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A Report of the Dartmouth Atlas Project

Trends and Variation in End-of-Life Care for Medicare Beneficiaries with Severe Chronic Illness

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Introduction

Health care for elderly Americans at the end of life is changing, but it still falls short of the care that most patients want. Medicare beneficiaries with severe chronic illness spent fewer days in the hospital at the end of life in 2007 than they did in 2003. They were also less likely to die in a hospital and more likely to receive hospice care in 2007 than in 2003. At the same time, they had many more visits from physicians, particularly medical specialists, and spent more days in intensive care units. Throughout this period, the constant was the importance of geography; the care patients received in the months before they died depended largely on where they lived and received their care.

In this and other reports, the Dartmouth Atlas Project has documented both regional and hospital-specific variations in the medical care provided to Medicare beneficiaries with one or more chronic illnesses at the end of life. The 2008 *Dartmouth Atlas of Health Care*, for example, reported that, in their last six months of life, chronically ill Medicare beneficiaries in some regions of the country spent more than three times as many days in the hospital and more than ten times as many days in an intensive care unit (ICU) as patients in other regions.[1]

This report updates to 2007 previous findings regarding regional variations in end-of-life care. It also documents trends from 2003 to 2007 in the use of medical resources to treat Medicare beneficiaries at the end of life, both among hospital referral regions and among 94 academic medical centers. The data presented in this report show that health systems can change—and are changing—the way they treat patients who are seriously ill with chronic illness. The pace of these changes is strikingly different from region to region and hospital to hospital. The overall picture is mixed; although patients experienced fewer hospital days and more hospice care, at the same time there was an increase in the intensity of care for patients who were still hospitalized. Major findings of this report are as follows:

1. From 2003 to 2007, the percentage of chronically ill Medicare patients dying in hospitals and the average number of days they spent in the hospital before their deaths declined in most regions of the country and at most academic medical centers. The percentage of deaths associated with a stay in intensive care also decreased in most regions and at about half of academic medical centers.

2. Over the same period and among the same cohort of patients, other indicators of the intensity of care increased, including a rise in the number of ICU days in the last six months of life. There were particularly sharp increases in the amount of physician labor used per patient in the last two years of life (measured as physician clinical full-time-equivalents) and in the number of patients who saw ten or more physicians during their last six months of life. So, although relatively fewer patients spent their final days in the hospital

overall, patients while hospitalized spent more days in the ICU and received more care by physicians.

3. The use of hospice care for these patients increased from 2003 to 2007 in almost all regions of the country and at almost all academic medical centers, reflecting a long-term national trend.

4. Trends in end-of-life care from 2003 to 2007 differed substantially across regions and academic medical centers. For example, the change in the percentage of hospital deaths ranged from a sharp decrease at some hospitals to a substantial increase at others.

5. Widespread regional variation persists in measures of end-of-life care. In 2007, the percentage of deaths in hospital varied by a factor of almost four across hospital referral regions, and the average number of hospice days per patient in the last six months of life varied by a factor of more than six.

Problems with end-of-life care have been widely recognized for years. In the 1990s, the Study to Understand Prognoses and Preferences for Outcomes and Risks of Treatment (SUPPORT) revealed that clinicians often did not follow patient preferences at the end of life. The study found that physicians rarely talked to patients about their preferences for end-of-life care and that less than half of physicians knew when patients preferred to avoid cardiopulmonary resuscitation.[2] A follow-up study using SUPPORT data showed that among a sample of 479 patients, 391 expressed a preference to die at home rather than in a hospital; nonetheless, 216 of those 391 patients ended up dying in the hospital.[3] In 1997, the Institute of Medicine summarized some of the shortcomings of end-of-life care in its report "Approaching Death: Improving Care at the End of Life." The report recommended increasing access to palliative and hospice care and encouraging physicians to talk to patients more openly about the care they wanted to receive.[4]

In the years since, the use of palliative and hospice care has increased, and research has suggested that, at least among some patient groups, patient preferences are now being followed more closely.[5,6] Unfortunately, an abundance of evidence shows that problems remain. Factors such as age, race and level of education can affect the likelihood that patients' treatment will align with their preferences.[7-9] One consequence of the misalignment of patient preferences and actual treatment is that some patients may receive unnecessary care, potentially diminishing their quality of life in their final weeks and days.[1,3,10,11]

In addition to its effects on patients' quality of life, unnecessarily aggressive care carries a high financial cost. About one fourth of all Medicare spending goes to pay for the care of beneficiaries in their last year of life, and much of the growth in Medicare spending in recent decades is the result of the high cost of treating chronic disease.[12,13] It may be possible to reduce spending while improving the quality of end-of-life care by ensuring that patient preferences are followed more closely.[14]

Many of the factors that influence the care of patients with chronic illness are invisible to local providers, but still extremely important. The Dartmouth Atlas Project has

shown that the local supply of medical resources plays a significant role in determining the amount of care delivered in a region.[1] Patients in regions with more hospital beds and more specialists, for example, tend to be admitted to the hospital more often and see more specialists than patients in regions with a lower supply of these resources. This phenomenon, which we have labeled *supply-sensitive care*, results from uncertainty about how best to treat patients with chronic diseases and the tendency of clinicians to use the resources available to them (e.g., hospital beds, ICU beds, physician FTEs), whether the capacity is low or high.

For example, when a patient's chronic condition worsens, it sometimes seems easier and safer to clinicians to treat the patient in the hospital, even though it may be reasonable to start outpatient treatment and monitor the patient's condition in clinic or by phone. If more hospital beds are available in an area, local care patterns unconsciously adapt to this higher capacity, and patients are more likely to be admitted. Similarly, research has shown that when ICU beds are readily available, more patients who are less severely ill will be admitted, and they will stay longer.[15] Yet greater use of the hospital or ICU as a site of care does not lead to better outcomes on average.[16]

Although it is possible that some of the differences across hospitals may be explained by differences in patients' preferences for care, studies show that regional variation in patient preferences overall explains very little of the variation in the intensity of end-of-life care.[17] Differences in patient populations themselves also explain some of the variation in care. But by examining patients close to the end of life who are similarly ill with severe chronic diseases, and by adjusting for differences in age, sex, race and illness—as the data in this report have been adjusted—it is possible to account for most of the variation in patient populations, leaving variation caused by other factors, such as the availability of medical resources and the practice styles of health systems and clinicians. As this report shows, the remaining variation is substantial, both in the use of medical care and in trends in end-of-life care.
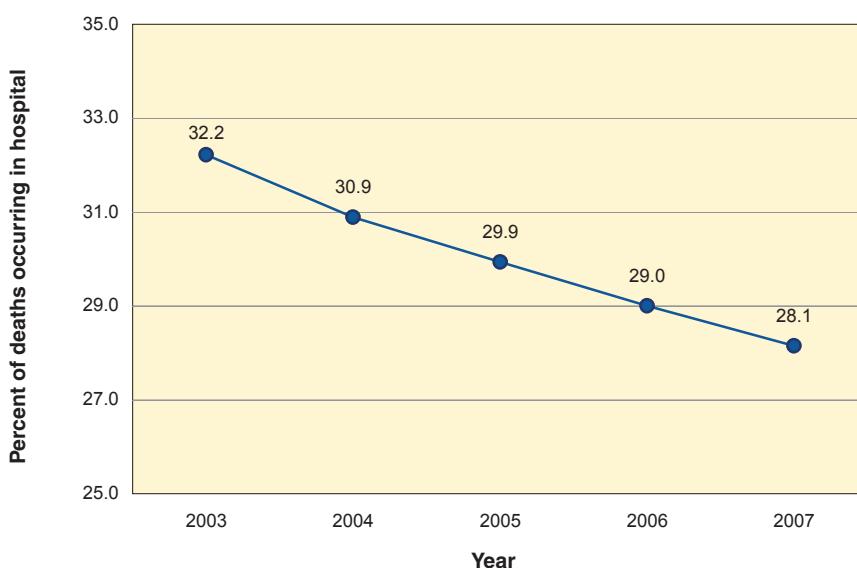
This report therefore has important implications for patients, providers and policymakers. Regional and hospital-specific patterns of care for patients with serious chronic illness are highly correlated with the patterns observed for Medicare beneficiaries with other chronic conditions. For example, regions and hospitals with high-intensity patterns of care for patients with serious chronic illness have been found to have high hospital and specialist utilization rates in the first year after a heart attack[18,19,20]; more aggressive care for patients with advanced cancer who are near the end of life[21]; and higher readmission and hospitalization rates for potentially avoidable causes of hospitalization.[19,20] The data presented in this report can thus provide insight into local and hospital-specific patterns of care for these other conditions. Patients can look to these data to get a sense of where care is likely to be more or less aggressive. Providers can look to these data for insights into the likely magnitude of savings they can achieve through improved care of chronic illness that allows patients to remain safely out of the hospital. Finally, policymakers can look to these data to identify regions that may have promising approaches—and those that may benefit from more support in improving the care of patients with serious chronic illness.

Trends and variation in end-of-life care for Medicare beneficiaries with chronic illness among hospital referral regions
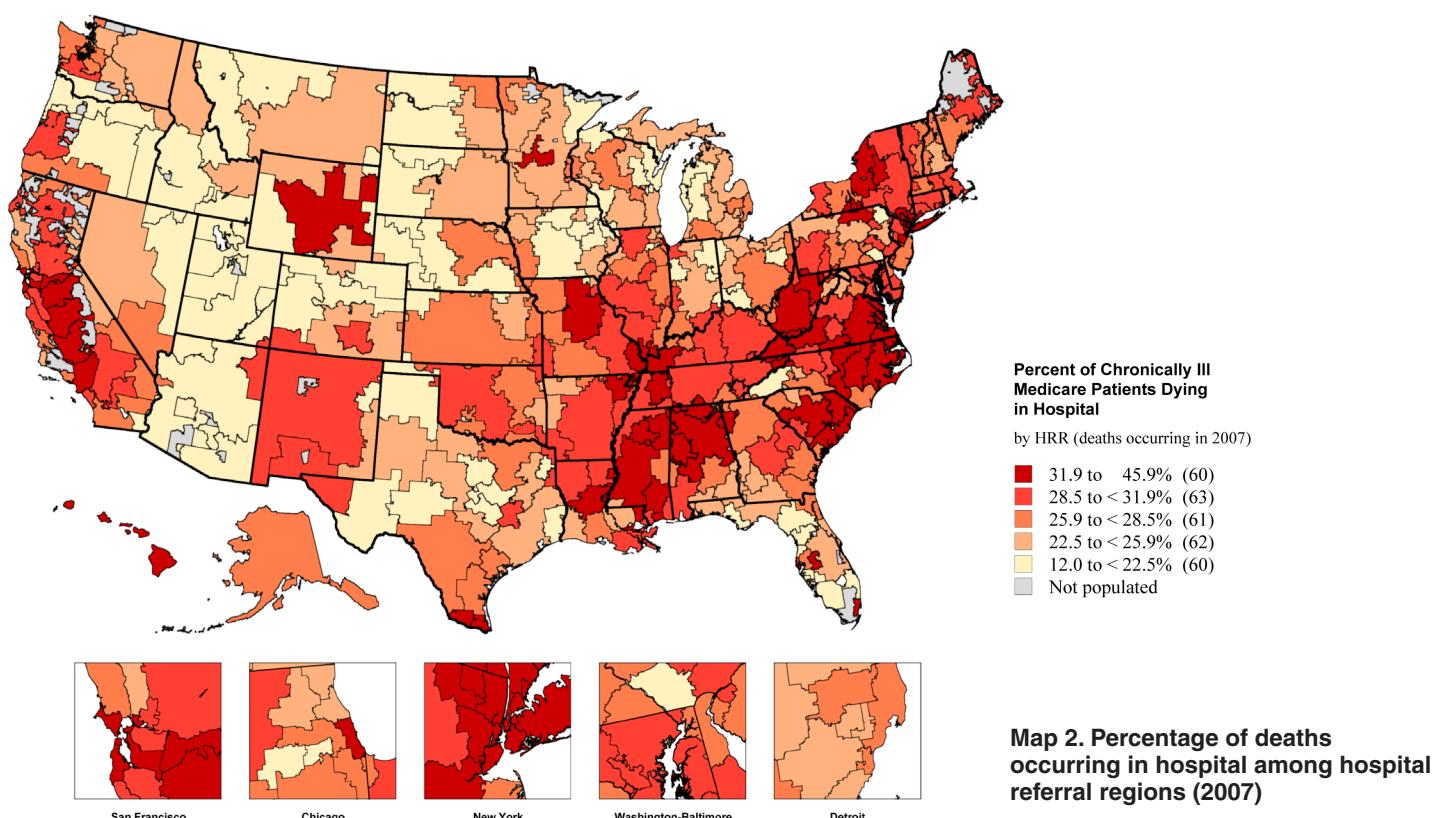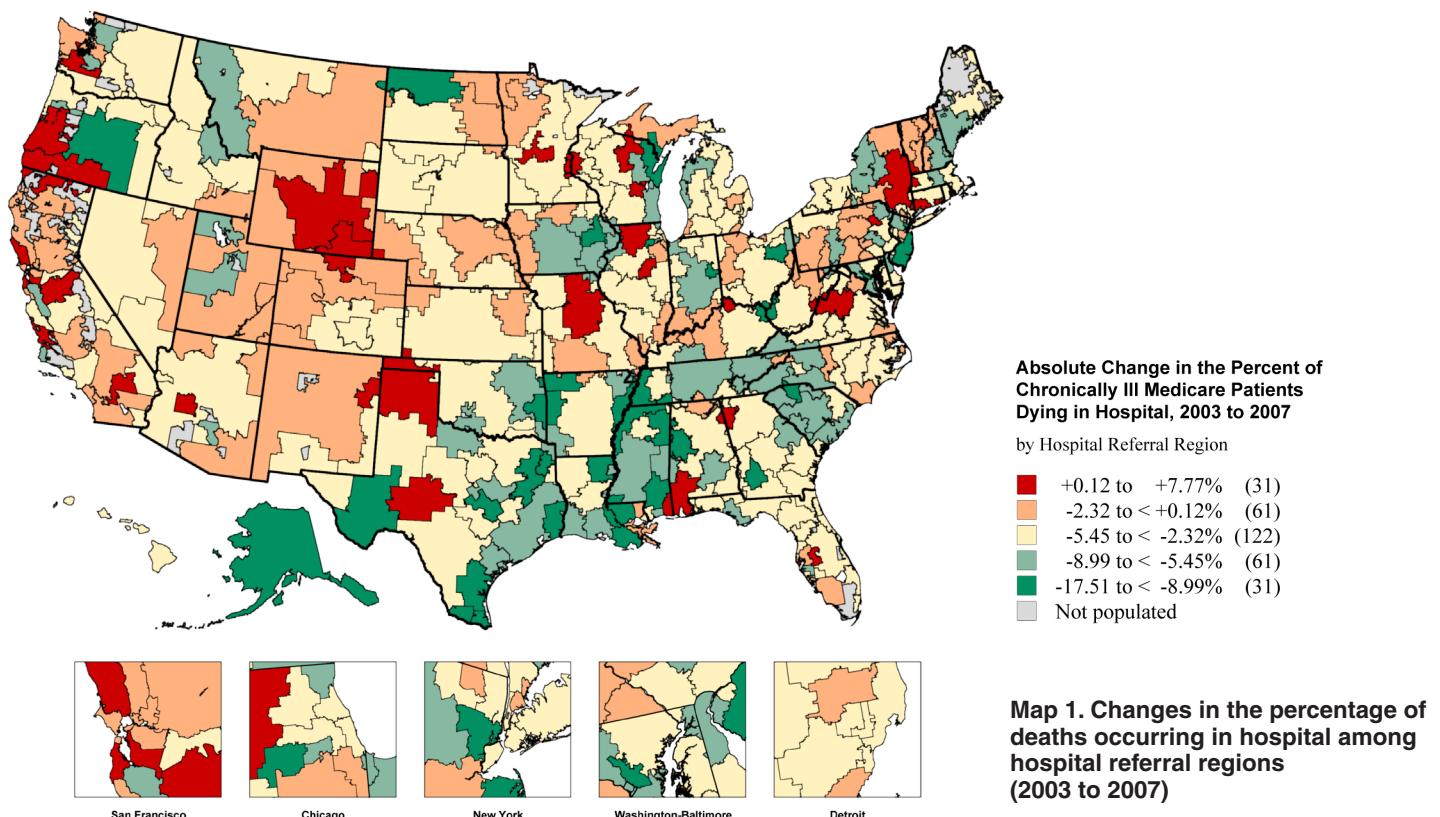
Deaths in hospital

From 2003 to 2007, the likelihood that a chronically ill Medicare beneficiary died in a hospital declined. In 2003, 32.2% of such patients died in a hospital; by 2007, the rate had dropped to 28.1% (Figure 1). Most hospital referral regions reflected this trend, as 272 of the 306 regions saw at least a slight decrease. The largest absolute decrease occurred in Aurora, Illinois, where the rate dropped 17.5 percentage points, from 35.2% to 17.7%. Corpus Christi, Texas (-14.0 percentage points), Memphis (-11.0) and Newark, New Jersey (-10.6) also had among the largest absolute decreases. The largest absolute increase occurred in St. Cloud, Minnesota, where the rate rose 7.8 percentage points, from 26.1% to 33.8%. Amarillo, Texas (+4.5), St. Petersburg, Florida (+3.6) and St. Paul, Minnesota (+3.2) also saw significant increases (Map 1).

In 2007, the highest rates of death in hospital were in regions in and around New York City, including Manhattan (45.8%), East Long Island (41.9%) and the Bronx (39.9%). Chronically ill Medicare beneficiaries in Manhattan were far more likely to die in a hospital than patients in Minot, North Dakota, where only 12.0% of patients died in a hospital. Fort Lauderdale, Florida (19.0%) and Portland, Oregon (19.6%) were also among the regions with the lowest rates (Map 2).
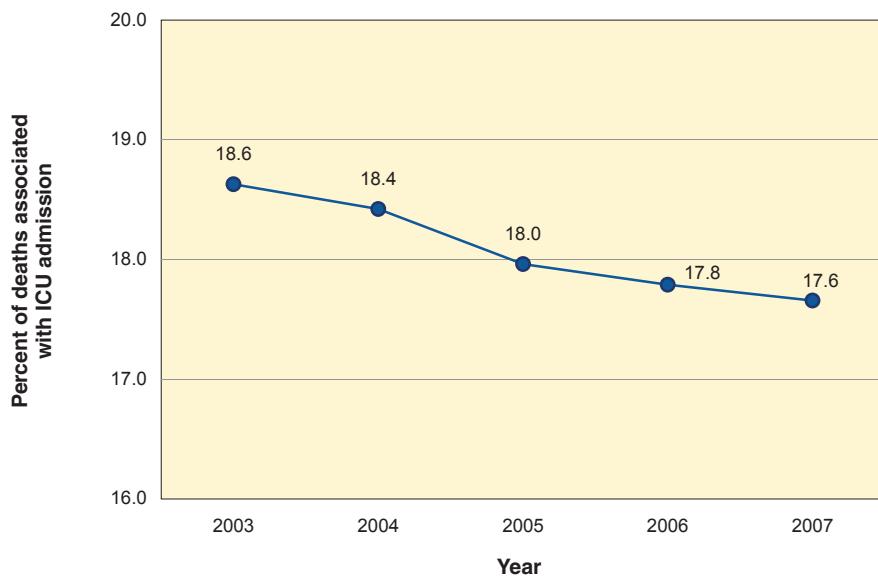
Figure 1. Change in the U.S. average percentage of deaths occurring in hospital among chronically ill Medicare patients (2003 to 2007)

Absolute Change in the Percent of Chronically Ill Medicare Patients Dying in Hospital, 2003 to 2007

by Hospital Referral Region

■	+0.12 to +7.77%	(31)
■	-2.32 to < +0.12%	(61)
■	-5.45 to < -2.32%	(122)
■	-8.99 to < -5.45%	(61)
■	-17.51 to < -8.99%	(31)
■	Not populated	

Map 1. Changes in the percentage of deaths occurring in hospital among hospital referral regions (2003 to 2007)

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Percent of Chronically Ill Medicare Patients Dying in Hospital

by HRR (deaths occurring in 2007)

■	31.9 to 45.9%	(60)
■	28.5 to < 31.9%	(63)
■	25.9 to < 28.5%	(61)
■	22.5 to < 25.9%	(62)
■	12.0 to < 22.5%	(60)
■	Not populated	

Map 2. Percentage of deaths occurring in hospital among hospital referral regions (2007)

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Deaths associated with admission to intensive care

As with the rates of death in hospital, the chance that a chronically ill Medicare beneficiary died in a hospital during a stay that included an admission to intensive care decreased from 2003 to 2007. The national rate declined from 18.6% in 2003 to 17.6% in 2007 (Figure 2). Many regions saw little change during this period, but some showed large increases or decreases. Relatively large absolute decreases occurred in Houma, Louisiana (-11.3 percentage points), Takoma Park, Maryland (-9.9) and San Jose, California (-6.0). The largest absolute increases took place in Olympia, Washington (+10.8), Bloomington, Illinois (+7.6) and St. Cloud, Minnesota (+6.7) (Map 3).

The likelihood that a patient spent time in intensive care during his or her final hospital admission varied widely in 2007. Almost one third (31.1%) of chronically ill Medicare beneficiaries in New Brunswick, New Jersey were admitted to intensive care during their final hospital admission, compared to only 4.2% of such patients in Appleton, Wisconsin. McAllen, Texas (30.4%), Los Angeles (29.3%) and Miami (29.1%) were among the regions with the highest rates, while Des Moines, Iowa (10.1%), Portland, Oregon (11.2%) and Madison, Wisconsin (11.5%) were among the regions with the lowest rates (Map 4).

Figure 2. Change in the U.S. average percentage of deaths associated with admission to intensive care among chronically ill Medicare patients (2003 to 2007)
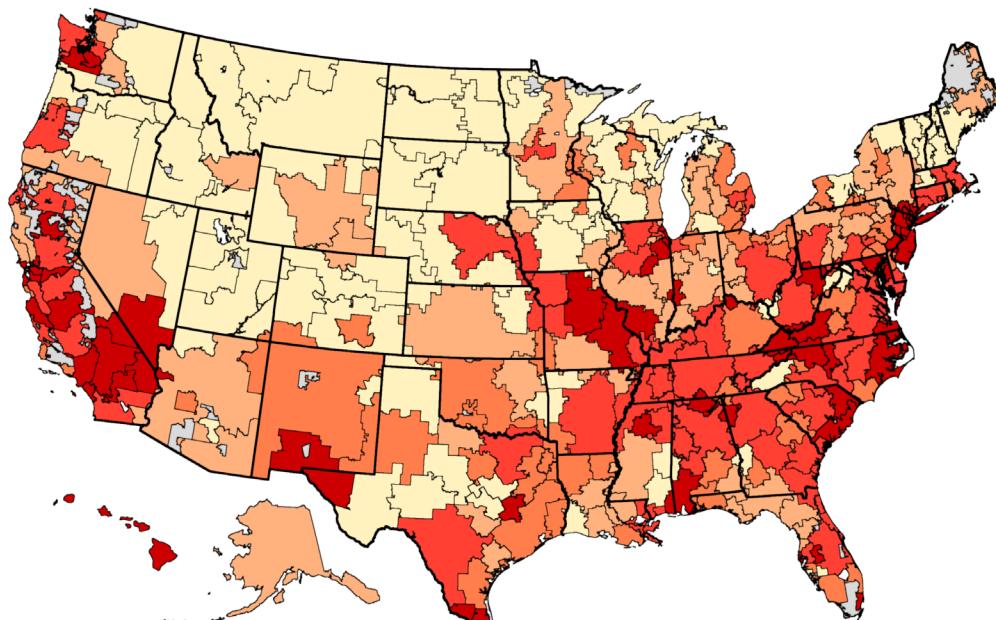
Absolute Change in the Percent of Deaths Associated with Intensive Care Admission, 2003 to 2007

by Hospital Referral Region

- +2.53 to   +10.81%   (31)
- +0.05 to <   +2.53%   (61)
- -2.28 to <   +0.05% (122)
- -4.75 to <   -2.28%   (61)
- -11.25 to <   -4.75%   (31)
- Not populated

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 3. Changes in the percentage of deaths associated with admission to intensive care among hospital referral regions (2003 to 2007)

Percent of Deaths Associated with Intensive Care Admission among Chronically Ill Medicare Enrollees

by HRR (deaths occurring in 2007)

- 20.1 to   31.1% (61)
- 17.6 to < 20.1% (63)
- 15.4 to < 17.6% (60)
- 12.8 to < 15.4% (60)
-   4.1 to < 12.8% (62)
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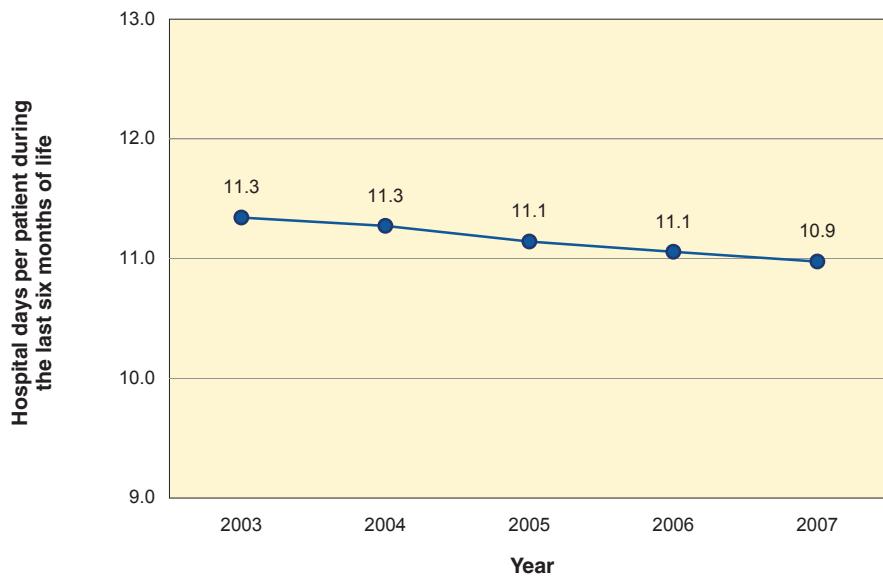
San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 4. Percentage of deaths associated with admission to intensive care among hospital referral regions (2007)
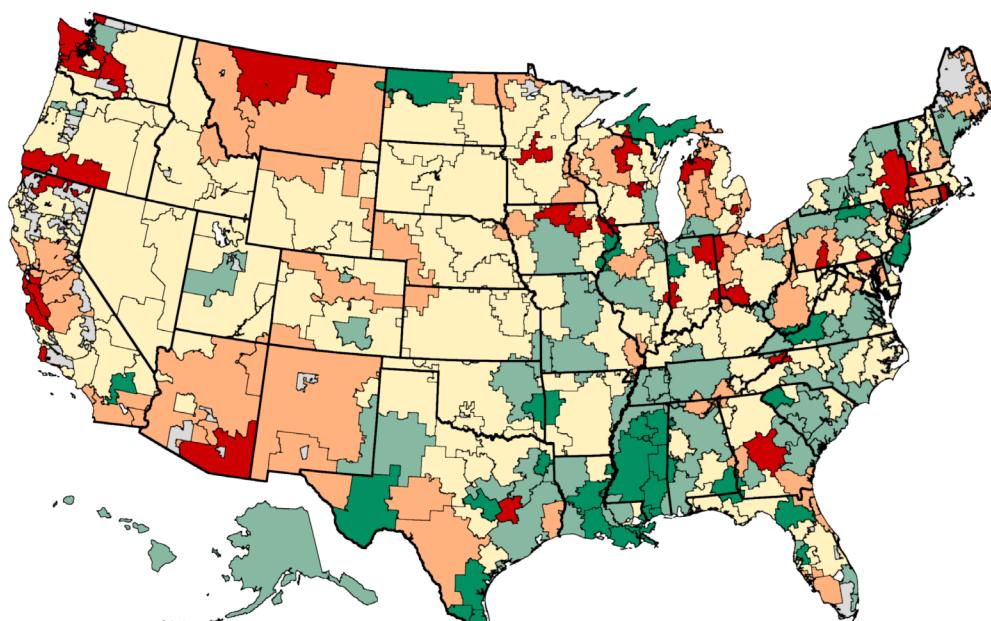
Hospital days during the last six months of life

Overall, the average patient spent slightly fewer days in the hospital during the last six months of life in 2007 than in 2003, as the national rate dropped slightly, from 11.3 to 10.9 hospital days per patient (Figure 3). Most regions saw little change. A few regions did have significant decreases, including Corpus Christi, Texas (-4.0 days), Newark, New Jersey (-3.5) and Tampa, Florida (-2.1). The largest increases were in San Mateo County, California (+2.6), Terre Haute, Indiana (+2.4) and Santa Cruz, California (+1.7) (Map 5).

In 2007, patients in Manhattan spent, on average, 20.6 days in the hospital during their last six months of life, almost four times more than patients in Ogden, Utah, where the average was 5.2 days. Other regions in New York and regions in New Jersey also had among the highest rates, including East Long Island (18.9) and the Bronx (18.1) in New York, and Newark (17.7), New Brunswick (17.5), Hackensack (17.2), Paterson (17.0) and Ridgewood (16.8) in New Jersey. Regions with the lowest average number of hospital days were found largely in the West and Midwest, including, in addition to Ogden, Salt Lake City (6.2), Portland, Oregon (7.2) and Spokane, Washington (7.4) (Map 6).
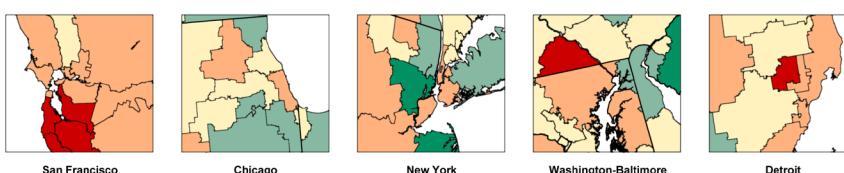
Figure 3. Change in the U.S. average number of days spent in hospital per chronically ill patient during the last six months of life (2003 to 2007)

Absolute Change in the Average Number of Hospital Days per Patient during the Last Six Months of Life, 2003 to 2007

by Hospital Referral Region

■	+0.69 to +2.57 days	(31)
■	+0.10 to < +0.69	(61)
■	-0.87 to < +0.10	(122)
■	-1.62 to < -0.87	(61)
■	-3.97 to < -1.62	(31)
■	Not populated	

San Francisco　Chicago　New York　Washington-Baltimore　Detroit
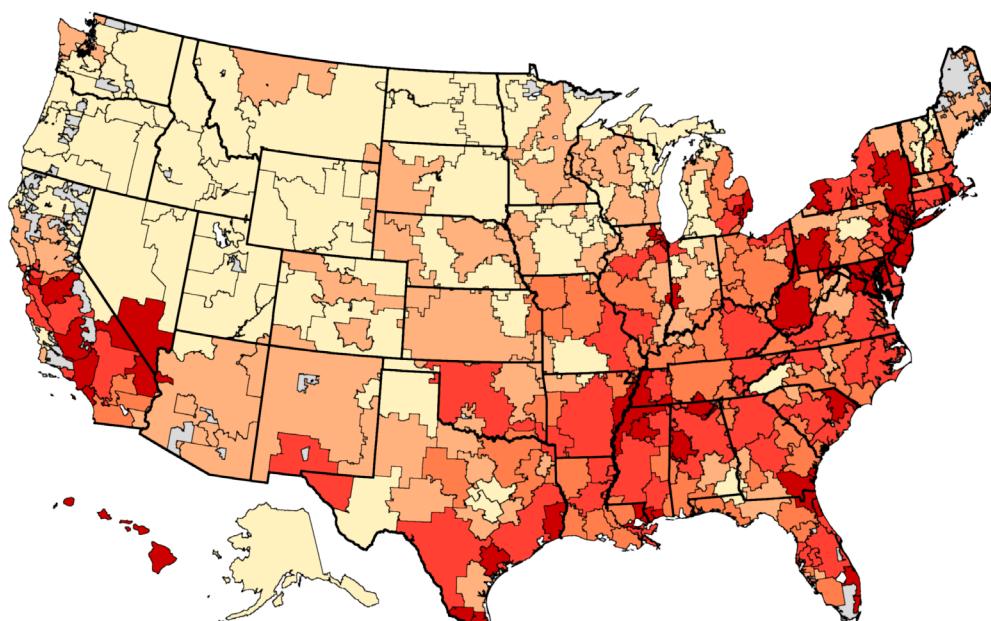
Map 5. Changes in the average number of days spent in hospital per chronically ill patient during the last six months of life among hospital referral regions (2003 to 2007)

Average Number of Hospital Days per Chronically Ill Patient during the Last Six Months of Life

by HRR (deaths occurring in 2007)

■	11.7 to 20.6	(60)
■	10.6 to < 11.7	(60)
■	9.6 to < 10.6	(59)
■	8.3 to < 9.6	(65)
■	5.2 to < 8.3	(62)
■	Not populated	

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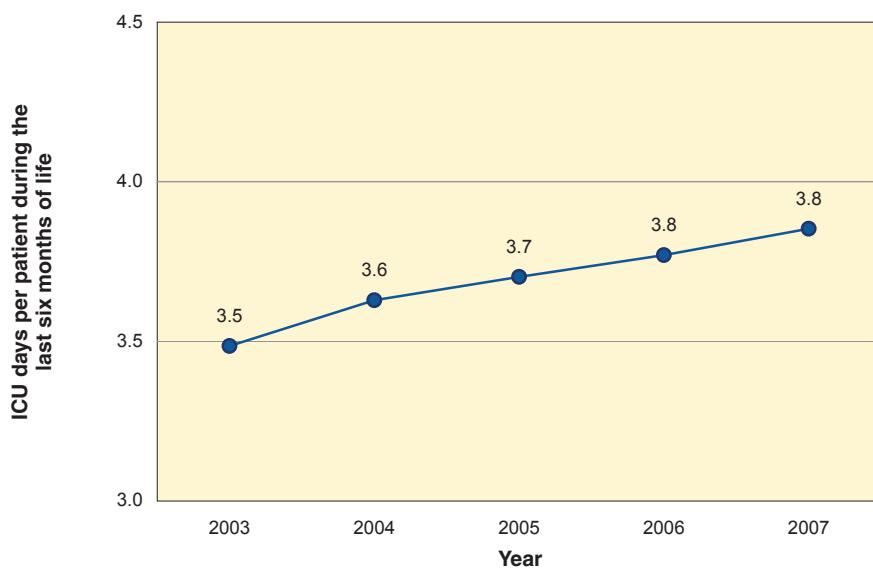
Map 6. Average number of days spent in hospital per chronically ill patient during the last six months of life among hospital referral regions (2007)
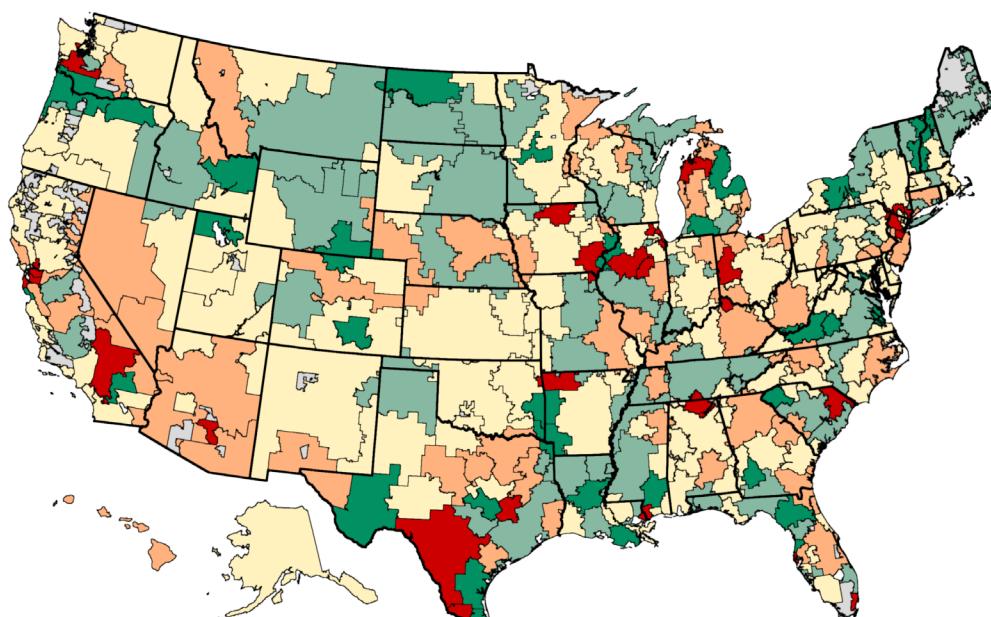
Intensive care days during the last six months of life

While patients spent slightly less time, on average, in the hospital in 2007 than in 2003, they spent more time in intensive care units (including both high- and intermediate-intensity beds), as the average number of intensive care days increased from 3.5 to 3.8 (Figure 4). The average changed little in most regions, but those with the largest decreases included Greenville, South Carolina (-1.8 days), Gainesville, Florida (-1.4) and Roanoke, Virginia (-0.9). The largest increases took place in Chicago (+2.5), Olympia, Washington (+2.4) and Clearwater, Florida (+2.4) (Map 7).

As with hospital days, patients' experiences varied widely in 2007 in terms of the average number of days spent in intensive care. Two Florida regions, Miami (10.7) and St. Petersburg (8.3), had the highest average number of days per patient. New Brunswick, New Jersey (8.1) and Los Angeles (8.0) also provided aggressive care according to this measure. Minot (0.7) and Bismarck (1.1), both in North Dakota, had the lowest average number of intensive care days per patient. Patients also spent relatively few days in intensive care in Portland, Maine (1.4) and Syracuse, New York (1.9) (Map 8).

Figure 4. Change in the U.S. average number of days spent in intensive care per chronically ill patient during the last six months of life (2003 to 2007)

Absolute Change in the Average Number of ICU Days per Patient during the Last Six Months of Life, 2003 to 2007

by Hospital Referral Region

■	+1.16 to +2.46 days	(31)
■	+0.55 to < +1.16	(61)
☐	-0.08 to < +0.55	(122)
■	-0.51 to < -0.08	(61)
■	-1.82 to < -0.51	(31)
☐	Not populated	

San Francisco   Chicago   New York   Washington-Baltimore   Detroit
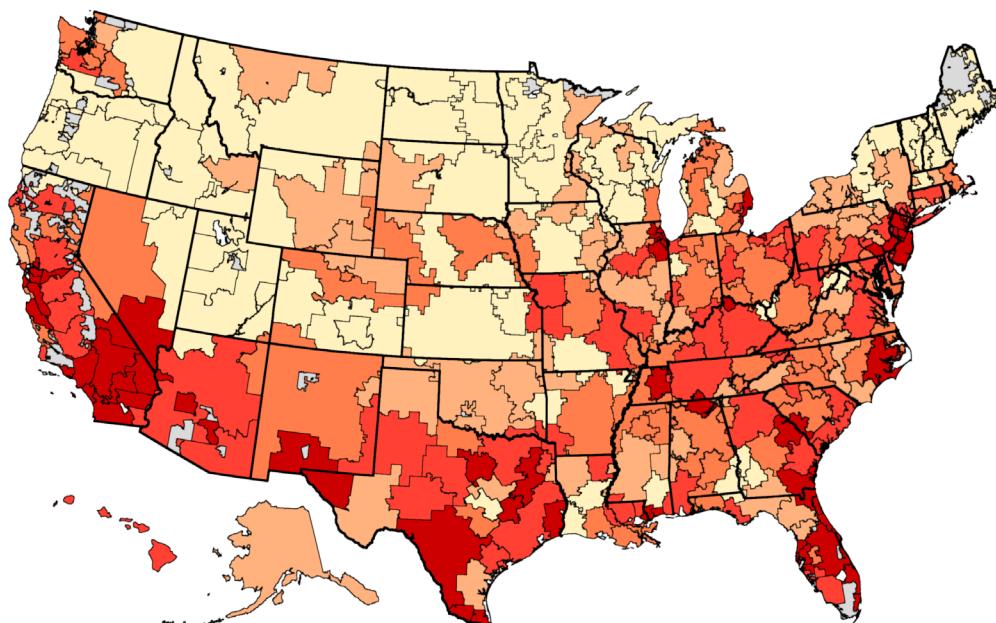
Map 7. Changes in the average number of days spent in intensive care per chronically ill patient during the last six months of life among hospital referral regions (2003 to 2007)

Average Number of ICU Days per Chronically Ill Patient during the Last Six Months of Life

by HRR (deaths occurring in 2007)

■	4.6 to 10.7	(58)
■	3.7 to < 4.6	(63)
■	2.8 to < 3.7	(67)
■	2.1 to < 2.8	(59)
☐	0.7 to < 2.1	(59)
☐	Not populated	

San Francisco   Chicago   New York   Washington-Baltimore   Detroit
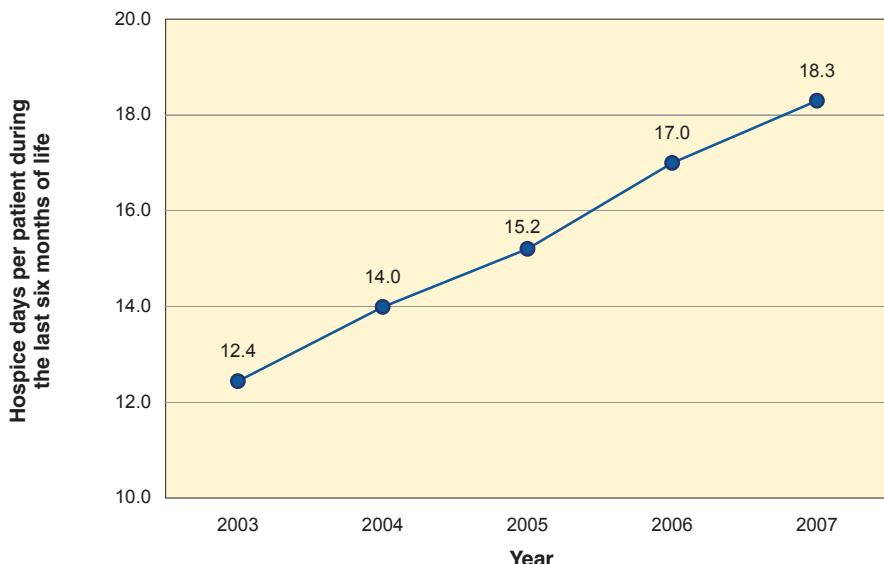
Map 8. Average number of days spent in intensive care per chronically ill patient during the last six months of life among hospital referral regions (2007)

Hospice days during the last six months of life
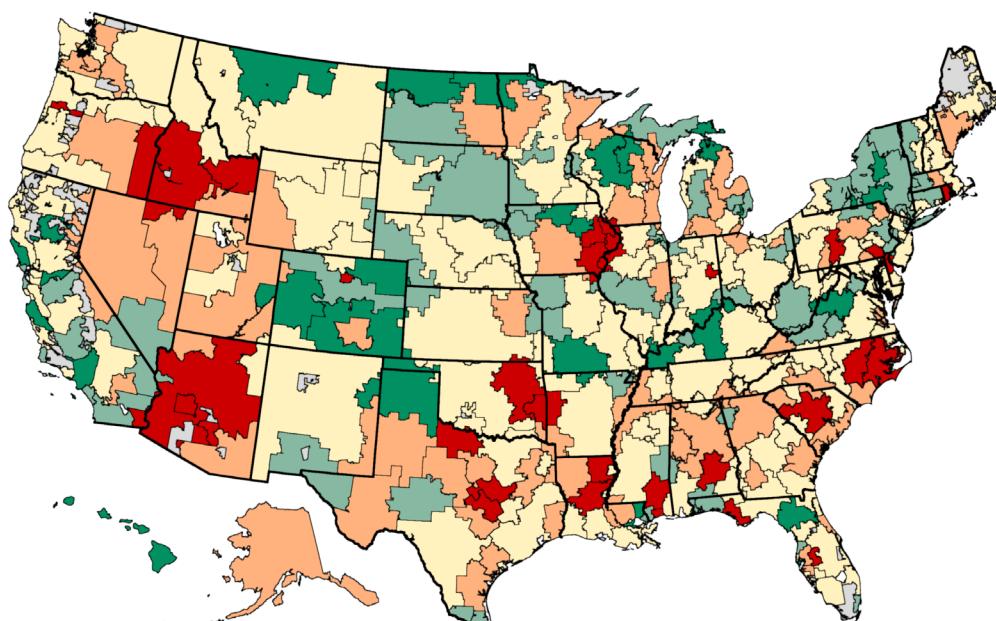
One important change in end-of-life care in recent decades has been the growing use of hospice care, which is intended to improve the quality of life for patients at the end of life, as well as to provide support to their families. Some studies, but not all, have found that a greater amount of hospice care is accompanied by a decrease in the cost of end-of-life care.[22,23]

Nationwide, the average number of hospice days per patient in the last six months of life increased substantially, from 12.4 days to 18.3 days (Figure 5). Reflecting the national trend, all but a few regions saw increases in hospice use from 2003 to 2007. Regions with the largest increases included Wichita Falls, Texas (+17.7 days), Mesa, Arizona (+17.5) and Tulsa, Oklahoma (+14.0). Among the few regions with decreases in hospice use were Waterloo, Iowa—where the rate dropped by 12.7 days per patient—Grand Junction, Colorado (-4.9) and Wausau, Wisconsin (-4.2) (Map 9).

In 2007, patients in Ogden, Utah, spent the most time in hospice care—an average of 39.5 days per patient in the last six months of life—more than six times the average number of days per patient in Elmira, New York (6.1). Lubbock, Texas (35.2) and Birmingham, Alabama (31.0) also ranked high, while Manhattan (7.3) and East Long Island, New York (8.7) were among the lowest-ranked regions (Map 10).


Figure 5. Change in the U.S. average number of days spent in hospice care per chronically ill patient during the last six months of life (2003 to 2007)

Absolute Change in the Average Number of Hospice Days per Patient during the Last Six Months of Life, 2003 to 2007
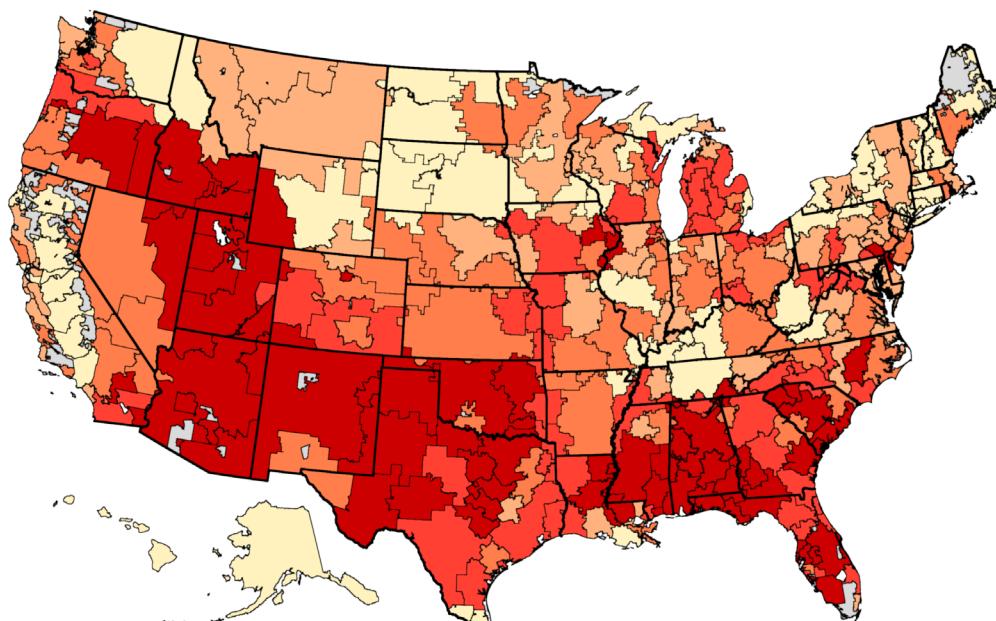
by Hospital Referral Region

- +10.65 to +17.73 days (31)
- +7.65 to < +10.65 (61)
- +4.15 to < +7.65 (122)
- +1.70 to < +4.15 (61)
- -12.73 to < +1.70 (31)
- Not populated

San Francisco | Chicago | New York | Washington-Baltimore | Detroit

Map 9. Changes in the average number of days spent in hospice care per chronically ill patient during the last six months of life among hospital referral regions (2003 to 2007)

Average Number of Hospice Days per Chronically Ill Patient during the Last Six Months of Life

by HRR (deaths occurring in 2007)

- 22.9 to 39.5 (61)
- 19.6 to < 22.9 (60)
- 16.6 to < 19.6 (62)
- 13.3 to < 16.6 (62)
- 6.0 to < 13.3 (61)
- Not populated
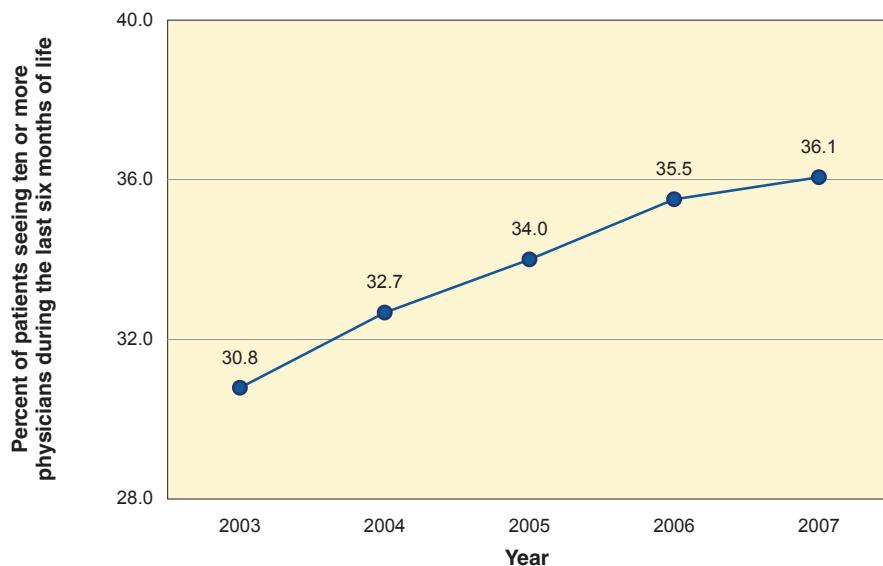
San Francisco | Chicago | New York | Washington-Baltimore | Detroit

Map 10. Average number of days spent in hospice care per chronically ill patient during the last six months of life among hospital referral regions (2007)
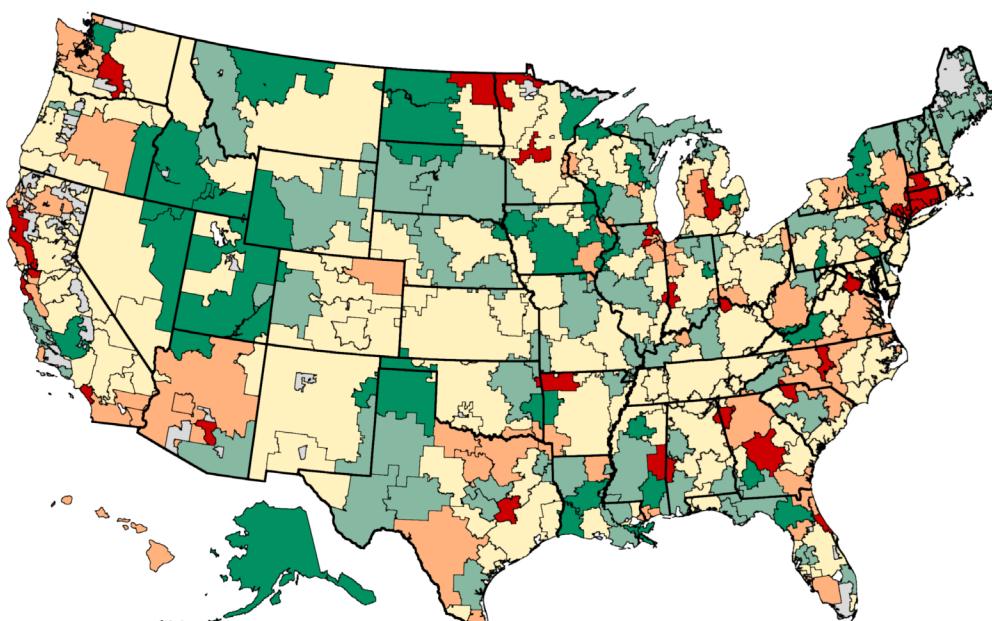
Patients seeing ten or more doctors during the last six months of life

Overall, Medicare beneficiaries with chronic disease were significantly more likely to be treated by ten or more doctors in the last six months of life in 2007 than they were in 2003, as the national rate increased from 30.8% to 36.1% (Figure 6). Large absolute increases were found in Mesa, Arizona (+15.4 percentage points), Macon, Georgia (+11.6) and Orange County, California (+10.0). Only 27 regions saw a decrease in this statistic from 2003 to 2007, including Binghamton, New York (-3.0) and Bakersfield, California (-2.2) (Map 11).

In 2007, patients in Royal Oak, Michigan received the most aggressive care by this measure, with 58.1% of chronically ill patients seeing ten or more doctors in the last six months of life. Other regions with high rates were Ridgewood, New Jersey (57.6%) and Philadelphia (57.2%). Regions with low percentages included Boise, Idaho (14.2%), Salt Lake City (15.0%) and Medford, Oregon (16.4%) (Map 12).

Figure 6. Change in the U.S. average percentage of chronically ill Medicare patients seeing ten or more physicians during the last six months of life (2003 to 2007)
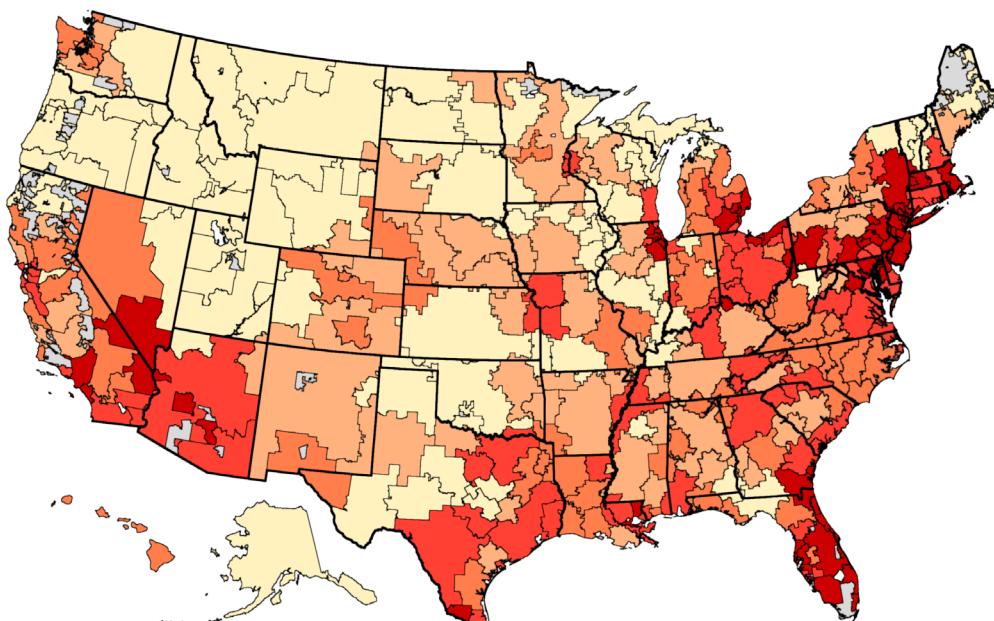
Absolute Change in the Percent of Patients Seeing Ten or More Physicians during the Last Six Months of Life, 2003 to 2007

by Hospital Referral Region

■	+9.40 to +15.39%	(31)
■	+6.38 to < +9.40%	(61)
■	+3.23 to < +6.38%	(122)
■	+0.40 to < +3.23%	(61)
■	-4.53 to < +0.40%	(31)
■	Not populated	

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 11. Changes in the percentage of chronically ill Medicare patients seeing ten or more physicians during the last six months of life among hospital referral regions (2003 to 2007)

Percent of Chronically Ill Patients Seeing Ten or More Physicians during the Last Six Months of Life

by HRR (deaths occurring in 2007)

■	42.3 to 58.1%	(60)
■	34.4 to < 42.3%	(62)
■	28.5 to < 34.4%	(61)
■	23.4 to < 28.5%	(61)
■	12.1 to < 23.4%	(62)
■	Not populated	

San Francisco   Chicago   New York   Washington-Baltimore   Detroit
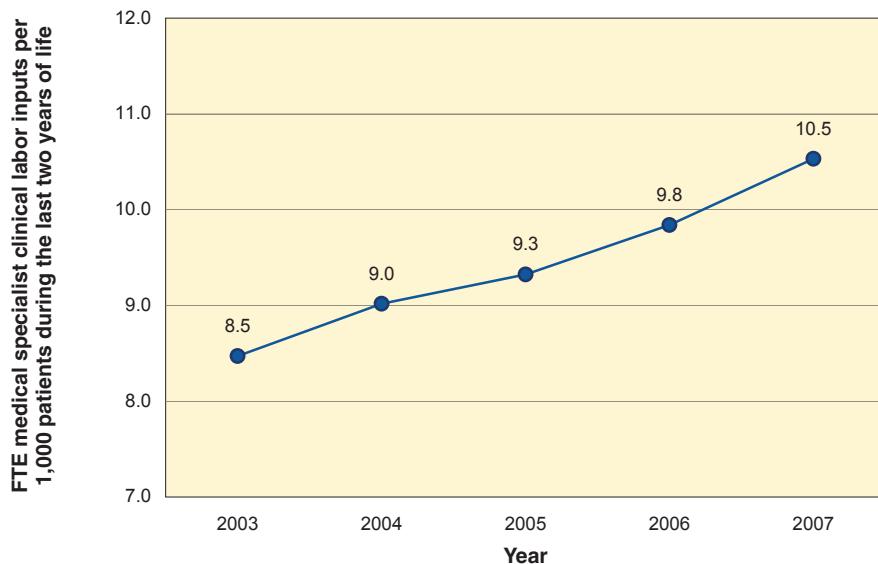
Map 12. Percentage of chronically ill Medicare patients seeing ten or more physicians during the last six months of life among hospital referral regions (2007)
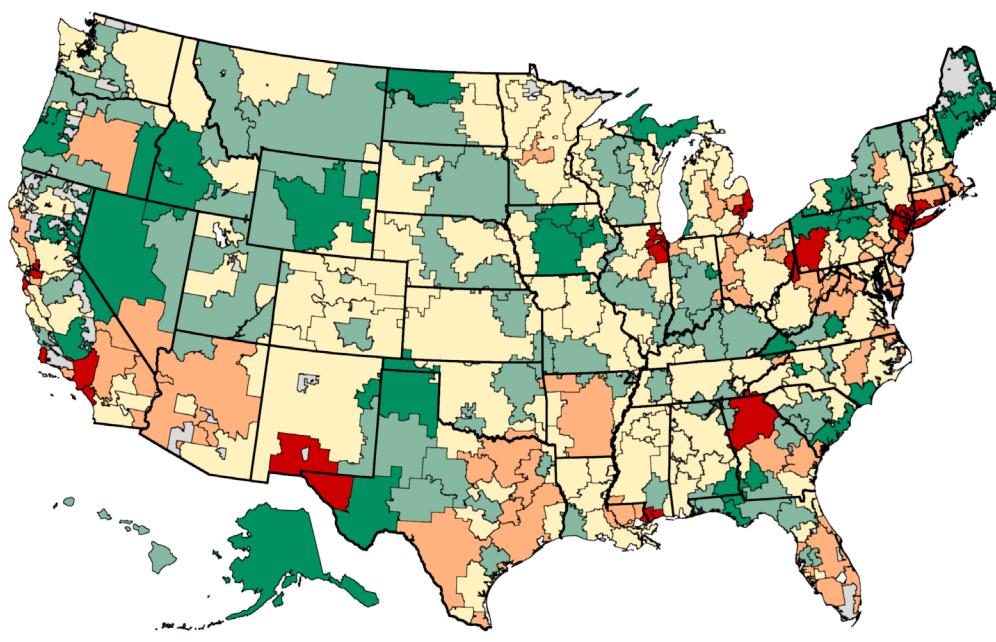
Number of full-time equivalent medical specialist clinical labor inputs per 1,000 decedents in the last two years of life

Nationwide, the use of medical specialist physician labor, as measured by full-time equivalent (FTE) medical specialist clinical labor inputs per 1,000 chronically ill patients, increased from 8.5 to 10.5 FTEs (Figure 7). Almost every region showed an increase, with the largest occurring in three New Jersey regions: Paterson (+6.0 FTEs), New Brunswick (+5.8) and Hackensack (+5.6). The few regions that saw a decrease included Waterloo, Iowa (-1.5), Odessa, Texas (-0.9) and Des Moines, Iowa (-0.5) (Map 13).

In 2007, New Brunswick had the highest utilization of medical specialist clinical labor at 23.1 FTEs, which was about six times the rate in Mason City, Iowa (3.8) and Bangor, Maine (3.8). Los Angeles (21.6) and Paterson (21.2) also had among the highest rates of medical specialist labor use per 1,000 patients. Regions ranked among the least aggressive in this category were Rochester, New York (5.1) and Minneapolis (6.5) (Map 14).

Figure 7. Change in U.S. average FTE medical specialist clinical labor inputs per 1,000 chronically ill patients during the last two years of life (2003 to 2007)

Absolute Change in Average FTE Medical Specialist Labor Inputs per 1,000 Patients during the Last Two Years of Life, 2003 to 2007
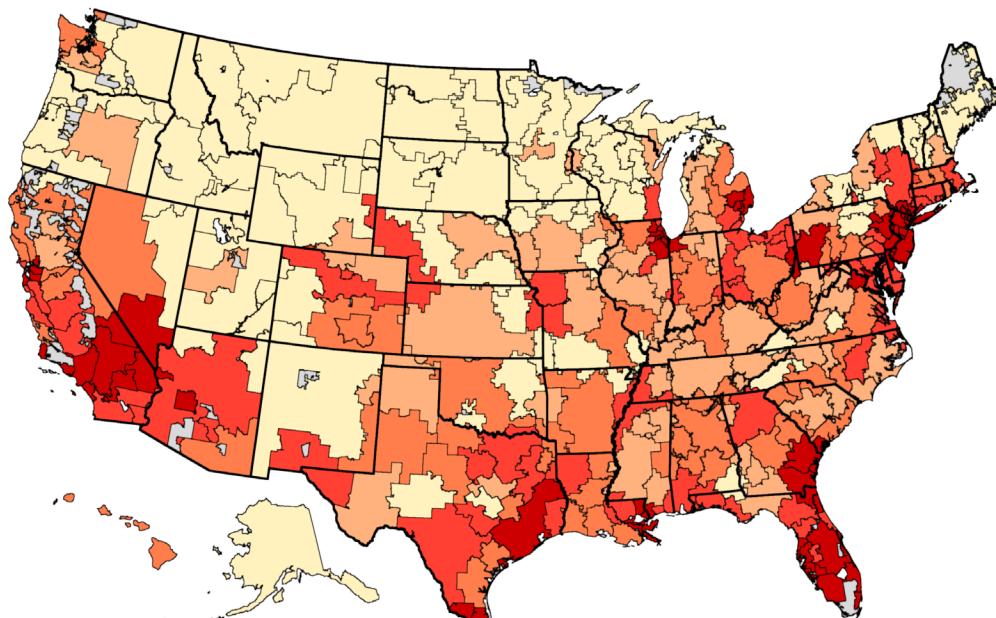
by Hospital Referral Region

- +3.12 to   +6.02 FTEs   (31)
- +2.07 to < +3.12   (61)
- +1.08 to < +2.07   (122)
- +0.46 to < +1.08   (61)
- -1.50 to < +0.46   (31)
- Not populated

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 13. Changes in FTE medical specialist clinical labor inputs per 1,000 chronically ill patients during the last two years of life among hospital referral regions (2003 to 2007)

Average FTE Medical Specialist Labor Inputs per 1,000 Chronically Ill Patients during the Last Two Years of Life

by HRR (deaths occurring in 2007)

- 12.0 to   23.1 (62)
- 9.4 to < 12.0 (58)
- 8.1 to < 9.4 (61)
- 6.6 to < 8.1 (62)
- 3.8 to < 6.6 (63)
- Not populated
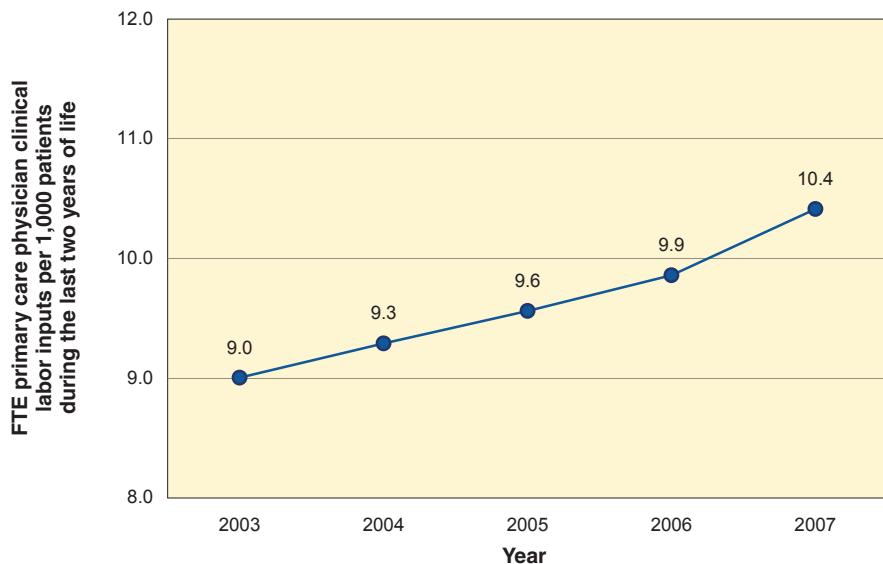
San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 14. FTE medical specialist clinical labor inputs per 1,000 chronically ill patients during the last two years of life among hospital referral regions (2007)
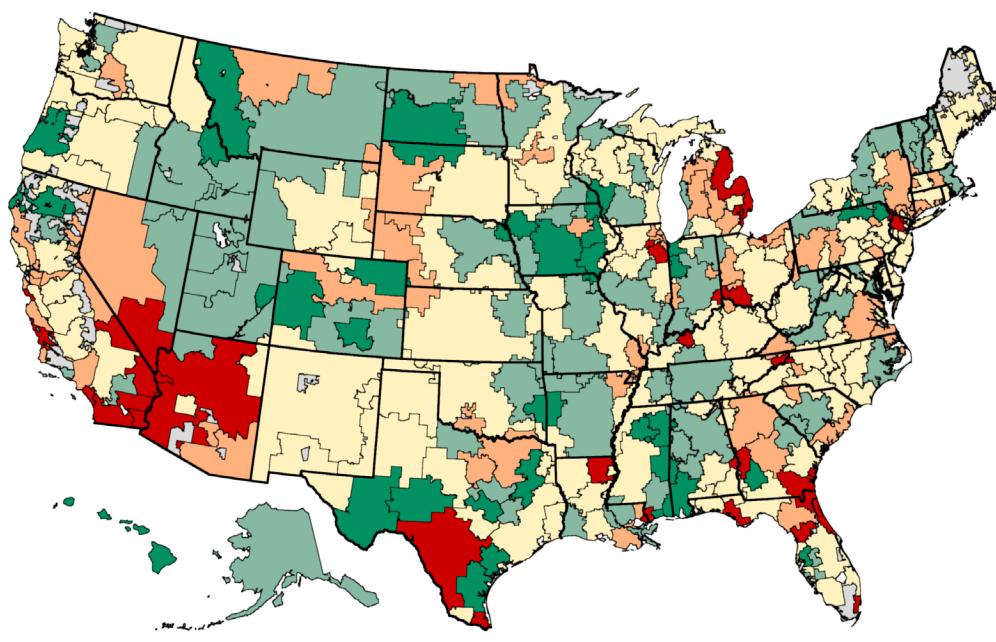
Number of FTE primary care physician clinical labor inputs per 1,000 decedents in the last two years of life

The use of FTE primary care physician clinical labor also increased from 2003 to 2007. Overall, the rate rose from 9.0 to 10.4, with most regions seeing at least a slight increase (Figure 8). The sharpest increases in rates of FTE primary care physician clinical labor input per 1,000 patients occurred in Morristown, New Jersey (+4.5 FTEs) and Panama City, Florida (+4.5). Jacksonville, Florida (+3.7) and San Diego (+3.2) also showed among the largest increases. Regions where the rate decreased included Corpus Christi, Texas (-1.5), Iowa City, Iowa (-1.5) and Mobile, Alabama (-0.6) (Map 15).

The highest rate of primary care physician labor use in 2007 was found in McAllen, Texas (17.6 FTEs) and the lowest in Appleton, Wisconsin (6.2). Dearborn, Michigan (17.6) and Miami (17.1) also had among the highest rates, while Salt Lake City (6.3) and Spokane, Washington (7.6) had among the lowest (Map 16).
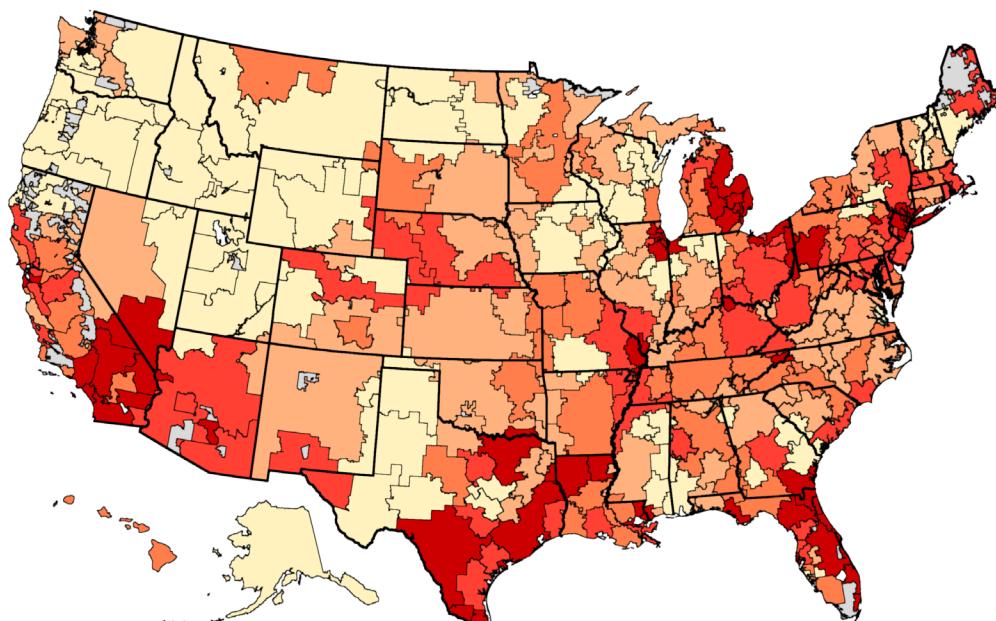
Figure 8. Change in U.S. average FTE primary care physician clinical labor inputs per 1,000 chronically ill patients during the last two years of life (2003 to 2007)

Absolute Change in Average FTE Primary Care Physician Labor Inputs per 1,000 Patients during the Last Two Years of Life, 2003 to 2007

by Hospital Referral Region

■	+2.55 to +4.50 FTEs	(31)
■	+1.74 to < +2.55	(61)
□	+0.83 to < +1.74	(122)
■	+0.15 to < +0.83	(61)
■	-1.99 to < +0.15	(31)
■	Not populated	

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 15. Changes in FTE primary care physician clinical labor inputs per 1,000 chronically ill patients during the last two years of life among hospital referral regions (2003 to 2007)

Average FTE Primary Care Physician Labor Inputs per 1,000 Chronically Ill Patients during the Last Two Years of Life

by HRR (deaths occurring in 2007)

■	11.3 to 17.7	(61)
■	10.1 to < 11.3	(56)
■	9.2 to < 10.1	(63)
■	8.1 to < 9.2	(63)
□	6.1 to < 8.1	(63)
■	Not populated	

San Francisco   Chicago   New York   Washington-Baltimore   Detroit

Map 16. FTE primary care physician clinical labor inputs per 1,000 chronically ill patients during the last two years of life among hospital referral regions (2007)
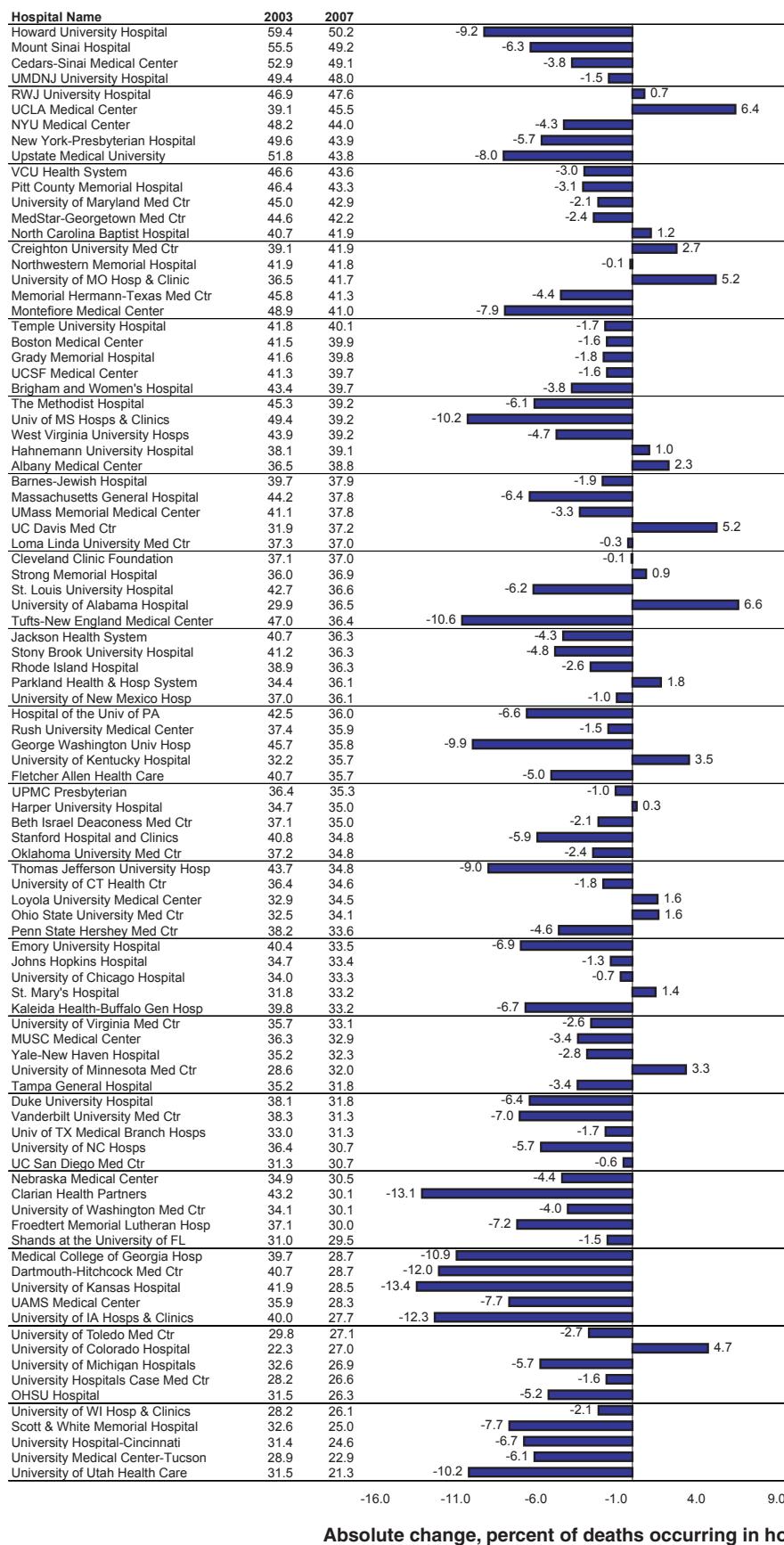
Trends in end-of-life care for Medicare beneficiaries with chronic illness at academic medical centers

The nation's academic medical centers are essential to the development of innovative treatments, the improvement of patient care and the training of future generations of physicians. Yet even at these elite institutions, where the care provided is assumed to be among the best in the world, the experiences of patients at the end of life differ remarkably. Most of the 94 academic medical centers discussed in this report substantially changed the intensity of the end-of-life care they provided from 2003 to 2007, but not in the same direction; some increased the aggressiveness of care, while others provided more conservative care. The following sections discuss the care of Medicare beneficiaries near the end of life with one or more chronic illnesses who received most of their care at one of these 94 academic medical centers.

Deaths in hospital

Among patient populations using 76 of the 94 academic medical centers for most of their care, rates of death in hospital decreased from 2003 to 2007 (Figure 9). The University of Kansas Hospital in Kansas City, Kansas had the largest absolute drop (-13.4 percentage points). Clarian Health Partners in Indianapolis (-13.1) and the University of Iowa Hospitals and Clinics in Iowa City (-12.3) also had large decreases. The largest increase was found at the University of Alabama Hospital in Birmingham (+6.6). Two California hospitals, UCLA Medical Center in Los Angeles (+6.4) and the University of California Davis Medical Center in Sacramento (+5.2) also were among the hospitals with large increases.

Several hospitals that had among the lowest rates of death in hospital in 2003 still saw substantial decreases over the five-year period; one example is University of Utah Health Care in Salt Lake City, where the rate dropped from 31.5% to 21.3%. In 2003, UCLA Medical Center and the Medical College of Georgia in Augusta had very similar rates, at 39.1% and 39.7%, respectively. Over the next five years, their rates moved in opposite directions, with UCLA joining those medical centers with the highest rates at 45.5%, while the rate at the Medical College of Georgia dropped to 28.7%.

Hospital Name	2003	2007	Absolute change
Howard University Hospital	59.4	50.2	-9.2
Mount Sinai Hospital	55.5	49.2	-6.3
Cedars-Sinai Medical Center	52.9	49.1	-3.8
UMDNJ University Hospital	49.4	48.0	-1.5
RWJ University Hospital	46.9	47.6	0.7
UCLA Medical Center	39.1	45.5	6.4
NYU Medical Center	48.2	44.0	-4.3
New York-Presbyterian Hospital	49.6	43.9	-5.7
Upstate Medical University	51.8	43.8	-8.0
VCU Health System	46.6	43.6	-3.0
Pitt County Memorial Hospital	46.4	43.3	-3.1
University of Maryland Med Ctr	45.0	42.9	-2.1
MedStar-Georgetown Med Ctr	44.6	42.2	-2.4
North Carolina Baptist Hospital	40.7	41.9	1.2
Creighton University Med Ctr	39.1	41.9	2.7
Northwestern Memorial Hospital	41.9	41.8	-0.1
University of MO Hosp & Clinic	36.5	41.7	5.2
Memorial Hermann-Texas Med Ctr	45.8	41.3	-4.4
Montefiore Medical Center	48.9	41.0	-7.9
Temple University Hospital	41.8	40.1	-1.7
Boston Medical Center	41.5	39.9	-1.6
Grady Memorial Hospital	41.6	39.8	-1.8
UCSF Medical Center	41.3	39.7	-1.6
Brigham and Women's Hospital	43.4	39.7	-3.8
The Methodist Hospital	45.3	39.2	-6.1
Univ of MS Hosps & Clinics	49.4	39.2	-10.2
West Virginia University Hosps	43.9	39.2	-4.7
Hahnemann University Hospital	38.1	39.1	1.0
Albany Medical Center	36.5	38.8	2.3
Barnes-Jewish Hospital	39.7	37.9	-1.9
Massachusetts General Hospital	44.2	37.8	-6.4
UMass Memorial Medical Center	41.1	37.8	-3.3
UC Davis Med Ctr	31.9	37.2	5.2
Loma Linda University Med Ctr	37.3	37.0	-0.3
Cleveland Clinic Foundation	37.1	37.0	-0.1
Strong Memorial Hospital	36.0	36.9	0.9
St. Louis University Hospital	42.7	36.6	-6.2
University of Alabama Hospital	29.9	36.5	6.6
Tufts-New England Medical Center	47.0	36.4	-10.6
Jackson Health System	40.7	36.3	-4.3
Stony Brook University Hospital	41.2	36.3	-4.8
Rhode Island Hospital	38.9	36.3	-2.6
Parkland Health & Hosp System	34.4	36.1	1.8
University of New Mexico Hosp	37.0	36.1	-1.0
Hospital of the Univ of PA	42.5	36.0	-6.6
Rush University Medical Center	37.4	35.9	-1.5
George Washington Univ Hosp	45.7	35.8	-9.9
University of Kentucky Hospital	32.2	35.7	3.5
Fletcher Allen Health Care	40.7	35.7	-5.0
UPMC Presbyterian	36.4	35.3	-1.0
Harper University Hospital	34.7	35.0	0.3
Beth Israel Deaconess Med Ctr	37.1	35.0	-2.1
Stanford Hospital and Clinics	40.8	34.8	-5.9
Oklahoma University Med Ctr	37.2	34.8	-2.4
Thomas Jefferson University Hosp	43.7	34.8	-9.0
University of CT Health Ctr	36.4	34.6	-1.8
Loyola University Medical Center	32.9	34.5	1.6
Ohio State University Med Ctr	32.5	34.1	1.6
Penn State Hershey Med Ctr	38.2	33.6	-4.6
Emory University Hospital	40.4	33.5	-6.9
Johns Hopkins Hospital	34.7	33.4	-1.3
University of Chicago Hospital	34.0	33.3	-0.7
St. Mary's Hospital	31.8	33.2	1.4
Kaleida Health-Buffalo Gen Hosp	39.8	33.2	-6.7
University of Virginia Med Ctr	35.7	33.1	-2.6
MUSC Medical Center	36.3	32.9	-3.4
Yale-New Haven Hospital	35.2	32.3	-2.8
University of Minnesota Med Ctr	28.6	32.0	3.3
Tampa General Hospital	35.2	31.8	-3.4
Duke University Hospital	38.1	31.8	-6.4
Vanderbilt University Med Ctr	38.3	31.3	-7.0
Univ of TX Medical Branch Hosps	33.0	31.3	-1.7
University of NC Hosps	36.4	30.7	-5.7
UC San Diego Med Ctr	31.3	30.7	-0.6
Nebraska Medical Center	34.9	30.5	-4.4
Clarian Health Partners	43.2	30.1	-13.1
University of Washington Med Ctr	34.1	30.1	-4.0
Froedtert Memorial Lutheran Hosp	37.1	30.0	-7.2
Shands at the University of FL	31.0	29.5	-1.5
Medical College of Georgia Hosp	39.7	28.7	-10.9
Dartmouth-Hitchcock Med Ctr	40.7	28.7	-12.0
University of Kansas Hospital	41.9	28.5	-13.4
UAMS Medical Center	35.9	28.3	-7.7
University of IA Hosps & Clinics	40.0	27.7	-12.3
University of Toledo Med Ctr	29.8	27.1	-2.7
University of Colorado Hospital	22.3	27.0	4.7
University of Michigan Hospitals	32.6	26.9	-5.7
University Hospitals Case Med Ctr	28.2	26.6	-1.6
OHSU Hospital	31.5	26.3	-5.2
University of WI Hosp & Clinics	28.2	26.1	-2.1
Scott & White Memorial Hospital	32.6	25.0	-7.7
University Hospital-Cincinnati	31.4	24.6	-6.7
University Medical Center-Tucson	28.9	22.9	-6.1
University of Utah Health Care	31.5	21.3	-10.2

-16.0   -11.0   -6.0   -1.0   4.0   9.0

Absolute change, percent of deaths occurring in hospital

Figure 9. Changes in the percentage of deaths occurring in hospital among patients receiving most of their care at academic medical centers (2003 to 2007)

Deaths associated with admission to intensive care

The changes from 2003 to 2007 in the rates of death associated with admission to intensive care differed widely among academic medical centers (Figure 10). About half saw at least a small decrease. Among those hospitals with the largest absolute decreases were the University of Medicine and Dentistry of New Jersey in Newark (-10.8 percentage points), Oklahoma University Medical Center in Oklahoma City (-9.5) and Dartmouth-Hitchcock Medical Center in Lebanon, New Hampshire (-8.0). Hahnemann University Hospital in Philadelphia had the largest absolute increase (+13.2). The University of Kentucky Hospital in Lexington (+9.6) and the University of Minnesota Medical Center in Minneapolis (+8.4) also saw large increases.

The experiences of patients who most frequently used four Philadelphia hospitals demonstrate the differences seen nationwide. From 2003 to 2007, the percentage of patients admitted to intensive care during their final hospital stay among those using Thomas Jefferson University Hospital dropped from 37.3% to 30.8%. Meanwhile, patients at Temple University Hospital—where the rate increased from 32.0% to 35.3%—and at Hahnemann University Hospital—where the rate increased from 23.7% to 36.9%—were more likely to be admitted to intensive care during their final hospital stay in 2007 than they were in 2003. The rate at the Hospital of the University of Pennsylvania remained virtually unchanged.

Hospital Name	2003	2007	Absolute change
UCLA Medical Center	35.4	40.9	5.5
RWJ University Hospital	35.8	38.0	2.1
Cedars-Sinai Medical Center	40.0	37.1	-3.0
Hahnemann University Hospital	23.7	36.9	13.2
Memorial Hermann-Texas Med Ctr	39.5	36.4	-3.1
Temple University Hospital	32.0	35.3	3.4
Howard University Hospital	40.5	34.2	-6.3
Loma Linda University Med Ctr	34.1	33.7	-0.4
NYU Medical Center	34.6	32.9	-1.8
Creighton University Med Ctr	25.9	32.9	6.9
University of Maryland Med Ctr	35.5	32.4	-3.1
UMDNJ University Hospital	42.6	31.9	-10.8
West Virginia University Hosps	35.1	31.9	-3.3
VCU Health System	25.9	31.1	5.2
North Carolina Baptist Hospital	29.2	31.0	1.8
Parkland Health & Hosp System	25.5	30.9	5.4
Pitt County Memorial Hospital	30.4	30.8	0.4
Thomas Jefferson University Hosp	37.3	30.8	-6.6
Grady Memorial Hospital	25.7	30.5	4.8
Tufts-New England Medical Center	33.5	30.2	-3.3
Stanford Hospital and Clinics	29.4	29.8	0.4
MedStar-Georgetown Med Ctr	28.8	29.5	0.7
Rush University Medical Center	28.0	29.4	1.4
The Methodist Hospital	33.5	28.8	-4.7
Penn State Hershey Med Ctr	30.6	28.5	-2.1
Northwestern Memorial Hospital	23.7	28.4	4.7
George Washington Univ Hosp	27.6	28.4	0.7
UC San Diego Med Ctr	23.7	27.9	4.3
UC Davis Med Ctr	26.4	27.8	1.4
University of MO Hosp & Clinic	24.3	27.7	3.4
Brigham and Women's Hospital	31.1	27.6	-3.5
Loyola University Medical Center	25.6	27.1	1.5
St. Mary's Hospital	21.7	27.1	5.4
University of Chicago Hospital	23.2	26.7	3.5
Boston Medical Center	26.5	26.6	0.1
St. Louis University Hospital	27.6	26.2	-1.4
Hospital of the Univ of PA	25.4	26.0	0.7
Emory University Hospital	28.6	25.5	-3.1
Nebraska Medical Center	25.0	25.5	0.5
Tampa General Hospital	25.0	25.5	0.5
University of Kentucky Hospital	15.9	25.5	9.6
UPMC Presbyterian	24.5	25.5	1.0
Jackson Health System	29.2	25.4	-3.8
MUSC Medical Center	23.8	25.2	1.4
Univ of MS Hosps & Clinics	25.5	25.2	-0.2
University of New Mexico Hosp	24.8	25.2	0.4
Barnes-Jewish Hospital	21.4	25.1	3.7
Ohio State University Med Ctr	18.8	24.9	6.1
Beth Israel Deaconess Med Ctr	22.3	24.7	2.4
University of NC Hosps	24.6	24.0	-0.6
Clarian Health Partners	24.0	23.9	-0.1
Johns Hopkins Hospital	23.1	23.2	0.1
Rhode Island Hospital	24.2	23.1	-1.2
UCSF Medical Center	20.3	23.0	2.7
Vanderbilt University Med Ctr	29.3	22.8	-6.6
University of IA Hosps & Clinics	20.4	22.7	2.3
University of Minnesota Med Ctr	14.2	22.6	8.4
Cleveland Clinic Foundation	22.3	22.2	-0.1
University of Washington Med Ctr	20.2	22.2	2.0
Massachusetts General Hospital	22.4	21.7	-0.8
Duke University Hospital	21.5	21.6	0.1
University of Alabama Hospital	16.1	21.2	5.2
University Hospital-Cincinnati	24.9	21.2	-3.7
University of Kansas Hospital	26.2	21.1	-5.1
Mount Sinai Hospital	21.3	21.1	-0.3
UMass Memorial Medical Center	22.2	21.0	-1.2
University of Virginia Med Ctr	18.4	20.7	2.3
Univ of TX Medical Branch Hosps	21.1	20.7	-0.4
Harper University Hospital	18.2	20.3	2.1
Shands at the University of FL	19.0	20.2	1.2
University Medical Center-Tucson	26.6	19.9	-6.7
New York-Presbyterian Hospital	26.6	19.8	-6.8
Montefiore Medical Center	17.5	19.8	2.3
Yale-New Haven Hospital	22.0	19.8	-2.2
OHSU Hospital	21.6	19.6	-2.0
University of Toledo Med Ctr	17.7	19.6	1.9
Upstate Medical University	13.8	19.6	5.8
Froedtert Memorial Lutheran Hosp	20.5	19.5	-1.0
University of Colorado Hospital	18.5	19.1	0.6
Albany Medical Center	20.1	18.7	-1.4
Strong Memorial Hospital	20.0	18.5	-1.6
Medical College of Georgia Hosp	25.8	18.5	-7.3
Stony Brook University Hospital	18.9	18.1	-0.8
Oklahoma University Med Ctr	27.6	18.1	-9.5
Kaleida Health-Buffalo Gen Hosp	20.9	18.1	-2.8
University of CT Health Ctr	17.2	17.7	0.6
University of Michigan Hospitals	18.9	17.6	-1.3
University Hospitals Case Med Ctr	16.6	17.4	0.8
UAMS Medical Center	19.0	17.0	-2.0
Fletcher Allen Health Care	19.5	16.2	-3.3
University of Utah Health Care	20.6	14.5	-6.1
University of WI Hosp & Clinics	15.5	14.0	-1.5
Dartmouth-Hitchcock Med Ctr	21.8	13.8	-8.0
Scott & White Memorial Hospital	13.5	11.5	-2.0

Absolute change, percent of deaths associated with ICU admission

Figure 10. Changes in the percentage of deaths associated with admission to intensive care among patients receiving most of their care at academic medical centers (2003 to 2007)

Hospital days during the last six months of life

Most academic medical centers did not see substantial changes from 2003 to 2007 in the average number of days their chronically ill Medicare patients spent in the hospital during the last six months of life (Figure 11). Among those where patients spent less time in the hospital in 2007 than in 2003 were the University of Texas Medical Branch Hospitals in Galveston (-5.0 days), the University of Iowa Hospitals and Clinics in Iowa City (-5.0) and Tufts-New England Medical Center in Boston (-4.6). Ten academic medical centers had increases of at least two days, including Hahnemann University Hospital in Philadelphia (+6.8), the University of California Davis Medical Center in Sacramento (+4.7) and the University of California San Diego Medical Center (+3.7).

Hospital Name	2003	2007	Change
NYU Medical Center	27.3	26.9	-0.4
Hahnemann University Hospital	18.5	25.3	6.8
Mount Sinai Hospital	23.1	22.3	-0.8
Cedars-Sinai Medical Center	22.9	22.0	-0.9
RWJ University Hospital	23.9	22.0	-1.9
New York-Presbyterian Hospital	21.3	20.9	-0.4
Thomas Jefferson University Hosp	20.7	20.5	-0.2
Montefiore Medical Center	17.6	19.3	1.7
UCLA Medical Center	16.2	18.7	2.5
The Methodist Hospital	17.5	18.1	0.6
UMDNJ University Hospital	18.5	18.1	-0.4
University of Maryland Med Ctr	18.4	17.8	-0.6
Howard University Hospital	22.0	17.6	-4.4
Jackson Health System	18.9	17.4	-1.5
MedStar-Georgetown Med Ctr	17.0	17.4	0.4
Johns Hopkins Hospital	16.6	16.9	0.4
Harper University Hospital	17.1	16.5	-0.6
Northwestern Memorial Hospital	17.1	16.3	-0.7
Temple University Hospital	17.3	16.3	-1.0
Hospital of the Univ of PA	17.1	16.2	-0.9
Massachusetts General Hospital	17.6	16.1	-1.5
Tampa General Hospital	15.4	16.0	0.6
Cleveland Clinic Foundation	13.6	16.0	2.4
UPMC Presbyterian	14.6	16.0	1.3
Yale-New Haven Hospital	14.3	15.9	1.6
Stony Brook University Hospital	17.1	15.8	-1.3
University of Minnesota Med Ctr	14.4	15.8	1.5
George Washington Univ Hosp	17.4	15.8	-1.5
Loma Linda University Med Ctr	13.9	15.7	1.8
University of Kansas Hospital	15.5	15.7	0.2
North Carolina Baptist Hospital	13.7	15.6	1.8
Rush University Medical Center	15.8	15.6	-0.3
Albany Medical Center	15.3	15.6	0.3
Barnes-Jewish Hospital	16.6	15.6	-1.0
Brigham and Women's Hospital	15.7	14.9	-0.8
Boston Medical Center	15.0	14.9	-0.1
Strong Memorial Hospital	15.1	14.6	-0.5
Ohio State University Med Ctr	15.1	14.6	-0.5
Rhode Island Hospital	13.7	14.6	0.9
UC Davis Med Ctr	9.9	14.6	4.7
Nebraska Medical Center	13.0	14.4	1.4
Memorial Hermann-Texas Med Ctr	12.0	14.4	2.4
St. Louis University Hospital	16.3	14.3	-2.0
Penn State Hershey Med Ctr	11.5	14.3	2.7
UCSF Medical Center	13.7	14.2	0.6
Tufts-New England Medical Center	18.9	14.2	-4.6
Beth Israel Deaconess Med Ctr	13.4	14.2	0.8
UC San Diego Med Ctr	10.4	14.1	3.7
University of Chicago Hospital	13.0	13.9	0.9
Shands at the University of FL	14.8	13.9	-0.8
Kaleida Health-Buffalo Gen Hosp	13.0	13.9	0.9
UMass Memorial Medical Center	12.6	13.9	1.3
University of Michigan Hospitals	12.8	13.8	1.1
UAMS Medical Center	14.8	13.8	-0.9
Emory University Hospital	16.2	13.7	-2.4
University of Toledo Med Ctr	12.2	13.4	1.2
Loyola University Medical Center	13.2	13.3	0.1
Pitt County Memorial Hospital	12.1	13.3	1.1
Duke University Hospital	13.5	13.0	-0.5
VCU Health System	10.8	13.0	2.1
Upstate Medical University	16.4	12.9	-3.5
University Hospitals Case Med Ctr	10.9	12.8	1.9
University of Alabama Hospital	10.6	12.8	2.2
Clarian Health Partners	13.1	12.8	-0.3
West Virginia University Hosps	13.9	12.7	-1.2
Stanford Hospital and Clinics	12.3	12.7	0.4
University of New Mexico Hosp	10.0	12.5	2.5
Creighton University Med Ctr	12.3	12.3	0.0
Froedtert Memorial Lutheran Hosp	12.9	12.1	-0.8
University of CT Health Ctr	12.0	12.1	0.1
Vanderbilt University Med Ctr	12.7	11.9	-0.8
Medical College of Georgia Hosp	13.1	11.7	-1.3
MUSC Medical Center	11.9	11.6	-0.4
Grady Memorial Hospital	13.8	11.5	-2.3
St. Mary's Hospital	12.1	11.4	-0.8
Oklahoma University Med Ctr	12.2	11.3	-0.9
University of Kentucky Hospital	10.1	11.2	1.2
University Medical Center-Tucson	9.7	11.2	1.5
University of Colorado Hospital	10.8	11.2	0.3
Fletcher Allen Health Care	10.5	11.0	0.5
University Hospital-Cincinnati	10.5	11.0	0.4
University of IA Hosps & Clinics	15.9	10.9	-5.0
University of Virginia Med Ctr	10.6	10.9	0.3
University of NC Hosps	12.0	10.7	-1.2
University of MO Hosp & Clinic	10.2	10.7	0.5
Dartmouth-Hitchcock Med Ctr	10.0	10.7	0.7
Univ of MS Hosps & Clinics	11.0	10.5	-0.5
Univ of TX Medical Branch Hosps	15.1	10.0	-5.0
University of WI Hosp & Clinics	11.7	9.8	-1.9
University of Washington Med Ctr	12.9	9.7	-3.1
OHSU Hospital	11.5	9.3	-2.2
University of Utah Health Care	9.8	9.2	-0.7
Scott & White Memorial Hospital	10.4	8.9	-1.5
Parkland Health & Hosp System	10.9	8.3	-2.6

-6.0 -4.0 -2.0 0.0 2.0 4.0 6.0 8.0

**Absolute change, hospital days per patient
during the last six months of life**

**Figure 11. Changes in the average number of days spent in hospital per chronically ill patient during the last six months of life among patients receiving most of their care at academic medical centers (2003 to 2007)**

Intensive care days during the last six months of life

As with the average number of hospital days per patient, the average number of days spent in intensive care units—both high and intermediate intensity—per patient changed only moderately at most academic medical centers (Figure 12). Vanderbilt University Medical Center in Nashville, Tennessee had the largest decrease in intensive care days per patient, dropping 2.1 days from 7.4 to 5.3. Brigham and Women's Hospital in Boston (-1.9 days), Oklahoma University Medical Center in Oklahoma City (-1.4) and Oregon Health Sciences University in Portland (-1.4) also saw decreases. Hahnemann University Hospital again had the largest increase, from 5.5 days to 13.7 days. Tampa General Hospital in Florida (+5.0) and the University of Minnesota Medical Center in Minneapolis (+4.4) also showed among the largest increases.

Hospital Name	2003	2007	
UCLA Medical Center	10.2	13.9	3.7
Hahnemann University Hospital	5.5	13.7	8.2
Thomas Jefferson University Hosp	12.7	13.5	0.8
RWJ University Hospital	9.0	11.1	2.1
Temple University Hospital	8.9	10.1	1.2
Jackson Health System	9.0	9.9	0.9
Cedars-Sinai Medical Center	9.2	9.6	0.4
Tampa General Hospital	4.5	9.5	5.0
NYU Medical Center	9.4	9.5	0.0
UC San Diego Med Ctr	6.8	9.3	2.4
Loma Linda University Med Ctr	7.9	9.2	1.4
Nebraska Medical Center	6.6	8.6	2.1
Howard University Hospital	7.2	8.6	1.4
Memorial Hermann-Texas Med Ctr	7.6	8.5	1.0
University of Maryland Med Ctr	8.9	8.2	-0.7
Penn State Hershey Med Ctr	5.6	7.7	2.1
UMDNJ University Hospital	7.9	7.7	-0.3
UC Davis Med Ctr	6.4	7.6	1.2
University of Kansas Hospital	6.9	7.5	0.6
University of Minnesota Med Ctr	3.0	7.5	4.4
Loyola University Medical Center	7.1	7.4	0.3
Stanford Hospital and Clinics	4.5	7.2	2.8
West Virginia University Hosps	6.8	6.9	0.1
Creighton University Med Ctr	4.7	6.7	2.1
University of Toledo Med Ctr	4.5	6.7	2.2
Pitt County Memorial Hospital	4.8	6.6	1.7
MUSC Medical Center	5.5	6.3	0.8
Clarian Health Partners	3.5	6.2	2.7
The Methodist Hospital	6.2	6.1	-0.1
University of New Mexico Hosp	4.0	6.0	2.0
Hospital of the Univ of PA	4.9	5.8	0.9
VCU Health System	3.5	5.7	2.2
Ohio State University Med Ctr	4.2	5.6	1.4
Cleveland Clinic Foundation	3.9	5.5	1.6
Rush University Medical Center	4.3	5.5	1.2
Vanderbilt University Med Ctr	7.4	5.3	-2.1
University Medical Center-Tucson	3.9	5.2	1.3
Univ of TX Medical Branch Hosps	4.4	5.2	0.7
University of Kentucky Hospital	2.9	5.1	2.3
University Hospital-Cincinnati	4.5	4.9	0.4
Boston Medical Center	4.5	4.9	0.5
Johns Hopkins Hospital	4.8	4.9	0.1
University of Chicago Hospital	3.7	4.9	1.2
Brigham and Women's Hospital	6.8	4.8	-1.9
Emory University Hospital	6.0	4.7	-1.3
UPMC Presbyterian	3.7	4.7	1.1
St. Mary's Hospital	4.2	4.7	0.6
Montefiore Medical Center	2.9	4.7	1.8
University of IA Hosps & Clinics	2.9	4.7	1.8
George Washington Univ Hosp	5.6	4.7	-0.9
St. Louis University Hospital	4.2	4.6	0.4
UAMS Medical Center	4.3	4.6	0.3
University of Virginia Med Ctr	1.8	4.5	2.7
North Carolina Baptist Hospital	3.7	4.5	0.8
New York-Presbyterian Hospital	4.7	4.5	-0.2
Northwestern Memorial Hospital	4.2	4.4	0.2
Grady Memorial Hospital	4.7	4.3	-0.4
Tufts-New England Medical Center	4.7	4.2	-0.5
Rhode Island Hospital	3.4	4.1	0.7
Duke University Hospital	3.1	4.0	0.9
MedStar-Georgetown Med Ctr	4.6	4.0	-0.6
Barnes-Jewish Hospital	4.2	4.0	-0.3
University of NC Hosps	3.7	3.9	0.2
Shands at the University of FL	4.1	3.9	-0.2
University of Alabama Hospital	2.7	3.7	1.0
Medical College of Georgia Hosp	3.1	3.6	0.5
University of MO Hosp & Clinic	3.1	3.6	0.4
UCSF Medical Center	3.4	3.6	0.1
Beth Israel Deaconess Med Ctr	3.2	3.5	0.3
Stony Brook University Hospital	3.3	3.4	0.0
University Hospitals Case Med Ctr	2.4	3.3	0.8
University of Utah Health Care	3.9	3.2	-0.7
Yale-New Haven Hospital	3.4	3.2	-0.2
Mount Sinai Hospital	3.1	3.2	0.1
University of Colorado Hospital	4.1	3.1	-1.0
Strong Memorial Hospital	3.1	3.1	0.0
Harper University Hospital	3.3	3.1	-0.2
University of CT Health Ctr	3.1	3.0	-0.1
University of Michigan Hospitals	2.7	3.0	0.3
UMass Memorial Medical Center	3.0	2.9	-0.1
University of Washington Med Ctr	2.2	2.6	0.4
Oklahoma University Med Ctr	4.1	2.6	-1.4
Kaleida Health-Buffalo Gen Hosp	2.5	2.6	0.1
Froedtert Memorial Lutheran Hosp	2.7	2.6	-0.1
Parkland Health & Hosp System	2.8	2.5	-0.3
Massachusetts General Hospital	2.7	2.4	-0.3
Albany Medical Center	3.3	2.4	-1.0
Univ of MS Hosps & Clinics	2.6	2.3	-0.2
University of WI Hosp & Clinics	2.0	2.3	0.3
Upstate Medical University	1.9	2.2	0.3
OHSU Hospital	3.2	1.8	-1.4
Fletcher Allen Health Care	1.9	1.8	0.0
Scott & White Memorial Hospital	1.7	1.6	0.0
Dartmouth-Hitchcock Med Ctr	1.8	1.6	-0.2

-4.0   -2.0   0.0   2.0   4.0   6.0   8.0   10.0

**Absolute change, ICU days per patient
during the last six months of life**

Figure 12. Changes in the average number of days spent in intensive care per chronically ill patient during the last six months of life among patients receiving most of their care at academic medical centers (2003 to 2007)

Hospice days during the last six months of life

All but ten academic medical centers followed the nationwide trend by increasing their use of hospice care from 2003 to 2007, and about two thirds had an increase of at least three days per patient (Figure 13). The largest rise was at George Washington University Hospital in Washington, D.C. (+10.9 days), while Memorial Hermann-Texas Medical Center in Houston (+10.4) and Emory University Hospital in Atlanta (+10.3) also saw sharp increases. Albany Medical Center in Albany, New York, had the largest drop (-4.1). Parkland Health and Hospital System in Dallas (-2.2), the University of Medicine and Dentistry of New Jersey in Newark (-1.6) and Loma Linda University Medical Center in Loma Linda, California (-1.5) also saw decreases of at least one day.

Hospital Name	2003	2007	Change
Tampa General Hospital	17.9	27.6	9.7
Oklahoma University Med Ctr	21.9	26.6	4.7
Scott & White Memorial Hospital	20.4	25.7	5.3
UAMS Medical Center	17.0	25.2	8.2
University of Alabama Hospital	22.5	24.1	1.6
Univ of TX Medical Branch Hosps	14.8	23.4	8.6
University of Michigan Hospitals	15.2	23.0	7.7
University Hospitals Case Med Ctr	17.1	21.3	4.2
Shands at the University of FL	19.7	21.2	1.5
University of Toledo Med Ctr	14.5	21.0	6.5
West Virginia University Hosps	16.1	19.9	3.8
University of IA Hosps & Clinics	13.0	19.9	7.0
Emory University Hospital	9.4	19.7	10.3
Cleveland Clinic Foundation	15.5	19.7	4.1
University of WI Hosp & Clinics	12.7	19.6	6.8
OHSU Hospital	13.6	19.5	5.9
University of New Mexico Hosp	17.5	19.4	1.9
Duke University Hospital	13.3	19.3	6.0
Hahnemann University Hospital	9.1	19.3	10.2
Memorial Hermann-Texas Med Ctr	8.9	19.3	10.4
University of Kentucky Hospital	16.1	19.2	3.1
Froedtert Memorial Lutheran Hosp	13.7	18.8	5.1
Univ of MS Hosps & Clinics	14.7	18.8	4.0
University of NC Hosps	11.1	18.6	7.5
University of Colorado Hospital	18.3	18.3	0.0
University of Washington Med Ctr	12.0	18.2	6.2
George Washington Univ Hosp	7.1	18.0	10.9
Ohio State University Med Ctr	11.5	18.0	6.5
University Hospital-Cincinnati	10.7	17.8	7.1
North Carolina Baptist Hospital	11.6	17.6	6.0
St. Mary's Hospital	11.7	17.4	5.7
University of Kansas Hospital	11.2	17.2	6.0
University of Virginia Med Ctr	10.9	17.1	6.2
UC San Diego Med Ctr	15.5	17.0	1.5
University of Utah Health Care	10.0	17.0	7.0
Jackson Health System	15.0	16.9	1.9
MUSC Medical Center	16.5	16.8	0.3
Pitt County Memorial Hospital	8.0	16.8	8.8
University Medical Center-Tucson	12.2	16.6	4.4
University of Minnesota Med Ctr	11.4	16.5	5.2
Vanderbilt University Med Ctr	10.7	16.4	5.7
Clarian Health Partners	10.4	16.3	5.9
St. Louis University Hospital	11.5	16.2	4.7
Medical College of Georgia Hosp	10.2	16.0	5.7
UPMC Presbyterian	8.3	15.9	7.6
Temple University Hospital	12.7	15.9	3.2
Nebraska Medical Center	13.2	15.8	2.6
Northwestern Memorial Hospital	12.5	15.5	3.0
University of Chicago Hospital	13.0	15.3	2.2
Thomas Jefferson University Hosp	12.5	15.1	2.6
Loyola University Medical Center	13.1	15.0	1.9
MedStar-Georgetown Med Ctr	8.8	14.9	6.1
UC Davis Med Ctr	11.0	14.9	3.9
Yale-New Haven Hospital	7.7	14.8	7.1
Stanford Hospital and Clinics	6.4	14.3	8.0
Parkland Health & Hosp System	16.5	14.2	-2.2
Loma Linda University Med Ctr	15.6	14.1	-1.5
Rhode Island Hospital	8.2	14.1	5.8
Boston Medical Center	5.5	14.1	8.5
Johns Hopkins Hospital	12.0	14.0	2.0
Harper University Hospital	10.1	13.8	3.7
Brigham and Women's Hospital	5.4	13.6	8.3
University of Maryland Med Ctr	8.0	13.5	5.6
Beth Israel Deaconess Med Ctr	7.9	13.2	5.3
University of MO Hosp & Clinic	13.3	13.1	-0.2
Stony Brook University Hospital	6.8	13.1	6.3
Grady Memorial Hospital	8.2	13.0	4.8
RWJ University Hospital	8.9	13.0	4.1
Penn State Hershey Med Ctr	10.1	12.7	2.6
Rush University Medical Center	10.3	12.7	2.4
Dartmouth-Hitchcock Med Ctr	8.2	12.7	4.5
The Methodist Hospital	9.4	12.6	3.2
UMass Memorial Medical Center	6.7	12.6	5.9
Barnes-Jewish Hospital	11.1	12.5	1.5
UCSF Medical Center	7.3	12.2	4.9
Massachusetts General Hospital	6.9	12.1	5.1
VCU Health System	12.3	12.0	-0.3
Kaleida Health-Buffalo Gen Hosp	6.1	12.0	5.8
Hospital of the Univ of PA	8.6	11.6	3.0
Upstate Medical University	6.4	10.8	4.4
University of CT Health Ctr	6.1	10.8	4.7
Montefiore Medical Center	4.6	10.5	5.9
Tufts-New England Medical Center	4.6	10.4	5.8
Fletcher Allen Health Care	10.5	10.4	-0.1
NYU Medical Center	7.4	10.3	2.9
UCLA Medical Center	9.2	9.6	0.4
Albany Medical Center	13.5	9.4	-4.1
Creighton University Med Ctr	10.1	9.3	-0.7
Strong Memorial Hospital	9.2	9.1	-0.1
UMDNJ University Hospital	10.2	8.5	-1.6
New York-Presbyterian Hospital	4.2	8.5	4.3
Cedars-Sinai Medical Center	5.5	8.1	2.7
Mount Sinai Hospital	3.8	8.1	4.3

-5.0   0.0   5.0   10.0   15.0

**Absolute change, hospice days per patient
during the last six months of life**

Figure 13. Changes in the average number of days spent in hospice care per chronically ill patient during the last six months of life among patients receiving most of their care at academic medical centers (2003 to 2007)

Patients seeing ten or more doctors during the last six months of life

Among the 35 academic medical centers for which data are available, 22 had increases in the percentage of their chronically ill patients seeing ten or more doctors in the last six months of life from 2003 to 2007, indicating increases in the aggressiveness of care (Figure 14). Emory University Hospital saw the largest absolute growth in this rate, from 40.4% to 63.2%, an increase of 22.8 percentage points. Three other medical centers had absolute increases of at least 10 percentage points: Beth Israel Deaconess Medical Center in Boston (+15.1), North Carolina Baptist Hospital in Winston-Salem (+11.7) and the University of Chicago Hospital (+10.6). The University of North Carolina Hospitals in Chapel Hill had the largest decrease (-9.8), followed by Shands at the University of Florida in Gainesville (-5.8), Robert Wood Johnson University Hospital in New Brunswick, New Jersey (-5.8) and NYU Medical Center in New York City (-5.6).

In 2003, the likelihood that a patient at Emory University Hospital would see ten or more doctors was similar to that for a patient at the University of North Carolina Hospitals. But over the next five years, the percentage of patients seeing ten or more doctors increased 22.8 percentage points at Emory, while the percentage dropped 9.8 percentage points, from 45.0% to 35.2%, at UNC Hospitals.
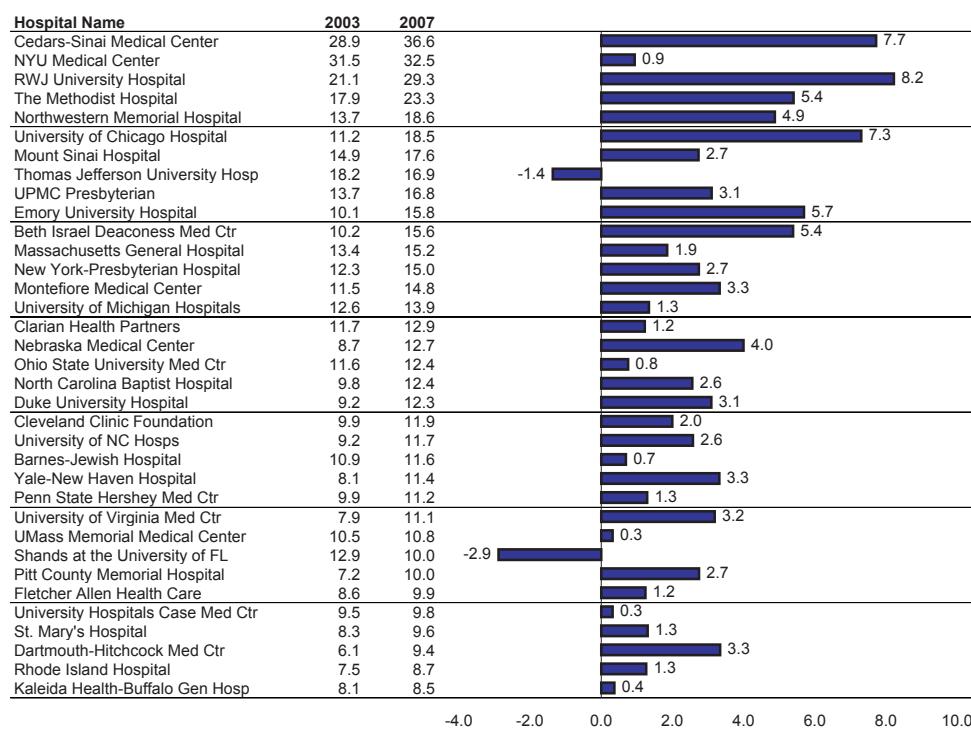
Figure 14. Changes in the percentage of chronically ill Medicare patients seeing ten or more physicians during the last six months of life among patients receiving most of their care at academic medical centers (2003 to 2007)

Hospital Name	2003	2007	
NYU Medical Center	74.3	68.6	-5.6
Cedars-Sinai Medical Center	59.5	67.7	8.1
Thomas Jefferson University Hosp	57.8	64.0	6.1
Montefiore Medical Center	58.7	63.7	5.0
Emory University Hospital	40.4	63.2	22.8
Beth Israel Deaconess Med Ctr	47.7	62.8	15.1
Mount Sinai Hospital	65.5	60.7	-4.8
Penn State Hershey Med Ctr	52.0	60.5	8.5
Cleveland Clinic Foundation	51.2	56.1	4.9
Northwestern Memorial Hospital	50.6	55.9	5.4
RWJ University Hospital	61.5	55.7	-5.8
UPMC Presbyterian	50.1	55.6	5.5
Massachusetts General Hospital	59.6	54.7	-4.9
University of Chicago Hospital	42.4	53.0	10.6
Ohio State University Med Ctr	50.1	52.1	2.0
The Methodist Hospital	50.1	52.0	1.8
New York-Presbyterian Hospital	46.1	51.2	5.1
UMass Memorial Medical Center	47.8	48.7	0.8
Clarian Health Partners	39.1	47.8	8.6
Kaleida Health-Buffalo Gen Hosp	46.0	47.5	1.5
St. Mary's Hospital	50.9	47.2	-3.7
Rhode Island Hospital	40.8	46.8	6.0
Yale-New Haven Hospital	38.7	46.1	7.4
University of Michigan Hospitals	49.6	45.6	-4.0
Barnes-Jewish Hospital	46.3	43.2	-3.1
North Carolina Baptist Hospital	30.2	41.9	11.7
Shands at the University of FL	47.5	41.7	-5.8
Pitt County Memorial Hospital	38.0	41.3	3.4
Dartmouth-Hitchcock Med Ctr	33.2	40.6	7.3
Nebraska Medical Center	31.8	40.4	8.6
University of Virginia Med Ctr	41.0	38.9	-2.1
University Hospitals Case Med Ctr	36.8	36.4	-0.4
University of NC Hosps	45.0	35.2	-9.8
Duke University Hospital	34.5	34.0	-0.4
Fletcher Allen Health Care	28.5	24.3	-4.3

-20.0   -10.0   0.0   10.0   20.0   30.0

Absolute change, percent seeing ten or more physicians during the last six months of life

Number of full-time equivalent (FTE) medical specialist clinical labor inputs per 1,000 decedents in the last two years of life

Among the 35 academic medical centers discussed in the previous section, all but two saw an increase in the average amount of medical specialist clinical effort used to care for seriously ill patients from 2003 to 2007 (Figure 15). Robert Wood Johnson Hospital in New Brunswick, New Jersey had the largest increase in FTE medical specialist clinical labor inputs per 1,000 decedents (+8.2 FTEs). Cedars-Sinai Medical Center in Los Angeles (+7.7) and the University of Chicago Hospital (+7.3) also saw large increases. Shands at the University of Florida in Gainesville (-2.9) and Thomas Jefferson University Hospital in Philadelphia (-1.4) were the only academic medical centers where the rates decreased.

In 2003, the rates at NYU Medical Center (31.5) and Cedars-Sinai Medical Center (28.9) were substantially higher than the rates at any of the other academic medical centers. Over the next five years, however, the trends at these two medical centers were quite different; NYU saw only a slight increase, to 32.5 FTE medical specialist clinical labor inputs per 1,000 decedents, while the rate at Cedars-Sinai climbed to 36.6.

Hospital Name	2003	2007	Absolute change
Cedars-Sinai Medical Center	28.9	36.6	7.7
NYU Medical Center	31.5	32.5	0.9
RWJ University Hospital	21.1	29.3	8.2
The Methodist Hospital	17.9	23.3	5.4
Northwestern Memorial Hospital	13.7	18.6	4.9
University of Chicago Hospital	11.2	18.5	7.3
Mount Sinai Hospital	14.9	17.6	2.7
Thomas Jefferson University Hosp	18.2	16.9	-1.4
UPMC Presbyterian	13.7	16.8	3.1
Emory University Hospital	10.1	15.8	5.7
Beth Israel Deaconess Med Ctr	10.2	15.6	5.4
Massachusetts General Hospital	13.4	15.2	1.9
New York-Presbyterian Hospital	12.3	15.0	2.7
Montefiore Medical Center	11.5	14.8	3.3
University of Michigan Hospitals	12.6	13.9	1.3
Clarian Health Partners	11.7	12.9	1.2
Nebraska Medical Center	8.7	12.7	4.0
Ohio State University Med Ctr	11.6	12.4	0.8
North Carolina Baptist Hospital	9.8	12.4	2.6
Duke University Hospital	9.2	12.3	3.1
Cleveland Clinic Foundation	9.9	11.9	2.0
University of NC Hosps	9.2	11.7	2.6
Barnes-Jewish Hospital	10.9	11.6	0.7
Yale-New Haven Hospital	8.1	11.4	3.3
Penn State Hershey Med Ctr	9.9	11.2	1.3
University of Virginia Med Ctr	7.9	11.1	3.2
UMass Memorial Medical Center	10.5	10.8	0.3
Shands at the University of FL	12.9	10.0	-2.9
Pitt County Memorial Hospital	7.2	10.0	2.7
Fletcher Allen Health Care	8.6	9.9	1.2
University Hospitals Case Med Ctr	9.5	9.8	0.3
St. Mary's Hospital	8.3	9.6	1.3
Dartmouth-Hitchcock Med Ctr	6.1	9.4	3.3
Rhode Island Hospital	7.5	8.7	1.3
Kaleida Health-Buffalo Gen Hosp	8.1	8.5	0.4

(axis: -4.0 -2.0 0.0 2.0 4.0 6.0 8.0 10.0)

Absolute change, FTE medical specialist clinical labor inputs per 1,000 patients during the last two years of life

Figure 15. Changes in FTE medical specialist clinical labor inputs per 1,000 chronically ill patients during the last two years of life among patients receiving most of their care at academic medical centers

Number of full-time equivalent (FTE) primary care physician clinical labor inputs per 1,000 decedents in the last two years of life

From 2003 to 2007, 26 of the 35 academic medical centers saw an increase in the average amount of primary care physician clinical effort used to care for end-of-life patients (Figure 16). Montefiore Medical Center in the Bronx (+4.1 FTEs), Ohio State University Medical Center in Columbus (+4.0), Kaleida Health-Buffalo General Hospital in Buffalo, New York (+3.2) and Dartmouth-Hitchcock Medical Center in Lebanon, New Hampshire (+3.2) had the largest increases. The three medical centers with a decrease of at least one primary care physician clinical FTE were Massachusetts General Hospital in Boston (-2.6), Mount Sinai Medical Center in Manhattan (-1.2) and NYU Medical Center in Manhattan (-1.0).

Figure 16. Changes in FTE primary care physician clinical labor inputs per 1,000 chronically ill patients during the last two years of life among patients receiving most of their care at academic medical centers

Hospital Name	2003	2007	
Montefiore Medical Center	14.1	18.2	4.1
Cedars-Sinai Medical Center	14.5	17.5	3.0
Mount Sinai Hospital	18.7	17.5	-1.2
Ohio State University Med Ctr	9.8	13.8	4.0
New York-Presbyterian Hospital	10.9	12.6	1.7
The Methodist Hospital	11.2	12.5	1.3
RWJ University Hospital	11.1	12.3	1.2
NYU Medical Center	12.8	11.8	-1.0
Beth Israel Deaconess Med Ctr	9.8	11.7	1.9
Thomas Jefferson University Hosp	12.0	11.7	-0.3
Kaleida Health-Buffalo Gen Hosp	8.3	11.5	3.2
Northwestern Memorial Hospital	10.0	11.5	1.4
Shands at the University of FL	10.9	11.3	0.4
Massachusetts General Hospital	13.2	10.6	-2.6
University of Michigan Hospitals	7.5	10.5	3.0
UPMC Presbyterian	9.3	10.1	0.8
University Hospitals Case Med Ctr	9.4	9.9	0.5
UMass Memorial Medical Center	8.4	9.7	1.3
Emory University Hospital	7.6	9.3	1.7
Cleveland Clinic Foundation	8.5	9.3	0.8
Barnes-Jewish Hospital	9.7	9.2	-0.5
Nebraska Medical Center	8.9	9.2	0.3
Rhode Island Hospital	10.0	9.2	-0.8
Clarian Health Partners	7.6	8.9	1.3
Penn State Hershey Med Ctr	7.3	8.7	1.4
University of Chicago Hospital	8.6	8.7	0.1
Dartmouth-Hitchcock Med Ctr	5.2	8.5	3.2
Pitt County Memorial Hospital	7.0	8.3	1.2
Yale-New Haven Hospital	5.8	7.6	1.9
Fletcher Allen Health Care	7.4	6.8	-0.5
University of NC Hosps	7.1	6.7	-0.4
Duke University Hospital	6.1	6.5	0.3
St. Mary's Hospital	6.3	6.2	-0.2
University of Virginia Med Ctr	5.3	6.1	0.8
North Carolina Baptist Hospital	4.5	6.1	1.5

-4.0   -2.0   0.0   2.0   4.0   6.0

Absolute change, FTE primary care physician clinical labor inputs per 1,000 patients during the last two years of life

Concluding remarks

The differences observed across both regions and academic medical centers in the approach to caring for patients with serious chronic illness underscore important opportunities to learn how to improve end-of-life care. The disparate trends in end-of-life care from 2003 to 2007 demonstrate that change is occurring in many regions and at many institutions, but not always in the direction that most patients prefer. Because it is highly unlikely that the patient populations cared for within a region or at an academic medical center changed as dramatically as the intensity of care, the findings point to the important role of the local delivery system in determining the care patients receive. It is likely that further change has occurred since 2007, as many health care systems have built additional capacity in palliative and hospice care. But growth in intensive care and medical specialist capacity can also lead to increased aggressiveness of care. These changes will likely be reflected in future reports on end-of-life care.

The general conclusion is that systems are important. The most likely explanation for variation in the treatment of chronically ill Medicare patients is that the care they receive depends largely on the systems of care within different regions and hospitals. The growing use of hospice care in recent years reflects one effort to meet the challenge of providing higher quality care near the end of life. Declines in the rates of death in hospital and of death associated with admission to intensive care may also be evidence of attempts to provide care that aligns more closely with many patients' preferences. But not all hospitals changed at the same pace, and in some regions and medical centers, patients were *more* likely to spend their last days of life in the hospital. Furthermore, the number of ICU days in the last six months of life increased both nationally and in most hospitals and regions; so, too, did the amount of physician labor used. Clearly, much more work remains to be done to ensure that future variation in care reflects real differences in patient preferences—not the local accidents of health care capacity and clinician practice style.

Methods Appendix

The methods used in the current report, "Trends and Variation in End-of-Life Care for Medicare Beneficiaries with Severe Chronic Illness," as well as the additional data provided on our web site, were developed over a number of years and have been described in detail in peer-reviewed publications.[24,25,26] This appendix provides a summary of these methods. In some instances, the methods were modified from those used in previous Dartmouth Atlas measures for chronically ill patients near the end of life[1], and these changes could affect the comparability of data between the previous 2001-05 and current 2003-07 study periods. Users should be aware of these changes when comparing and interpreting the rates, especially for smaller hospitals and areas. All changes are indicated with italics.

Databases used in the analysis

The primary database is derived from eight research files from the Centers for Medicare and Medicaid Services (CMS) for traditional (fee-for-service) Medicare: the Denominator file (which provides information on all Medicare beneficiaries' demographic data, eligibility status and date of death); and seven files that contain records of Medicare claims, namely, the MedPAR file (acute care discharges and stays in skilled nursing, rehabilitation, psychiatric, and other long-stay facilities), the Inpatient file (used to classify intermediate- and high-intensity subtypes of intensive care unit stays), Physician/Supplier Part B (physician services for a 20% sample of Medicare beneficiaries), the Outpatient file (the facility component of outpatient services for a 20% sample of Medicare beneficiaries), and the Home Health Agency (HHA), Hospice, and Durable Medical Equipment (DME) files.

Study populations

The follow-back from death studies reported in this edition of the Atlas are for two study populations, one based on assignment of decedents to the hospital they most frequently used in the last two years of life (data for specific hospitals), the other on place of residence at time of death (data for regions and states). To allow for two years of follow-back for all patients, the populations are restricted to those whose age on the date of death was 67 to 99 years, and to those having full Part A and Part B entitlement throughout the last two years of life. Persons enrolled in managed care organizations were excluded from the analysis.

Populations assigned to specific hospitals. We identified Medicare beneficiaries who died over the five-year period from January 1, 2003 to December 31, 2007 and who were hospitalized in an acute care hospital at least once during the last two years of life for a medical (non-surgical) condition. Patients with surgical admissions only were excluded, because the surgery may not have been offered by the hospital and medical staff that usually provided their care; in other words, a patient whose only hospital admission was for bypass surgery could only be assigned to the hospital where the surgery was performed, even if most of his or her care was provided by physicians associated with another hospital. Excluding these patients also reduces the likelihood that a surgical complication was the cause of death.

We further restricted the analysis to patients who had one or more of nine chronic illnesses associated with a high probability of death[27] coded on at least one of their hospital discharge claims. *The changes in diagnostic codes (ICD-9-CM 204) used in the current cohort were: cancer – addition of.xx to 208.xx and of 209.21-23, 209.30, 511.81; coronary artery disease – addition of 414.2, 414.3; peripheral vascular disease – addition of 440.4; diabetes with end organ damage – addition of 249.xx, 362.03-362.07; chronic renal failure - deletion of 585.1-585.3.*

Patients were assigned a primary chronic condition based on the first qualifying ICD-9-CM diagnosis code encountered on the claim closest to death. Discharge claims were then used to assign each patient to the hospital to which the patient was admitted most often during the last two years of life. In the case of a tie (equal number of discharges from more than one hospital), patients were assigned to the hospital associated with the discharge closest to date of death. Because seriously ill patients are highly loyal to the hospital where they receive their care—as has been shown elsewhere[28]—hospital-specific utilization rates reflect the approach to chronic disease management of the physicians who practice in association with that hospital. In some instances there were too few deaths at the hospital to calculate reliable measures and a numeric rate is not reported. The minimum population count for reporting hospital measures based on the 100% MedPAR, Inpatient, Hospice, HHA, and DME files is 80 deaths; for the 20% Part B and Outpatient files it is 400 deaths.

Several changes were made in the selection and exclusion criteria for the hospital and physician claims compared to previous cohorts. The net result of these changes was minor. (1) We excluded discharges from long-term care units of hospitals that are not reimbursed through prospective payment, and from hospital beds with skilled nursing facility (SNF) swing-bed designation. This could affect measures for small hospitals with disproportionately high numbers of these claims. Excluding some of these non-acute care discharges could also eliminate some patients from the cohort if these discharges were the sole basis for their inclusion in the hospitalized cohort. (2) We excluded outpatient claims that did not include physician encounters (e.g., filling prescriptions). The effect of this (the reduction in the number of patients) was small, because it was very rare that patients who had chronic conditions coded in these encounters did not have any other physician encounters during the last two years of life. The total impact of these two changes was examined for the same year (2005) using the previous and current methods. Summary of impact of changes: (1) Hospitalized cohort population was reduced by 1%; (2) Regional cohort population was reduced by 2%. (3) Number of hospital claims in the last two years of life was reduced by 4%.

Populations grouped by place of residence. The state- and region-level analyses are based on patients who were residents of a given geographic area at the date of death. Data are a 20% sample of deaths occurring over the five-year period 2003-07 (specifically, those deaths that were included in the CMS Part B claims of a 20% beneficiary sample). The state and regional analyses include all hospitalizations (including the patients excluded in the hospital-specific studies who only had

surgical hospitalizations) and all patients who had one or more of the nine chronic illnesses, whether or not they were hospitalized during the last two years of life. Non-hospitalized patients with chronic illness were identified as those with two or more physician encounters (on different days) with one or more of the nine chronic conditions coded; each patient's primary chronic condition was that which occurred most frequently in the physician encounter claims data for their last two years of life.

Table A provides information on the number of decedents according to primary chronic condition for the hospital-specific chronic illness cohort and the geographic chronic illness cohort. Table B describes the characteristics of decedents who were hospitalized, according to their cause of hospitalization (and thus whether they are included in the hospital-specific chronic illness cohort). Table C describes the characteristics of decedents and chronic illness and hospitalization status.

Table A. Number of Decedents According to Cohort and Primary Chronic Condition, 2003–07

Primary Chronic Condition	2003–07 Hospital-Specific Chronic Illness Cohort*	2003–07 Geographic Chronic Illness Cohort**
	Number of Decedents	Number of Decedents
Malignant Cancer/Leukemia	809,926	201,691
Congestive Heart Failure	1,497,465	342,278
Chronic Pulmonary Disease	903,696	218,932
Dementia	570,479	192,562
Diabetes with End Organ Damage	48,342	17,838
Peripheral Vascular Disease	108,696	39,522
Chronic Renal Failure	349,611	80,035
Severe Chronic Liver Disease	52,841	11,586
Coronary Artery Disease	325,152	105,608
Total Decedents	**4,666,208**	**1,210,052**

* From a 100% sample of Medicare beneficiaries.

** From a 20% sample of Medicare beneficiaries.

Table B. Hospital-Specific Chronic Illness Cohort and Excluded Hospitalized Decedents, 2003–07

	2003–07 Hospitalized Decedents	
	Number of Decedents	% of All Decedents
Hospital-Specific Chronic Illness Cohort	4,666,208	69.99
Hospitalized Decedents Excluded from Cohort		
Chronic Illness, Surgery Only	344,249	5.16
Other Medical Illness	459,380	6.89
Other Surgery	101,043	1.52
Assigned to Non-U.S.* Hospitals	551	0.01
All Hospitalized Decedents	5,571,431	83.57
Total Decedents	**6,667,105**	**100.00**

*Non-U.S. hospitals include those in U.S. territories such as Puerto Rico, the U.S. Virgin Islands, Guam, American Samoa, and others.

The hospital-specific chronic illness cohort includes only those hospitalized with at least one medical admission and a diagnosis of one of the nine chronic illnesses listed in Table A on at least one admission record. Data are based upon a 100% sample of Medicare enrollees.

Table C. Decedents 2003–07 According to Cohort Membership Status

	2003-07 Geographic Database		
	Percent of Decedents		
	Number of Decedents	% of Chronically Ill	% of All Decendents
Chronic Illness Cohort	1,210,052	100.00	90.81
Hospital-Specific Cohort	933,894	77.18	70.09
Chronic Illness, Hospital Surgery Only	68,758	5.68	5.16
Hospital, Other Medical Illness	53,650	4.43	4.03
Hospital, Other Surgery	12,305	1.02	0.92
Assigned to Non-U.S. Hospitals	96	0.01	.01
Not Hospitalized	141,349	11.68	10.61
Excluded Decedents (without chronic illness)	122,415		9.19
Hospitalized Decedents	45,527		3.42
Not Hospitalized	76,888		5.77
Total Decedents	1,332,467		100.00

The chronic illness cohort includes all decedents with one of the nine chronic illnesses listed in Table A, regardless of whether they were hospitalized during the last two years of life. The hospital-specific chronic illness cohort corresponds to the cohorts described in Tables A and B, but is smaller due to the use of a 20% sample of beneficiaries.

Measures of resource inputs

Measures of resource inputs, including physician labor (provided in this report) hospital beds, intensive care beds, and Medicare program spending (reimbursements) (provided on our web site) are presented as summary measures over the last six months or two years of life. Bed input rates were calculated by summing patient days and dividing by 365. Physician labor inputs were measured by summing the work relative value units (W-RVUs) on a specialty-specific basis and dividing by the average annual number of W-RVUs produced by that specialty. The measure was used to estimate the standardized full-time equivalent (FTE) physician clinical labor input. Both bed and FTE physician resources are expressed as inputs per 1,000 decedents.

Inpatient reimbursements were calculated by summing Medicare reimbursements from the MedPAR record and reflect total reimbursements, including indirect costs for medical education, disproportionate share payments, and outlier payments. Part B payments are for all services included in the Part B Physician Supplier file; likewise, payments for outpatient, SNF, hospice, home health and DME services reflect all services included in their respective files. Inpatient reimbursements and payments from Part B and all other files are measured as spending per decedent. All resource input rates were calculated based on the total experience of the population over the given period of time, not only from the care received at the assigned hospital or physicians associated with that hospital. In the case of the geographic studies, it includes care given by providers located out of region as well as in region.

Measures of utilization

We calculated and have provided in this report and/or on our web site hospital days, intensive care unit days (high-intensity and intermediate-intensity days, overall and

separately) and physician visits (overall and separately for primary care physicians and medical specialists) for each patient over the last six months and the last two years of life; additional measures include home health visits, and days spent in SNFs and hospice. Physician visits were also calculated by place of service, by grouping selected HCPCS codes from Part B line item data. We also included visits to rural health centers and federally qualified health centers, obtained from the Outpatient file. Utilization rates were calculated on the total experience of the cohort, not just the services provided by the hospital and the physicians associated with the hospital to which the decedent was assigned. The proportion of total hospital care provided by the assigned hospital (loyalty) was high, so the variations in utilization among hospital cohorts primarily reflect clinical choices made by the associated physicians.[29] Similarly, in the geographic studies, most care was provided by hospitals and physicians located within the state or region. The measures of utilization—patient days in hospital and other facilities, patient days in intensive care units, and physician visits—are traditional epidemiologic, population-based rates of events occurring over a designated period of time.

Quality of care indicators

Two claims-based quality of care measures were used. The percent of patients seeing ten or more physicians is a measure of the propensity to refer patients. High scores on this measure could indicate lack of continuity of care. The percent of deaths occurring during a hospitalization that involved one or more stays in an ICU is an indicator of the aggressiveness with which terminal patients were treated. In light of the evidence that more aggressive care in managing patient populations with chronic illness does not lead to longer length of life or improved quality of life, higher scores on this measure can be viewed as an indicator of lower quality of death. By contrast, the percent of decedents receiving hospice benefits indicates less aggressive end-of-life care.

The measure of the percent of patients seeing ten or more different physicians during the last six months of life was updated to include the Outpatient file. The previous estimate would have been low for patients living in rural or underserved areas who relied upon federally qualified and/or rural health centers for their primary care.

Statistical methods

We compared measures of resource inputs, utilization, and quality at fixed intervals prior to death among geographic regions and hospitals. All utilization and resource input measures were further adjusted for differences in age, sex, race, primary chronic condition, and whether patients had more than one of the nine chronic conditions. The adjustments used ordinary least squares to adjust the Medicare spending variables provided on our web site[30] and used overdispersed Poisson regression models for all other variables; 95th percentile confidence limits were calculated for all variables.

Statistical models and patient assignment to hospitals

Previously we assigned patients to hospitals without regard for whether the hospital was open at the end of the study period (2005). The models were run with all hospitals that fit inclusion criteria, and then hospitals that were closed, had merged with another, or had transitioned to another designation (long-term care hospital, rehabilitation facility, SNF, etc.) by the end of 2005 were excluded from reporting.

For 2003-07 measures, we tracked hospitals that transitioned from one acute care to another acute care provider number (stemming from mergers, changes in ownership, etc.) or to another status during the study period. In the case of mergers or acquisitions, the old provider identification number was mapped to the new one, and the combined entity was treated as one facility for the duration of the study. These changes may have a sizeable impact on the cohort sizes for hospitals that absorbed patients previously assigned to other hospitals by way of mergers.

Where hospitals had closed or transitioned, they were not run individually in the models, but rather, grouped into residual categories. As before, hospitals with small cohort populations (< 80 deaths assigned to hospital for events based on a 100% sample: < 400 deaths for events based on a 20% sample) were also grouped for modeling purposes.

Caveats and limitations

Certain limitations of our measures need to be mentioned.
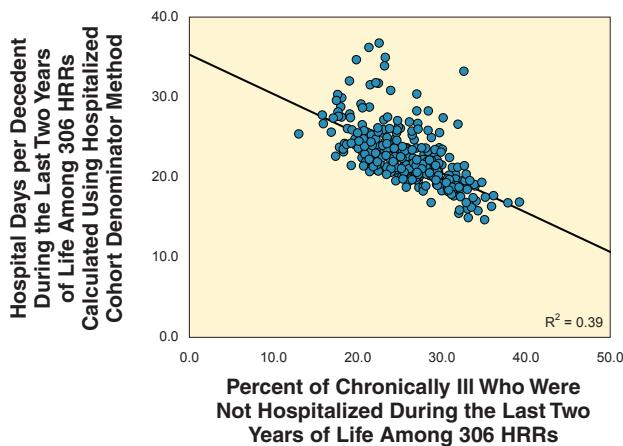
Sample sizes and data issues. The data are for the traditional Medicare (Part A and Part B) program and do not include Medicare enrollees enrolled in managed care organizations under Medicare Part C. The measures of physician resource input and utilization are based on a 20% sample, reducing the precision of our estimates. For hospital-specific cohorts, we addressed this by limiting reporting for these services to 2,826 hospitals with 400 decedents (expected 20% sample size for 5 years = 80 deaths). Data fields for measures based on Part B are left blank for hospitals with fewer than 400 decedents. Approximately 16% of hospitals (682) failed to report on their use of intensive care beds, and, for these hospitals, measures related to intensive care utilization are left blank. Our measure of the propensity to use multiple physicians—the percent of decedents seeing ten or more physicians—depends on the accuracy of the coding of individual physician encounters using the UPIN number; if a given patient was seen by multiple physicians but only one UPIN number was recorded, this would result in an underestimate of the number of individual physicians seen.

Denominator for hospital-specific cohorts. The hospital-specific studies are based on Medicare decedents with one or more medical hospitalizations during the last two years of life (as shown in Table B). Because we had no reliable method for assigning non-hospitalized patients with chronic illness to hospitals, decedents who were not hospitalized were not included in the denominator used in calculating population-based resource input and utilization rates for the hospital-specific cohort.
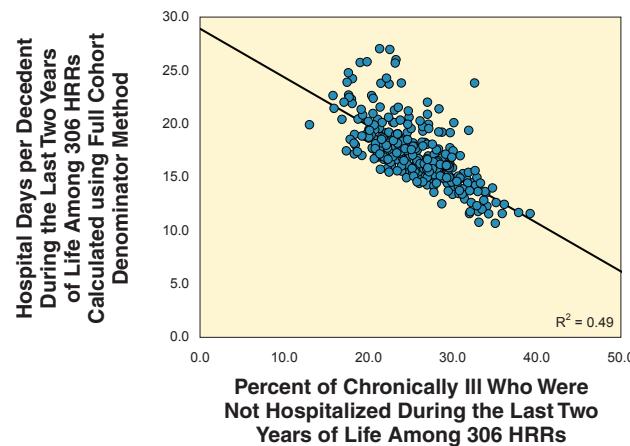
This limitation does not exist at the regional level where patients were assigned to regions on the basis of their place of residence, making it possible to identify patients who were not hospitalized.

To estimate the impact of not including non-hospitalized patients with chronic illness in the denominator for calculating rates for the hospital-specific cohort, we compared rates for regions calculated without the inclusion of non-hospitalized chronically ill decedents in the denominator (Hospitalized Cohort Denominator Method) to rates calculated with the inclusion of non-hospitalized decedents (Full Cohort Denominator Method). This analysis, from a previous edition of the Atlas[1], compared rates under each of these two methods, which were calculated for the 306 regions for deaths occurring in 2000-03. The key findings were:

• The proportion of Medicare decedents with severe chronic illness who were not hospitalized at least once for a medical (non-surgical) admission varied substantially from region to region—from less than 15% to more than 35% among regions.

• Regions with lower percentages not hospitalized tended to have higher per capita utilization rates. The correlation among regions between the percent of chronically ill decedents who were not hospitalized during the last two years of life and patient days per decedent calculated under the Hospitalized Cohort Denominator Method had an $R^2 = 0.39$ (negative association) (Figure A); and the same correlation using the patient days calculated under the Full Cohort Denominator Method had an $R^2 = 0.49$ (negative association) (Figure B).

Figure A. The Relationship Between the Percent Not Hospitalized and Hospital Days per Decedent During the Last Two Years of Life (Hospitalized Cohort Denominator Method) Among Hospital Referral Regions (Deaths Occurring 2000–03)
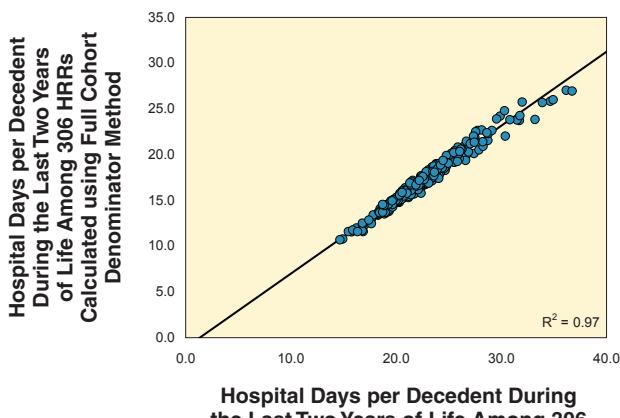
Figure B. The Relationship Between the Percent Not Hospitalized and Hospital Days per Decedent During the Last Two Years of Life (Full Cohort Denominator Method) Among Hospital Referral Regions (Deaths Occurring 2000–03)
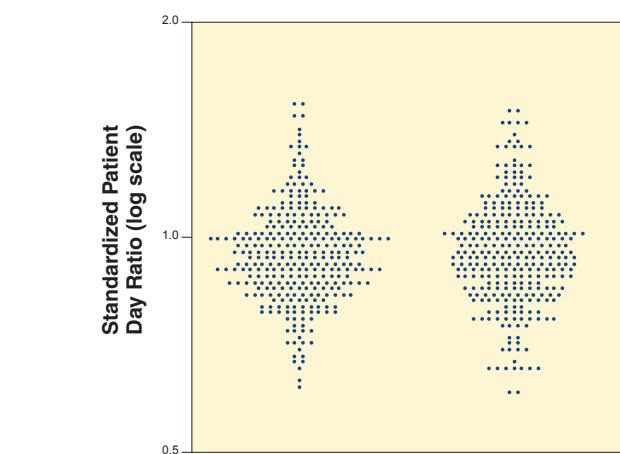
• In examining the estimates of patient days per decedent obtained by the two methods, it became apparent that (1) the correlation between rates generated using the two methods was very high: $R^2 = 0.97$ (Figure C); and (2) variation was less (measured by the extremal range, interquartile ratio, and coefficient of variation) when the rates were calculated using the Hospitalized Cohort Denominator Method (Figure D).

These studies show that the Hospitalized Cohort Denominator Method (which we use for our hospital-specific analyses) underestimates the "true" population-based rates to a greater extent in regions with lower utilization rates. A reasonable inference would be that our hospital-specific analyses underestimate the variation among hospitals, and that those hospitals with lower patient day rates would actually be even more conservative (have even lower rates) than we report if we were able to include all decedents cared for by the hospital and its associated physicians.

Exclusion of isolated surgical hospitalizations. The hospital-specific follow-back studies of the chronically ill were designed to require at least one medical (non-surgical) hospitalization to qualify for inclusion. This was done to avoid confusing (1) a surgical referral as evidence that a given hospital was involved in the medical management of chronic illness and (2) a surgical death as a death from chronic illness. In the regional analysis, our interest in accounting for all Medicare spending and utilization in patients with chronic illness led us to include all Medicare hospitalizations (and Part B services) in the rates.

Figure C. The Relationship Between Hospital Days per Decedent During the Last Two Years of Life Among Hospitalized Cohort and Full Cohort Denominators Among Hospital Referral Regions (Deaths Occurring 2000–03)

	Hospitalized Cohort Denominator Method	Full Cohort Denominator Method
Extremal ratio	2.50	2.53
Interquartile ratio	1.19	1.23
Coefficient of variation	15.9	17.2

Figure D. Hospital Days per Decedent During the Last Two Years of Life Among Hospitalized Cohort and Full Cohort Denominators Among Hospital Referral Regions (Deaths Occurring 2000–03)

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29. Loyalty measures for hospitals are available on the Atlas website: www.dartmouthatlas.org.

30. Where hospital spending is reported by sectors on our web site (e.g., Part B spending by place of service), a "partitioning approach" has been used: each hospital's (fully-modeled) total Part B payments were partitioned into components based on the proportional distribution of its *crude* component spending rates. Similarly, MedPAR payments for inpatient, long-term and SNF stays, and hospice, home health, and DME payments were partitioned from the hospital's (fully modeled) total reimbursement rate based on the sum of payments from all these 100%-type files.

The Dartmouth Atlas Project works to accurately describe how medical resources are distributed and used in the United States. The project offers comprehensive information and analysis about national, regional, and local markets, as well as individual hospitals and their affiliated physicians, in order to provide a basis for improving health and health systems. Through this analysis, the project has demonstrated glaring variations in how health care is delivered across the United States.

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