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Where People Die

A Multilevel Approach to Understanding Influences on Site of Death in America

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Despite documented preferences for home death, the majority of deaths from terminal illness occur in hospital. To better understand variation in place of death, we conducted a systematic literature review and a multilevel analysis in which we linked death certificates with county and state data. The results of both components revealed that opportunities for home death are disproportionately found in certain groups of Americans; more specifically, those who are White, have greater access to resources and social support, and die of cancer. From the multilevel analysis, the higher the proportion minority and the lower the level of educational attainment, the higher the probability of hospital death while investment in institutional long-term care, measured by regional density of nursing home beds and state Medicaid payment rate, was associated with higher probability of nursing home death. These results reinforce the importance of both social and structural characteristics in shaping the end-of-life experience.

Keywords: *site of death; end-of-life; multilevel analysis; nursing home*

Introduction

The past few decades have seen a dramatic increase in both public and professional concern about the quality of end-of-life care. This has been driven by the

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aging of the population coupled with increasingly protracted periods of chronic and ultimately fatal illness. In response, several influential organizations have acted to emphasize the urgent need to improve end-of-life care. The Institute of Medicine has published two reports (Institute of Medicine 1997, 2001) and large-scale research programs, such as Last Acts and Project on Death in America, have been undertaken to identify end-of-life needs and to promote improvements in quality of care (Last Acts 2005; Project on Death in America 2005).

Recently, Last Acts released a policy statement in which facilitating a patient's death in his or her preferred location (such as home or hospital) was identified as an important quality indicator of end-of-life care (Last Acts 2002). This reflects the end-of-life movement's fundamental notion that good care empowers patients and families to control the decision-making process. More importantly, it reflects public sentiment. Surveys of the general population as well as the seriously ill reveal that people overwhelmingly would prefer to die at home (Dunlop, Davies, and Hockley 1989; Townsend et al. 1990). In a systematic review of the international literature, Higginson and others (Higginson and Sen-Gupta 2000) reported that preference for home death ranged from 59% to 81% in the general population and from 49% to 90% among cancer patients. Others have reported similar preferences for home care and death in U.S. samples (Hays et al. 2001; Tang 2003). For some patients, this preference was unconditional, while for others it was dependent on circumstances such as the ability to control pain or to minimize the burden on loved ones (Fried et al. 1999b; Hays et al. 1999).

Despite the public's relatively consistent preference for home death, most Americans still die in an institutional setting. As of 2001, nearly 50% of deaths due to chronic illness occurred in an acute care facility. While this figure is down from over 62% in 1989, acute care hospitals are still the number one site of death for people with chronic illnesses. The decrease in hospital deaths can be partially attributed to a substantial increase in home deaths. From the late 1980s to 2001, the national proportion of home deaths increased from 16% to 23%. This, however, varied strikingly from state to state and ranged from a low of 12.4% in Washington, D.C. to a high of 38.4% in Oregon. Such interstate variation can also be seen for hospital deaths: Louisiana, Tennessee, and the District of Columbia reported the highest proportion of hospital deaths in 2001, all at or near 60%, whereas Oregon and Idaho reported the lowest at only between 30% and 40% of deaths (Facts on Dying 2004).

The purpose of this paper is twofold. First, we synthesize the current literature on the factors associated with variation in site-of-death and highlight some of the general limitations of that literature. We then present the results of our own analysis of U.S. death certificate data for 1997 in which we empirically test the influence of individual area and state factors on the likelihood of hospital or nursing home death.

Systematic Literature Synthesis

We conducted a systematic review of the published literature describing site of death and the factors associated with where people die. Using Medline Silverplatter (1966–2003), Cancerlit (1993–1999), and Pubmed Cancer subset (2000–2003), we searched the key phrases (“site of death” or “place of death” or “location of death” or “where people die”) in conjunction with (“palliative care” or “terminal care” or “end of life care” or “hospice care” or “home care”). We excluded reviews, letters, and editorials and then further screened abstracts to identify papers with: a sample size of 30 or more, an adult sample, and a focus on nontraumatic causes of death. Finally, we limited the search to studies that looked at site of death as the primary outcome and that focused on the characteristics of the decedent (or dying individual). Of 349 abstracts, 70 studies met our screening criteria but 4 were excluded because they either did not provide adequate information for their methods to be assessed or included outcomes that are not relevant in the U.S. context. This resulted in a total of 66 eligible studies. Of these, multivariable methods were used in 29 studies. A summary of the studies we reviewed can be found in Appendix A.

The results of the literature search confirmed that the opportunity for home death is disproportionately found among certain groups of decedents and that this appears to be the case in both the United States and other Western industrialized nations. Further, there was overwhelming consistency from study to study with respect to the associations between site of death and several decedent-level characteristics (Appendix B). In studies that included measures of race/ethnicity, being White or living in a less racially diverse area was associated with home death (Gallo, Baker, and Bradley 2001; Higginson et al. 1999) while being Black, Latino, or non-White was predictive of hospital death (Bruera et al. 2003; Pritchard et al. 1998; Sambamoorthi et al. 2000; Weitzen et al. 2003). Similarly, two studies found that native-born decedents were more likely to die at home than were foreign-born decedents (Costantini et al. 2000; Wilson et al. 2001). Studies that have used various measures of socioeconomic status or resource availability, including education and income, have all found that higher SES was associated with home death (Costantini et al. 1993, 2000; De Conno et al. 1996; Gallo, Baker, and Bradley 2001; Mor and Hiris 1983; Weitzen et al. 2003). This was also the case when measures of area deprivation were examined (Gatrell et al. 2003; Higginson et al. 1999).

The association between social support and site of death was slightly less consistent but this may be because of the difficult task of adequately measuring this construct. The majority of studies used marital status as a proxy for social support and overwhelmingly found that being married was predictive of home death (Bruera et al. 2003; Clifford, Jolley, and Giles 1991; Costantini et al. 1993, 2000; Davison et al. 2001; De Conno et al. 1996; Gallo, Baker, and Bradley 2001; Hunt, Bonett, and

Roder 1993; Moinpour and Polissar 1998; Mor and Hiris 1983; Weitzen et al. 2003). Various other measures of social support, such as number of children, home help, and presence of more than one caregiver, confirmed an increased probability of home death with more support (De Conno et al. 1996; Fukui et al. 2003; Mor and Hiris 1983). Izquierdo-Porrera and colleagues (Izquierdo-Porrera, Trelis-Navarro, and Gómez-Batiste 2001) found no association between any measure of support and site of death. In a specialized population of older adults who elected community-based services, the authors (Temkin-Greener and Mukamel 2002) found inconsistent relationships across multiple measures of social support.

When multiple causes of death were examined, decedents with cancer were repeatedly found to have an increased likelihood of home death and a decreased likelihood of hospital death (Clifford, Jolley, and Giles 1991; Pritchard et al. 1998; Weitzen et al. 2003). Of studies that looked only at people with cancer, those with leukemia, lymphoma, or hematological cancers were the most likely to die in hospital (Bruera et al. 2002, 2003; Costantini et al. 1993, 2000; Davison et al. 2001; Gatrell et al. 2003; Hunt, Bonett, and Roder 1993; McCusker 1983) while those with stomach, prostate, or respiratory cancers were most likely to die at home (Costantini et al. 2000; Gatrell et al. 2003). A single study reported that patients with colorectal cancer had a decreased likelihood of home death (Gallo, Baker, and Bradley 2001).

While the majority of studies focused on individual characteristics with some attention to neighborhood aggregates, only a few considered the association between the availability of regional health services and site of death trends. Various measures of hospital use intensity were each positively associated with increased hospital death. Such measures included number of hospital beds (Bruera et al. 2002; Gaumer and Stavins 1992), average hospital length of stay (Sager et al. 1989), and hospital days per capita (Pritchard et al. 1998). Related to this, Gallo, Baker and Bradley (2001) found that home death was more common among individuals who lived further away from a university health center than among those who lived closer. Only two studies included measures of physician availability and they reported inconsistent results. Gaumer and Stauvins (1992) found that more primary care physicians in a region were associated with a decrease in hospital deaths while Pritchard and colleagues (1998) reported no such association.

The influence of managed care penetration was examined in three studies, with little consensus. Pritchard and colleagues (1998) found no associations but both Sager and colleagues (1989) and Emanuel and colleagues (Emanuel et al. 2002) found a negative association with hospital death and managed care penetration in the market. In the study by Emanuel and others (2002), the decreased occurrence of hospital death was directly attributed to greater hospice use among managed care enrollees. It is important to note that the authors of this study did not use multivariable methods. Finally, the presence of hospice was measured by distance (Gatrell et al. 2003) and Medicare spending (Pritchard et al. 1998) and in each case was negatively associated with hospital death.

New Contribution

While the current site of literature on death has helped to highlight consistent and important determinants of where people die, significant limitations remain. The most obvious limitation is the almost complete omission of nursing homes as a site of death in most studies. Between 1989 and 2001, the proportion of deaths from chronic illness that occurred in nursing homes in the United States increased by nearly 25% and the most recent figures reveal that roughly a quarter of all deaths occur in a nursing home (Facts on Dying 2004). This too varies substantially by region. Nonetheless, with states such as Minnesota and Rhode Island closing in on 40%, it is clear that nursing homes are rapidly emerging as a major site of end-of-life care and death. This will likely continue to increase as the Baby Boomers age, life expectancy at 65 extends, and government and insurance policies continue to promote reduced hospital lengths of stays.

The bias introduced by the exclusion of nursing homes in studies of end of life is evident in the inconsistent associations of each age and gender with site of death. In a retrospective study of site of death trends, Wilson and colleagues (Wilson et al. 2001) found that over a 50-year period, decedents over the age of 65 had the greatest decline in hospital death. This is consistent with the negative association between older age and hospital death that some have reported (Bruera et al. 2002, 2003; Burge, Lawson, and Johnston 2003; Gaumer and Stavins 1992; Pritchard et al. 1998) but not with the several others who found no such association (Bruera et al. 2002; De Conno et al. 1996; Fried et al. 1999a; Fukui et al. 2003; Izquierdo-Porrera, Trelis-Navarro, and Gómez-Batiste 2001; Karlson and Addington-Hall 1998; Mann et al. 1993; Tang 2002). Studies that have focused on factors associated with home death are even more inconsistent in that nearly half reported a positive association (Costantini et al. 1993, 2000; Gallo, Baker, and Bradley 2001; Moinpour and Polissar 1998) and half a negative association with age (Clifford, Jolley, and Giles 1991; Davison et al. 2001; Gatrell et al. 2003; Higginson et al. 1999; Hunt, Bonett, and Roder 1993; Temkin-Greener and Mukamel 2002). Similarly, the inconsistent associations between gender and site of death are likely the result of excluding nursing homes, whose residents are predominantly very old and female. Not surprisingly, those studies that have included nursing home as a distinct outcome have reported that both being female and being older were negatively associated with hospital death (Gatrell et al. 2003; Weitzen et al. 2003). The exclusion of nursing homes in analyses done to date limits our ability to fully understand the relative importance of personal and area factors that influence where people die because estimates may be biased unless all major sites of death are considered.

The current site of death literature is also limited by the lack of studies that have examined factors at multiple levels. As discussed above, a few studies have attempted to measure the effects of health care infrastructure variables, such as number of hospital beds per capita (Bruera et al. 2002; Gaumer and Stavins 1992), physician availability (Gaumer and Stavins 1992; Pritchard et al. 1998), and Medicare spending on hospice (Pritchard et al. 1998), but none have simultaneously considered both individual and contextual characteristics. Further, several of such studies used data from specific regions in the country. For instance, in the study by Emanuel and colleagues (2002), the effect of HMO penetration on home death was examined but by comparing only two states. Research done within local settings allows for the identification and examination of several individual factors but limits the generalizability of results related to contextual factors. In order to fully understand the forces that influence where people die, research that can integrate the complex relationships between individual, health system, and population characteristics is needed. This means considering variables from multiple sources in combination with the most appropriate statistical methods.

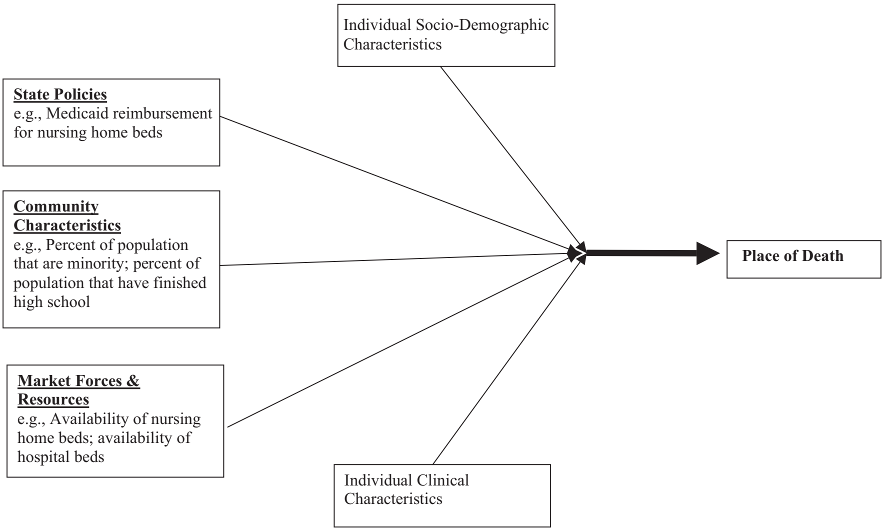
Our objective in this study was to identify characteristics associated with site of death but to add to the current literature by addressing the gaps described above. The three main sites of death, hospital, home, and nursing home, were all included as separate outcomes. We combined data from several nationally representative sources, including mortality records from the National Center for Health Statistics, the Area Resource File, and select state-level variables. Integrating data from all these sources allowed us to model and interpret the associations between site of death and individual, market, and state policy characteristics. This ultimately provides us with a more complete understanding of the forces that influence where people die.

Conceptual Framework and Research Questions

The conceptual model in figure 1 provides a framework for depicting the various forces that influence where adults with chronic conditions die. Individual factors include both demographic and clinical conditions; the latter shape the end-of-life illness and its likely duration, while the former reflect social position, social support and resources, as well as whether death is “premature.” Community factors reflect the social norms and expectations, as well as the relative wealth and generosity of the area and state. Market forces reflect the supply of health-related resources in the area, which influence access to various kinds of end-of-life services. Finally, states’ policies, particularly those governing Medicaid reimbursement of various long term care options, can influence access to and/or encourage use of nursing home or other formal long term care services. The paragraphs below present our rationale for including these independent variables along with our expectation for the direction of the relationship.

Age represents a biological and developmental life-course phenomenon which has implications for the nature of preferred medical care. On one hand, advanced age may be associated with an acceptance of impending mortality. On the other, society and individuals are more prepared to invest intensive medical interventions, generally found only in hospitals, in younger members of society; historically, there has been less an expectation for “everything” to be done for older adults nearing the end of life (Angus et al. 2004; Stearns et al. 1996). As well, the likelihood of residing in a nursing home increases dramatically after the age of 80. The decision to hospitalize nursing home

Figure 1
Individual and Regional Variables that Influence Location of Death for People with Chronic Illnesses (Simplified Conceptual Model)



residents is strongly influenced by institutional forces that differ considerably from those forces affecting hospitalization in community-dwelling adults (Intrator, Castle, and Mor 1999; Intrator, Zinn, and Mor 2004). We expect older decedents to be more likely to die in a nursing home and the youngest decedents to be more likely to die in hospital.

Cause of death provides some indicator of the nature of the decedents' clinical conditions in the days and weeks leading up to their death. Slow, progressive deaths, characterized by cancer, offer patients and families opportunity to prepare and, if they so choose, to make the necessary arrangements to die at home. More sudden deaths, such as myocardial infarction, may also be more likely at home, but progressive, irregular conditions like congestive heart failure, where there is a possibility of delaying death, may result in patients' being more likely to die in a hospital.

Demographic characteristics such as race and ethnicity represent a more complex social meaning that has been associated with end-of-life care preferences and outcomes. On average, they represent life-long socioeconomic status that will ultimately influence patterns of care at the end of life, a time when decisions on care are highly value-laden. At the same time, these individual features are strongly associated with access to and use of formal resources, such as hospitals and nursing homes (Elmore et al. 2005; Gornick 2003). Based on this, we expect that African American decedents will be more likely to have died in hospital and less likely to have died in nursing home than White decedents.

Marital status is an important measure of social support, which is critical to the provision of care in a noninstitutional setting. Available social support is often a requirement for in-home hospice so that daily care needs can be met. Among adults, with the exception of those at the most advanced ages, this care is most commonly carried out by the dying individual's spouse (Lackan et al. 2005). We expect that married decedents will be less likely to die in an institutional setting.

The robustness of each person-level variable in previous research on the determinants of site of death underscores the importance of these features in describing how different types of people will use medical resources at the end of life. We expect that these person-level variables will continue to be significant even when we control for the effect of the environment.

The community environment creates specific kinds of opportunities for end-of-life care that affect all members of a community regardless of that individual's own propensity for a particular kind and setting of care. Characteristics of the political and cultural environment in which decedents lived may directly influence site of death by virtue of resource availability. Individuals residing in communities with a high proportion of poor or minority families are likely to have patterns of service use that are consistent with those groups, regardless of individual group membership. Among disadvantaged segments of society, the use of medical services is typically delayed until conditions are quite advanced after which they receive intensive hospital-based care (Borum, Lynn, and Zhong 2000; Weinreb et al. 2006). At the same time, non-hospital health care resources available in such communities may be more impoverished than those in wealthier communities, thereby reinforcing the implicit preference for hospital services (Mor et al. 2004).

We also hypothesize that characteristics of the local health care market contribute to expectations regarding medical care utilization, thereby contributing to an environment defined by its health care capacity. The number of hospital and nursing home beds per population is a measure of community resources. Further, it is a measure of the importance placed on institutional care and the priority that it is given as an investment of those resources. The scope of influence that regional cultural expectations have on variation in medical practice patterns has been repeatedly observed by Wennberg and colleagues for almost three decades and the introduction of national reimbursement schemes has not appeared to diminish the size of these regional differences in medical practice patterns (Baicker et al. 2004; Fisher and Wennberg 2003; Wennberg and Gittelsohn 1973). Consequently, we expect that decedents living in markets with higher concentrations of hospital beds or of nursing home beds per capita will be more likely to die in such settings, all other things being equal.

State Medicaid reimbursement for nursing homes is another clear example of the importance different political constituencies place on the decision to invest public resources into institutional care. There is substantial interstate variation in these Medicaid payment rates and some evidence to suggest that higher rates are associated with fewer hospitalizations of nursing home residents and other better clinical outcomes (Intrator and Mor 2004).These political decisions clearly have an impact on the conditions that permit nursing homes to care for dying patients in the facility rather than favoring hospitalization. Therefore, we expect that decedents in states with higher Medicaid nursing home payment rates will be more likely to die in nursing home than in states with lower rates.

While the generosity of a state's Medicaid nursing home payment makes possible caring for dying patients outside the hospital, a more global indicator of the munificence of the state's population is the per capita contributions to United Way. Such nonprofit support is often devoted to community services, reflecting the values of the population for nontraditional services such as hospice and home care, which theoretically facilitate home death.

In summary, where individuals spend their last days of life is influenced by individual demographic and clinical characteristics as well as the degree to which their community has the interest in and sufficient wealth to invest in service resources such as hospitals, nursing homes, or home and hospice care services. Although, the literature clearly indicates most Americans would like to die at home surrounded by family, there is variation in the strength of that preference when decisions are being made regarding the nature of medical care provided at the time of a serious, potentially terminal, illness. We posit that the strength of those preferences will be a function of individuals' social position and the level of resources in their local environment to actualize their preference.

Methods

Study Design and Data

This is a cross-sectional study in which we attempt to explain variation in site of death both in terms of individual and regional factors. Data on site of death and other individual-level characteristics were taken from the National Vital Statistics System (NVSS). The NVSS includes death certificates for all deaths that occurred within the United States for the year 1997. These data are publicly available, as federal law mandates the collection and publication of all such statistics (http://www.cdc.gov/nchs/deaths.htm). Place of death was identified from the death certificate as either acute care hospital, nursing care facility, home, or other. For this analysis, only those that occurred either at home, in a nursing home, or hospital were considered. Individual-level characteristics taken from the death certificate were: age, gender, ethnicity/race, education, marital status, and lead underlying cause of death. Age was categorized as: less than 65, 65 to 74, 75 to 84, and 85 and older. Deaths in children and adolescents were excluded since they represent special cases and so warrant a separate study (1.8% of all deaths). Ethnicity/race was defined as: White (non-Hispanic), Black (non-Hispanic), Mexican, Puerto Rican, Cuban, Central/South

American, other Hispanic, Other, or Unknown. Education was categorized as: less than 9 years, 9 to 11 years, 12 years, 13 to 15 years, 15 or more years, and unknown. Marital status was classified as married, widowed, single, divorced, or not stated at the time of death. Cause of death was categorized according to the ICD-9 Classification System. Since very different forces influence where deaths due to chronic conditions and deaths due to trauma may occur, deaths resulting from "external" causes were excluded. These were deaths due to accident (motor vehicle or other), homicide, and pregnancy (7.1% of all deaths). All other causes of death were grouped as follows: cancer, heart disease, chronic obstructive pulmonary disease (COPD), pneumonia, diabetes, nephritis, liver disease, Alzheimer's disease, HIV/AIDS, congestive heart failure, and other. In all analyses, cancer was set as the reference group.

Patterns of funding and patient origin suggest that the county is a reasonable approximation of the long term care market (Banaszak-Holl, Zinn, and Mor 1996). Therefore, we believe that county is an appropriate marker for regional variation and context. Confidentiality requirements imposed by the National Center for Health Statistics prohibit matching deaths that occurred in counties with fewer than 50 deaths with county-level data, meaning that we were required to exclude them from the analysis. County data was taken from the Area Resource File (ARF). The ARF summarizes a large array of census, health, and social resource information gathered from sources such as the American Hospital Association, the U.S. Census of population and housing, the Centers for Disease Control and Prevention, and the national Center for Health Statistics. Data are available for the whole of the United States. The availability of health services in each county was described as: the average number of nursing home beds per 1000 and the average number of hospital beds per 1000. Aggregate descriptors of socioeconomic circumstance were described by: median family income in thousands of dollars, percent of adults with less than a ninth grade education, and percent of families living below the poverty line (as defined by the 2000 census). Counties were also demographically described by the percent of the population that was Black, Hispanic, and over the age of 65 years. The Metropolitan Statistical Area score (MSA) was categorized as 0, 1, 2, or 3–5 where 0 represented the most urban and 5 the least.

Three state-level variables were included in the analysis. Data on the average Medicaid reimbursement rate for nursing home beds for each state were obtained from the 1998 State Data Book on Long Term Care and Market Characteristics (Harrington et al. 1999). Since we also examined per capita income at the county level, we did not adjust the Medicaid reimbursement rate for the state wage index. Two other variables were derived from data on the United Way website (http://national.unitedway.org/). Income inequality was defined as a ratio of incomes by dividing the average household income in the top fifth percentile of the state by the average household income in the bottom fifth percentile of the state. This ratio is used as a proxy measure of area income disparity such that the higher the ratio, the greater the socioeconomic distance between the wealthiest and poorest individuals in the state. The creation of a ratio measure rather than a difference allows for a cleaner comparison between states by removing the underlying variability in income across states. Finally, as a marker of social capital, we included per-capita contributions to the United Way. While the United Way is only one of several potential recipients of charitable giving, we believe that donations to the United Way represent a conscious investment by citizens in the local community. We therefore view this variable not only as a measure of the ability of residents to donate but also as a proxy for residents' commitment to investing in the voluntary social welfare network.

Analyses

We developed two models to quantify the association of each independent variable with the outcome. In the first model, we estimated the probability of dying in hospital against that of dying at home, while in the second we estimated the probability of dying in a nursing home against that of dying at home. In each model, home death was chosen as the reference since it is often considered the preferred site of death. Both models were developed using generalized estimating equations (GEE) in order to account for the hierarchical structure of the data. Due to the volume of data, fitting a full three-level model (state, county, and person) was computationally infeasible. Instead, we included an indicator variable for each state to account for state-level variation. All analyses were carried out using SAS version 8 (SAS Institute Inc., NC).

Results

Individual Characteristics

There were 2,348,434 deaths in the United States in 1997. Deaths were excluded if the decedent was under 15 years (43,325 or 1.8%), the decedent was a foreign resident (34,069 or 1.5%), or the cause of death was pregnancy-related, homicide/suicide, or accident (167,463 deaths or 7.1%). Of the remaining 2,130,192 deaths, 59,424 (2.8%) were excluded because the site of death was either missing or because it did not meet our inclusion criteria. Due to county-size restrictions, 683,700 deaths (32.1%) could not be matched to county-level data. This resulted in a total of 728,025 deaths (34.2%) that were excluded because of site of death inclusion criteria, county restrictions, or both (15,099 cases overlapped).

A total of 1,402,167 deaths were available for complete analysis. Of those, 740,405 (52.8%) occurred in hospital, 331,315 (23.6%) occurred in nursing homes, and 330,447 (23.6%) occurred at home (table 1). Slightly over half of all decedents were female (52.1%), and the vast majority were White (80.8%) and over the age of 65 years (79.1%). The two leading causes of death were heart disease (30.5%) and cancer (25.1%), while the least common causes of death were HIV/AIDS and Alzheimer's disease (1.0% each).

Table 1
Sample Characteristics

	Total Sample $N = 1,402,167$	Died in Hospital $n = 740,405$	Died at Home $n = 330,447$	Died in Nursing Home $n = 331,315$
Gender				
Male	47.9	57.3	25.5	17.2
Female	52.1	48.7	21.8	29.5
Age				
<65	20.9	64.4	29.2	6.4
65–74	21.2	59.3	28.1	12.6
75–84	30.8	52.7	22.7	24.6
85–94	22.8	40.8	16.9	42.3
95+	4.2	28.0	14.5	57.6
Marital status				
Never married	9.1	55.9	21.5	22.7
Married	41.1	59.0	26.9	14.1
Widowed	39.6	45.2	19.9	34.9
Divorced	9.8	54.6	26.1	19.2
Not stated	0.4	57.1	24.9	18.0
Race/Ethnicity				
White	80.8	49.7	24.2	26.1
Black	12.7	66.4	20.2	13.5
Hispanic/Latino	4.2	65.2	22.7	12.1
Other/unknown	2.4	63.4	21.7	14.9
Education (years)				
<9	17.8	50.8	20.3	29.0
9–11	11.6	54.7	23.0	22.3
12	39.6	53.5	23.8	22.7
13–15	12.4	51.9	26.4	21.7
15+	12.4	50.8	27.7	21.6
Unknown	6.3	56.8	18.8	24.4
Cause of death				
Heart disease	30.5	56.2	22.3	21.6
Cancer	25.1	41.9	40.1	17.9
Cerebrovascular accident	7.4	54.6	35.9	9.5
Chronic obstructive pulmonary disease	5.0	55.8	21.0	23.2
Pneumonia	4.1	63.6	4.6	31.9
Diabetes	2.2	55.1	22.4	22.5
Nephritis	1.1	65.6	10.7	237.0
Liver disease	1.3	68.1	20.8	11.1
Alzheimer's disease	1.0	16.6	16.8	66.6
Septicemia	1.1	82.2	1.7	16.1
HIV/AIDS	0.9	66.7	20.4	12.8
Congestive heart failure	3.6	46.3	27.4	26.4
Other	16.8	57.2	15.3	27.5

Note: In the first column of the table, the characteristics of the entire sample are presented. In the final three columns, the distribution of characteristics across each of the sites of death is presented. To see the percent of males that died at each site, read across the columns.

The distributions of the descriptive characteristic between sites of death are presented in the last three columns of table 1. The frequency of nursing home death increased with age and among the oldest adults, nursing homes were the most common site of death. A greater percent of women than men died in the nursing home (29.5% vs. 17.2%) but the converse was seen for other sites of death. Married and divorced decedents showed the greatest frequency of home death (26.9% and 26.1%, respectively) while widowed decedents showed the greatest frequency of nursing home death (34.9%). Approximately half of all White decedents died in hospital but well over 60% of each other racial/ethnic group died in hospital. Of those who died outside the hospital, White decedents were equivalently split between home and nursing home while other groups more frequently died at home than in nursing home. For all causes of death the most common place of death was hospital, with a few notable exceptions. Among decedents with cancer, an equivalent percent died in hospital (41.9%) and at home (40.1%). The vast majority of decedents with Alzheimer's disease died in the nursing home (66.6%), with similar proportions in home and hospital (16.8% and 16.6%, respectively).

Regional Characteristics

Descriptive statistics revealed that counties varied substantially with respect to all sociodemographic and health services variables (table 2). The percent of county residents who were Black and Hispanic/Latino averaged 15.1 and 14.1, respectively with each ranging from less than 1% to a clear majority (69.5% for Blacks and 99.4% Hispanics/Latinos). It should be noted that the exclusion of counties with 50 or fewer deaths reduced the number of predominantly White counties, thereby inflating the average percent of county residents who were either Black or Hispanic/Latino relative to national statistics. The average percent of county residents who were over the age of 25 and did not attend high school was 9.1.

As for health services variables, the average number of nursing home beds per 1000 in the population was 6.4 and the average number of hospital beds per 1000 was 3.4. Again, there was substantial variability; for both types, counties ranged from having no beds to nearly 20 beds per 1000 in the population.

The average Medicaid reimbursement rate in 1998 for nursing home beds was $100. The average household income ratio was 10.6, meaning that, on average there was a 10-fold difference in the incomes of the wealthiest and poorest people in the state. The mean per capita United Way contribution was $519 (table 2).

Multivariable Analysis

The results of the hierarchical multivariable analyses are presented across two tables; the estimates associated with decedent level characteristics (controlling for county factors) are presented in table 3 and the estimates associated with county,

Table 2
County Characteristics

	Mean	Minimum	Maximum
Health Services Descriptors			
Nursing home beds per 1000	6.4	0.66	17.0
Hospital beds per 1000	3.4	0	18.9
Demographic Descriptors			
Percent Black	15.1	0.28	69.5
Percent Hispanic/Latino	14.1	0.39	99.4
Percent of adults over the age of 65	13.1	4.2	34.0
Socioeconomic Circumstance Descriptors			
Percent of adults without high school education	7.0	1.5	33.8
Median family income, $	53,346	26,009	92,146
Percent of families living below the poverty line	9.1	1.6	31.3
Metropolitan Statistical Area (MSA), %			
0 (Most urban)	59.4	n/a	n/a
1	2.5	n/a	n/a
2	28.5	n/a	n/a
3–5 (Least urban)	9.6	n/a	n/a
State Level Descriptors			
Medicaid reimbursement rate for nursing home beds, $	100	62	254
Average household income for top 5th/average household income for bottom 5th of population	10.6	6.9	27.1
Per capita United Way contributions, $	519	185	1,295

Note: Data is presented for counties included in the full analysis only (i.e., those counties that reported at least 50 deaths in 1997).

MSA, and state characteristics (controlling for patient factors) are presented in table 4. In view of the large sample size and small standard errors around the coefficients, many associations reach conventional levels of statistical significance but actually have relatively small effect sizes. We have chosen to highlight those associations that have an associated chi-square value (with one degree of freedom) in excess of 50. While arbitrary, it provides some basis for selecting from among numerous statistically significant relationships.

Controlling for cause of death, being older, having more education, and being unmarried (for any reason) were all associated with a reduced likelihood of hospital death. Being African American or any of the Hispanic ethnicities was associated with a much greater likelihood of dying in the hospital. As expected, relative to cancer, all causes of death other than Alzheimer's disease were associated with an increased

(*text continues on page 368*)

Table 3
Results of the Multivariable Analysis for Decedent Level Characteristics

	Risk of Dying in Hospital vs. Home				Risk of Dying in Nursing Home vs. Home			
Parameter	Odds Ratio	95% Confidence Interval		Chi-Square	Odds Ratio	95% Confidence Interval		Chi-Square
Female	1.00	0.99	1.01	0.46	1.26	1.24	1.28	1351.15
Age								
<65	Reference				Reference			
65–74	1.00	0.98	1.01	0.54	2.28	2.23	2.33	5439.31
75–84	1.00	0.99	1.02	0.12	4.71	4.61	4.81	21206.3
85–94	0.92	0.91	0.93	110.16	9.10	8.90	9.31	37139.3
95+	0.64	0.62	0.66	832.37	12.82	12.41	13.24	23757
Education								
<9 years	Reference				Reference			
9–11 years	0.99	0.97	1.01	1.73	0.99	0.97	1.01	0.47
12 years	0.96	0.95	0.98	30.83	0.94	0.92	0.95	62.13
13–15 years	0.91	0.89	0.92	136.15	0.84	0.82	0.86	263.47
15+ years	0.84	0.83	0.86	409.89	0.77	0.76	0.79	568.44
Unknown	1.05	1.02	1.08	14.89	1.18	1.15	1.22	112
Marital status								
Married	Reference				Reference			
Single	0.89	0.87	0.9	201.65	2.04	2.00	2.09	3917.96
Widowed	0.88	0.87	0.89	516.77	1.52	1.50	1.55	3309.93
Divorced	0.86	0.85	0.88	373.82	1.81	1.77	1.85	3073.55
Unknown	0.69	0.64	0.73	115.19	1.54	1.40	1.69	80.29

(*continued*)

Table 3 (continued)

	Risk of Dying in Hospital vs. Home				Risk of Dying in Nursing Home vs. Home			
Parameter	Odds Ratio	95% Confidence Interval		Chi-Square	Odds Ratio	95% Confidence Interval		Chi-Square
Race								
White	Reference				Reference			
Black	1.39	1.37	1.41	2024.8	0.93	0.91	0.95	39.96
Other	1.49	1.44	1.54	560.64	0.87	0.83	0.92	29.13
Unknown	1.10	1.02	1.18	6.62	0.98	0.89	1.08	0.13
Ethnicity								
White	Reference				Reference			
Mexican	1.19	1.16	1.23	133.62	0.63	0.60	0.66	397.57
Puerto Rican	1.46	1.38	1.55	180.96	0.93	0.85	1.02	2.64
Cuban	1.42	1.29	1.57	49.89	0.87	0.75	1.00	3.63
C/S American	1.43	1.33	1.54	99.47	0.59	0.52	0.67	67.26
Other	1.10	1.03	1.17	8.25	0.71	0.64	0.77	58.39
Cause of death								
Cancer	Reference				Reference			
Heart disease	2.32	2.29	2.34	23478.8	1.22	1.20	1.23	675.55
Cerebrovascular accident	5.45	5.32	5.57	20882.4	4.54	4.42	4.65	13012.5
Chronic obstructive pulmonary disease	2.57	2.51	2.62	8049.63	1.72	1.68	1.77	1671.04
Pneumonia	13.61	13.06	14.17	15796.5	7.94	7.59	8.30	8348.63
Diabetes	2.14	2.08	2.21	2574.23	1.75	1.69	1.82	830.77
Nephritis	5.42	5.14	5.71	4021.26	3.06	2.87	3.26	1205.48
Liver Disease	2.98	2.87	3.10	3132.8	1.83	1.72	1.94	383.59
Alzheimer’s	0.93	0.88	0.99	5.14	4.54	4.32	4.76	3731.67
HIV/AIDS	2.34	2.23	2.45	1303.83	3.94	3.69	4.21	1655.39
Congestive heart failure	1.56	1.53	1.60	1414.26	1.20	1.17	1.24	156.54
Other	3.51	3.46	3.56	30737.8	2.57	2.53	2.62	10933.5

Table 4
Results of the Multivariable Analysis for County and State Characteristics

	Risk of Dying in Hospital vs. Home				Risk of Dying in Nursing Home vs. Home			
Parameter	Odds Ratio	95% Confidence Interval		Chi-Square	Odds Ratio	95% Confidence Interval		Chi-Square
Nursing home beds/1000	1.01	1.01	1.01	34.72	1.07	1.07	1.08	1136.54
Hospital beds/100	1.00	0.99	1.00	8.37	0.99	0.99	1.00	6.72
Percent Black	1.97	1.83	2.12	342.98	0.93	0.84	1.02	2.34
Percent Hispanic/Latino	1.29	1.17	1.42	27.65	1.55	1.37	1.76	45.43
Percent 65+ years	0.87	0.71	1.06	2.01	0.15	0.12	0.20	216.89
Percent adults withoutout high school	1.03	1.03	1.03	338.17	1.00	0.99	1.00	4.81
Median income	1.00	1.00	1.00	2.53	1.00	1.00	1.00	15.76
Percent families in poverty	0.98	0.98	0.99	100.74	0.98	0.97	0.98	107.06
Metropolitan Statistical Area								
0 (Most urban)	Reference				Reference			
1	0.99	0.96	1.02	0.38	0.97	0.94	1.01	1.92
2	0.95	0.94	0.97	49	1.07	1.06	1.09	72.65
3–5 (Least)	0.99	0.97	1.01	1.85	0.98	0.96	1.00	3.05
Medicaid rate	0.99	0.99	0.99	205.6	1.01	1.01	1.01	68.95
Income ratio	1.09	1.04	1.14	14.27	0.67	0.63	0.72	140.67
United Way contributions	1.00	1.00	1.00	2.84	1.00	1.00	1.00	93.08

likelihood of hospital death. The determinants of dying in a nursing home relative to home were not necessarily the mirror image of the determinants of dying in hospital relative to home. While being female, being older, and being unmarried were strongly associated with nursing home death, advanced education was inversely related to nursing home death as was the case for hospital death. Relative to Whites, Black decedents were not less likely to die in a nursing home, but Mexican and Central Americans were much less likely to do so. As for cause of death, relative to cancer, all other causes, particularly Alzheimer's disease, were associated with an increased likelihood of nursing home death.

In table 4, we present the MSA, county, and state factors that influence where people die. Beyond individual factors, we observed that the number of nursing home beds per 1000 was associated with increased nursing home death but that the number of hospital beds was associated with neither site of death. The racial/ethnic composition of the county seemed to influence the likelihood of hospital death but not nursing home death. As the percent of Black county residents increased so did the probability of dying in hospital but an association was not seen between percent Black and nursing home death nor was a strong association seen between percent Hispanic/Latino and either site of death. Conversely, as the percentage of county residents over 65 increased, so did an individual's probability of nursing home death but not hospital death.

Socioeconomic indicators of the county were also observed to affect site of death in that the percent of adults without a high school education was positively associated with dying in hospital, whereas the percent of families living in poverty was negatively associated with hospital and nursing home death. The extent to which an area was defined as rural or urban was neither consistently nor unidirectionally related to site of death.

The association of state policies, economic stratification, and "generosity" with site of death is displayed at the bottom of Table 4. The level of state Medicaid payment rate had a strong negative association with hospital death and a positive association with nursing home death. The ratio of the richest to the poorest segments of the population was found to be negatively associated with nursing home death, such that the greater the income disparity in a state, the lower the probability of dying in a nursing home. No similar associations were seen for hospital death. Per capita contributions to the United Way, an indication of the generosity of the population in investing in the social support network, were not associated with hospital death but were somewhat positively associated with nursing home death.

Discussion

As the discussion around end-of-life care intensifies, where that care is provided and how well it meets peoples' preferences becomes increasingly important. While this has meant an overall reduction in hospital deaths over time, very salient discrepancies in who dies where have emerged. The literature reveals that a number of features are associated with place of death and the consistency of these associations emphasizes the role of culture, access, and circumstance in influencing that place of death. Previous research was limited by ignoring nursing home deaths and largely focusing on individual level factors. Our analysis addressed both of these limitations and contributes to the literature by placing individuals into a geographic context.

Our individual-level results are largely consistent with those reported by others. However, they highlight the importance of including the nursing home in any evaluation of the determinants of end-of-life care. One of the most striking features of our findings is the lack of symmetry among the three main sites. That is, a particular group's decreased likelihood of hospital death relative to home death is not necessarily translated into an increased likelihood of nursing home death relative to home death. For instance, all non-White decedents had substantial increases in the probability of hospital death but no corresponding decrease in the probability of nursing home death (except for those who were Mexican or Central/South American).

Similarly, we found that being married was associated with a decreased likelihood of nursing home death and an increased likelihood of hospital death relative to home death. While this finding does not support our hypothesis that being married would be associated with home death, it is not completely surprising given how our sample differed from those used in prior research studies. We chose not to test interactions between marital status and either age or gender, but they may help to further clarify the role of marital status in affecting end-of-life care decisions.

The different effects in the two models illustrates that even though hospitals and nursing homes are both institutions, they are very different kinds of institutions that attract very different kinds of patients. The sorting processes that determine which kinds of people die where cannot be elucidated without simultaneously testing for home, hospital, and nursing home death.

The county level variables contextualize regional preferences and culture. In our multilevel analyses, this is striking since we control for the individual characteristics that might mediate this influence. Decedents who were not White were more likely to die in hospital than were those who were White. Meanwhile, a decedent who lived in a county with a high proportion of minority residents was more likely to die in hospital than was a decedent who lived in a county with a low proportion of minorities, regardless of that individual's own race/ethnicity. Similarly, a county's overall educational profile was associated with different probabilities of hospital death, regardless of individual education and its independent effect on site of death.

The strength of these county level variables provides support for our underlying conceptual framework. The market has clearly responded to some aggregate preference and in turn affected individual outcomes. Although we cannot identify the exact mechanism through which this process acts, we do know that certain groups, such as African Americans, have stronger preferences for more aggressive care (Borum, Lynn, and Zhong 2000; Hopp and Duffy 2000; Kwak and Haley 2005). What drives these differences in preferences is not relevant here; what is, however, is that they do appear to exert influence on all individuals by acting through the existing health care infrastructure designed to serve individuals' end-of-life needs.

Each individual's site of death outcome is a function of both preference and access. While certain groups may be more likely to choose a specific treatment alternative, others may not have that choice available to them. Living in a county with a high proportion of families living below the federal poverty line may be a proxy for living in a county with few resources. The net result of this is decreased access to hospital and nursing home beds. Since we did not have access to individual income data, we were unable to estimate the effect of personal income. In any case, understanding the influence of contextual factors may be more salient since individuals' income and assets at the end of life might be quite different from those available to them earlier in life.

Access also encompasses the availability of health services resources. Others have found that as a region's capacity to provide health services increases so does utilization of those services (Fisher et al. 2000; Fisher and Wennberg 2003; Wennberg et al. 1989). The observed association between number of nursing home beds and increased probability of dying in a nursing home directly mirrors this phenomenon. Surprisingly, no similar association was seen for number of hospital beds. It is unlikely that this is truly the case. Rather, we suspect that this association was obscured by the inclusion of other, perhaps more influential, variables. For instance, the percent of families living below the poverty line clearly represents a measure of county resource availability and may directly contribute to actual hospital bed availability. In other words, if counties without the resources to build more hospital beds are home to poorer residents, by controlling for regional resource availability (poverty level and educational level) we may have mitigated the effect health services capacity has on site of death.

Other research has shown that even a $10 difference in Medicaid daily reimbursement rate was associated with a reduced risk of hospitalization from the nursing home (Intrator and Mor 2004). Our observation of an increased risk of nursing home death with increased Medicaid payment rate is consistent with this earlier finding. Higher payment rates would facilitate the provision of more medically oriented care as acuity increased but would also provide an incentive to nursing homes to continue to serve their patients in the nursing home. This too is consistent with the finding that nursing facilities in states with higher nursing home Medicaid payment rates are significantly more likely to hire advanced practice nurses and to have higher levels of skilled nurses on staff (Intrator et al. 2005).

We expected that per capita United Way contribution would be a direct reflection of a population's investment in community services and that this would translate into greater availability of home-based and hospice care and a related increase in rates of home death. It is surprising to us that per capita contributions were not associated with hospital death but were positively associated with nursing home death. It may be that these contributions were invested in services for other segments of the population, such as services for children. Alternatively, the state may have been too large a region over which to generalize such community investments. Perhaps contributions were intended to strengthen a more local social network and that within-state variability in capacity and willingness to donate is large. We were unable to test this since this data was not available at the county level.

Finally, we found that the average household income ratio, which we included as a measure of income disparity, was strongly associated with decreased nursing home death. The most poor and the most rich are different in their ability and willingness to use nursing homes. States with greater disparity may have more older residents who are unable to afford nursing home care. Additionally, the segment of wealthier residents in these states may be more likely to use alternatives to nursing home care, such as assisted living or private home care services. This is consistent with our findings for measures of county wealth.

Limitations

While our study adds to the current literature in several ways, it is still limited by a number of factors. Due to NCHS restrictions we were unable to use the data of any decedent who died in a county with fewer than 50 deaths. When summed across all small counties, this resulted in a very large number of decedents and was the largest contributor to the total number of excluded deaths. Because of this, we are unable to generalize our findings to residents of less populated counties. More importantly, though, is the bias that may have been introduced. Smaller counties have different demographic profiles and health services capacity than do mid- or large-sized ones. Our representation of the population of U.S. decedents and the composition of counties is skewed; this is most notable in the mean proportion of minority residents across counties. We are unable to anticipate exactly how this may have affected our results. As discussed earlier, we lacked information on decedent income, which would have given us the ability to more appropriately examine and control for the effects of individual resource availability. Finally, we are limited by the lack of data on individuals' experiences leading up to the point where a "choice" was made about place of death. Where a person died is not necessarily the same as where that person was cared for and we are unable to determine the extent to which these two correlate. Similarly, we do not know what type or quality of care was actually provided prior to death.

Future Research

The desired outcomes in end-of-life care relate to comfort, support, and satisfaction, all of which are measures of how well provided care meets individual preferences and expectation. To date, however, we have only crude understandings of people's preferences for place of care and death. We have yet to learn how preferences for site of death change as illness advances and what this means for care providers. We also do not fully understand the role that racial and ethnic background have in shaping preferences for end-of-life care or how that will change as the demographic composition of the United States changes.

Beyond documentation, there is a need to ensure that there are programs and policies in place to actualize those preferences. Detailed qualitative research would enable us to identify what individuals, in different settings and with different needs, view as the major obstacles to care and death in a preferred site. Similarly, understanding the perceptions of health care providers may provide clues as how to better integrate end-of-life care into the larger health services framework and to encourage early discussions about preferences for the final days of life. Finally, research on regional health services infrastructure, including capacity and integration, will highlight what types of policies allow that infrastructure to be most responsive to the needs and desires of the local community.

Conclusions

Prospective interviews and surveys of the general population have shown that people would prefer to die at home but that this preference is affected by pragmatism and experience (Hays et al. 1999; Higginson and Sen-Gupta 2000; Townsend et al. 1990). Meanwhile, interviews with bereaved family members have revealed that dissatisfaction and unmet needs were more common among those cared for in any type of institution before death (Teno et al. 2004). It is difficult to deal with those individual issues in a large population-based analysis such as this one; however, if we set expressed preferences as our benchmark, we are able to at least determine how well our system of care meets that mark. Our research reveals that individual characteristics are the strongest predictors of where people die but that the local environment plays an important role in determining whether a person with chronic illness will die at home, in hospital, or in a nursing home. This is significant. Features of the local environment are amenable to change and can be shaped to facilitate the preferences of the local population. This can be observed in a community's investment in various forms of health care infrastructure, such as home and hospice care, each of which directly influence where people are cared for and ultimately die.

Appendix A
Summary of Published Papers on Site of Death that Met Inclusion Criteria for Review

	Author (Year of Publication)	Year of Data Collection	Country	Outcome[a]	Cause of Death
1	Bruera, Russell, Sweeney, Fisch & Palmer (2002)	1997–1998	U.S.A.	Hospital vs. home	Cancer
2	Bruera, Sweeney, Russell, Willey & Palmer (2003)	1997–1998	U.S.A.	Hospital vs. home	Cancer
3	Burge, Lawson & Johnston (2003)	1992–1997	Canada	Hospital vs. other	Cancer
4	Cantwell, Turco, Brenneis, Hanson, Neumann & Bruera (2000)	Not reported	Canada	Home vs. institution	All
5	Clifford, Jolley & Giles (1991)	1988	Australia	Home vs. other	All
6	Costantini, Balzi, Garronec, Orlandini, Parodi, Vercelli & Bruzzi (2000)	1991/1987–1988/1995	Italy	Home vs. other	Cancer
7	Costantini, Comoirano, Madeddu, Bruzzi, Verganelli & Henriquet (1993)	1991	Italy	Home vs. hospital	Cancer
8	Davison, Johnston, Reilly & Stevenson (2001)	1977/1987/1997	United Kingdom	Home vs. hospital vs. nursing home vs. hospice	Cancer
9	DeConno, Caraceni, Groff, Brunelli, Donati, Tamburini & Ventafridda (1996)	1989–1991	Italy	Home vs. hospital	Cancer
10	Fried, Pollack, Drickamer & Tinetti (1999a)	1989–1990	U.S.A.	Home vs. hospital/ hospice. Hospice vs. hospital/home	All
11	Fukui, Kawagoe, Masako, Noriko, Hiroko & Toshie (2003)	2001	Japan	Home vs. hospital	Cancer
12	Gallo, Baker & Bradley (2001)	1994	U.S.A.	Home vs. institution (not nursing home)	Cancer

(*continued*)

Appendix A (continued)

13	Gatrell, Harman, Francis, Thomas, Morris & McIllmurray (2003)	1993–2000	United Kingdom	Home vs. other. Hospital vs. other. Nursing home vs. other. Hospice vs. other	Cancer
14	Gaumer & Stavins (1992)	1982–1986	U.S.A.	Hospital vs. other	All
15	Higginson, Jarman, Astin & Dolan (1999)	1985–1994	United Kingdom	Home vs. other	Cancer
16	Hunt, Bonnett & Roder (1993)	1981/1985/1990	Australia	Home vs. other Nursing home vs. other	Cancer
17	Izquierdo-Porrera, Trelis-Navarro & Gomez-Baptiste (2001)	1995–1997	Spain	Hospital vs. other	Cancer
18	Karlsen & Addington-Hall (1998)	1995–1996	United Kingdom	Home vs. other	Cancer
19	Mann, Loesch, Shurpin & Chalas (1993)	1980–1990	U.S.A.	Home vs. hospital	Cancer (gynecologic)
20	McCusker (1983)	1976–1978	U.S.A.	Home vs. hospital. Home vs. nursing home	Cancer
21	Moinpour & Polissar (1998)	1980–1985	U.S.A.	Home vs. other	Cancer
22	Mor & Hiris (1983)	1981–1982	U.S.A.	Home vs. medical setting	Cancer
23	Pritchard, Fischer, Teno, Sharp, Reding, Knaus, Wennberg & Lynn (1998)	1992–1993	U.S.A.	Hospital vs. other	All
24	Sager, Easterling, Kindig & Anderson (1989)	1981–1985	U.S.A.	Hospital vs. other	All
25	Sambamoorthi, Walkup, McSpiritt, Warner, Castle & Crystal (2000)	1991–1998	U.S.A.	Hospital vs. other	AIDS
26	Tang (2002)	1991–1997	Taiwan	Home vs. hospital	Cancer
27	Temkin-Greener & Mukamel (2002)	1983–1998	U.S.A.	Home vs. hospital vs. nursing home	All
28	Weitzen, Teno, Fennell & Mor (2003)	1993	U.S.A.	Home vs. hospital vs. nursing home	All
29	Wilson, Northcott, Truman, Smith, Anderson, Fainsinger & Stingl (2001)	1927–1950 1950–1997	Canada	Hospital vs. other	All

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[a] Based on the dependent variable defined for statistical analyses. Nursing home as a site of death outcome specified only when independently identified in original article.

Appendix B
Summary of Associations between Selected Independent Variables and Site of Death[a]

	Associations with Hospital Death			Associations with Home Death		
	Positive	Negative	None	Positive	Negative	None
Age	13, 25	2, 3, 14, 23, 27, 28, 29	1, 17	6, 7, 12, 21	5, 8, 13, 15, 16, 22	9, 10, 11, 18, 19, 26
Gender (female)	14	3, 28, 29	1, 23, 25	6, 7, 10	9, 12, 13, 15, 16	5, 8, 11, 21, 22, 26
Race/ethnicity (non-White)	2, 23, 25, 28, 17,[b] 27				12, 22	
Social support (includes marital status)		2, 23	1	4, 5, 6, 7, 8, 9, 11, 12, 16, 21, 22		10, 18, 19, 26
Diagnosis (cancer)		23, 28	3, 17	5, 10		19, 26
Income/SES		13	3, 23	9, 12, 13, 15, 16, 22		4, 5, 20, 21
Education				6, 7, 22		
Physical impairment	27			10, 11, 26	18	
Proximity to hospital	13					
Year of death		3, 8		19		

[a] The numbers presented in the cells of the table correspond to the numbers assigned to each paper within Appendix A.

[b] Association found for females only.

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