Use of Intensive Care Services during Terminal Hospitalizations in England and the United States

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Rationale: **Despite broad concern regarding the provision and cost of health care at the end of life, country-specific patterns of care have rarely been compared.**

Objectives: **To assess the use of hospital and intensive care services during terminal hospitalizations in England and the United States, two populations with similar socioeconomic backgrounds and life expectancies.**

Methods: **Retrospective cohort study over a 1-year period (2001) using national (England) Hospital Episode Statistics, and regional (seven U.S. states) administrative discharge data as well as English and U.S. census data. We measured hospitalization rates and death rates during hospitalization with and without intensive care.**

Measurements and Main Results: **Age-adjusted acute hospitalization rates were 110.5 per 1,000 population in England versus 105.3 in the seven U.S. states, with the same mortality rate (0.9 per 1,000 population) in both countries. Of all deaths, 50.3% occurred in hospital in England and 36.6% in the United States, yet only 5.1% of all deaths in England involved intensive care, versus 17.2% in the United States, representing 10.1% of hospital deaths in England versus 47.1% in the United States. Greater intensive care use in the U.S. was most notable with older age; among decedents 85+ years, intensive care was used for 31.5% of medical deaths and 61.0% of surgical deaths in the United States versus 1.9 and 8.5% of deaths in England.**

Conclusions: **Despite similar overall hospitalization rates in England and the United States, there were marked differences in terminal hospitalizations, with far greater use of intensive care services in the United States, especially among medical patients and the elderly population.**

Keywords: hospital mortality; intensive care units; terminal care; United States; England

AT A GLANCE COMMENTARY

Scientific Knowledge on the Subject

Despite broad concern regarding the provision and cost of health care among decedents, little is known about differences in patterns of care across countries.

What This Study Adds to the Field

Patterns of care among decedents differ dramatically in the United States and England. Half of all hospital deaths involve intensive care in the United States, compared with only 1 in 10 in England. The greatest limitations on intensive care during terminal hospitalizations in England occur among the elderly population and medical patients.

Intensive care services represent one of the most costly and labor-intensive aspects of healthcare in the developed world, involving expensive medications (1), high-tech equipment and interventions (2), and a high staff-to-patient ratio. There are calls to expand U.S. intensive care capacity to meet the demand as the population ages (3) and to find ways to decrease spending. It remains unclear whether the U.S. experience represents a high, low, or similar use of intensive care services, especially during terminal hospitalizations, in comparison with other countries.

Life expectancies both at birth and at age 65 are comparable in England and the United States, which also have similar age distributions of populations (4). Both also have large, predominantly urban, minority populations (5). In England, with universal healthcare provided by the National Health Service, much lower per-capita expenditures compared with the United States are enforced by national budgets and explicit (guidelines from the National Institute for Health and Clinical Excellence) and implicit rationing of services and treatments (6, 7). The use of intensive care, in particular, is limited by supply and admission to intensive care is predicated on the balance between resources and the likelihood of benefit to specific patients (8–10). How these more limited resources are distributed remains unknown.

The goal of this study was to quantify differences in patterns of care during terminal hospitalizations in England and the United States. Specifically, we examined the use of acute hospital and intensive care services among decedents with an exploration of variation by age and type of patient. Some of the results of this study have been previously reported in the form of an abstract (11).

METHODS

This is a retrospective cohort study of the use of acute hospital and intensive care services in England and the United States during terminal hospitalizations.

Data Sources

We used data from the year 2001 to coincide with the most recent accurate population-based census data from the two countries (the last census in the United States was 2000 and in England 2001). For websites accessed, *see* the online supplement. For England, population estimates for 2001 were from the UK National Statistics website, and national mortality data were from the same site (dataset name: PD1016A, taken from Table 6 published in Mortality Statistics, general, 2001 [series DH1 no. 34]). We obtained data from the Hospital

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Episode Statistics database for the year 2001, which includes administrative data on all hospitalizations in England, including information on intensive care use and hospital mortality. For the United States, we used estimates of intensive care use previously published by Angus and colleagues, updated from the original 1999 data to 2001 with an additional state, for a more accurate comparison with England (12). We examined all discharges recorded in seven states' hospital discharge databases. These seven states (Florida, Massachusetts, New Jersey, New York, Texas, Virginia, and Washington) represent 29% of the U.S. population and have high-quality hospital discharge data, including information on intensive care use. For their representativeness of overall U.S. hospital data, please see the article by Angus and colleagues (12). We obtained national and state-specific population estimates from the U.S. Census Bureau for 2001 and national and state-specific mortality data from the CDC-NCHS National Vital Statistics System.

Sample Selection

The sample for this analysis included all persons discharged from a National Health Service Trust acute care hospital in England and from any acute care hospital in seven states in the United States from January 1 through December 31, 2001. For exclusions, please *see* the online supplement. Dates of intensive care unit (ICU) admission, discharge, and of extubation were not available in these data from either country. Therefore, we could not determine whether persons who died in hospital after intensive care admission were in the ICU on the day of death (e.g., died "in" an ICU) or had been transferred to a general floor or stepdown unit. Therefore, this article refers to patients as using intensive care services during terminal hospitalizations rather than as dying in the ICU. We also did not attempt to classify the number of days of intensive care, thereby avoiding any concerns regarding exact billing of number of intensive care or intermediate intensive care days in the United States (13).

We examined patients by medical and surgical status and their use of intensive care services during terminal hospitalizations. These definitions in the England data were based on whether the admission included at least one operative procedure code. In the U.S. data, these definitions were based on the Diagnostic Related Categories for each discharge. We also examined discharges with a few specific medical diagnoses: solid neoplasms, hematologic neoplasms, cerebrovascular disease, and pneumonia. These diseases were not chosen to be exhaustive; rather, they were chosen for illustrative purposes because they represent common diagnoses that are a mix with regard to age of presentation and expected mortality. For example, hematologic malignancies occur throughout life, whereas pneumonia has a high prevalence among the elderly population. We also selected three surgical procedures for comparison: hip replacement, lung surgery, and coronary artery bypass grafting (CABG). These surgical procedures were selected to cover a range of procedures that were circumscribed with regard to the actual procedures performed. Details of the specific ICD-9, ICD-10, and OPCS-4 categories are given in the online supplement.

Statistical Analysis

We calculated the overall hospitalization rates and hospital mortality in England and the seven states in the United States, with the England rates standardized to the population of the seven U.S. states using 5-year age groups, and summarized the overall use of intensive care. We calculated the proportion of decedents who died with and without the use of intensive care services by age groups, medical/surgical subgroups, and specific diseases and surgical procedures. The database management and calculation of descriptive statistics were performed using Visual FoxPro 9.0 (Microsoft, Redmond, WA), Excel (Microsoft), and Stata 9.0 (StataCorp LP, College Station, TX). Appropriate ethics approval for this study was sought and waived by the Columbia University Institutional Review Board.

RESULTS

Use of Hospital and Intensive Care Services

There were approximately 5,726,709 hospitalizations in 2001 in England and 8,462,172 hospitalizations in the seven states in the United States. This represented a similar number of age-adjusted acute hospitalizations per 1,000 population in the two countries (110.5 in England vs. 105.3 in the United States) (Table 1). Surgical discharges made up 42.8% of all discharges in England, compared with 31.7% in the United States. Overall crude hospital mortality was slightly higher in England (4.3%) compared with the United States (3.0%). Of all hospital discharges, only 2.2% used intensive care services in England, whereas 19.3% used intensive care services in the United States. Hospital mortality for the small number of patients who used intensive care services in England was higher (19.6%) compared with those using intensive care services in the United States (7.4%).

Use of Intensive Care Services among Decedents

In 2001, there were 493,054 deaths in England (0.9 deaths per 1,000 population, age-standardized to the population of the seven U.S. states) and 704,028 deaths in the seven U.S. states (0.9 per 1,000 population). Of these deaths, 50.3% occurred in an acute hospital in England, versus 36.6% in the United States. For all deaths in England, only 5.1% involved intensive care services, versus 17.2% in the United States. In addition, 10.1% of hospital deaths involved intensive care services in England, versus 47.1% in the United States.

Variation in Decedents' Hospital and Intensive Care Use by Age

A higher percentage of people died in an acute hospital (vs. outside of the hospital) across all age groups in England compared with the United States (Figure 1). In particular, a substantially greater proportion of the elderly patient population (85 years and older) died in the hospital in England compared with the United States (47.4 vs. 31.2%). Despite the high hospital use at the end of life for the elderly population in England, there was minimal use of intensive care services in this age group, with only 1.3% of all decedents over the age of 85 receiving intensive care versus 11.0% in the United States.

TABLE 1. ESTIMATED NATIONAL MORTALITY, HOSPITAL, AND INTENSIVE CARE USE IN 2001 IN ENGLAND AND THE UNITED STATES*

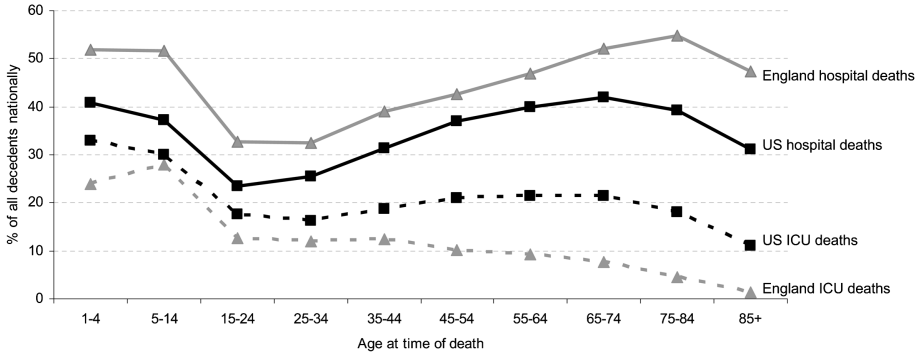
	England	United States (seven states)
Total population	48,867,538	80,336,618
Total hospital discharges	5,726,709	8,462,172
Surgical discharges, %	42.8	31.7
Hospital discharges with intensive care, n	127,614†	1,634,220
Hospital discharges with intensive care, %	2.2†	19.3
Hospital discharges per 1,000 population‡	110.5	105.3
Hospital mortality for discharges with intensive care, %	19.6	7.4
Hospital length of stay, median, (IQR)	3 (1–8)	4 (2–7)
Mean ± SD	8.1 ± 18.1	5.8 ± 8.8
Hospital deaths	247,913	257,906
Hospital mortality, %	4.3	3.0
Hospital deaths with intensive care	24,991†	121,411
Total deaths (in and out of hospital)	493,054	704,028
Total deaths per 1,000 population‡	0.9	0.9
Deaths in the hospital, % of total	50.3	36.6
Deaths involving intensive care, % of total	5.1†	17.2
Deaths involving intensive care, % of hospital deaths	10.1†	47.1

Definition of abbreviation: IQR = interquartile range.

* All data exclude those less than 1 years of age. Length of stay data were truncated at 365 d.

† For England, scaled up from the 56% of intensive care beds included in the analysis of intensive care data.

‡ Age standardized using 5-yr age bands to U.S. population in the seven states.



US (7 states)	n=1,450	1,883	8,636	12,448	27,289	49,005	70,735	125,381	207,331	199,870
England	n=552	786	2,763	4,849	9,170	20,767	41,979	91,242	164,169	156,777

Figure 1. The percentage of all decedents in England and the United States in 2001 who died in the hospital and the percentage of all decedents who received intensive care services, stratified by age. ICU = intensive care unit.

Variation in Decedents' Intensive Care Services by Surgical (vs. Medical) Admission

In England and the United States, a greater percentage of surgical patients who died in the hospital received intensive care services compared with medical patients (Figure 2). The highest use was among surgical patients aged 1 to 4 years in the United States; 90% of those who died received intensive care. All percentages in both countries declined among the elderly population, with the lowest use of intensive care services in England for medical decedents aged 85 years or older (1.9% of hospital deaths vs. 31.5% in the United States).

The overall use of intensive care among hospital decedents with specific medical diagnoses was very similar (and low) across all the diagnoses examined in England (Figure 3), with significant variation depending on the diagnosis in the United States. Intensive care among hospital decedents who received different surgical procedures was overall higher in England than for the medical diagnoses examined, consistent with the overall trends for medical and surgical patients. For CABG, the use of intensive care before death in the hospital in England was very similar to the use in the United States.

DISCUSSION

In two developed countries with similar life expectancies and overall use of acute care hospital services, the use of in-hospital resources during terminal hospitalizations was dramatically different. More deaths in England occurred in the hospital compared with the United States. Yet, there was a fourfold higher use of intensive care services in the United States compared with England. The largest divergence in use appeared to be among older people. In England, a greater percentage of deaths among older people occurred in the hospital compared with the United States. There was almost no use of intensive care services among decedents 85 years of age and older in England.

Given that the United Kingdom has one sixth the number of intensive care beds per capita, it is not surprising that large differences in care patterns exist (14). The two countries have similar rates of intensive care use among children and young adults who died. Young persons represent a small fraction of all ICU admissions and deaths, placing less of a burden on available resources. They may also be the most unexpected and thus difficult to plan for in the United Kingdom. Alternately, the higher rate of terminal intensive care among young persons than among older persons in the United Kingdom may represent an emphasis on "fair innings" (i.e., giving younger people every chance to have a full life) rather than (age-blind) distributive justice (15). The overall higher use of intensive care among surgical decedents in both countries may also reflect a population whose deaths were less expected so as to preclude rationing decisions in the United Kingdom. Alternately, it may reflect a fiduciary commitment to treatment in the context of (potentially iatrogenic) complications with untoward outcomes in both countries.

A few studies have quantified place of death in England and the United States (16–18). Between 1988 and 1995, the proportion of Medicare beneficiaries dying in an acute care hospital decreased, which is consistent with the trend toward decreasing acute care hospital beds in the United States (19). The higher percentage of deaths in acute hospitals in England compared with the United States, however, is perhaps surprising, given the

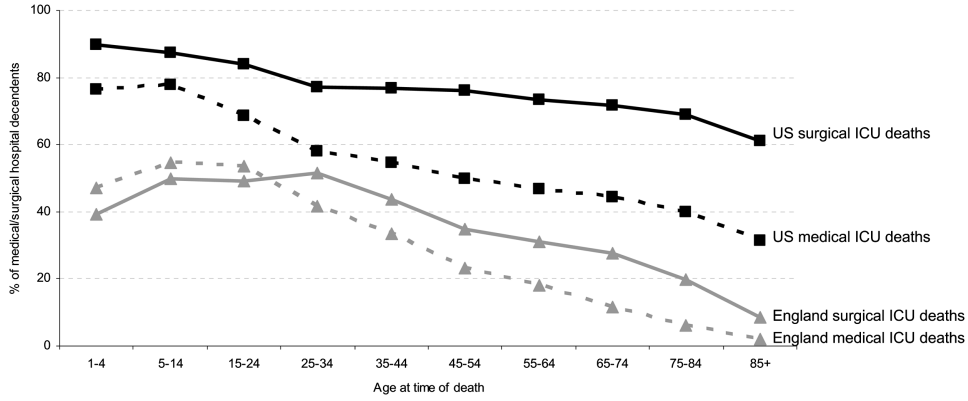


Figure 2. The percentage of all patients who died in hospital in England and the United States in 2001 who received intensive care services, stratified by medical and surgical status and age. ICU = intensive care unit.

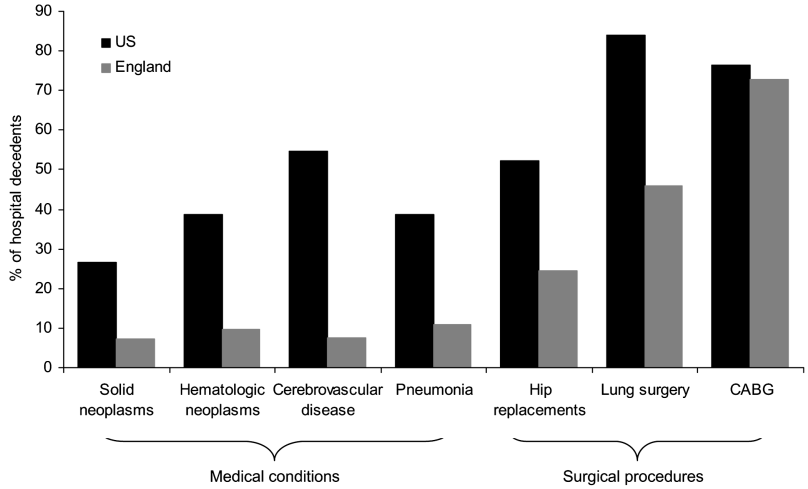


Figure 3. The percentage of patients with specific medical conditions and surgical procedures who died in hospital in 2001 who received intensive care services. Medical conditions examined: solid neoplasms, hematologic neoplasms, cerbrovascular disease, and pneumonia. Surgical procedures: hip replacements, lung surgery, and coronary artery bypass grafting (CABG).

overall lower expenditure on healthcare in the United Kingdom and the similar number of hospital beds per capita compared with the United States (20). One possible explanation is the increasing use of skilled nursing and out-of-hospital hospice care in the United States (21). The percentage of deaths that occur in U.S. hospitals may be lower, not because of a lower overall hospitalization rate or death rate but because patients near death are being discharged to other facilities, such as hospice, to die (22).

There are a number of limitations to this study. First, these data are from large administrative databases and were not collected prospectively for this study. The use of state and national administrative datasets to examine intensive care services during terminal hospitalizations limits our ability to describe details of these patterns; in particular, we were unable to clarify whether patients died in the ICU versus in the hospital after transfer out of intensive care. However, other data in England and the United States suggest that about two thirds of deaths involving intensive care patients occur in the unit, and the other third occur after transfer out of intensive care (23, 24). Moreover, prior analysis by Angus and colleagues examining U.S. ICU deaths found that 40.7% of the decedents spent the entire hospital episode in the ICU, and 55.9% spent 2 days or less outside the ICU, suggesting that the majority of intensive care use occurs at or near to the end of life (12). Data from Northern Europe suggest that for the majority of patients who die during or after intensive care, only a small fraction (10%) undergo unsuccessful cardiopulmonary resuscitation, whereas the rest have withholding or withdrawing of care (25). Even though planning of care for the end of life may not be predictable in terms of weeks or months, some planning seems to occur during the majority of terminal hospitalizations that involve intensive care.

Another limitation is potential differences in intensive care. We have tried to use comparable definitions based on the data available in the two countries, but it is possible that there are differences in the groups being compared with regard to definitions of intensive care, the intensity of interventions, and nursing. In particular, we used an inclusive definition of intensive care for England by including all high dependency units (HDUs) and excluded those who received coronary care in both countries (unless they were in a "mixed" unit in England). Moreover, definitions of patients who require "level 2" and "level 3" care in England, which we have included in this study, are comparable to the definition under Medicare of critical care services (26). The data on intensive care among decedents who had a CABG provide a useful reassurance that these data adequately capture intensive care use in a similar way. For these patients, the use of intensive care among decedents was very high in both countries, which would be expected because patients are likely to receive intensive care after CABG surgery no matter where the surgery is done. Older survey data from the United Kingdom demonstrated that zero wards and only 11% of HDUs reported the ability to provide mechanical ventilation for patients, and (in the late 1990s) less than half of hospitals had the ability to provide noninvasive positive pressure ventilation for patients with chronic obstructive pulmonary disease, suggesting that critical care was unlikely to be routinely provided outside of defined units despite the low number of ICU beds (27, 28). More recent survey data suggest this may be slowly changing, with greater availability of services such as noninvasive positive pressure ventilation (29). The question remains of whether we have captured all delivery of critical care services, especially "high-dependency" or "step-down" care in each country.

These data quantify the deaths that occurred in each country as a whole during terminal hospitalizations and do not capture the substantial variation in intensity and quality of care that are known to exist within England and the United States (30, 31). We cannot identify patients at high risk of death or provide detailed information on severity of illness to comment on the relative quality of care delivered or expected mortality. Moreover, we cannot elucidate the decisions of clinicians, patients, and families but are restricted to commenting on patients who died during a hospitalization. Therefore, we are limited in the conclusions we can draw regarding the relative utility of intensive care. Other studies that have examined the potential mortality associated with refusal of admission to intensive care, or suboptimal care (including late admission), have consistently found higher mortality among patients who did not receive immediate intensive care (8, 32).

Many factors likely influence the divergent patterns of care at the end of life in these two countries. Legally who makes decisions regarding treatment for incapacitated patients is different between England and the United States. In England the decisions regarding care usually ultimately rest with the clinician, whereas the U.S. model places much more emphasis on the autonomy of the patient and/or surrogate decision-makers (33). Cultural norms, in terms of patient expectations and caregiver decisions, may also differ (34, 35). For example, an international survey of physicians demonstrated variation between the United States and Northern Europe with regard to aggres-

siveness of care for a given patient scenario, with more aggressive care given by U.S. physicians (36), although surveys suggest that in neither country would the majority of people choose to die in the hospital (37, 38). The different availability of resources, and particularly intensive care beds, may also influence decision-making out of necessity and may therefore shape cultural expectations for care.

Understanding of patterns of care and "how" we die is an area where health information is lacking (39). Knowledge regarding use of intensive care services is particularly important because it is costly, resource intensive, and potentially traumatic for patients and families. Whether England underuses intensive care or the United States overuses it is unclear. Further research is needed to learn how to optimize the balance between life-saving and nonbeneficial intensive care in developed countries with aging populations; clearly the United States and United Kingdom approach this balancing act in very different ways.

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