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Temporal trends in the relative cost of dying: Evidence from Canada

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ABSTRACT

Objective: To measure change over time in the relationship between health care expenditures for individuals that die in a given year and age matched survivors.
Methods: Administrative data covered government-funded hospital, physician, prescription drug, and continuing care services for the entire population aged 65 and over in the province of British Columbia between 1991 and 2001. Individuals were separated according to age group and decedent/survivor status. The average utilization cost was estimated for each age group and survivor status in each year from 1991 to 2001. Time trends in decedent and survivor costs, and the ratio between the two, were analyzed for each service category.
Results: Inflation-adjusted decedent costs rose by almost 10% between 1991 and 2001, while survivor costs fell slightly. The ratio of decedent to survivor costs increased for all age groups, and was greatest for hospital and continuing care costs. Although the study population mortality rate fell over the study period, the proportion of health care costs allocated to decedents grew by 8%.
Conclusions: If mortality rates continue to fall, lower survivor costs and higher decedent costs will lower future growth in health expenditures due to aging.

1. Introduction

The aging population – commonly expressed as an increase in the percentage of the population over 65 years of age – is often identified as one of the primary drivers of health expenditures [1–3]. Forecasters combine the observation of higher per capita spending at older ages with the growth in the proportion of the population in these age groups to demonstrate how aging may lead to expenditure growth [4–6]. However, age-specific per capita expenditures are not necessarily stable over time. In the United States, lower than average rates of per capita expenditure growth among older cohorts have mitigated the effect of the aging population [7,8].

One possible reason for the low expenditure growth for the elderly may be reduced age-specific mortality. Between 1985 and 2000, US mortality rates fell by 15.5% for the cohort aged 65–74 and by 4.5% for those 75+ [9]. With a decline in mortality rates, the share of Medicare expenditures attributed to individuals that died in a given year fell. While Lubitz and Riley [10] attributed 31% of 1980 Medicare expenditures to decedents, Hoover [11] found this figure had dropped to 26% over the 1992–1996 period.

With the aging trend in Western countries set to accelerate in the coming decades [12], understanding the trends in health expenditures among the elderly, and how these trends might respond to different scenarios regarding mortality and life expectancy is an important research objective. 'Cost of dying' studies, which compare expenditures and/or utilization for individuals who die in a given year ('decedents') to those of the same age who continue

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to live beyond that year ('survivors'), can provide valuable insight into the way in which health care resources are allocated. For example, studies have shown that expenditures attributable to decedents decline with age at death for both hospital and US Medicare program expenditures [10,11,13–20], while they increase with age at death for the US Medicaid program, nursing homes, and home-based care [11,18,20–22]. In contrast, for survivors, expenditures on all services rise with age, and dramatically so for nursing homes and home care [11,18,20,22].

The disparity between cost of dying estimates for emergency services versus long-term care services suggests that, to use the dichotomy employed by Polder et al. [20], treatment of health crises associated with death shifts from medical "cure" to social "care" as age at death rises. In these conditions, trends towards older populations and longer life expectancy would be expected to increase pressures on social care resources. However, it is possible that cost of dying estimates may not be stable over time. In the last few decades, there has been a shift in many jurisdictions from facility-based to community-based care; increased use of pharmaceuticals and outpatient procedures [23]; significant decreases in hospital admissions and lengths-of-stay [13,23,24]; and improvements in age-specific mortality and morbidity [25–27]. Measuring how decedent and survivor expenditures have responded to these trends would help inform expectations for future expenditures given continued growth in and changes to the aging of the population.

Our study seeks to shed light on the question of time trends in the cost of dying among the elderly. We expand on the existing literature by using a longer – and more recent – utilization period. The study covers a broad spectrum of health care services, through use of data from the British Columbia Linked Health Database (BCLHD). In Section 2, we describe the data and the assumptions made in its preparation, and the methods used to calculate the cost of dying. The findings are outlined in Section 3, while Section 4 address the implications and limitations of our study. In Section 5, we briefly summarize our conclusions.

2. Materials and methods

In British Columbia, as in the rest of Canada, the majority (approximately 70%) of health expenditures are financed by government [28]. Ninety-four percent of hospital and 99% of physician expenditures are publicly financed. Overall, public coverage of health spending in BC was between 72.9 and 74.2% over the study period from 1991 to 2002.

The BCLHD contains vital statistics as well as individual-level utilization records for publicly funded hospitals, physicians' services, prescription drugs, and home- and facility-based continuing care [29]. We used these data to estimate service utilization costs for each individual in each year, and related these costs to an individual's survivor status and known date of death (if any).

The cohort includes all individuals aged 65+ in each year. Individuals first appeared in our dataset the year they turned 65 and dropped out due to death or departure from the province. We chose 65 as our cut-off since prescription drug coverage is not provided on a universal basis to those less than 65 years of age.

The study population comprised 97.6% of the actual 65+ population in 1991, and over 99% of that cohort in every year between 1994 and 2002 [30]. Such extensive coverage alleviates the potential for selection bias. The study period was from 1991 through 2001. Data from 2002 were partially used for the decedent cohort due to the way in which decedent years were created for comparative purposes (see section).

While physician billings and prescription data were provided in monetary terms, hospital and continuing care data provided only utilization, which then needed to be converted to costs. For hospitals, we multiplied the resource intensity weight (RIW) per day for each episode of care by the cost per weighted case (CWC). RIWs are calculated by the Canadian Institute for Health Information (CIHI) using Canadian data to model how treatment intensity and expected length of stay vary according to diagnosis, complexity, and age [31]. CWC estimates the dollar value for a case with unitary RIW. Province-wide CWCs for the study period were obtained from the BC Ministry of Health [32]. For continuing care costs, we used calculations from Hollander [33], which applied unit costs to continuing care data (such as labour rates and equipment costs) to obtain per diem rates for facility care, by level of care, and for adult day care and homemaking services for the years 1991/1992 and 1996/1997. Service costs for years other than 1991/1992 and 1996/1997 were estimated through interpolation and extrapolation. All service costs were adjusted for medical inflation for British Columbia as calculated by Statistics Canada [34] and reported in 2002 Canadian dollars.

The data set contained 878,375 unique individuals, of whom 276,221 (31.4%) died during the study period. After eliminating duplicate death records ($n = 77$) and individuals for whom care episodes took place after the date of death ($n = 2868$), the final study population was 875,430.

For the comparison of decedent and survivor expenditures in annual increments, decedent or survivor status was determined and expenditures were allocated to annual periods. Decedent status was based on available death dates. To protect privacy, the BCLHD provides only the month and year of death, but not the precise day. To account for this, we adjusted death dates to the last day of the month of death, resulting in an underestimate of decedent costs since the year of death includes some days in which individuals were dead. Our method systematically shortens the utilization period by approximately 4% (an average of one half-month out of 12), but expenditures are expected to be underestimated by a smaller amount as these are typically weighted towards the last months of life [35,36].

Survivors consisted of all individuals who both did not die in a given year and appeared in the registry subsequent to the period being measured. The latter criterion eliminates drop-outs whose death status is unknown and ensures that all individuals have a full year of utilization data. The drop-out rate due to reasons other than death was approximately 0.5% per year.

All expenditure comparisons between survivors and decedents were based on a 12-month data period. While expenditure data for survivors were based on a calendar year (January to December), comparable data for decedents were based on the 12 months up to and including the month

of death. In order to create a comparable group of decedents for those who survived a given year, decedents were selected with a month of death between July of that year and June of the following year. Under this method, the average year for the decedent cohort ends in December, matching the calendar year used for survivors. Although the decedent cohorts under this method cover overlapping 2-year periods (from July of the previous year to June of the year following), we believe this does not detract from the ability to measure and compare trends in expenditures. Decedent trends may be expected to be slightly less volatile due to the overlap, but the overall trend measured should be comparable to that for survivors.

The study population was divided into four age groups: 66–70, 71–80, 81–90, and 91+. We remove those aged 65 in each of the study years because some of their health service use may not be included in the data as they may only be eligible for certain services after their 65th birthday. For example, while all individuals turning 65 in a given year are included in the data, they are only eligible for drug coverage for a portion of that year after their 65th birthday. In each age group and for each service category, we calculate and compare trends in decedent and survivor expenditures.

3. Results

In this Section, decedent and survivor expenditure trends are presented separately. We compare these trends using decedent/survivor cost ratios and assess the proportion of expenditures associated with decedents. We end by decomposing the factors that contribute to overall health expenditure growth and compare these results to similar decompositions for US Medicare expenditures.

3.1. Decedent costs

Inflation-adjusted decedent costs (see Fig. 1) were stable over the study period, with a slight dip in the mid-1990s followed by a rise later in that decade. Over the whole period, costs for all services rose by 5–10% for all age groups with the exception of the 91+ group, where costs fell by 0.5%. Total decedent costs grew fastest for those aged 71–80, at 10% over the study period. In absolute terms, decedent costs increased with age, rising from $25,000–$30,000 for the youngest cohort to over $40,000.

Continuing care stands out compared to other components in both temporal trends and in the relationship between age and costs. While decedent costs for hospitals, physicians, and drugs either fell or rose slowly during the first half of the study period and accelerated thereafter, the opposite trend was observed for continuing care. Continuing care costs for those aged 66–70 and 91+ were the only decedent cost categories that fell over the whole study period. With respect to age, continuing care costs for decedents rose dramatically, from approximately $5,000 for those aged 66–70 to over $25,000 for those aged 91+. For the other three service categories, decedent costs fell with age, between 40 and 70%. Consequently, as a proportion of total costs, continuing care costs increased from 15 to 20% for those aged 66–70 to more than 65% for those aged 91+.

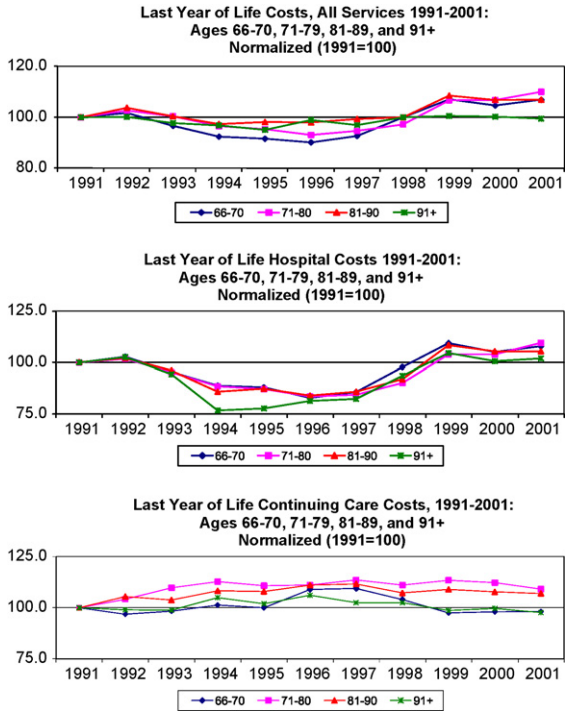

Fig. 1. Decedent cost trends, by age group and service type.

3.2. Survivor costs

There were several similarities between decedent cost trends and those for individuals with more than one year to live. Hospital, drug, and physician costs all showed weaker growth in the first versus the second half of the study period (as did the costs for all services combined), while the relationship was reversed for continuing care. Costs rose with age for all services combined and for continuing care. Drug costs grew significantly faster than costs for any other service category. The 91+ cohort had the largest decline in costs between 1991 and 2001 for hospitals and physicians, and for all services combined.

There were, however, greater differences than similarities between decedent and survivor costs over the study period. Where inflation-adjusted decedent costs for most services ended the period higher than where they began, survivor costs fell over the study period for all age groups for all services combined (see Fig. 2) as well as for hospital and continuing care costs individually. The drop in continuing care costs in the second half of the study period was particularly steep, with average costs falling between 15 and 25% between 1996 and 2001. While continuing care survivor costs rose rapidly with age, similar to decedent costs, the highest level of survivor costs for the other three service categories occurred in the middle age ranges of 71–80 and 81–90. Survivor costs for all services combined ranged from approximately $3,000 for younger age groups to $20,000 for older individuals. Continuing care accounts for more than half of survivor expenditures for individuals aged 81+.

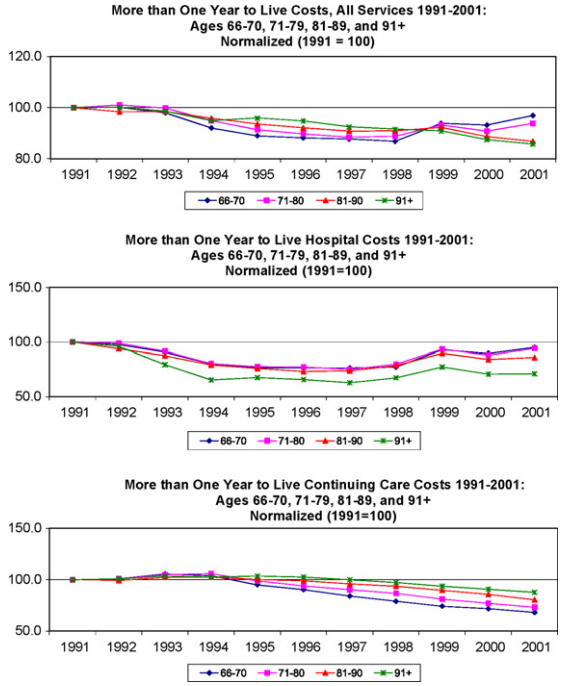

Fig. 2. Survivor cost trends, by age group and service type.

3.3. Decedent/survivor ratio

Table 1 summarizes decedent and survivor costs in the first and last year of the study period as well as both the ratios of those costs and the change in the ratio. The combination of relatively flat decedent costs and falling survivor costs resulted in a rising decedent/survivor ratio. Those aged 81–90 experienced the highest percentage rise in the ratio, by 23% from 3.1 to 3.8.

All services demonstrated a pattern of lower ratios at older ages. Ratios were highest for hospital services and lowest for prescription drugs. Ratios changed by less than 10% for drugs and physicians, but increased substantially for hospitals and continuing care. The largest percentage increase was experienced by the oldest age groups for hospital services (ages 91+ up 43% from 2.4 to 3.5) and by the youngest age groups for continuing care (ages 66–70 up 44% from 7.5 to 10.8 and ages 71–80 up 49% from 4.4 to 6.6).

3.4. Death rates and proportion of spending on decedents

In our study, the 65+ death rate was almost 20% lower than that in the US for comparable dates (CDC 2006), and was relatively unchanged over the study period, at 4.2%. However, the very slight drop in death rates for the entire population masks larger changes for specific ages. Overall, age-standardized death rates fell from 4.2% in 1991 to

Table 1
Decedent and survivor costs and ratios, 1991 and 2001.

	1991			2001			2001/1991, Change in ratio (%)
	Decedents	Survivors	Ratio	Decedents	Survivors	Ratio	
All ages, 66+							
All services combined	$33,406	$5,909	5.7×	$36,148	$5,779	6.3×	10.6
Hospital	$17,104	$1,928	8.9×	$17,932	$1,831	9.8×	10.4
Doctor	$2,463	$908	2.7×	$2,577	$981	2.6×	−3.2
Drugs	$863	$525	1.6×	$1,056	$703	1.5×	−8.5
Continuing care	$12,977	$2,548	5.1×	$14,583	$2,264	6.4×	26.5
Ages 66–70							
All services combined	$28,395	$3,109	9.1×	$30,352	$3,013	10.1×	10.3
Hospital	$19,163	$1,182	16.2×	$20,679	$1,122	18.4×	13.7
Doctor	$3,246	$809	4.0×	$3,472	$832	4.2×	4.0
Drugs	$1,183	$476	2.5×	$1,484	$621	2.4×	−3.8
Continuing care	$4,804	$642	7.5×	$4,718	$438	10.8×	44.0
Ages 71–80							
All services combined	$31,180	$5,259	5.9×	$34,284	$4,936	6.9×	17.1
Hospital	$19,122	$1,914	10.0×	$20,967	$1,803	11.6×	16.4
Doctor	$2,867	$948	3.0×	$3,161	$1,039	3.0×	0.6
Drugs	$1,012	$559	1.8×	$1,225	$748	1.6×	−9.6
Continuing care	$8,180	$1,839	4.4×	$8,931	$1,346	6.6×	49.1
Ages 81–90							
All services combined	$35,299	$11,456	3.1×	$37,723	$9,956	3.8×	23.0
Hospital	$16,239	$3,205	5.1×	$17,113	$2,753	6.2×	22.7
Doctor	$2,092	$1,008	2.1×	$2,278	$1,085	2.1×	1.2
Drugs	$728	$550	1.3×	$957	$733	1.3×	−1.5
Continuing care	$16,240	$6,693	2.4×	$17,375	$5,385	3.2×	33.0
Ages 91+							
All services combined	$40,258	$23,014	1.7×	$40,048	$19,736	2.0×	16.0
Hospital	$11,104	$4,576	2.4×	$11,313	$3,257	3.5×	43.1
Doctor	$1,437	$881	1.6×	$1,441	$851	1.7×	3.9
Drugs	$442	$425	1.0×	$648	$583	1.1×	6.8
Continuing care	$27,276	$17,132	1.6×	$26,645	$15,044	1.8×	11.2

Table 2
Components of annual HCE growth, United States Medicare (ages 65+, 1987–1999) versus British Columbia (ages 66+, 1991–2001)[a].

	US Medicare (%)	BC Health (%)
1. Rate of medical inflation	5.78	2.24
2. Rate of population growth	1.33	2.33
3. Age-weighted growth in per capita HCE, adjusted for medical inflation	0.24	
3a. Effect of change in last-year-of-life costs		0.13
3b. Effect of change in survivor costs		−0.76
4. Effect of shift in age distribution	0.33	0.83
5. Change in total costs due to change in death rates		0.13
Annual growth rate, HCE[b]	7.76	4.57

Sources [7,8], authors' calculations.

[a] Medicare age distribution is in 10-year cohorts (65–74, 75–84, 85+), while BC age distribution is in 1-year cohorts.

[b] Components may not sum to exact total due to rounding and intersection effects.

3.8% in 2001, a drop of 10.1%. Over the study period, the proportion of spending on decedents was between 20 and 22%. Since decedent costs were stable, while survivor costs fell during the study period, the proportion of spending on decedents rose nearly two percentage points, even though the crude death rate was unchanged.

3.5. Decomposition of expenditure growth

Table 2 decomposes the growth in health expenditures over the study period and compares such growth rates to those for the US Medicare program for the period 1987–1999. In each case, expenditure growth is broken down into the rate of medical inflation over the time period; population growth; the average rate of growth in per capita health expenditures, adjusted for medical inflation, holding the age distribution constant; and the effect of the shift in age distribution, holding age-specific rates of spending constant. The BC attribution adds a greater level of detail to that for the US by accounting for the effect of per capita survivor and decedent expenditures individually, as well as the effect of lower death rates. For both the US and the BC study population, medical inflation and population growth were the main factors that accounted for overall expenditure growth. In BC, the combination of lower death rates (−0.13%) and lower per capita survivor costs (−0.76%) completely offset the effect of the shift in age distribution (i.e. the increase in the average age of the 65+ cohort, +0.83%).

4. Discussion

Our results showed decedent costs for hospital, continuing care and all costs combined were stable, while survivor costs declined at rates between 5 and 30%. Findings from the literature using data from earlier time periods demonstrate the opposite trend in decedent and survivor medical costs (Medicare in the US or hospital costs in Canada and Britain): survivor costs grew faster than decedent costs [10,16,18,21,36,37]. Our results for continuing care costs are consistent with those of McGrail et al. [18], who used the same BCLHD data and found slightly rising decedent costs and falling survivor costs between 1986 and 1993. The 20–22% of total spending on decedents from our study is significantly lower than the 26% and higher figures from other jurisdictions [11,18,20,22]. This may be attributed to the lower death rate in British Columbia, differences in the included cost categories, and the slight underestimation of decedent costs due to use of the month of death as opposed to exact day of death

As a result of the differences between our findings and those of earlier Medicare studies, where decedents accounted for a declining portion of overall Medicare spending between 1980 and 1996 [10,11], decedents in BC accounted for a growing share of publicly financed health care costs, even as the proportion of the elderly dying in a given year fell slightly. The interpretation of this apparently important shift depends, naturally, on its possible causes.

The reduced expenditure on survivor populations may be attributed to a combination of health and policy factors. Certainly, policy changes enacted in British Columbia during the 1990s – first, to shorten hospital stays and later to restrict access to continuing care to the most needy [38–41] – appear to have had an effect on those two service areas, reducing the amount of care provided to survivor populations. In the case of continuing care specifically, tight health care budgets may have had a disproportionate effect on this sector. It is also possible that at least a portion of the decline in community care costs for survivors was due not to overall lower utilization, but to a larger proportion of utilization taking place in the informal or private market. Coyte and McKeever [42] found that the private share of all health care costs excluding physician and hospital services in Canada rose from 52 to 57% between 1975 and 1999.

Besides possible public–private substitution, it is also possible that reduced spending on survivors may reflect an improvement in health status. While data are not available for BC specifically, numerous studies from the industrialized world have found broad improvements in age-specific morbidity among the elderly [43–46]. To the extent that improved health is due to lifestyle and not to more health care, lower morbidity would be associated with lower utilization of intensive services such as hospitals and continuing care. In this context, relatively higher survivor utilization of less intensive services more oriented towards prevention and maintenance – such as physician visits and drugs – is not surprising.

Regardless of the cause, the trend towards stronger growth in decedent versus survivor costs could have a significant effect on forecasts of the effect of aging on future expenditure growth. Miller [19] found that Medicare expenditure forecasts for the year 2070 could be reduced by 15% if the relative cost of dying is taken into account and life expectancy is assumed to grow to 82 years. If the relative cost of dying is increasing (and survivor costs are falling), as our results suggest, the effect could be even more dramatic.

The effect of trends in the cost of dying on future expenditure forecasts depends critically on the direction of future mortality. If mortality gains continue, as is assumed by Miller and projected by the Congressional Budget Office in their Medicare forecasts [47], the proportion of indi-

viduals at any given age in their last year of life will fall, leading to a decline in overall average spending levels at each age, and for the population as a whole. If, on the other hand, longevity approaches a limit, as forecast by Fries and Olshansky [48,49], or longevity is reduced due to more sedentary lifestyles, higher obesity, and the concomitant comorbidities [50], the reverse may be true. An increase in the spending share attributed to decedents places increased importance on future mortality rates.

The divergence between decedent and survivor cost trends during the study period raises policy questions concerning the allocation of health care resources. In the 1990s, a major goal of British Columbia health policy was to shift the emphasis of care to the community and increase prevention and maintenance services while decreasing the intensity of emergency care [40,41]. While the increase in the share of survivor expenditures devoted to drugs and physicians is consistent with these objectives, the increase in the share of hospital and continuing care expenditures allocated to decedents – even in light of the decline in the death rate – may be less so. Garber et al. [51] noted a similar trend in US Medicare expenditures between 1988 and 1995, where, in spite of increased use of hospice and home health care by dying beneficiaries, overall usage of hospitals and the intensity of end-of-life treatment did not decline. Increasing service intensity for the dying could raise concerns with respect to health system efficiency as health care accounts for an increasing share of the economy.

The limitations to this study concern generalizability, costing assumptions, and the omission of health care services not covered by the government.

As our data are limited to one region in Canada, caution should naturally be exercised in drawing conclusions with respect to other jurisdictions. Nevertheless, government coverage in BC of roughly 70% of all health care expenditures compares closely with that in other developed nations, including the United States for the 65+ population, who are covered by Medicare. With similar economic and demographic conditions, results from British Columbia might reasonably be expected to be at least indicative to those in other developed countries, though differences in health systems and policies should be duly noted.

For hospital and continuing care costs, we needed to make assumptions about the cost of a wide variety of services delivered by hundreds of providers across the province over a period of eleven years. The provincial cost-per-weighted case methodology for hospitals changed midway through the study period, and the results changed from a relatively stable cost to one that was rapidly increasing. Our continuing care cost estimates were based on two point estimates for 1991/1992 and 1996/1997, respectively, without any more recent information available. Generally, we believe that the broad nature of the study makes the necessary cost assumptions tolerable, and that the effect on relative comparisons between decedents and survivors where the same cost assumptions are used would not be significant.

While publicly funded health care in Canada is among the most universal and comprehensive in the Western world, there are still some services and costs that are not covered by public insurers and thus would not be captured in our data. In particular, there is a significant market for private services in continuing care, such as home support services and retirement homes [28,42]. Some types of physiotherapy or occupational therapy may not be covered; dentistry and over-the-counter medicines are not captured in the public data either. Bearing these limitations in mind, we feel that our data covers the vast majority of health care expenditures for the elderly and compares favorably in terms of comprehensiveness to data used in other cost of dying studies.

5. Conclusion

Our study examined the relationship between decedent and survivor expenditures in British Columbia and the time trends in each for a range of health service components and all components combined. The result of falling survivor costs, particularly for hospital and continuing care is important for future health care system development and resource planning. Further research is needed to determine the extent to which falling survivor utilization reflects improved health and lower need on the one hand, or reduced access and cost shifting to the private sector on the other. The implications of these two possible causes differ considerably.

An increasing decedent/survivor ratio suggests that a forecast of future health expenditures using our cost of dying data and assuming increased life expectancy could significantly reduce expected costs in comparison with simple age-based models. Aging may not be the significant threat to health care budgets that is commonly assumed, and researchers and policy makers should take care that a focus on the effects of aging does not distract from other causes of health care cost inflation such as technology, the market for labor, and income effects.

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