

Original Investigation

Comparison of Site of Death, Health Care Utilization, and Hospital Expenditures for Patients Dying With Cancer in 7 Developed Countries

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IMPORTANCE Differences in utilization and costs of end-of-life care among developed countries are of considerable policy interest.

OBJECTIVE To compare site of death, health care utilization, and hospital expenditures in 7 countries: Belgium, Canada, England, Germany, the Netherlands, Norway, and the United States.

DESIGN, SETTING, AND PARTICIPANTS Retrospective cohort study using administrative and registry data from 2010. Participants were decedents older than 65 years who died with cancer. Secondary analyses included decedents of any age, decedents older than 65 years with lung cancer, and decedents older than 65 years in the United States and Germany from 2012.

MAIN RESULTS AND MEASURES Deaths in acute care hospitals, 3 inpatient measures (hospitalizations in acute care hospitals, admissions to intensive care units, and emergency department visits), 1 outpatient measure (chemotherapy episodes), and hospital expenditures paid by insurers (commercial or governmental) during the 180-day and 30-day periods before death. Expenditures were derived from country-specific methods for costing inpatient services.

RESULTS The United States (cohort of decedents aged >65 years, N = 211 816) and the Netherlands (N = 7216) had the lowest proportion of decedents die in acute care hospitals (22.2% and 29.4%, respectively). A higher proportion of decedents died in acute care hospitals in Belgium (N = 21 054; 51.2%), Canada (N = 20 818; 52.1%), England (N = 97 099; 41.7%), Germany (N = 24 434; 38.3%), and Norway (N = 6636; 44.7%). In the last 180 days of life, 40.3% of US decedents had an intensive care unit admission compared with less than 18% in other reporting nations. In the last 180 days of life, mean per capita hospital expenditures were higher in Canada (US \$21 840), Norway (US \$19 783), and the United States (US \$18 500), intermediate in Germany (US \$16 221) and Belgium (US \$15 699), and lower in the Netherlands (US \$10 936) and England (US \$9342). Secondary analyses showed similar results.

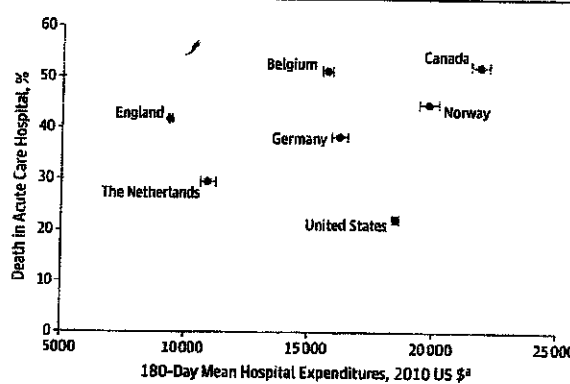
CONCLUSIONS AND RELEVANCE Among patients older than 65 years who died with cancer in 7 developed countries in 2010, end-of-life care was more hospital-centric in Belgium, Canada, England, Germany, and Norway than in the Netherlands or the United States. Hospital expenditures near the end of life were higher in the United States, Norway, and Canada, intermediate in Germany and Belgium, and lower in the Netherlands and England. However, intensive care unit admissions were more than twice as common in the United States as in other countries.

Table 1. Health Insurance Systems, Hospital Payment Structures, and Data Sources in 7 Developed Nations

Country	Health Insurance System	Hospital Payment Structure	Data Source	Source Description	Population Covered by Data Source
Belgium	Statutory multipayer insurance	Global lump sum with DRG-based hospital budget and per diem payments	InterMutualist Agency, comprising data from all 7 sickness funds mandated by statutory health insurance; cases with cancer as identified through the Belgian Cancer Registry were selected	Linked registry-administrative claims data set for all health-insured persons in Belgium (health insurance is mandatory in Belgium)	10.5 million persons (95% of Belgium's population in 2010)
Canada	Single public payer by province	Global, lump-sum payments	Ontario Health Insurance Plan in Canada's most populous province; linkage via encrypted health insurance numbers to the Canadian Institute for Health Information Discharge Abstracts Database, the Same Day Surgery, the National Ambulatory Care Reporting System database, and the Registered Persons Database	Linked registry-administrative claims data set for all health-insured persons in Ontario; there are small differences in cohort population sizes for expenditure and nonexpenditure data because expenditure cohort size relied on real-time calculations reflecting small dynamic updates in the registered persons database	All people in Ontario, a population of 12.9 million persons in 2011 (38% of the Canadian population in 2011)
England	Single public payer	Global, lump-sum payments combined with per-patient payments by DRG	Hospital Episode Statistics linked to death certificates	Linked registry data set comprising all hospital admissions for persons in England matching a death registered in England or Wales	All people in England, a population of 52.6 million persons in 2010
Germany	Statutory multipayer insurance	Per-patient payments by DRG	BARMER GEK, the largest sickness fund mandated by statutory health insurance	Administrative claims data set	8.5 million persons in Germany (10.4% of Germany's population in 2010)
The Netherlands	Multipayer private insurance	Per-patient diagnosis-treatment combinations, which are DRG-like	Achmea, the major health care insurer, linked to the Hospital Discharge Register and Cause of Death Register, provided by Statistics Netherlands	Linked registry-administrative claims data set	3.6 million persons in the Netherlands (22% of the Netherlands' population in 2010)
Norway	Single public payer	Global, lump-sum payments combined with per-patient payments by DRG	Norwegian Patient Register, comprising data on all hospital admissions in Norway	Administrative claims data set	All people in Norway, a population of 4.9 million persons in 2010
United States	Public and private multipayer insurance	Per-patient payments by DRG (Medicare)	Centers for Medicare & Medicaid Services Medicare files	Administrative claims data set	100% of all fee-for-service Medicare beneficiaries aged >65 y in the United States

Abbreviation: DRG, diagnosis related group.

Figure. Hospital Expenditures in the Last 180 Days of Life for Patients Older Than 65 Years Dying With Cancer in Acute Care Hospitals in 7 Developed Nations



Physician costs associated with hospital admissions are included in mean hospital expenditures reported for the 6 non-US nations. United States expenditures shown are an underestimate because physician costs are not included; in the United States, it is estimated that Medicare Part B, which includes physician costs, adds an average of 11.5% in expenditures to mean hospital expenditures. Error bars indicate 95% confidence intervals.

* Using 2011 health-specific purchasing power parity conversion.

Table 2. Characteristics of Cohorts of Decedents Older Than 65 Years With Any Cancer

Characteristics	Belgium	Canada	England	Germany	The Netherlands	Norway	United States
Country statistics for persons aged >65 y, No.							
National population, 2010 ^a	1 860 159	4 819 600	8 020 000	19 933 067	2 538 328	670 733	40 267 984
Deaths due to all cancers, 2010 ^b	21 054	53 467 ^c	97 099	167 406 ^d	30 621 ^e	8387 ^f	396 173 ^g
Decedents in cohort, 2010, No. ^h	21 054	20 818 ^b	97 099	24 434	7216	6636	211 816
Female, No. (%)	9665 (45.9)	9722 (46.7)	45 609 (47.0)	12 427 (50.9)	2981 (41.3)	2960 (44.6)	94 697 (44.7)
Age, y							
Mean (SD)	78.9 (7.5)	78.8 (7.9)	79.2 (7.6)	79.5 (7.9)	78.7 (7.7)	78.5 (7.6)	79.4 (7.8)
No. (%)							
66-74	6383 (30.3)	6745 (32.4)	45 609 (30.5)	7726 (31.6)	2330 (32.3)	2203 (33.2)	65 190 (30.8)
75-84	9411 (44.7)	8723 (41.9)	41 749 (43.0)	9450 (38.7)	3063 (42.4)	2800 (42.2)	87 055 (41.1)
≥85	5259 (25.0)	5350 (25.7)	25 700 (26.5)	7258 (29.7)	1823 (25.3)	1632 (24.6)	59 520 (28.1)
Cancer diagnoses, No. (%)							
Lung	4063 (19.3)	4622 (22.2)	21 092 (21.7)	3577 (14.6)	1354 (18.8)	1241 (18.7)	44 942 (21.2)
Breast	1369 (6.5)	812 (3.9)	6256 (6.4)	2692 (11.0)	480 (6.7)	358 (5.4)	21 970 (10.4)
Colon	2969 (14.1)	2082 (10.0)	10 298 (10.6)	3630 (14.9)	954 (13.2)	803 (12.1)	20 544 (9.7)
Prostate	1663 (7.9)	1395 (6.7)	8368 (8.6)	2865 (11.7)	697 (9.7)	783 (11.8)	39 312 (18.6)
Hematologic	1347 (6.4)	2394 (11.5)	7796 (8.0)	2732 (11.2)	562 (7.8)	531 (8.0)	28 508 (13.5)
Other	9622 (45.7)	9513 (45.7)	43 299 (44.6)	8938 (36.6)	3169 (43.9)	2913 (43.9)	56 540 (26.7)

^a Canada and Norway population as reported by the World Bank. England and the Netherlands population as reported by the Office for National Statistics (England) and Statistics Netherlands. Belgium population as reported by Eurostat. United States population as reported by the US Census Bureau. Germany population as reported by Eurostat.

Canada, Canadian Vital Statistics, Death Database.

^d As reported by Statistisches Bundesamt, Mortality Statistics 2010 (Todesursachenstatistik).

^e Cause of death as registered at Statistics Netherlands.

^f As reported by the Norwegian Cause of Death Registry (includes age >65 years).

^g As reported by the US Census Bureau.

^h Ontario province, comprising approximately 38% of the Canadian population.

^c Estimated mortality rates for benign and malignant cancers in 2010, Statistics