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J Am Geriatr Soc. Author manuscript; available in PMC 2014 June 10.

Published in final edited form as:
J Am Geriatr Soc. 2011 December ; 59(12): 2321–2325. doi:10.1111/j.1532-5415.2011.03718.x.

Determinants of Death in the Hospital Among Older Adults

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Abstract

OBJECTIVES—To investigate patient-level determinants of in-hospital death, adjusting for patient and regional characteristics.

DESIGN—Using multivariable regression, the relationship between in-hospital death and participants' social, functional, and health characteristics was investigated, controlling for regional Hospital Care Intensity Index (HCI) from the Dartmouth Atlas of Health Care.

SETTING—The Health and Retirement Study, a longitudinal nationally representative cohort of older adults.

PARTICIPANTS—People aged 67 and older who died between 2,000 and 2,006 (N = 3,539) were sampled.

MEASUREMENTS—In-hospital death.

RESULTS—Thirty-nine percent (n = 1,380) of participants died in the hospital (range 34% in Midwest to 45% in Northeast). Nursing home residence, functional dependence, and cancer or dementia diagnosis, among other characteristics, were associated with lower adjusted odds of in-hospital death. Being black or Hispanic, living alone, and having more medical comorbidities

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Author Contributions: All authors contributed to the study concept and design, interpretation of the data, and preparation of the manuscript. Kelley and Sarkisian: Acquisition of data. Kelley and Ettner: Data analysis.

Sponsor's Role: The sponsors had no role in the design, methods, participant recruitment, data collections, analysis, or preparation of the manuscript.

Conflict of Interest: The authors report no financial or personal conflicts of interest. While conducting this work, Dr. Kelley was supported by the National Research Service Award Fellowship Program at the Univeristy of California at Los Angeles and the Brookdale Leadership in Aging Fellowship. Dr. Sarkisian is supported by the Veterans Affairs Greater Los Angeles Healthcare System Geriatric Research Education Clinical Center.

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were associated with greater adjusted odds, as was higher HCI. Sex, education, net worth, and completion of an advance directive did not correlate with in-hospital death.

CONCLUSION—Black race, Hispanic ethnicity, and other functional and social characteristics are correlates of in hospital death, even after controlling for the role of HCI. Further work must be done to determine whether preferences, provider characteristics and practice patterns, or differential access to medical and community services drive this difference.

Keywords

hospital use; end-of-life care; health services

Many people die in the hospital despite a commonly reported preference to avoid in-hospital death.[1–3] Studies have demonstrated that in-hospital death is associated with lower quality and satisfaction, as well as complicated grief of surviving family members.[4–7] Some speculate that people's fear of being a burden to family or having limited home care resources contribute to high rates of in hospital death.[1,8] The inability to accurately predict life expectancy of individuals with serious illness and the innate human desire to avoid death may also influence treatment plans and, thereby, site of death.[9–11] Regional characteristics and practice patterns may also influence location of death.[3,12]

Recent work from the Dartmouth Atlas of Health Care has demonstrated that one-third of Medicare beneficiaries with advanced cancer die in hospitals, and this rate varies widely (7–47%) in different geographic regions.[12] This study identified many systems-level factors associated with this variation but was not able to examine whether and to what extent individual characteristics contribute to this variation. Identification of patient-level determinants of in-hospital death, adjusting for geographic region, could advance understanding of possible sources of regional variation and may offer opportunities for intervention to align location of death with patient preference and care needs. Therefore, patient and regional characteristics were used to investigate patient-level determinants of death in the hospital.[13] It was hypothesized that, after adjusting for region, greater number of medical comorbidities, poor self-rated health, prior hospitalizations, and poorer functional status would be associated with greater odds in-hospital death and that higher educational attainment, higher net worth, and completion of an advance directive would decrease the odds of in-hospital death.

METHODS

Data Sources

Decedents from the Health and Retirement Study (HRS), a longitudinal nationally representative cohort of adults aged 50 and older were sampled. (Details of the HRS recruitment and enrollment procedures can be found at http://hrsonline.isr.umich.edu/sitedocs/irb/HRS_IRB_WebPackage-09-09.pdf.) During each interview cycle, HRS identifies participants who have died in the 2 years since the last interview wave. In these cases, an "exit" interview is conducted with someone who is knowledgeable about the deceased participant, usually a surviving spouse, adult child, or other close family member. The overall response rate for exit interviews is 93%. Given that a proxy cannot report self-

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rated health, this data element was collected from the preceding participant interview, conducted 0–2 years before the participant's death. All other participant variables were drawn from the exit interview. In sum, the HRS data comprise detailed information, including participants' demographic, social, functional, and medical characteristics. The sample of HRS decedents was limited to those aged 67 and older between 2000 and 2006 (N = 3,539 persons) to ensure that the vast majority of participants were insured by Medicare for 2 years before death.

Using the decedent's ZIP code, the HRS data were linked to the decedent's Hospital Referral Region (HRR) and the local Hospital Care Intensity Index (HCI). The Dartmouth Atlas of Health Care research group computed the HCI composite score (range 1–100), which reflects each HRR's intensity of hospital use and physician services.[14]

Statistical Analysis

Univariate and multivariate logistic regression were used to investigate the relationships between participants' demographic, social, functional, and medical characteristics and in-hospital death vs death in any other location. Being in the hospital at the time of death, the primary outcome, is indicative of a higher level of treatment intensity in the time immediately preceding death and is therefore distinct from death in other settings (home, assisted living, nursing home, hospice facility, and other), which were aggregated.

The independent variables age, race and ethnicity, sex, education, completion of an advance directive (living will, durable power of attorney for health care), net worth, number of medical comorbidities, self-rated health, functional status (ability to complete activities of daily living independently), nursing home residence, and living alone (a marker of limited social support) were included. The HCI was included in the multivariable model to adjust for regional intensity of hospital use and physician services in each participant's area of residence.[14] Sensitivity analyses were conducted adjusting for fixed HRR effects, but this did not change the results of the model. To account for within-region correlation of the error term, the final model was adjusted for regional clustering according to HRR. Multiple imputations (five cycles) were used to account for missing data.[15] Missing data accounted for 3.5% of data values and were most frequent for race (2%), education (7%), and net worth (14%). SAS 9.1 (SAS Institute, Inc., Cary, NC) and STATA 10 (Stata Corp., College Station, TX) were used for all statistical analyses and procedures. The University of California at Los Angeles Office for the Protection of Research Subjects, the Mount Sinai School of Medicine Institutional Review Board, and the HRS Data Confidentiality Committee approved the study.

RESULTS

Thirty-nine percent of HRS decedents died in the hospital. 26% at home, 26% in a nursing home, 6% in a hospice facility, and 1% in an assisted living facility. Rate of in hospital death varied according to major geographic region from 34% (Midwest) to 45% (Northeast). The median age of death was 83. Fifty-four percent of decedents were female, 77% were white, 44% lived alone, 36% were nursing home residents, and 60% had an advance

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directive. In the 3 months before death, 23% were independent in all basic activities of daily living. Thirty-one percent reported four or more medical conditions (Table 1).

Multivariable regression revealed several participant characteristics associated with greater adjusted odds of in hospital death (Table 2), including living alone (adjusted odds ratio (AOR) = 1.26, 95% confidence interval (CI) =1.03–1.54), stroke (AOR = 1.28, 95% CI = 1.02–1.61), greater number of medical comorbidities (AOR = 1.14, 95% CI = 1.03–1.25), black race (AOR = 1.63, 95% CI = 1.29–2.07), and Hispanic ethnicity (AOR = 1.46, 95% CI = 1.04–2.04). Many other characteristics were associated with lower adjusted odds of in-hospital death: nursing home residence (AOR = 0.53, 95% CI = 0.42–0.66), severe (AOR = 0.75, 95% CI = 0.59–0.96) or complete) AOR = 0.60, 95% CI = 0.48–0.75) dependence in activities of daily living, cancer (AOR = 0.69, 95% CI = 0.58–0.82), dementia (AOR = 0.70, 95% CI = 0.57–0.87), hospitalization within the past 2 years (AOR = 0.55, 95% CI = 0.47–0.65), and expectation of death by family (AOR = 0.76, 95% CI = 0.64–0.90). In addition, the local HCI was positively correlated with in-hospital death (AOR = 1.01, 95% CI = 1.00–1.01). To illustrate this effect size, a person living in an area with an HCI 1 SD above the mean would have a 28% greater odds of dying in the hospital, all else being equal. Completion of an advance directive was not significantly correlated with in-hospital death.

DISCUSSION

Black and Hispanic older adults are more likely to die in the hospital than non-Hispanic whites, even after controlling for socioeconomic, medical, and functional characteristics, as well as the hospital care intensity of the participants' geographic region. This finding is consistent with prior studies of other aspects of treatment intensity that demonstrate greater use of intensive care and higher medical costs at the end of life for black and Hispanic older adults.[16,17] Population-based survey evidence suggests that this may be at least partially due to racial and ethnic variations in treatment preferences,[18] yet further work is needed to determine whether the observed difference in location of death is truly aligned with participant and family preference or whether other factors also play a role such as differential access to medical and community services, such as hospice, that might make it easier for people to choose to spend their final days in their own home.[19,20] Greater odds of in-hospital death for black and Hispanic older adults may indicate that racial and ethnic disparities in health care persist throughout the life course.[21]

Other functional, medical, and social characteristics are statistically significant correlates of death in the hospital, and many of these relationships remain highly significant even after adjusting for regional clustering and index of treatment intensity. This finding suggests possible opportunities for targeted interventions to improve the match between care and preferences. For example, the odds of in-hospital death increase with the number of medical comorbidities. Perhaps efforts to improve the quality and coordination of care for people with multiple medical conditions who prefer to die at home would help more of these people achieve this goal.[22] Similarly, those who live alone are more likely to die in the hospital. This may indicate that lack of adequate social and community support are barriers to providing care in a noninstitutional setting. Individuals with compromised health status who live alone may be an important group to target for interventions to prospectively identify

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goals of care and provide the necessary support services to achieve those goals in a community setting.

These data also suggest that uncertainty surrounding prognosis may increase one's odds of in-hospital death. Prognostic inaccuracy is frequently cited as a barrier to timely advance care planning and provision of palliative care.[9,10,23] In this study, participants with more-predictable prognoses (diagnosis of cancer or dementia, complete functional dependence, prior hospitalizations) had lower odds of in-hospital death, whereas those with multiple chronic medical conditions had higher odds. Although improving communication about goals of care and expanding access to hospice and palliative medicine services for individuals with cancer and dementia are important goals, these results suggest that we may already be succeeding for those with specific terminal illnesses but may be missing an important opportunity to target such efforts on people with other chronic illnesses, multimorbidity, and less-predictable clinical trajectories.

Several characteristics did not have the expected relationship with in-hospital death. Although it had been hypothesized that higher educational attainment, higher net worth, and completion of an advance directive would decrease the odds of in-hospital death, none of these characteristics had an independent relationship with in-hospital death. In addition, it was hypothesized that prior hospital admission would be positively correlated with death in the hospital; the opposite was found. This may reflect patient or family preference to avoid hospitalization based upon a prior negative experience in the hospital; alternatively, the prior hospitalization may have provided an opportunity to clarify the person's previously unknown preferences. Further investigation of this relationship is important.

The absence of direct measurement of each participants' treatment preferences limit the results of this study. Although completion of an advance directive was included, this variable, defined in this study as a living will or durable power of attorney for health care, could not capture other forms of advance care planning or discussions of personal preferences and goals of care. In addition, the HRS data used in these analyses are drawn from interviews with proxy informants, typically a surviving spouse or adult child. Medical comorbidities are determined according to proxy report and do not necessarily reflect which conditions directly contributed to the participant's death. This study does not evaluate variation in hospital treatment intensity for those who died in the hospital. There is also potential bias, in that individuals residing in areas with higher intensity of care may have more diagnoses and hospital admissions, in addition to greater odds of death in hospital, although it was found that those with prior hospitalizations had lower odds of in-hospital death rather than higher odds, as one might expect with such a bias. Odds ratios must be interpreted cautiously when the likelihood of the outcome is common, as is the case for in hospital death. Finally, because the goal was to identify correlates of in-hospital death specifically, this site of death was evaluated in relation to any other site. Those who died at home may have been different from those who died in a nursing home, for example, but this study did not attempt to evaluate that difference.

To the knowledge of the authors, this study is the first to examine an extensive set of patient-level determinants of hospital death while adjusting for regional variation in

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treatment intensity. The results, based upon a nationally representative sample of older adults, provide an important step in examining the relationship between patient characteristics and end-of-life treatment intensity. These findings, in conjunction with further investigation of other aspects of treatment intensity, should help to prospectively identify individuals at risk for unwanted in-hospital death.

Acknowledgments

This work was presented as a poster on May 1, 2009, at the American Geriatrics Society national meeting, Chicago, Illinois, and May 14, 2009, at the Society of General Internal Medicine national meeting, Miami, Florida.

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Table 1

Participant Characteristics (N = 3,539)

Characteristic	Value
Female, n (%)	1,915 (54)
Age, n (%)	
<75	705 (20)
75–84	1,289 (36)
≥85	1,545 (44)
Education, n (%)	
<High school	1,368 (43)
Some college	1,407 (44)
≥College	396 (11)
Married, n (%)	1,385 (39)
Net worth, quartile ($), n (%)	
1 (<6,800)	697 (20)
2 (6,800–82,899)	738 (21)
3 (2,900–237,999)	734 (21)
4 (≥238,000)	762 (22)
Residential status, n (%)	
Nursing home resident	1,268 (36)
Living alone in community	1,559 (44)
Living with others in community	712 (20)
Activities of daily living 3 months before death (deficiencies), n (%)	
Independent (0)	817 (23)
Partially dependent (1–3)	545 (15)
Severe dependence (≥4)	500 (14)
Restricted to bed	1,677 (47)
Medical characteristics, n (%)	
Cancer	1,172 (33)
Congestive heart failure	808 (25)
Stroke	907 (27)
Dementia	639 (18)
Number of medical comorbidities, n (%)	
0	165 (5)
1–3	1,940 (63)
≥4	968 (31)
Self-rated health (up to 2 years before death), n (%)	
Poor or fair	1,991 (63)
Good	737 (23)
Very good or excellent	445 (14)

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Characteristic	Value
Hospital admission in past 2 years, n (%)	2,285 (65)
Advance directive completed, n (%)	2,082 (60)
Death expected by family, n (%)	2,111 (61)
Race, n (%)	
White	2,724 (77)
Black	512 (14)
Hispanic or Latino	234 (7)
Asian–Pacific Islander	19 (1)
In-hospital death, n (%)	1,374 (39)
Hospital Care Intensity Index, mean ± SD	53.5 ± 23.5

SD = standard deviation.

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Table 2

Unadjusted and Adjusted Odds of Death in the Hospital

	Unadjusted	Adjusted
Participant Characteristic (N = 3,539)	**Odds Ratio (95% CI)**	
Female	0.84 (0.74–0.97)*	0.94 (0.81–1.09)
Age (reference: <75)		
75–84	1.25 (1.08–1.43)†	0.96 (0.76–1.20)
>85	0.64 (0.56–0.74)†	0.79 (0.61–1.02)
Education (reference: <high school)		
Some college	0.89 (0.77–1.03)	1.00 (0.84–1.18)
≥College	1.10 (0.89–1.37)	1.22 (0.93–1.61)
Married	1.16 (1.01–1.34)*	0.94 (0.79–1.12)
Quartile of net worth (reference: Quartile 1)		
2	1.02 (0.86–1.21)	0.90 (0.73–1.12)
3	0.95 (0.80–1.13)	0.93 (0.73–1.20)
4	0.96 (0.81–1.14)	0.93 (0.73–1.19)
Residential status (reference: living with others in community)		
Nursing home resident	0.34 (0.29–0.39)†	0.53 (0.42–0.66)†
Lives alone in community	2.11 (1.84–2.42)†	1.26 (1.03–1.54)*
Activities of daily living (reference: independent)		
Partially dependent	1.56 (1.29–1.88)†	1.09 (0.87–1.37)
Severely dependent	0.86 (0.71–1.06)	0.75 (0.59–0.96)*
Restricted to bed	0.44 (0.38–0.50)†	0.60 (0.48–0.75)†
Medical characteristics		
Cancer	0.78 (0.67–0.90)†	0.69 (0.58–0.82)†
Congestive heart failure	1.00 (0.85–1.18)	0.93 (0.73–1.19)
Stroke	1.22 (1.04–1.43)*	1.28 (1.02–1.61)*
Dementia	0.52 (0.43–0.63)†	0.70 (0.57–0.87)†
Number of medical comorbidities	1.08 (0.96–1.23)	1.14 (1.03–1.25)†
Self-rated health (reference: very good or excellent)		
Poor or fair	0.95 (0.82–1.10)	1.08 (0.83–1.41)
Good	1.08 (0.91–1.28)	1.12 (0.85–1.49)
Hospital admission in past 2 years	0.49 (0.42–0.56)†	0.55 (0.47–0.65)†
Advance directive completed	0.63 (0.55–0.72)†	0.99 (0.83–1.17)
Death expected by family	0.49 (0.43–0.57)†	0.76 (0.64–0.90)†
Race (reference: non-Hispanic white)		
Black	1.67 (1.39–2.02)†	1.63 (1.29–2.07)†

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	Unadjusted	Adjusted
Participant Characteristic (N = 3,539)	**Odds Ratio (95% CI)**	
Hispanic or Latino	1.75 (1.34–2.29)†	1.46 (1.04–2.04)*
Asian–Pacific Islander	0.42 (0.14–1.26)	0.35 (0.13–0.96)*
Hospital Care Intensity Index (range 0–100)	1.01 (1.01–1.01)†	1.01 (1.00–1.01)†

Multivariable model adjusted for regional clustering according to Hospital Referral Region.

*$P < .05$,

†$P < .01$.

CI = confidence interval.