

# Geographic Access to Hospice in the United States

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## Abstract

**Background:** Despite a 41% increase in the number of hospices since 2000, more than 60% of Americans die without hospice care. Given that hospice care is predominantly home based, proximity to a hospice is important in ensuring access to hospice services. We estimated the proportion of the population living in communities within 30 and 60 minutes driving time of a hospice.

**Methods:** We conducted a cross-sectional study of geographic access to U.S. hospices using the 2008 Medicare Provider of Services data, U.S. Census data, and ArcGIS software. We used multivariate logistic regression to identify gaps in hospice availability by community characteristics.

**Results:** As of 2008, 88% of the population lived in communities within 30 minutes and 98% lived in communities within 60 minutes of a hospice. Mean time to the nearest hospice was 15 minutes and the range was 0 to 403 minutes. Community characteristics independently associated with greater geographic access to hospice included higher population density, higher median income, higher educational attainment, higher percentage of black residents, and the state not having a Certificate of Need policy. The percentage of each state's population living in communities more than 30 minutes from a hospice ranged from 0% to 48%.

**Conclusions:** Recent growth in the hospice industry has resulted in widespread geographic access to hospice care in the United States, although state and community level variation exists. Future research regarding variation and disparities in hospice use should focus on barriers other than geographic proximity to a hospice.

## Introduction

THERE HAS BEEN DRAMATIC GROWTH in the number of hospices in the United States, with more than 900 new hospices since 2000 (a 41% increase).<sup>1</sup> However, only 39% of decedents in the United States in 2008 received hospice care<sup>2</sup> and there is persistent evidence of disparities in hospice use by race/ethnicity,<sup>3-9</sup> income,<sup>4-7,10</sup> and education.<sup>5,7,10</sup> Given that more than 90% of hospice care involves staff making home visits<sup>1</sup> and hospice staff visit multiple homes in a given day, proximity to a hospice is important in ensuring access to these services.

Existing studies<sup>11,12</sup> of geographic access to hospice have found limited access to hospice in rural compared to urban areas; however, these studies are almost a decade old and do not reflect the recent substantial growth in the hospice industry. Additionally, these studies<sup>11,12</sup> do not evaluate whether geographic access to hospice differs across communities that vary in racial/ethnic composition, income, and education, which are known to be related to hospice use.<sup>3-10</sup> Furthermore, existing studies<sup>11,12</sup> do not evaluate state-

specific Certificate of Need (CON) policies for hospice, which were designed to manage the supply of hospices within a state and thus may be related to geographic access to hospice.

To provide an updated and more comprehensive estimate of geographic access to hospice, we estimated the proportion of the U.S. population living within 30 and within 60 minutes driving time of a hospice in 2008. We identify community characteristics associated with being within 30 minutes driving time of a hospice and describe state-by-state variation in results.

## Methods

### Study design and sample

We conducted a cross-sectional analysis of geographic access to hospice using the 64,260 Census tracts in the 2000 U.S. Census data<sup>13</sup> for the 50 states and Washington, D.C. Census tracts are statistical subdivisions of a county with between 2500 and 8000 people designed to be homogeneous with respect to population characteristics, economic status, and living conditions.

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Our sample of hospices consists of the 3306 active Medicare-certified hospices in the 2008 Medicare Provider of Services (POS) file.<sup>14</sup> The Medicare POS file contains information on the 94% of hospice agencies that participate in the Medicare program.<sup>2</sup>

### Data and measures

The 2000 U.S. Census data<sup>13</sup> was used to identify all Census tracts in the United States. We used the Census data to obtain information regarding the following Census tract-level characteristics: population per square mile, percentage of the population age 65 or older, median household per capita income, percentage of the population age 18 or older with less than a high school education, black population percentage, and Census region. We used population per square mile to measure the degree of rurality of a community because population per square mile is measured at the census tract level, compared with other measures of rurality (e.g., Rural–Urban Continuum codes) that are measured at the more aggregated county level.

We used the 2008 Medicare POS file<sup>14</sup> to identify the address of each hospice and the year in which the hospice was first certified by Medicare to provide hospice care. We identified the following states as having hospice CON programs: Alaska, Arkansas, Arizona, Connecticut, Florida, Illinois, Kentucky, Maryland, Mississippi, Nevada, New York, North Carolina, Ohio, Tennessee, Vermont, Washington, and West Virginia.<sup>15</sup> Hospices that seek to open in states with hospice CON programs must demonstrate to the state that there is need for a new hospice agency.

### Analysis

We used a geographic information system (Environmental Systems Research Institute [ESRI] ArcMap 9.1, Redlands, CA) to estimate the driving time from each Census tract to the nearest hospice. Because the geographic information system only maps distances between two points, we identified the population center of each Census tract (provided by the U.S. Census Bureau), which corresponds to the approximate location within a Census tract closest to most of its residents. We then translated the population center of each Census tract and each hospice's address into sets of latitude and longitude coordinate points. We used the ESRI StreetMap USA dataset and the ArcEditor (ESRI ArcMap 9.2) network analyst extension to map the population center of each Census tract to the nearest hospice and calculate the driving time as the product of estimated distances and projected travel speeds across different road types (i.e., interstate, state, and local). Our approach is consistent with other recent studies using geographic information systems to estimate distance to health care providers.<sup>16,17</sup>

We estimated the mean, median, and range of driving times between Census tract population centers and the nearest hospice. We report the time to the nearest hospice by census tract characteristics and compared group means using Welch's analysis of variance (ANOVA),<sup>18</sup> which is robust to the assumption of equal within group variances. We report and compare mean time to the nearest hospice by census tract characteristics stratified by population per square mile. We also estimated the following: the percentages of the population living within 30 and within 60 minutes of at least one hospice; the percentages of the population living within 30 and within

60 minutes of at least two hospices; and the percentages of the population nearest to a hospice first certified by Medicare to provide hospice care in 2000 or later and prior to 2000.

Logistic regression was used to estimate the associations between census tract community characteristics and the following outcomes: (1) being within 30 minutes driving time of at least one hospice and (2) being within 30 minutes driving time of at least two hospices. Regression models are adjusted for population density (measured as population per square mile) or stratified by population density, as this has already been shown to be associated with geographic access to hospice.<sup>11,12</sup>

## Results

### Time to the nearest hospice

In 2008, an estimated 88% of the U.S. population lived in communities within 30 minutes driving time of at least one hospice and 98% lived in communities within 60 minutes driving time of at least one hospice. The mean number of minutes between community centers and the nearest hospice was 15 minutes (standard deviation, 18 minutes), the median number of minutes was 9 minutes, and the range was 0 to 403 minutes.

Time to the nearest hospice by community characteristics is shown in Table 1. In bivariate analyses, there are significant differences in the mean time to the nearest hospice by each measured community characteristic. The mean number of minutes to the nearest hospice was significantly lower for communities that were more urban (higher population per square mile), had a lower percentage of the population who were age 65 or older, higher median household income, lower percentage of population with less than a high school education, higher black population percentage, located in states without CON programs, and by census region. These patterns were also evident when the data were stratified by population per square mile.

The association between community characteristics and a community center being within 30 minutes driving time of a hospice are shown in Table 2. In the fully adjusted model, factors significantly associated with being within 30 minutes of a hospice were: higher population per square mile, a lower percentage of the population who were age 65 or older, higher median household income, lower percentage of the population with a less than high school education, higher black population percentage, location in a state without a CON program, and being in the Northeast compared to each other census region. Stratification by population per square mile yielded similar results within each quartile of population per square mile (although for the most urban areas (quartile 4 of population per square mile) census region variables were removed from the multivariate model due to quasi-complete separation of the data points).

### Proximity to "newer" hospices

Overall an estimated 34% of the U.S. population was nearest to a hospice newly certified by Medicare in 2000 or later and thus part of the recent dramatic growth in the number of hospice providers (Table 3). This percentage was consistent across rural and urban areas as measured by population per square mile. Specifically, 30% of the population in the most rural communities was closest to a hospice newly established in 2000 or later and 36% of the population in the most urban communities was closest to a hospice newly established in 2000 or later.

TABLE 1. TIME TO THE NEAREST HOSPICE BY COMMUNITY CHARACTERISTICS

	<i>Minutes to nearest hospice, mean (SD)</i>				
	<i>Total</i>	<i>By population per square mile</i>			
		<i>Quartile 1</i>	<i>Quartile 2</i>	<i>Quartile 3</i>	<i>Quartile 4</i>
Population per square mile					
Quartile 1: Less than 250	33.1 (25.1) <sup>a</sup>				
Quartile 2: 250 to 2099	13.9 (14.4)				
Quartile 3: 2100 to 5499	8.6 (9.5)				
Quartile 4: Greater than or equal to 5500	6.5 (4.6)				
Percent of population age 65 or older					
Less than 8%	12.3 (18.6) <sup>a</sup>	33.3 (39.9) <sup>a</sup>	14.3 (16.0) <sup>a</sup>	9.7 (12.5) <sup>a</sup>	6.9 (4.8) <sup>a</sup>
8% to 11%	14.3 (14.8)	28.4 (19.2)	13.2 (10.1)	8.3 (6.5)	6.3 (4.3)
12% to 16%	16.9 (18.4)	32.6 (21.4)	13.4 (14.4)	8.1 (7.8)	6.3 (4.4)
Greater than or equal to 16%	17.1 (20.9)	39.2 (26.9)	14.6 (15.9)	8.4 (9.9)	6.3 (4.9)
Median income					
Less than \$30,000	16.4 (22.5) <sup>a</sup>	41.6 (30.6) <sup>a</sup>	14.3 (17.1) <sup>a</sup>	8.1 (11.2) <sup>a</sup>	6.3 (5.1) <sup>a</sup>
\$30,000 to \$39,999	18.6 (20.6)	34.7 (23.2)	15.5 (17.6)	8.8 (10.6)	6.4 (4.4)
\$40,000 to \$49,999	14.6 (16.2)	28.4 (20.7)	13.8 (15.2)	8.5 (7.1)	6.5 (4.3)
Greater than or equal to \$50,000	11.7 (12.1)	23.5 (21.6)	12.9 (9.9)	8.9 (8.7)	6.9 (4.4)
Percent with < high school education					
Less than 10%	10.9 (13.7) <sup>a</sup>	26.0 (32.0) <sup>a</sup>	12.2 (10.6) <sup>a</sup>	8.2 (7.8) <sup>a</sup>	6.4 (4.9)
11% to 19%	16.1 (19.3)	31.8 (25.2)	14.5 (16.4)	9.0 (10.5)	6.6 (4.7)
20% to 29%	18.3 (20.2)	34.4 (23.9)	15.2 (14.5)	9.1 (11.1)	6.6 (4.6)
Greater than or equal to 30%	15.4 (18.3)	35.9 (23.0)	14.3 (15.0)	8.1 (8.2)	6.5 (4.5)
Black population percentage					
Less than 1%	23.2 (23.8) <sup>a</sup>	35.4 (27.1) <sup>a</sup>	16.1 (15.7) <sup>a</sup>	9.6 (8.8) <sup>a</sup>	7.0 (5.3) <sup>a</sup>
1% to 3%	12.1 (14.9)	30.2 (28.6)	13.2 (10.8)	8.4 (7.1)	6.3 (4.6)
3% to 14%	11.9 (15.1)	29.2 (18.3)	13.6 (17.0)	8.7 (12.8)	6.4 (4.9)
Greater than or equal to 15%	11.4 (12.3)	29.9 (17.6)	11.6 (11.1)	7.9 (6.5)	6.6 (4.1)
State has a Certificate of Need program					
No	14.6 (19.2) <sup>a</sup>	33.1 (26.9)	12.9 (14.9) <sup>a</sup>	7.7 (9.6) <sup>a</sup>	6.1 (4.1) <sup>a</sup>
Yes	17.0 (15.9)	33.2 (19.5)	16.5 (12.4)	11.2 (8.7)	7.7 (5.6)
Census Region					
Northeast	12.0 (13.5) <sup>a</sup>	27.8 (21.4) <sup>a</sup>	11.2 (7.4) <sup>a</sup>	6.9 (4.5) <sup>a</sup>	5.0 (3.2) <sup>a</sup>
Middle Atlantic	11.9 (10.9)	26.3 (14.5)	13.5 (9.7)	10.3 (8.4)	6.9 (5.0)
South Atlantic	16.9 (14.7)	30.9 (17.4)	15.5 (11.7)	10.6 (8.0)	8.1 (5.5)
East North Central	13.5 (13.2)	27.2 (15.7)	13.1 (10.7)	8.1 (7.6)	5.9 (3.9)
East South Central	19.5 (16.4)	30.7 (15.8)	12.4 (11.0)	7.0 (5.9)	6.8 (3.1)
West North Central	20.6 (23.9)	37.9 (27.9)	13.7 (14.2)	6.5 (5.4)	5.4 (2.7)
West South Central	15.8 (18.2)	33.1 (21.6)	13.2 (14.2)	6.4 (6.1)	6.0 (4.2)
Mountain	20.8 (33.0)	56.7 (46.8)	15.7 (24.0)	7.5 (7.0)	6.3 (4.1)
Pacific	12.7 (22.0)	39.9 (39.6)	16.2 (25.5)	9.8 (17.6)	6.4 (4.7)

<sup>a</sup> $p < 0.001$  for comparison of group means using Welch's analysis of variance (ANOVA).

### Geographic access to at least two hospices

In 2008, an estimated 74% of the U.S. population lived in communities within 30 minutes driving time of at least 2 hospices and 94% of the population lived in communities within 60 minutes driving time of at least 2 hospices. Community characteristics associated with being within 30 minutes driving time of at least 2 hospices are similar to those associated with being within 30 minutes driving time of one hospice and are not shown.

### State-level variation

The average driving time between community centers and the nearest hospice by state ranged from 5 minutes for Washington, D.C. to 84 minutes for Alaska (Table 4). There was variability in the percentage of the state's population in

communities further than 30 minutes and further than 60 minutes from the nearest hospice. Eleven states had 10% or less of their population in communities further than 30 minutes driving time of a hospice: Connecticut, California, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, Ohio, Pennsylvania, Rhode Island, and Washington D.C. In contrast, eight states had more than 30% of their population living further than 30 minutes driving time of a hospice: Arkansas, Kentucky, Montana, North Dakota, South Dakota, Vermont, West Virginia, and Wyoming.

The percentage of the state's population living within 60 minutes driving time of a hospice similarly varied by region and population density. Nine states had approximately all of their community centers within 60 minutes of a hospice: Connecticut, New Jersey, Delaware, Ohio, Indiana, New Hampshire, Iowa, Pennsylvania, and Washington D.C. Six

TABLE 2. ASSOCIATION BETWEEN COMMUNITY CHARACTERISTICS AND BEING WITHIN THIRTY MINUTES OF A HOSPICE

	By population per square mile											
	Quartile 1			Quartile 2			Quartile 3			Quartile 4		
	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio	95% confidence interval	Adjusted odds ratio <sup>a</sup>	95% confidence interval		
Population Per Square Mile												
Quartile 1: Less than 250	1.00											
Quartile 2: 250 to 2099	6.83	(6.37, 7.33) <sup>b</sup>										
Quartile 3: 2100 to 5499	31.25	(27.81, 35.12) <sup>b</sup>										
Quartile 4: Greater than or equal to 5500	126.26	(102.33, 155.80) <sup>b</sup>										
Percent of population age 65 or older												
Less than 8%	1.00											
8% to 11%	1.10	(0.99, 1.22)										
12% to 16%	0.75	(0.68, 0.83) <sup>b</sup>										
Greater than or equal to 16%	0.53	(0.48, 0.59) <sup>b</sup>										
Median income												
Less than \$30,000	1.00											
\$30,000 to \$39,999	1.44	(1.33, 1.55) <sup>b</sup>										
\$40,000 to \$49,999	2.20	(2.00, 2.43) <sup>b</sup>										
Greater than or equal to \$50,000	3.84	(3.42, 4.33) <sup>b</sup>										
Percent with < high school education												
Less than 10%	1.00											
11% to 19%	0.62	(0.55, 0.69) <sup>b</sup>										
20% to 29%	0.52	(0.46, 0.59) <sup>b</sup>										
Greater than or equal to 30%	0.47	(0.41, 0.54) <sup>b</sup>										
Black Population Percentage												
Less than 1%	1.00											
1% to 3%	1.44	(1.31, 1.57) <sup>b</sup>										
3% to 14%	1.39	(1.27, 1.51) <sup>b</sup>										
Greater than or equal to 15%	1.75	(1.58, 1.93) <sup>b</sup>										
State has a Certificate of Need program												
No	1.00											
Yes	0.49	(0.45, 0.52) <sup>b</sup>										
Census Region												
Northeast	1.00											
Middle Atlantic	0.55	(0.45, 0.66) <sup>b</sup>										
South Atlantic	0.49	(0.41, 0.59) <sup>b</sup>										
East North Central	0.52	(0.43, 0.62) <sup>b</sup>										
East South Central	0.66	(0.55, 0.80) <sup>b</sup>										
West North Central	0.34	(0.28, 0.41) <sup>b</sup>										
West South Central	0.40	(0.33, 0.49) <sup>b</sup>										
Mountain	0.20	(0.16, 0.25) <sup>b</sup>										
Pacific	0.31	(0.26, 0.37) <sup>b</sup>										

<sup>a</sup>Multivariate model excludes Census Region variables due to quasi-complete separation of data points.

<sup>b</sup> $p < 0.001$ .

<sup>c</sup> $p < 0.005$ .

TABLE 3. COMPARISON OF THE PERCENTAGE OF THE U.S. POPULATION IN COMMUNITIES NEAREST TO A HOSPICE ESTABLISHED SINCE 2000 AND PRIOR TO 2000, BY POPULATION PER SQUARE MILE

	<i>Population nearest to a hospice established since 2000</i>			<i>Population nearest to a hospice established prior to 2000</i>		
	<i>N (in millions)</i>	<i>%</i>	<i>Minutes to nearest hospice mean (SD)</i>	<i>N (in millions)</i>	<i>%</i>	<i>Minutes to nearest hospice mean (SD)</i>
Total	94.9	34%		182.6	66%	
Population per Square Mile						
First quartile (more rural)	18.4	30%	32.2 (24.5)	43.4	70%	33.5 (25.3)
Second quartile	25.0	34%	12.3 (11.0)	48.6	66%	14.7 (15.7)
Third quartile	26.0	37%	7.5 (6.1)	44.9	63%	9.2 (10.8)
Fourth quartile (more urban)	25.5	36%	5.9 (3.7)	45.7	64%	6.8 (5.0)

SD, standard deviation.

states had more than 10% of their population further than 60 minutes from a hospice: Alabama, West Virginia, Montana, North Dakota, South Dakota, and Wyoming.

### Discussion

There is widespread geographic access to hospice in the United States. The vast majority of the population lives within 30 minutes driving time of a hospice, and the average driving time between where people live and the nearest hospice was only 15 minutes. Our data suggest that the growth in the number of hospices since 2000 may have improved access to hospice care as the closest hospice for approximately one third of the population, in both rural and urban areas, is a relatively new hospice, certified by Medicare since 2000.

Our data further suggest that most of the population may have greater choice among hospices due to their geographic proximity to 2 or more hospices within 30 minutes driving time. Although it is not known if patient and family choice between hospices is associated with higher quality care for patients and families, there is mounting evidence that hospices vary nationally in program structure<sup>19-23</sup> and patient care.<sup>24-30</sup> Future studies regarding the extent to which having greater choice between hospices improves a family's ability to find a hospice that meets their needs and the potential linkage between hospice choice and hospice quality of care are needed.

### Areas lacking geographic access to hospice

Despite widespread geographic access to hospice, there remain approximately 35 million individuals living in communities more than 30 minutes from a hospice and 6 million individuals in communities more than 60 minutes from a hospice. Our results confirm existing literature finding greater geographic access to hospice in more urban compared to more rural areas.<sup>6,11</sup> However, our research identified lower income, lower educational attainment, and a lower percentage of the population who are black as associated with a community being more than 30 minutes from a hospice, independent of population density and even in more urban areas. These findings are important as they may be pertinent to understanding documented disparities in hospice use by income,<sup>4-7,10</sup> and education.<sup>5,7,10</sup>

Differential location of hospices across communities that vary by sociodemographic features may contribute to differ-

ential enrollment of individuals in these communities for many possible reasons. First, greater distance from a hospice may simply mean that the community is too far to receive services. Second, greater distance from a hospice may mean that community members are less likely to serve as volunteers, employees, or board members, which may increase language, trust, and cultural issues that have been found to be barriers to hospice enrollment.<sup>23,30</sup> This is particularly relevant given that most of hospice care is provided in the patient's home, where cultural sensitivity is critical. Third, greater distance from a hospice may impede the diffusion of knowledge and understanding of hospice services within a community, which has been found to encourage hospice use.<sup>23</sup>

Interestingly, we found that communities with higher percentages of the population who are black are more likely to have geographic access to hospice, controlling for population density. Given that people who are black are less likely to use hospice relative to people who are white,<sup>3-7</sup> our results suggest that differential use is not likely due to lack of geographic proximity to hospice for black individuals. Recent evidence finds that African Americans have significantly less knowledge of hospice than people who are white and that greater knowledge of hospice is associated with higher rates of hospice use.<sup>31</sup> It may be that although hospices are located in or near communities with greater proportions of people who are black, accurate information regarding hospice does not fully diffuse throughout the community. Future research regarding the extent to which hospices are involved in community outreach and education, particularly in minority communities, is needed.

### State variation in geographic access to hospice

Although geographic access to hospice was highly correlated with a state's population density, there were a number of exceptions. Included among the 11 states with more than 90% of the population in communities within 30 minutes of a hospice, was New Hampshire, which has a population density below the median for all states, and Ohio and Michigan, which have population densities in the third quartile of the distribution for all states. Controlling for population density, the existence of CON policies was associated with more limited geographic access to hospice. However, results are to be interpreted with caution due to potential state-level confounders not included in these analyses. Furthermore,

TABLE 4. GEOGRAPHIC ACCESS TO HOSPICE BY CENSUS REGION AND STATE

	<i>Mean time to nearest hospice (minutes)</i>	<i>Population per Square mile</i>	<i>% of population in communities more than 30 minutes from a hospice</i>	<i>% of population in communities more than 60 minutes from a hospice</i>
United States	15.0	—	12%	2%
New England				
Connecticut	9.5	3691	0%	0%
Maine	28.8	1002	29%	9%
Massachusetts	8.0	6739	1%	1%
New Hampshire	13.5	1566	5%	0%
Rhode Island	9.4	5176	2%	2%
Vermont	25.7	826	31%	1%
Middle Atlantic				
New Jersey	9.3	8199	1%	0%
New York	13.3	24267	12%	1%
Pennsylvania	11.2	4716	7%	0%
East North Central				
Indiana	14.1	1974	12%	0%
Illinois	12.2	7189	11%	1%
Michigan	14.9	2922	10%	2%
Ohio	11.7	2980	6%	0%
Wisconsin	17.2	3107	17%	3%
West North Central				
Iowa	16.4	1408	16%	0%
Kansas	19.5	1679	24%	5%
Minnesota	17.8	2657	19%	2%
Missouri	17.8	2127	21%	3%
Nebraska	21.4	2144	22%	7%
North Dakota	40.9	1015	38%	16%
South Dakota	52.7	767	37%	18%
South Atlantic				
Delaware	14.7	3477	19%	0%
District of Columbia	5.1	14301	0%	0%
Florida	18.4	3550	16%	3%
Georgia	15.9	1656	14%	1%
Maryland	12.6	5098	7%	1%
North Carolina	17.0	1242	14%	1%
South Carolina	16.3	1125	14%	1%
Virginia	15.9	2773	14%	3%
West Virginia	30.7	920	48%	11%
East South Central				
Alabama	15.8	1077	13%	2%
Kentucky	25.0	1498	34%	5%
Mississippi	18.1	873	23%	1%
Tennessee	18.9	1393	22%	2%
West South Central				
Arkansas	25.0	745	33%	5%
Louisiana	12.5	3072	11%	1%
Oklahoma	13.2	1658	13%	1%
Texas	15.9	3067	13%	3%
Mountain				
Arizona	17.9	4147	12%	6%
Colorado	15.3	3678	11%	4%
Idaho	27.4	1449	25%	10%
New Mexico	25.4	1924	27%	9%
Montana	42.8	1025	33%	16%
Utah	14.9	3776	11%	3%
Nevada	22.8	5958	12%	7%
Wyoming	36.1	1088	38%	25%
Pacific				
Alaska	84.0	2613	26%	25%
California	10.5	8570	5%	1%
Hawaii	12.9	9416	13%	2%
Oregon	17.4	2895	14%	4%
Washington	17.9	3092	14%	3%

even in states with CON policies, the average distance to the nearest hospice was under 20 minutes.

### Study limitations

In this study, we provide the most recent and comprehensive estimate of geographic access to hospice in the United States. However, a number of limitations exist. First, these data include only the 94% of hospices that are Medicare certified<sup>2</sup> and thus we may have understated geographic access to hospice to the extent that communities are within 30 or 60 minutes of a noncertified hospice and not a certified hospice. Second, our analyses estimated the time between census tract population centers and the nearest hospice. In doing so, we may have underestimated or overestimated the time from each individual's residence to the nearest hospice. However, our methods are consistent with other published analyses estimating proximity to health care providers using GIS software<sup>16,17</sup> and estimating the time from every individual's address in the United States to the nearest hospice is beyond the scope of this study. Third, these data do not include satellite offices of hospices that are too small to have their own Medicare hospice provider number. However, this omission would understate our finding of overwhelming geographic access to hospice care. The extent to which satellite offices exist and are able to provide the full spectrum of hospice care is unknown.

The growth in the hospice industry during the past decade has been dramatic and the positive outcome of such growth is broad geographic access to hospice care across the United States. While there exist a small subset of communities for which geographic access to hospice remains a concern, future research regarding variation in hospice use should focus on other potential barriers to hospice care including hospice admission criteria, hospice size/capacity, and patient-level financial and cultural factors.

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