence on changes in bed stock. Medicaid spend-down eligibility level did not have a significant coefficient for 1979 nor a significant change in coefficient during the 1979-84 period. There is, then, no evidence that Medicaid eligibility influences changes in bed stock (although it is strongly related to levels of bed stock). This suggests that Medicaid lacks the ability to influence changes in bed stock through the generation of Medicaid demand for nursing home beds.

Undersupply of nursing home beds

Swan and Harrington (1986) have previously estimated the undersupply of nursing home beds in the 1979-82 period. Characterization of beds as undersupplied was defined, in part, in terms of residuals of bed stock per aged population in an equation containing demand factors. The question here is whether undersupply conditions tend to persist.

A by-year analysis for the period 1981-84, with the model from Table 5, to which has been added the undersupply characterization of each State lagged 2 years (i.e., for the years 1979 through 1982) is given in Table 7. For each year during the period 1981-84, bed stock is strongly related to the undersupply characterization for the 2 previous years. Two years later, the undersupply States average between 14.5 and 23.1 fewer beds per 1,000 aged than the adequate-supply States do. This suggests that bed stock adjustments had not eliminated undersupply up to 2 years after it had been detected. It also suggests that an extension of the undersupply estimation to years after 1982 would be of interest.

Table 7
Regression analysis of nursing home bed stock, by previous undersupply: United States, 1981-84

Coefficient and t-score for independent variable	1981	1982	1983	1984
Intercept	[1]86.35	[1]88.73	[1]104.45	[1]73.16
Undersupply 2 years before	[2]−23.11 (−5.47)	[2]−15.71 (−3.75)	[2]−14.51 (−3.33)	[2]−17.12 (−5.17)
Percent of population 65 years of age or over	0.51 (0.41)	0.61 (0.46)	0.94 (0.69)	0.47 (0.44)
Personal income per capita	[1]4.57 (2.59)	[1]4.55 (2.55)	[1]4.50 (2.21)	2.00 (1.62)
Percent unemployed	[1]−1.73 (−1.89)	[1]−1.63 (−2.05)	−1.02 (−1.12)	−0.24 (−0.29)
Average annual temperature	[2]−0.61 (−3.02)	[2]−0.60 (−2.80)	[1]−0.54 (−2.15)	[1]−0.46 (−2.41)
Home health visits per 1,000 population	[1]−65.58 (−1.76)	[1]−51.62 (−1.73)	−30.43 (−1.12)	[2]−55.41 (−2.80)
Physicians per 1,000 population	0.10 (0.07)	−11.21 (−0.84)	−21.31 (−1.50)	−6.25 (−0.53)
Hospital occupancy	−0.01 (−0.03)	0.12 (0.29)	−0.43 (−1.05)	−0.31 (−1.00)
Hospital beds per 1,000 population	2.34 (0.86)	2.52 (1.04)	3.37 (1.20)	[2]7.21 (3.42)
Nursing pay per employee	−4.36 (−1.63)	−3.22 (−1.36)	−2.22 (−0.84)	0.46 (0.28)
Medicaid spend down	−0.19 (−0.23)	−0.05 (−0.07)	−0.57 (−0.71)	−0.86 (−1.39)
Intermediate care facility per diem rate	0.10 (0.30)	−0.29 (−0.88)	0.07 (0.16)	−0.26 (−1.29)
N[3]	42	48	46	44
R[2]	[2].816	[2].735	[2].663	[2].787
Adjusted R[2]	.740	.644	.540	.704

[1]Significant at the .05 level, one-tailed test; except two-tailed test for effect of income per capita.
[2]Significant at the .01 level, two-tailed test; except two-tailed test for effect of income per capita.
[3]Arizona has no institutional Medicaid program. The District of Columbia was excluded for disproportionate influence, judged by Cook's D. Data are missing for Alaska, Idaho, Indiana, Mississippi, Nebraska, New Mexico, North Dakota, Ohio, Rhode Island, Vermont, West Virginia, and Wyoming.

NOTE: Numbers in parentheses are t-scores.

SOURCE: (Institute for Health and Aging, 1983 and 1986).

Effects of waiver programs

Measures of Medicaid 2176 waiver programs were available for 4 years of the analysis period, 1981-84. The regressions of nursing home bed supply on the existence of a waiver program in each State as well as on the other factors already considered are given in Table 8. Waiver programs did not have significant coefficients in any year. The coefficient was positive for 1981 and negative for subsequent years; but a time-series cross-sectional analysis of change in this coefficient (not shown) showed no significant change over time. Thus, as suggested earlier, waiver programs appear to be too small and of too limited duration for their existence to affect nursing home bed stock.

Summary and conclusions

This article contains data on numbers of nursing home beds per State for the period 1978-86. These bed data were drawn from telephone surveys of all of the States, conducted in 1984 and 1986. In general, there was great variation in beds per population across the States. A very few States accounted for a large proportion of all nursing home beds nationwide. The growth rates for both SNF and ICF beds

Table 8
Regression analysis of nursing home bed stock, by waiver programs: United States, 1981-84

Coefficient and t-score for independent variable	1981	1982	1983	1984
Intercept	76.24	69.84	[2]107.17	[2]111.65
Percent of population 65 years of age or over	0.35 (0.20)	0.28 (0.18)	0.70 (0.50)	1.33 (0.99)
Personal income per capita	2.29 (0.98)	2.65 (1.29)	2.75 (1.34)	2.94 (1.63)
Percent unemployed	[1]−2.54 (−1.91)	[2]−2.44 (−2.52)	[2]−2.37 (−2.69)	[1]−2.16 (−2.10)
Average annual temperature	[2]−0.77 (−2.76)	[2]−0.65 (−2.44)	[1]−0.51 (−1.95)	[1]−0.53 (−2.04)
Home health visits per 1,000 population	−55.98 (−1.13)	−48.26 (−1.31)	−23.48 (−0.85)	−23.35 (−0.91)
Physicians per 1,000 population	−3.01 (−0.18)	−8.46 (−0.52)	−17.23 (−1.06)	−19.07 (−1.22)
Hospital occupancy	0.23 (0.39)	0.61 (1.19)	0.08 (0.18)	−0.26 (−0.62)
Hospital beds per 1,000 population	4.82 (1.56)	3.99 (1.38)	3.36 (1.30)	3.26 (1.32)
Medicaid aged or disabled waiver program exists	6.44 (0.42)	−2.70 (−0.56)	−3.93 (−0.98)	−3.93 (−0.89)
N[3]	48	48	48	48
R^2	[2].528	[2].581	[2].611	[2].591
Adjusted R^2	.383	.453	.493	.486

[1]Significant at the .05 level, one-tailed test for slopes.
[2]Significant at the .01 level, one-tailed test for slopes.
[3]Arizona has no institutional Medicaid program. Alaska and the District of Columbia are excluded based on their disproportionate influence, as judged by Cook's D.

NOTE: Numbers in parentheses are t-scores.

SOURCE: (Institute for Health and Aging, 1983 and 1986).

appeared to be steadily increasing, but these growth rates have not kept pace with the growth in population. The ratios of beds per population were gradually declining, although this decline has slowed in more recent years. There is considerable interstate variation in changes in numbers of beds, beds per aged population, and changes in beds per aged population; and regional patterns are very strong.

This article also contains an analysis of factors explaining part of the interstate variation in the level of nursing home beds per aged population. Consistent with the study hypotheses, the cost of providing care (extended-care nursing pay per employee), supply of alternative care (hospital bed supply per population), and climate (average annual temperature) explained significant proportions of the interstate variation in bed capacity. The State Medicaid program's spend-down eligibility level and average Medicaid per diem ICF reimbursement rate also had significant positive coefficients, in accord with hypotheses. The coefficient estimated for Medicare home health utilization was not significant.

The results differed, however, for changes in bed capacity. Although home health care did not have a significant effect in 1979, its effect became significantly more negative during the 1979-84 period, suggesting that home health care increasingly substituted for nursing home beds, perhaps because of the rapid growth in home health providers. Nursing pay per employee had a negative effect in 1979, but this effect may have declined during the period, for reasons unknown.

Most important here are the effects of the Medicaid policy variables. Medicaid eligibility had no measurable effect on change in bed stock between 1978 and 1979 nor did this effect change over time. Although the level of the bed stock was related to eligibility, changes in bed stock were not so related. As hypothesized, both level and changes in bed stock were positively related to Medicaid per diem reimbursement rate. The effect on changes in bed stock declined significantly over time, however, suggesting that Medicaid rates were decreasingly effective in persuading providers to change bed stock. These results for both Medicaid policy variables suggested that the Medicaid program had low or declining influence over bed stock adjustments, a finding in accord with the observed declining share of nursing home care paid for by the Medicaid program. The implications include that the State Medicaid programs may be decreasingly able to ensure adequate access to nursing home beds by influencing bed stock adjustments. Insofar as undersupply assures that Medicaid eligibility will not influence access to existing beds (Scanlon, 1980b) and as reimbursement rates are too low to allow Medicaid to adequately bid against private-pay rates for access to existing beds (Harrington and Swan, 1987), this bed capacity finding suggests that access to nursing home beds by Medicaid recipients will continue to decline.

Medicaid waiver programs showed no effect on nursing home bed stock. Waiver programs in this

period were small and were established for short periods, with much doubt about their continued funding. It is, therefore, not surprising that they would fail to influence State bed capacity.

Additional research is clearly needed on the determinants of bed capacity. This is especially true because the tractable policy variables showed declining influence over bed stock. In particular, lagged effects of policies, and of other factors, should be examined on bed supply. In addition, previous work on the estimation of undersupply of nursing home beds should be extended to the full 1978-86 period. Finally, additional analysis employing nursing home bed supply measures to explain Medicaid nursing home utilization and expenditures are needed. A structural model of supply and demand for nursing home care, including changes in bed stock, is currently under development by the authors.

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