S E D A P

A PROGRAM FOR RESEARCH ON

SOCIAL AND ECONOMIC DIMENSIONS OF AN AGING POPULATION

APOCALYPSE NO: Population Aging and the Future of Health Care Systems

R.G. Evans, K.M. McGrail, S.G. Morgan, M.L. Barer, C. Hertzman

SEDAP Research Paper No. 59

For further information about SEDAP and other papers in this series, see our web site:
http://socserv2.mcmaster.ca/sedap

Requests for further information may be addressed to:
Secretary, SEDAP Research Program
Kenneth Taylor Hall, Room 426
McMaster University
Hamilton, Ontario, Canada
L8S 4M4
FAX: 905 521 8232
e-mail: qsep@mcmaster.ca

APOCALYPSE NO: Population Aging and the Future of Health Care Systems

R.G. Evans, K.M. McGrail, S.G. Morgan, M.L. Barer, C. Hertzman

SEDAP Research Paper No. 59

October 2001

The paper, which appeared in the *Canadian Journal on Aging*, Vol. 20, Supplement 1, 2001, pp. 160-191, was presented at the SEDAP Conference on Population Aging, the Health Care System, and the Economy, held April 27-29, 2001 in Burlington, Ontario..

The Program for Research on Social and Economic Dimensions of an Aging Population (SEDAP) is an interdisciplinary research program centred at McMaster University with participants at the University of British Columbia, Queen's University, Univérsité de Montréal, and the University of Toronto. It has support from the Social Sciences and Humanities Research Council of Canada under the Major Collaborative Research Initiatives Program, and further support from Statistics Canada, the Canadian Institute for Health Information, and participating universities. The SEDAP Research Paper series provides a vehicle for distributing the results of studies undertaken by those associated with the program. Authors take full responsibility for all expressions of opinion.

Running title: APOCALYPSE NO

Keywords: aging, health care utilization, demography, health care financing

Abstract:

Illness increases with age. All else equal, an older population has greater needs for health care. This logic has led to dire predictions of skyrocketing costs – "apocalyptic demography". Yet numerous studies have shown that aging effects are relatively small, and all else is *not* equal.

Cost projections rest on specific assumptions about trends in age-specific morbidity and health care use that are far from self-evident. Sharply contrasting assumptions, for example, are made by Fries, who foresees a "compression of morbidity" and *falling* needs. Long term trends in health care use in British Columbia show minimal effects of population aging, but major effects, up *and* down, from changes in age-specific use patterns. Why then is the demographic apocalypse story so persistent, despite numerous contrary studies? It serves identifiable economic interests.

The Authors:

Robert Evans is a Professor of Economics at the University of British Columbia and Faculty at the Centre for Health Services and Policy Research. He is past head of the CIAR Program in Population Health, was a member of the BC Royal Commission on Health Care and Costs, and of the Prime Minister's National Forum on Health.
Kimberlyn McGrail is a researcher with the Centre for Health Services and Policy Research at UBC, and a PhD student in the UBC Department of Health Care and Epidemiology.
Steve Morgan is a CIHR-funded post-doctoral fellow at the Centre for Health Services and Policy Research. His PhD thesis in economics concerned developing appropriate measures for price and quantity change in the pharmaceutical sector.
Morris Barer is a Professor in the Department of Health Care and Epidemiology, the Director of the Centre for Health Services and Policy Research , a member of the CIAR program in Population Health, a former member of the Federal/Provincial/Territorial Advisory Committee on Health Services and is the newly appointed Scientific Director of the CIHR's Institute of Health Services and Policy Research.
Clyde Hertzman is a Professor in the Department of Health Care and Epidemiology at UBC and an Associate Director of the Centre for Health Services and Policy Research. He is currently head of the Canadian Institute for Advanced Research Program in Population Health and a Fellow of the program in Human Development.

APOCALYPSE NO: Population aging and the future of health care systems

Evans RG, McGrail KM, Morgan SG, Barer ML and Hertzman C
Centre for Health Services and Policy Research, University of British Columbia

I. Preamble

"Every man would live long, but no man would be old". (Swift). Indeed not. "The cold friction of expiring sense…" (Eliot) On the whole, I'd rather be in Philadelphia. (W.C. Fields) But if we may "think not to resist the coming on of the years" (Bacon), what may we expect, prepare for, and hope? "Let [us]disclose the gifts reserved for age". (Eliot)

For the average individual, aging is associated with declining functional capacities, first physical and later mental, and increased prevalence of both acute and chronic illness. Gerontological research has demonstrated that the rates of decline typical of modern populations are not in fact physiologically determined, and that "healthy aging" can slow the process significantly. Many elderly people continue to live healthy and active lives. Nonetheless, the direction of the trend is not in question, only the slope.

The inevitability of this individual experience has been combined with demographic trends at the level of populations to yield predictions that have been described as "apocalyptic demography" (Gee and Gutman, 2000). In these scenarios, continuing increases in life expectancy, combined with a low birth rate, lead to steady increases in the average age of a population and an increasing concentration in the older age groups. Per capita, then, health and functional capacity decline and care needs and costs increase. This places an ever-growing burden on the shrinking proportion of the population that is economically productive. Overall, well-being declines as a larger and larger share of collective resources have to be devoted to supporting an ever-older, ever-sicker population.

Onto this gloomy long-run prospect is superimposed an alleged shorter-run crisis. In those countries that experienced a "baby boom" after the second world war, or that have gone through a sharp decline in birth rates as part of the process of modernization, there is a temporary bulge in the population pyramid that is now working its way through the age structure. In Canada the "boomers", born between 1946 and 1964, are now in their most productive years. In 2011, however, the first of them will reach the age of sixty-five, and over the next twenty years they will all cross that threshold. The resulting "temporary" bulge in the retired population will have a powerful impact first on labour markets and pensions, somewhat more gradually on the health care system, and eventually – in the 2030s – specifically on long term care. It is important to be clear that these apocalyptic scenarios have nothing to do with the growth of the population *per se*. All things being equal, more people use more care, in total, and generate higher costs. Those responsible for planning capacity and budgeting for its use must take account of trends in overall numbers. But a growing population also includes a growing labour force, and can invest in a larger capital stock. Population growth poses no particular problem if both needs and productive capacity grow in proportion. A problem does arise, however, if the components of the population with greatest needs (and least productive capacity) are growing faster than the rest.

Then average use and cost *per capita* rise, and that is why we focus in this paper exclusively on *per capita* measures. To combine the effects of these structural changes with overall population growth under the general heading of "demographic effects" is, we think, to invite confusion.

These scenarios have powerful face validity.[1] Older people do retire, do have, on average, significantly higher health care costs, and are more likely to be dependent. And there is no doubt that the proportion of elderly people is growing, and will continue to grow, in all modern populations. In the field of health care policy in particular these acknowledged facts have generated widespread (and somewhat illogical) concerns about the "sustainability" of universal public systems for financing health care.[2] More detailed analysis of the projections, however, shows that they are not sufficient in themselves to sustain the scenarios of apocalyptic demography. The latter rest on a more extensive set of implicit assumptions that are neither self-evident *a priori*, nor consistent with existing research or emerging evidence.[3] An "apocalypse" cannot be definitively ruled out, but at this point it appears to be a very dubious proposition indeed.

This paper has three objectives. First, we shall lay out the structure of assumptions that is required to link the "acknowledged facts" above with any forecasts about future trajectories of health care use and costs. For illustrative purposes we revive a debate from the 1980s associated with the work of James Fries. Second, we update and summarize an extensive body of evidence drawn from studies of the health care system of British Columbia as it has evolved over the last three decades, showing how and why it has departed from the types of projections that lead to apocalypse. And finally we attempt to explain the persistence and tenacity of the apocalyptic demography scenarios, their widespread acceptance and deep embedding in the conventional wisdom of health care policy, despite their frequently demonstrated inconsistency with an extensive and continually growing body of evidence. What purposes do they serve that over-ride that evidence?

II: James Fries and His Critics

In 1980 James Fries advanced the hypothesis that the human life span was physiologically limited, fixed by the nature of the species, and that little had

---

[1] They provide a point of departure for "…alarmist journalism… too familiar in media that rely on sensationalist headlines to push their wares." Foot (2000, p. 499) reviewing Peterson (1999).

[2] Since financing health care from private sources is typically more expensive, as well as consistently less equitable, than public financing (e.g. Evans, 2001), the reasons why the *latter* should become "unsustainable" in the face of escalating costs have always been somewhat obscure. We offer an alternative explanation below.

[3] Apocalyptic projections can be generated, for example, by adding an assumption that the per capita use and/or costs of health care *must* rise over time -- for reasons unconnected with population aging -- at or faster than the rate of general economic growth (e.g. Baumol and Bowen, 1966; Newhouse, 1977; Henripin, 1994). The effects of aging – relatively modest in themselves -- are then added to these other sources of increase, ensuring that the total must outpace the growth of the economy and force a steady increase in the share of income devoted to health care (e.g. Robson, 2001). This increasing economic burden is then ascribed to population aging. But the underlying assumption lacks a basis in theory or fact; for a fuller discussion see www.chspr.ubc.ca/misc/Apocalypse-Regained.htm.

changed in at least 100,000 years (Fries, 1980). Life expectancy, on the other hand, has increased steadily as a larger and larger proportion of the population live long enough to approach this limit. Cohort survival curves, that in the 'natural' state declined more or less exponentially (a similar probability of death at each age, though obviously from different causes) have become "rectangularized" as living conditions improved. In modern, healthy societies almost everyone in a given birth cohort survives through early and mid-life; not until old age does the probability of death rise sharply and the survival curve correspondingly drop off.

Fries postulated that this rectangularization of mortality was associated with an underlying "compression of morbidity" in which healthy environments and behaviours delayed the onset of morbidity and pushed it out toward the physiological limits set by the life span. People would thus remain healthy for an increasing proportion of their lives, until at the end all systems began to fail at once, bringing on a relatively short period of acute illness ending in "natural death." To the extent that clinicians recognized and accepted the onset of natural death and the limits imposed by the physiological structure of the species, they would limit their interventions to maintaining comfort and dignity during the inevitable final passage. In this "wonderful one-hoss shay" scenario, "heroic interventions" would be, and would be recognized to be, quite futile, and the use and cost of health care would actually be relatively low.

The assumptions of Fries' scenario point up the implicit counter-assumptions of the apocalyptic scenario. First, the fixed life span contrasts with the presumption that life expectancies will go on increasing indefinitely. In the former case there is (for any given growth rate) an upper bound to the proportion of elderly people in the population; in the latter that upper bound is removed.

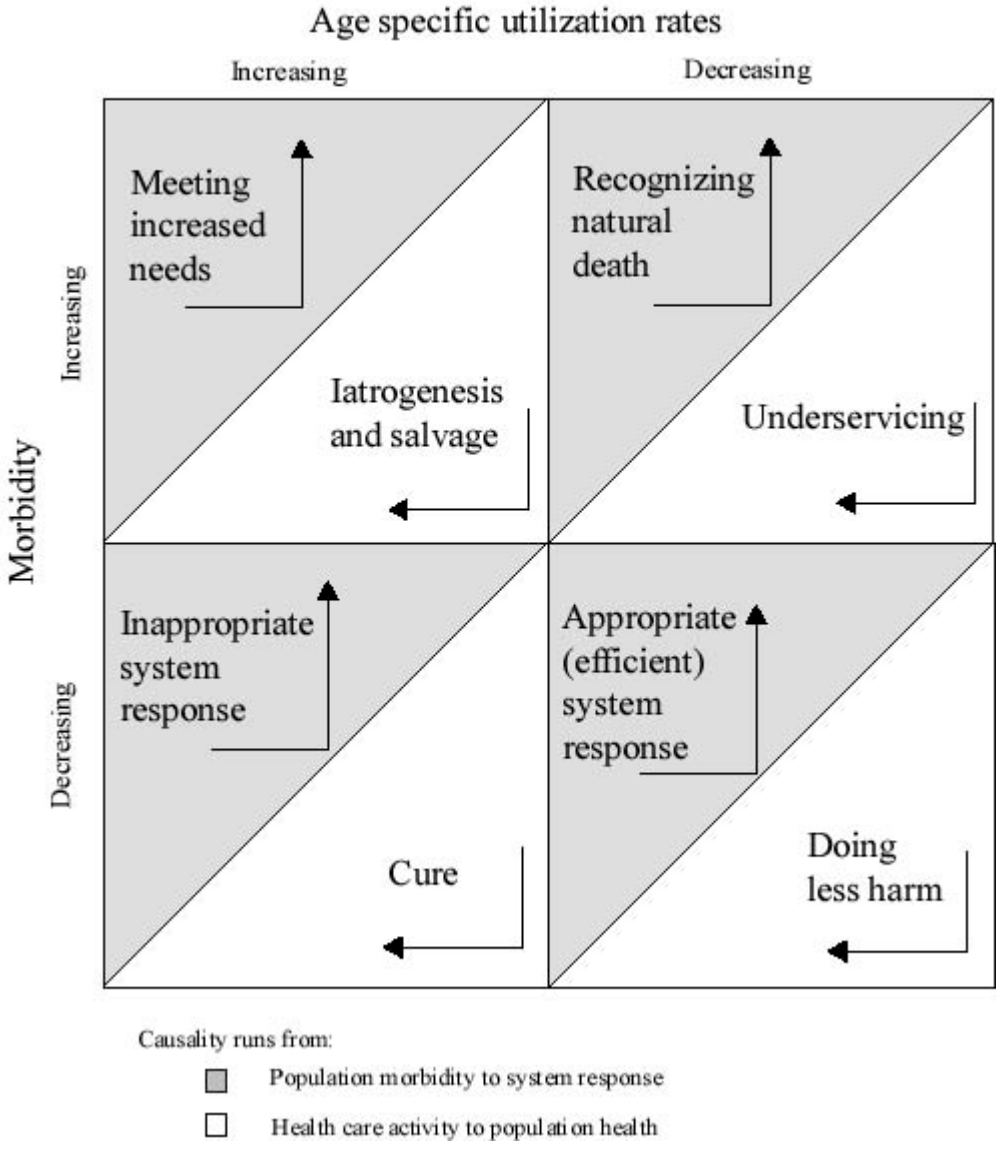
Second, Fries assumes that the increase in life expectancy is accompanied by a compression of morbidity. People become healthier, and therefore need and use less health care, at each age prior to the onset of the processes leading to natural death. The determinants of this improved health lie outside the health care system. The apocalyptic scenarios assume that age-specific rates of use and costs do not fall as life expectancy increases. If anything, they may rise as sicker patients that would previously have died remain within the population and increase the average intensity of servicing -- "successful but costly salvage". Moreover, any reduction in morbidity in the years prior to death is a consequence of more intensive and effective servicing, not reduced need.

And finally Fries' assumption that clinicians will recognize and accept the onset of natural death is replaced with the assumption that they will, instead, continue to battle death with all the resources at their command. "Nunc dimittis" will not replace "never surrender", and death will continue to be a very expensive process.

The contrast between Fries' quite optimistic scenario and the gloomy forecasts of apocalyptic demography bring out the fact that any such projection depends upon assumptions about (i) the nature of the organism itself (us) and its natural lifespan; (ii) the determinants of health, and the extent to which they lie in or outside the health care system; and (iii) the behaviour of health care systems, and the intensity and effectiveness with which they respond to the condition(s) of patients.

The latter, in turn, is partially (but only partially) dependent upon the state of medical knowledge and technology. Lewis Thomas has classified medical technologies according to the quality of their underlying science base and the extent of understanding of the disease process (Thomas, 1971). First stage technologies are based on little or no understanding, and are consequently palliative, cheap, and mostly ineffective. Second stage or half-way technologies are based on sufficient understanding to relieve some of the symptoms of an illness or injury, and are semi-effective and quite expensive. Mature third stage technologies are based on full understanding, permit decisive interventions to "cure" the disease, and are again relatively inexpensive. The treatment of polio, with the development of first the iron lung and then the vaccine, is illustrative of the second and third stages.

Figure 1: The eight-way causogram



The possible pathways from demographic trends to trajectories of health care use and costs are summarized in the "causogram" shown in Figure 1 (Barer et al., 1987). The causogram has as its base a standard two-by-two table, with an additional layer of complexity acknowledging that each relationship can be generated by two possible directions of action. For example, decreasing morbidity might be associated with increasing age-specific utilization as newly developed technologies or interventions can relieve hitherto untreatable diseases. On the other hand, a decreasing burden of illness may be accompanied by increasing utilization of inappropriate or unnecessary services. The latter is quite plausible given the increasingly strong commercial interests in expanding sales of particular types of therapies and interventions. Direct-to-consumer advertising of prescription pharmaceuticals, for example, has the goal of creating demands and costs not only for the drugs themselves, but also for contacts with prescribing physicians. (Mintzes, 2000).

Fries makes the optimistic assumption at each juncture – fixed life span, falling need for health care at each age (because people are healthier, or undergoing "natural death") and reduced servicing in recognition of reduced need. The promoters of the apocalyptic scenarios adopt the opposite assumptions – ever older, ever sicker, and ever more (and more expensive) care. Both cannot be right. Can research evidence help sort this out?

III: Projections of Health Care Use and Costs – The Canadian Experience

Over twenty years ago, Boulet and Grenier (1978) projected the costs of publicly insured health care in Quebec, on the assumption of constant age-specific use rates and then-available demographic projections.[4] (The assumption that age-use curves will remain constant over time is made not because it is expected to hold, but because it permits one to isolate the impact on overall utilization of shifts in the population structure from those of other forces.) They found that while utilization rates per capita would rise – as they must with an aging population – the rates of increase were not particularly large, and were readily sustainable assuming rates of economic growth well within past experience. In December, 2000, the Canadian Institute for Health Information revisited this issue for Canada as a whole, and concluded "… expenditure increases resulting from population growth and aging, by themselves, will be stable and relatively modest…" (CIHI, 2000, p 42). Between these dates extensive research, including work with data sets for the province of British Columbia, has explored this issue in considerable detail (Barer et al., 1995, 1998). All studies reach the same conclusion. Demographic trends *by themselves* explain some, but only a small part, of trends in health care use and costs, and in and of themselves will require little, if any, increases in the share of national resources devoted to health care. Throughout this period, however, the "conventional wisdom" in Canada has continued to hold that the aging population would inevitably result in major increases in health care costs, perhaps

[4] Even earlier Denton and Spencer (1975) projected health care costs per capita and as a share of national income, under various demographic and migration scenarios, "…using a model of the complete economic-demographic system…" While theoretically more elegant and satisfying, this approach makes it difficult to disentangle demographic effects from those of their hypothesized economic relationships and parameters. They found demographic effects significant only over decades, not years – a glacier, not an avalanche – again suggesting a focus on patterns of change within the health care system itself.

"bankrupting" the publicly financed system. Possible reasons for this extreme disconnect between evidence and rhetoric – a disconnect quite common in public debates over health care (Roos, 2000) – will be explored below.

Evidence from the B.C. Linked Health Data Set

Detailed data on health care utilization and costs are compiled in the administrative records of the public programs that reimburse providers of health care services in each of the Canadian provinces. These programs provide universal comprehensive coverage for the services of hospitals and physicians; the British Columbia system also provides coverage of pharmaceuticals for the population 65 and over. We can thus track the changing patterns of use by age for these three categories of health care over a number of years, although the data sets are of varying historical depth.

Hospitals, physicians, and prescription drugs made up, in 1998, 57.9% of national health expenditures (CIHI, 2000, Table A.3.2). Another 16.6% was accounted for by dentistry, public health, private health insurance administration, and research, categories that are not sensitive to the age structure of the population. A mixed bag of non-prescribed drugs, capital spending, vision care, services of other professionals, and "other" makes up a further 16.1%; it is difficult to know how sensitive spending in any of these categories – much of it in the private sector – might be to population ageing.

Only 9.6% of total national health expenditures, in 1998, was attributable to an excluded category – " other [non-hospital] institutional care" – in which per capita expenditure might be expected to rise considerably as the population ages. Curiously, though, it has not done so over the last quarter century – this category accounted for 9.2% of the total in 1975. In any case a substantial increase in this category would still have little effect on the total.

There are two other categories of age-sensitive expenditure that are not separately identified in the CIHI data – community-based continuing care and hospital-based extended care. The former are divided among several of the reported categories, and the latter are included with acute care as "hospitals". Extended care use now accounts for over half of inpatient days in British Columbia (McGrail et al., 2001), but the B.C. Ministry of Health estimates that extended care days cost only about one fifth as much as those for acute care patients.

Use of long term care services, moreover, is heavily concentrated among the very eldest of the elderly, typically aged 80 or more. Even the first "boomers" will not begin to use these services in any significant numbers until after the mid-2020s – the end of our projection period. The peak boomer cohort of 1959 do not turn 80 until 2039. How much care they will require at that time is very much the question at issue between Fries and his critics.

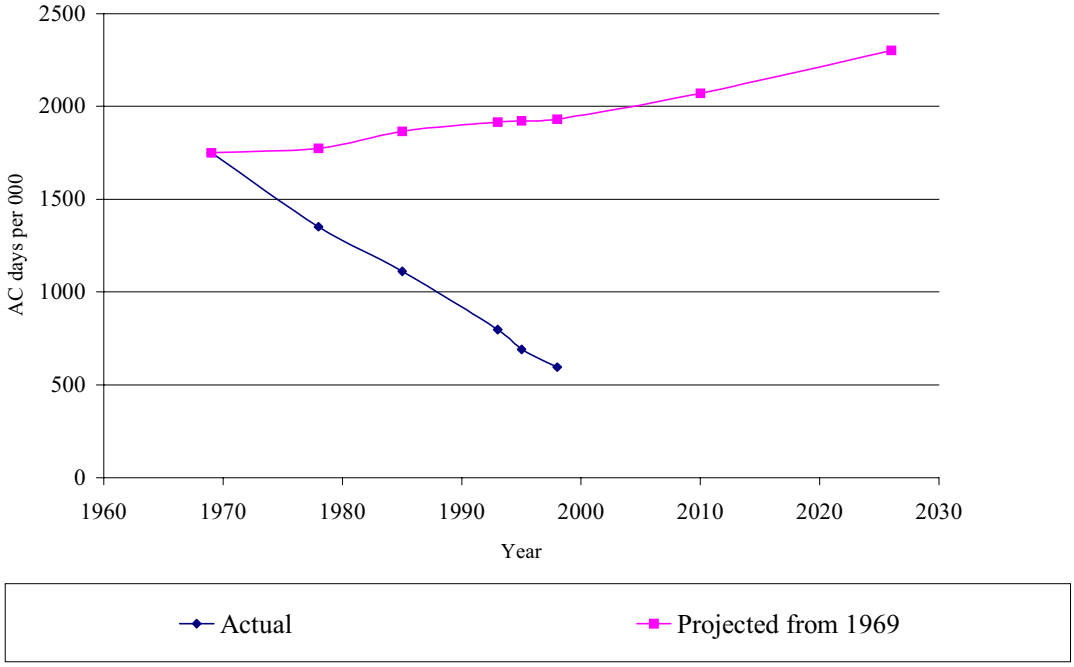
The historical record of continuing care use, both institutional and in the community, has been so dominated by the influence of changing policy choices that it is difficult to know how to interpret the changing patterns in age-specific use rates. Thus we do not address trends in the use of long-term institutional care

and home care. While these are clearly age-sensitive, they remain a relatively small part of the overall health sector.

Our analysis is thus focused on the relation between population aging and utilization trends in acute inpatient hospital days, fee for service physician payments, and prescription drug reimbursements (for the 65+ population). Utilization estimates for the latter two are derived by adjusting payment or reimbursement data for changes in fees and prices. Age-specific use rates over our period of analysis moved downward for hospitals but increased for physicians' services and, apparently, for pharmaceuticals. Closer examination, however, reveals that the latter trend is in large measure price inflation masquerading as increasing utilization.

We also find that trends in age-specific use rates within the elderly population tend to diverge significantly from those of the rest of the population. Consequently projections for the entire population based on the experience of this segment alone can create significantly inflated estimates of the impact of aging on the health care system as a whole.

Figure 2: Acute hospital days, actual and projected



A. Hospital Use:

Figure 2 plots the (unadjusted) rate of use of hospital acute care inpatient days per thousand population in B.C for selected years from 1969 to the late 1990s, showing the pronounced decline that has occurred over this period.[5] On the same

[5] A detailed description of sources and methods is provided in McGrail et al. (2001).

figure we have plotted a ”forecast” of rates of hospital use that one would have made in 1969, had one used then-current age-specific rates of use (by five-year age groups, up to 85+, with children 0-1 as a separate category), combined with the **actual** populations (or the most current forecast) in each age category in the year in question. This projection is, then, based on assuming that, in 1969, we could have known the age-specific population of the province in each of the forward years. The discrepancy between the curves reflects only changes in use rates, not errors in forecasting the population age structure.

A projection of use made in 1969 based on assumed constant age-specific use rates would have been not merely erroneous but wildly so – triple the actual value for the whole B.C. population at the end of the century. The relatively flat projection line confirms the point emphasized in the previous section, that the effect of population aging per se would have been relatively modest and manageable within normal rates of economic growth. But that effect is trivial compared with the dramatic decline in utilitzation rates themselves, as reflected in the actual trend in average per capita utilization.

These declines in inpatient days per capita are associated with both shortening average lengths of stay and an increased proportion of hospital cases receiving same day surgical care (McGrail et al., 2001). In general these have been regarded as positive trends; most observers agree that inpatient utilization in Canada has historically been unnecessarily high. But whether one regards the downtrend as a desirable squeezing out of inappropriate use, or a growing gap in adequacy of provision, it is clearly the factors underlying use rates, not the changes in demographic structure, that matter.

Figure 3: Acute hospital days, actual and projected, ages 65+

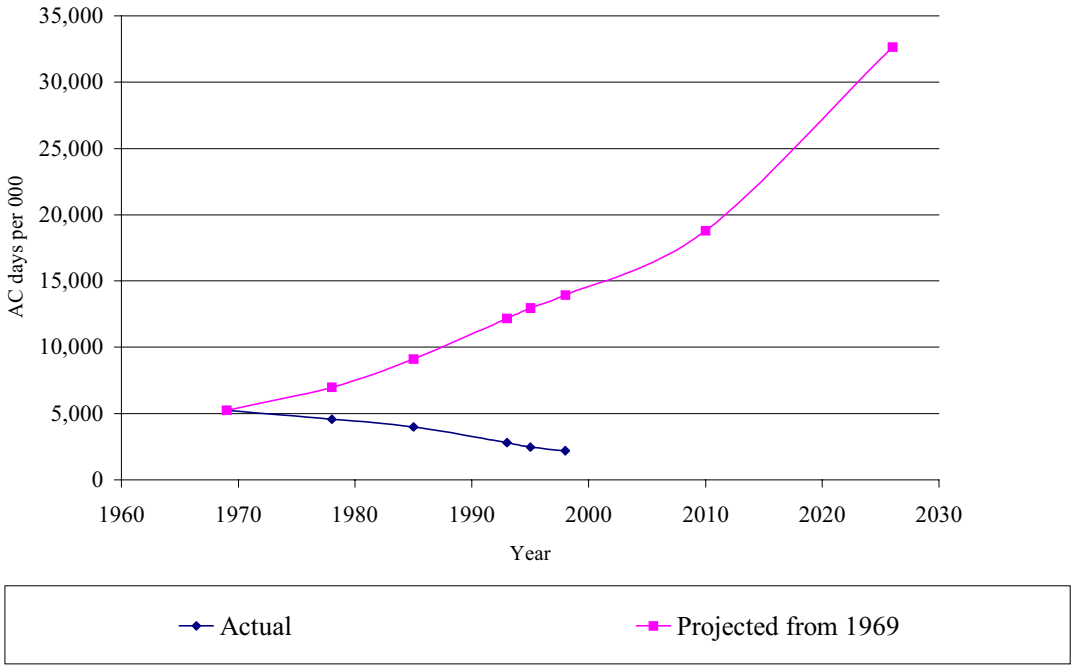


Figure 3 replicates the analysis of Figure 2, but only for the population 65 and over. Here the 1969 projection (assuming omniscience with respect to future population) would have been truly hair-raising – a near tripling of rates by the end of the century, more than doubling again over the next quarter century – resulting from an increasing proportion of very elderly among the over 65 population. But again the reality has been very different from the predictions, at least so far. Acute care use rates among the population over 65 have been cut roughly in half since 1969 – not as steep a fall as in the rest of the population, but significant enough.

The contrast between the projections in the two figures is instructive. The latter projected an increase of nearly seven-fold in rates of use among the elderly. At the same time, there has been a steady increase in the proportion of elderly in the general population. The projected increase in overall use would have been much smaller – only about 30%. Dramatic changes that affect a small proportion of a population do not have a large impact on the whole population. Extrapolation from the expected experience of a sub-set to that of a whole population can be seriously misleading. In this case it would have been, even if age-specific use rates had not fallen.

Figure 4: Acute hospital days, actual and projected

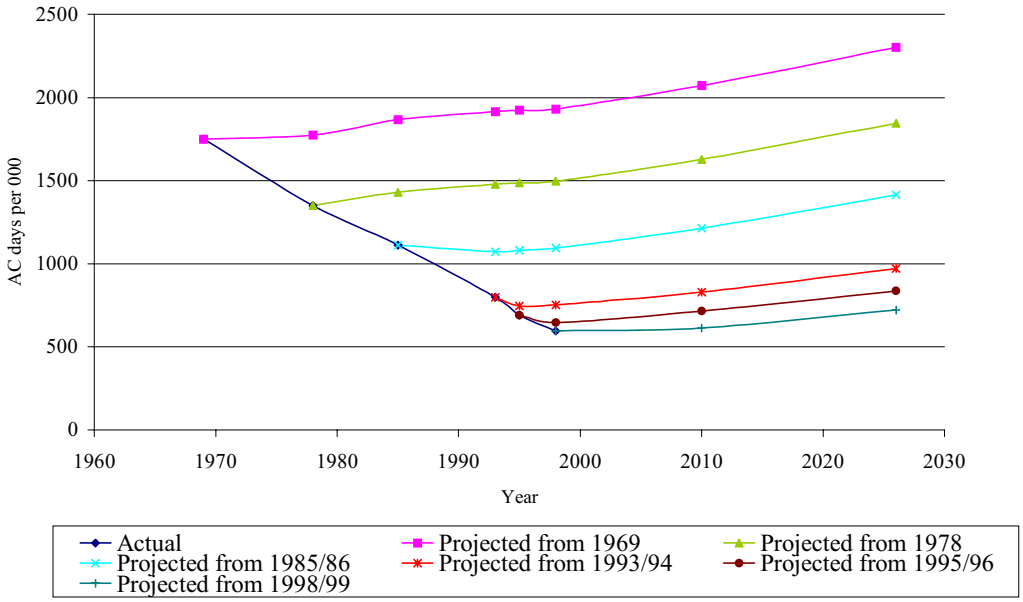
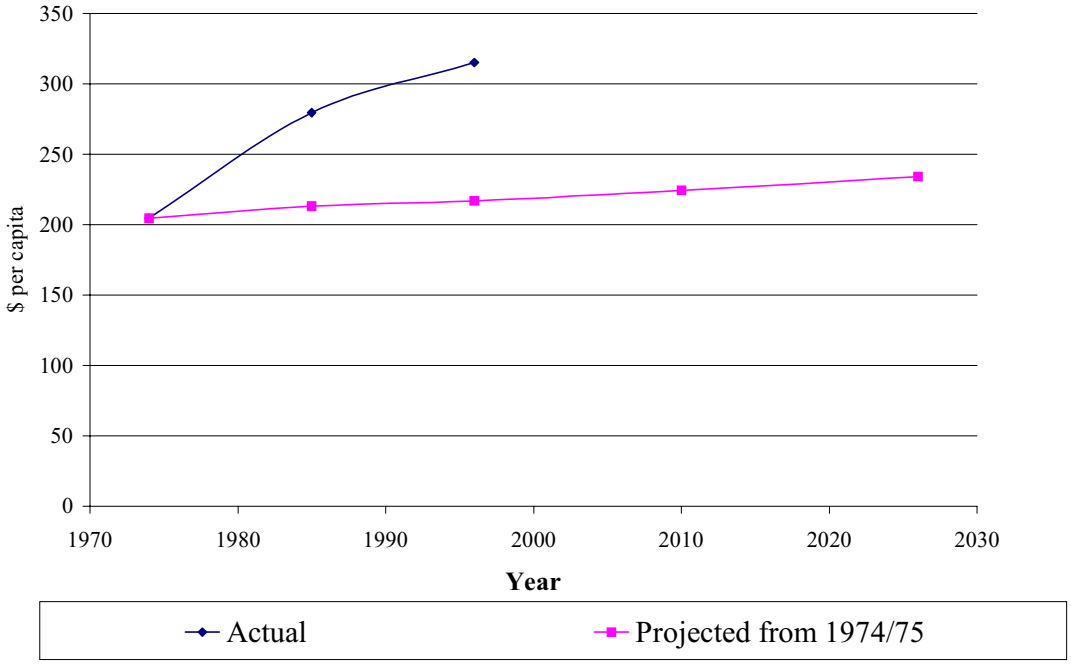


Figure 4 extends the information in Figure 2 by adding the results of projections made in each of the subsequent years. The trajectories projected from different points in time maintain a similar shape, reflecting the stability of demographic trends, while their fall from one projection date to the next reflects the steady fall in actual age-specific use rates. Throughout the period from 1969 to the present, any forecast of the use of inpatient acute care based on assumed constant age-specific use rates would not only have been too high, but would also have missed the trend.

B. Physicians' Services:

While the use of physicians' services also tends to rise with age, the increase is much less pronounced than it is for hospital services. The effect of changes in age structure on average use per capita is thus much smaller. Figure 5 shows average per capita expenditures on physicians' services in British Columbia adjusted for changes in the fee schedule, for selected years from 1974/75 to the late 1990s.[6] A projection made in 1974/75 would have led one to expect an increase of only twenty percent over the next fifty years, indicating the relatively trivial effect of population aging on the use of physicians' services. As previous studies have shown, the effect of population aging varies greatly depending upon the type of service being considered. (Woods Gordon Management Consultants, 1984).

Figure 5: Fee-adjusted MSP expenditures per capita, actual and projected

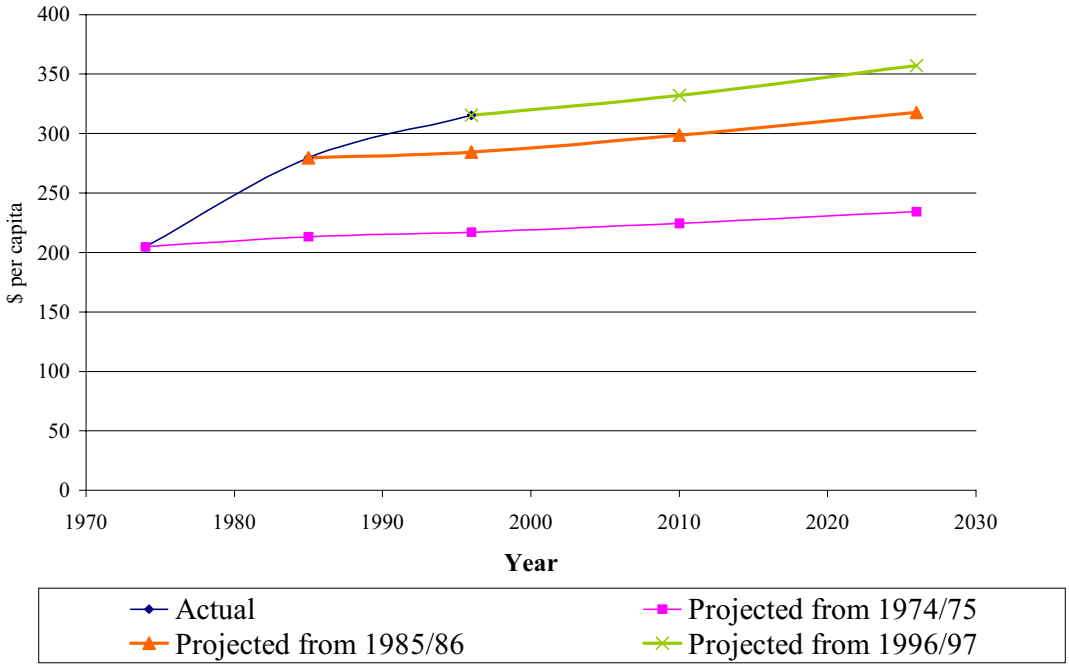


While the projection is relatively flat, however, there has been a marked upward trend in actual utilization per capita. This has been associated with both an increase in the number of physicians per capita, and (particularly for specialists) an increase in service output – or at least billings – per physician. The increase in age-specific use rates is more marked among seniors than among the general population (not shown), such that more recent projections of future use show a somewhat greater effect of changes in the overall age structure (Figure 6). But at each projection date, the expected impact of changes in age structure remains very small.

[6] Methods of adjustment are described in detail in Pascali (1995) and applied to more recent data.

In this the physician and hospital data are comparable. While the successive projections fall over time for hospitals and rise for physicians, in both sectors it is trends in the age-specific use rates that dominate the overall trends. In neither sector are projected changes in age structure a major factor in accounting for trends in use.

Figure 6: Fee-adjusted MSP expenditures per capita, actual and projected



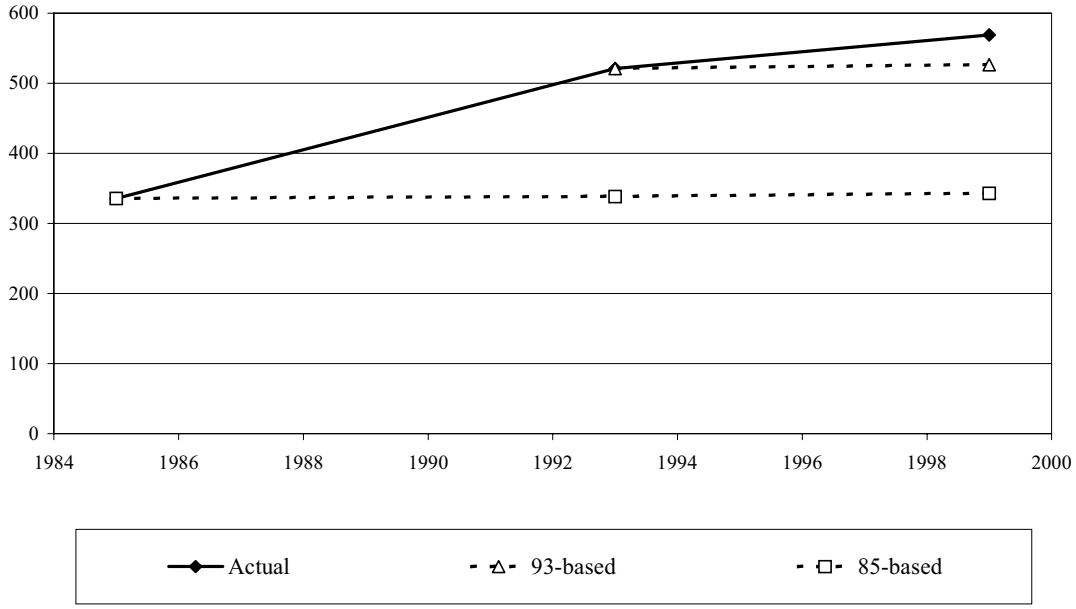
C. Pharmaceuticals:

Undertaking a comparable analysis for the pharmaceutical sector is restricted by a number of data limitations. Comprehensive public coverage is provided only for certain sub-populations (e.g. the elderly), and person-specific, population-based data are available only since 1985. The analysis here is restricted, therefore, to data on per capita public expenditures on prescription drugs, and on projections based on the changing population age structure for selected years from that date, but only for the population 65 and over. For payment purposes, there is a distinction made between the ingredient costs of a prescription and the dispensing fee. In what follows we shall be focusing only on the costs of the pharmaceuticals themselves; other data sources reporting total expenditures on pharmaceuticals may include both.

In Figure 7 we show actual per capita drug expenditures for 1985, 1993 and 1999, and projected expenditures for 1993 and 1999. The actual expenditure levels in 1985 and 1993 were inflated to 1999 dollars by multiplying by the change in the B.C. Consumer Price Index over the corresponding period. The projected expenditures were calculated by holding these 1999 dollar age-specific costs at

their 1985 or 1993 levels while the population age structure changed to its actual 1993 and 1999 shares.

Figure 7: General inflation adjusted per capita pharmaceutical costs actual versus predicted by aging of elderly cohort (1999 dollars)



Actual per capita expenditures on prescription drugs for the elderly rose far faster than would have been projected on the basis of changes in the age structure even of the elderly population. As in the case of both hospital use and physicians' services, other factors played a far more important role. But this observation is of particular significance in the case of pharmaceuticals, because these expenditures have grown so rapidly since the mid-1980s. Total expenditures on drugs in British Columbia more than tripled between 1985 and 1999, rising at an average annual rate of 9.0 percent! Expenditures on hospitals and physicians' services rose only 5.5 percent annually (CIHI, 2000).

IV. If Not Demography, Then What?

The evidence from British Columbia is quite clear. Changes in the age structure of the overall population have not in the past been major contributors to trends in the per capita utilization of health care services, and they will not be in the future. Very significant changes in these rates have occurred for various types of health care in the past, and presumably will in the future, but their sources are elsewhere. A full analysis is far beyond the ambitions of this paper – it would be an entire research program in itself. But some exploration of factors underlying the utilization trends in B.C. trends that are similar to patterns elsewhere, may be of value. Are the increasing rates of use of physicians' services and drugs, for example, responses to increased levels of need in the population – are people "sicker" now? Or, need defined as "capacity to benefit from intervention" could

be increasing as progress in medical technology makes possible new and more effective treatments.

Pharmaceuticals are of particular interest. The cost escalation is primarily driven by the introduction of new and more expensive drugs. To the extent that these provide more effective treatment for a number of ailments, they may "increase needs" in two ways. New drugs have increased need in the sense of capacity to benefit. And insofar as they may keep people alive who would otherwise have died (earlier), they increase the average level of illness in the (living) population. The validity of this interpretation of the trend in Figure 7 holds, however, only to the extent that the new drugs are in fact more effective then those they replace.

The Rising Cost of Pharmaceuticals

There is a significant conceptual problem in representing trends in pharmaceutical use. Hospital use can be measured by counting a physical unit – inpatient days – although for acute care in particular, days are far from homogenous across either institutions or time. Physicians' services can be measured as the total of all services provided in a given year, each valued according to the fee schedule in effect in a common base year. But the mix of pharmaceuticals in use is in constant flux over time, as new drugs are introduced and old ones fall out of favour. There is no single "correct" way of partitioning trends in expenditure into changes in price and changes in utilization. Different assumptions as to the relative "quantity" change represented by the introduction of different drugs lead, as we shall show, to major differences in apparent trends in use.

A consequence of adjusting costs using the Consumer Price Index (as in Figure 7) is that the increases in actual per capita expenditures include sector-specific inflation rates along with utilization changes. To the extent that rates of price increase for drugs — however one chooses to define them — exceed (fall short of) general inflation rates, these increases in age-specific expenditures will overstate (understate) increases in utilization.

An understanding of the "other factors", the cost drivers that lie behind the extraordinary recent escalation in drug expenditures, requires a more detailed disaggregation of these expenditures. Changes in per capita expenditures can be partitioned into four components. The first of these, the effect of changing age structure, has been shown in Figure 7 to be relatively small. Three other components — changing age-specific exposure rates or treatment patterns, changing volume and mix of drugs used by each patient, and pure price change for a particular drug brand, in a particular dosage size and form — combine to make up the changes in age-specific expenditure rates.

To identify the relative contribution of the latter three components, we grouped the multiplicity of different medications into 48 therapeutic classes identified by the American Hospital Formulary Service coding system.[7] Patients using therapeutically similar drugs will (on average) have similar illnesses. This permits

[7] Analyses involving 106 and 196 therapeutic classes as defined by the AHSF coding system did not differ significantly from those reported here. A complete description of the therapeutic classes and formulae is contained in Morgan (2001).

one to associate particular illnesses with particular classes of drugs, as in the chronic disease mapping done in other studies (see, e.g. Clark et al., 1995; Steinberg et al., 2000). The illnesses, and the therapeutic classes, remain constant over time, while the products within each class may appear or disappear.

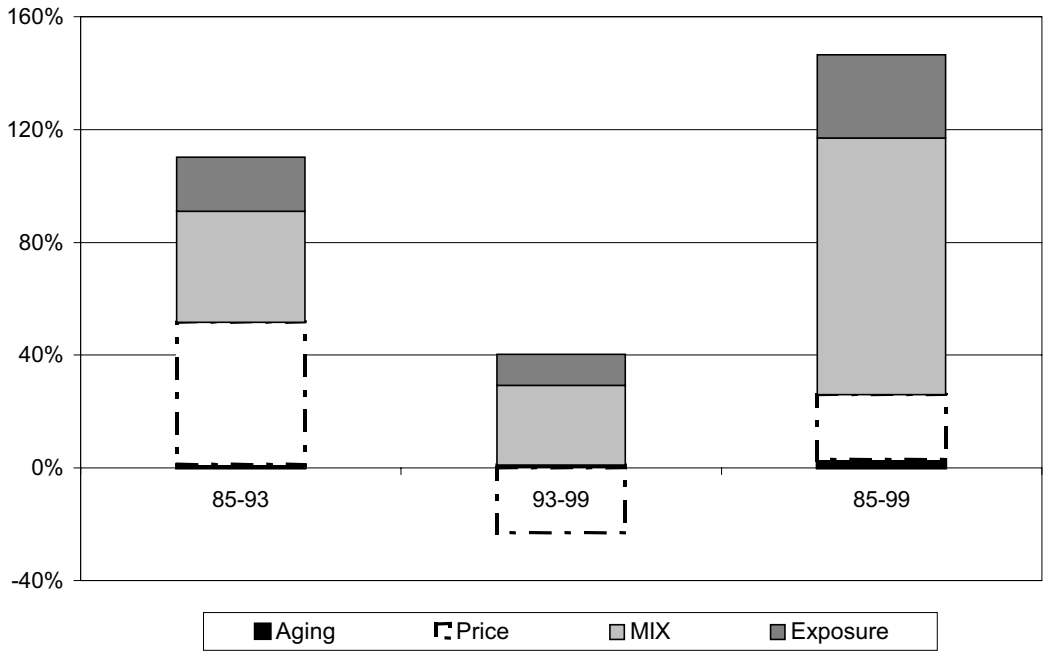
Age-specific drug expenditures per capita are then the sum of per capita expenditures in each of the 48 therapeutic classes. Expenditures in each class can be decomposed into the proportion of people in each age group who receive one or more prescriptions for a drug in that class, and the age-specific average cost per patient (person receiving drugs) in that class. For example, the average cost of anti-depressant drugs per 65 to 74 year old receiving them was $75 in 1985. The proportion of people receiving one or more prescriptions in each therapeutic class can be described as the exposure rate. There will be a different exposure rate for each age group and therapeutic class. The set of all of these exposure rates we refer to as the treatment pattern.

Finally, age-specific costs per patient in each therapeutic class can be decomposed into the quantity of each type of medication – chemical entity, dosage form and strength – received by each patient, and the price per unit paid for that product. The latter represents "pure" price change – change in the average price of equal-sized bottles of pills or drops of similar chemical composition. In the pharmaceutical field these prices tend to rise (often at a rate equal to or just above general inflation) while products are under patent, and to fall (in nominal and real terms) after patent expiry rise while a product is patented and fall after patent expiry as brand-name drugs are replaced by lower-priced generic equivalents. Despite falling prices due to generic entry, average drug costs per patient may—and in fact do—go up, because of increased intensity of dosage per patient treated, shifts to more expensive dosage forms, or most commonly because of the introduction of newer, more expensive therapeutic agents that are prescribed in preference to older products in the same therapeutic class. Together these effects can be described as changes in the product mix within each therapeutic class.

Figure 8 illustrates the relative contributions to per capita expenditure growth from each of these four determinants.[8] Between 1985 and 1999, total outlays per capita on the ingredient costs of prescriptions for seniors in B.C. (adjusted for inflation) rose by 147 percent. The contribution of population aging to this overall increase is vanishingly small—accounting for only 2 percent of this increase (3 percentage points).[9] Changes in the profile of treatment patterns, i.e. more of the population receiving prescriptions in more different therapeutic categories, accounted for 30 percentage points, or about one-fifth of the overall increase. But over three quarters of the increase (114 of 147 percentage points) was accounted for by changes in the cost per patient (product mix and price change) within each therapeutic class. Spending more per person under treatment for particular illnesses, rather than treating more people for more illnesses, is thus the main story behind increased drug expenditures, at least for the elderly.

[8] The decomposition uses formulae based on the Fisher Ideal Index; these are available from SG Morgan
[9] This minuscule effect is consistent with findings from a study in Belgium by Van Tielen, Payes and Genaert (1998).

Figure 8: Decomposition of total change in inflation-adjusted expenditures per capita



But even this large increase understates the effect of shifts from less to more expensive therapeutic agents. The average price paid per bottle of pills of equivalent size and contents rose 4 percent per annum (virtually identical to the rate of general inflation) between 1985 and 1993 and then *fell* quite dramatically from 1993 to 1999, largely due to a shift from branded to generic drugs incited by a generic substitution policy implemented in 1994. The net effect was an average rate of price change of less than 1 percent per year from 1985 to 1999—far less than the 2.7 percent per year change in the general price level. This reduction in "real" drug prices was however overwhelmed by the impact of shifts to more expensive drugs and dosages within each therapeutic class. Such shifts generated a 91 percent increase in per capita costs over this fourteen-year period (see Figure 8).

As noted above, however, the definition of price change is ambiguous when the mix of products is changing rapidly over time. Restricting the definition of "price change" only to changes in the prices of equivalent bottles implicitly defines the whole of the increase in cost due to changes in product mix within a therapeutic class as an increase in some form of "quantity". In effect, when an established drug is replaced by a newer one costing ten times as much per pill, each of the new pills is treated as ten times as much "quantity" of medication. This would be perfectly transparent if the dosage regimen for the new drug required only one tenth as many pills. But this is not in general the case – if it were, the drug mix within therapeutic classes would not be becoming more expensive. Instead, the apparent increase in "quantity" has to correspond to some increase "quality" which is of value to the user in the same way that a Mercedes-Benz is perceived as higher quality and therefore as more value than a compact Chevrolet.

This additional value can only be found in increased therapeutic effect. It could show up in one or both of reductions in the cost of other necessary forms of treatment, or improved patient well-being. If the new drug has neither of these benefits, relative to the older drug it replaces, then the additional cost of the newer drug is in fact a pure price increase – higher cost for similar outcome. Whether one regards the rapid increase in drug expenditures as corresponding to a rapid increase in patient benefits from the expansion of therapeutic capacity, or merely an extraordinarily rapid rate of sector-specific price inflation, thus turns on how one evaluates the consequences of product substitution within therapeutic classes.

The drug industry is well aware of this, hence their claim that the dramatic reduction in hospital use is a consequence of the improved effectiveness of newer pharmaceutical agents. The critical question in partitioning the expenditure increases thus comes down to the identification and valuation of patient benefit. A comprehensive evaluation would be very difficult, given the extraordinary range of new products available and the paucity and sometimes unreliability of available data on effect. (Data are required on effect as used in practice, not merely results from randomized trials. The latter are typically conducted on patients most likely to benefit, since their purpose is to evaluate efficacy under optimal conditions.)

Fortunately (for our purposes), almost half (45 percent, or 65 of 147 percentage points) of the total change in expenditures can be traced to two therapeutic categories in which the shift to a more expensive mix of drugs and/or increased in utilization by the elderly can be compared with good quality evidence of relative therapeutic effect. As it turns out, that evidence indicates that the more costly mix of drugs prescribed did not yield corresponding improvements in therapeutic outcomes.

Drugs used in the treatment of hypertension and non-arrhythmia cardiac illnesses were the fastest growing category—accounting for 27 percent of the total change in expenditures from 1985 to 1999. Over half (56 percent) of the growth in the costs of this class was due to the increased cost of drugs prescribed per patient receiving such treatments. This was the result of a shift in prescribing away from thiazide diuretics and beta-blockers toward calcium channel blockers and ACE-inhibitors during the 1980s and early 1990s. Yet, the best available evidence, then and now, should have directed prescribing toward increased (not decreased) use of the older, less-costly medicines (McAlister et al, 1997; Maclure et al., 1998; Hill, Levine and Whelton, 1988; Arnst, 1998; Wright, Lee and Chambers, 1999). This suggests that most of the observed change in the prescribing within this class of drugs was unnecessarily inflationary—if there was an increase in "needs," as reflected by increased exposure, they could have been (better) met at lower cost.

The second leading category for expenditure growth was the anti-lipemic agents—drugs used to control cholesterol levels. They accounted for 18 percent (or 25 percentage points) of the total change in expenditures between 1985 and 1999. As with hypertension treatments, just over half of the increase in expenditures on these products was due to increases in the cost of drugs prescribed per patient within the class. But unlike hypertension treatment, for which there is good evidence of therapeutic benefit (only the choice of agent is at issue), there is no

evidence of benefit from the routine use of *any* cholesterol-reducing drugs among the elderly. Lowering blood lipid levels is not a benefit in itself, but only a hypothesized intermediate step towards reductions in cardiac disease and death. The link from treatment to beneficial outcomes among elderly populations has in fact never been shown (Savoie, Wright and Maclure, 1998; Michael, Phillips and Mulrow, 2000; Savoie, 2000).

In a sense this excursion into the factors underlying the escalation of drug costs for seniors is beside the main point of this paper, since it has already been amply demonstrated that changes in population age structure are *not* the principal, or even a significant, contributor. Indeed, such effects are almost undetectable. There *has* been some increase in the (age-specific) proportion of seniors under drug treatment for particular illnesses, but this too is not the major factor. By far the dominant source of cost escalation has been the increase in costs of treatment for particular patients suffering from particular illnesses. Some of this increase is the result of "pure" price increases for particular drugs—the standard measure of price inflation. But there has been a very large increase in *de facto* prices resulting from shifts in prescribing from less to more expensive agents without evidence of therapeutic benefit.[10] Focusing on either the pure price numbers or the increasing age of the elderly serves only to distract attention – sometimes deliberately—from the real and remediable cost drivers.

But Maybe the Patients are Sicker Now…?

The more general question raised by observed increases in the use of physicians' services and (to the extent that they are not *de facto* price increases) drugs is whether changes may be taking place in the average level of age-specific "need" in the elderly population. The possibility of such changes gives rise to variants on the main theme of "apocalyptic demography" that are less readily refutable.

That main theme is derived from rather mechanical assumptions about patient needs and corresponding health care system responses. Observed rates of use at a particular point in time are implicitly taken as normative for people in each age bracket, reflecting (on average) their relative needs for, or capacity to benefit from, health care. These age-specific needs are then assumed to be constant over the subsequent projection period, and (a separate assumption) providers of services are assumed to continue to respond to those needs in an appropriate way. In reality, of course, patient needs at various ages will change, increasing or decreasing because of changes both in their underlying health status and in the technology and applicability of health care.

Nor can one in general assume that patterns of utilization of health care at a particular time correspond to patient needs. This is vividly demonstrated by the history of hospital inpatient use in Canada over the last forty years (as well as by the pharmaceutical examples above).

[10] Where there is corresponding benefit, the expenditure increase is buying increased "quantity" – or quality, rather than simply paying increased prices. When the benefit is only to a small and definable sub-population of those receiving the more expensive drug, however, the expenditure for the rest represents increased price.

In the 1960s the use of acute inpatient care in Canada was regarded by all observers as far too high. Practice was based on habit and inertia rather than patient need. A projection of the effect of changing age structure based on the age-specific use rates of 1969, as in Figure 2, implicitly treats as "needed" a pattern of care that was known to be excessive. The decline over the last thirty years has been a slow and quite deliberate adjustment towards more appropriate levels.

Whether current rates of inpatient use are too low, about right, or even still too high is a question that is almost totally clouded by a conflict of political agendas. Despite the apparently universal public impression (energetically promoted by and through the media) that hospital capacity is now desperately short, there is in fact evidence to support the view that inpatient rates are still too high, particularly if appropriate changes were made in primary care and community-based long term care (Wright, Cardiff and Kilshaw, 1997; HSURC, 1998). But there is no question at all as to the desirability of bringing rates down well below their levels in the 1960s.

This point cannot be overemphasized in the present context, because strong claims to the contrary are being made by the marketers of prescription drugs. The decline in hospital use, they allege, is a consequence of the introduction of new and more effective drugs. These drugs, so the argument goes, may be much more expensive than those they replace. But rather than being concerned over, and trying to contain, the rapid increases in drug costs, those who pay for health care should recognize (and welcome) them as the source of overall savings in treatment costs.

The argument is bogus, and rests on several fallacies, but perhaps the most fundamental is the assumption that treatment patterns and costs, whether with new drugs at present or with more inpatient care in the past, are and were determined by patient needs. The assumption is that much higher rates of hospital use thirty years ago were appropriate to that time; only the availability of new drug therapies made it possible to reduce them without threats to patients' health. Yet the over-utilization of hospitals was notorious thirty years ago. The changes in treatment style – shorter stays, greater use of day surgical and day medicine facilities, and reductions in questionable surgical procedures, were all known and in some areas implemented back in the 1960s and early 1970s. The claim that these changes only became possible with the more recent developments in pharmacology depends upon collective amnesia as well as ignorance of the medical literature. (There may be some link between shortened inpatient stays and the development of new anaesthetic agents – but these are included in hospital budgets, not in national expenditures on prescription drugs.)

Apart from the known history, the claim that increasing drug costs have "bought" lower hospital use runs afoul of the timing of effects. Many of the new and expensive drugs are alleged to have beneficial effects on health, and thus on health care use, through their long-term effects. Yet the fall in inpatient use is both prior to, and contemporaneous with, the rapid escalation of expenditures on drugs.

And finally, as noted above, for at least one major therapeutic class of drugs there is evidence that the new agents do not in fact provide any superiority in outcome. Their much higher cost per treatment day or episode is thus a *de facto* price

increase, not an increase in some hypothetical index of "quantity" (in the sense of greater effectiveness).. Price increases are not a substitute form of therapy. Nor is there any reason to believe – in fact there is evidence not to believe – that this class is an aberration. Several other heavily marketed new drugs lack any solid evidence at all of effectiveness. (Barer et al., 2000)

Apocalyptic predictions of the impact of population change might be rescued from the un-cooperative data above, however, if one could argue that the changing age structure interacts with other factors to generate continuing increases in age-specific use rates, at least among the elderly. Its impact would thus be underestimated by projections that take these rates as constant.

For example, increasing life expectancies might result from medical progress "salvaging" people who would previously have died but now survive – for a time – in a greater or lesser state of illness or incapacity. People, particularly elderly people, might therefore be "sicker", on average, at each age, and need more care. At the same time, advances in medical technology may make it possible to do more to and for people – especially elderly people – increasing their capacity to benefit from interventions and thus expanding "needs".

But these are empirical questions; the direction of such effects cannot be established by *a priori* assertion. Recall that a principal issue separating Fries and his critics was precisely that of whether increasing life expectancies would be associated with improving or deteriorating age-specific health status. And whether or not one accepts Fries' full hypothesis, to the extent that health care use and cost are concentrated at the end of life, delaying that end will push these costs up to older ages and tend to lower age-specific costs among the "younger-old".

In the 1980s such evidence as there was seemed to point towards "ever older, ever sicker". Life expectancies were increasing at all ages, while measures of age-specific health status showed declines among the older age groups. Such observations would provide some justification for continuing increases in age-specific use rates. But more recent data seem to support a more optimistic view. While there is still no sign that life expectancies are reaching a natural limit, it does appear that age-specific health status may now be improving, at least in "western" industrialized countries.

An improvement (or decline) in health status might first be detected in trends in mortality. All trends show continuing declines in mortality rates for both males and females at all ages. (Chen and Millar, 2000; Statistics Canada, 1999). But this does not tell us anything about how healthy people are while they are alive – and therefore how much health care they are likely to require.

The prevalence of chronic disease in Canada remained relatively stable for the two decades starting in the late 1970s. At the same time, the proportion of the population aged 75+ receiving long-term nursing care in institutions decreased from 16% to 14%. Long term activity limitation decreased for the young-old (65-74) and remained stable for those over 75. (Statistics Canada, 1999) This is an important combination of findings because the surveys that are the basis of these trends are interviews only with the elderly who live in the community. A decrease in institutionalization might be hypothesized to lead to an increase in the

prevalence of chronic disease or activity limitation in the community. The fact that it did not implies that the elderly are, in fact, healthier at the end of the century than they were in the two preceding decades.

Other evidence suggests that since the mid-1980s, life expectancy overall has increased faster than the number of years spent in disability. (Martel and Bélanger, 1999) While the time period under study was short (only a decade) the implication is that disability is getting compressed even while average lifetimes continue to increase.

Trends in health status – separated from what might be inferred from trends in health services utilisation – are rather elusive. It will probably take another decade or two of data collection to truly understand the multitude of mechanisms – age effects, cohort effects, period effects -- that are having their influence on health status. In the meantime, it seems safe to say that the health status of the elderly is improving. There is at least no evidence that it is declining, and thus no support for arguments about 'salvage' and 'ever older, ever sicker' as sources of utilisation increase.

Will this trend continue? Consideration of the broader determinants of population health might lead to concern for the future. Increasing inequality of incomes is suggestive of deteriorating social cohesion and other changes that have potentially adverse effects on population health status. Changes in these indicators would, however, have to be balanced against improvements that may be occurring in other areas such as housing or social networks. In any case, such general changes in the determinants of health that lie outside the health care system, whatever their net effect, are separable from the effects of changing age *structure per se.*

As for advances in medical technology, again there is no *a priori* reason why these must always lead to more extensive and expensive interventions. In fact they do not. There are many examples of advances that have significantly lowered the intensity of treatment and its' overall cost per patient.

Serious cost-increasing biases are present, however, in both the pricing and the rate of uptake of new technologies. Prices and fees charged tend to be "sticky downwards" in the face of cost-reducing innovations, though they rise quickly to cover more costly innovations. And new techniques and products that expand billing or sales opportunities tend to be accepted much more readily than those that might reduce activity levels and income opportunities. Moreover, new technologies are typically applied well beyond their range of demonstrated effectiveness. Drug therapy provides a number of leading examples, but these biases are far from exclusive to that industry. They arise from peculiarities of economic organization in the health care sector that have nothing at all to do with demography.

The rise in age-specific use rates for physicians' services (Figures 5 and 6) likewise points back to processes in the health care sector itself. For over twenty years, from the late 1960s to the early 1990s, the supply of physicians in Canada increased substantially faster than the population. (This was not a deliberate policy; it resulted from a rapid build-up of medical school capacity in anticipation

of a continuation of the baby boom.) But average physician workloads did not fall as the physician-to-population ratio increased. Whatever ones' interpretation of the mechanism, it is clear that the increase in physician supply was matched by an increase in utilization rates. If the physician-to-population ratio remains stable in future, then use rates can rise only to the extent that physician productivity – or at least average billings – increase. But with medical school capacity again being expanded, a renewed uptrend in use rates seems the most probable outcome. In either case, demographic changes will continue to have little or nothing to do with the trends.

Yet if the uptrends in physicians' services and pharmaceuticals are a consequence of features peculiar to the health care sector itself, what are we to make of the stark contrast between these sectors and the strong downtrend in the hospital sector on the other? The difference may be a result of the way utilization is being measured. For hospitals it is measured in physical units – acute inpatient days – whereas for the other two it is measured in (inflation-adjusted) dollars, of billings and of sales.

Expenditures per capita (inflation-adjusted) on hospitals in British Columbia, over the period 1975 to 2000, show a pattern very different from Figure 2.[11] Between 1975 and 1992, per capita expenditures rose by 26 percent in real terms, or about 1.4 percent per year (CIHI, 2000), while patient-day use was dropping steadily. Costs per patient day were rising sufficiently rapidly that they more than offset the decline in days. Only in the five years after 1992 did expenditures per capita turn down – in response to very tight provincial budgets – falling by 12 percent or 2.5 percent per year. (Forecasts for 2000 put them up 6.5 percent over 1997.) Both the decline in inpatient days and the turnarounds in budgets reflect deliberate provincial government policies, restricting the availability of first beds and then dollars. What is striking is both that the long-term reduction in utilization had no detectable effect on per capita costs, and that the really strong political backlash from the hospital sector, and the public concerns over inadequate supply, have been responses to the more recent reductions in money, not to the earlier reductions in bed days.

V What Keeps the Zombie Walking?

Apocalyptic demography, or more generally the claim that attempting to meet the health care needs of an aging population will bankrupt modern societies, or make universal health care systems unsustainable, is a "zombie", an idea or allegation that is intellectually dead but can never permanently be put to rest. However many times it is refuted by fact and argument, it always pops back up again to walk about, sowing confusion and making mischief. Attempts to understand and to manage health care systems are unfortunately plagued by quite a large number of such zombies (Evans et al., 1994; Barer et al., 1998).

[11] The expenditure data are available only since 1975, and as noted above include both acute and extended care (but not other, lower-level institutional care). Extended care use in B.C. has increased over this period, but the trend in total hospital inpatient use is still downward, and the bulk of expenditure is generated in acute care.

Zombies appear to derive their vitality from two characteristics. First, they have a superficial plausibility or intuitive appeal. It is true that older people use more health care, sometimes a lot more, than younger people, and it is true that the proportion of older people in all modern populations is increasing. So why should this not lead to large increases in health care use and costs? But more important, the zombie is constantly disinterred and reactivated because it serves the interests of some identifiable interest group. Who benefits from the "aging population" story?

The most obvious beneficiaries are providers of care, at all levels, for whom health care expenditures are in fact incomes. Every dollar of expenditure is a dollar of someone's income, and a claim that expenditures must rise dramatically to meet rapidly increasing needs is simultaneously a demand for a larger pool of incomes for providers of care. These may emerge as higher wages, or more jobs, or increased profits and share prices, but one way or another increased expenditures are increased incomes.

Moreover the demographic story provides an apparent justification for past expenditure trends. It draws attention away from questions as to the appropriateness or effectiveness of patterns of care provision, or of the levels of income they generate. Past cost escalation, like future needs, is attributed to purely external factors – changes in the demographic mix – for which no one in the health care sector could possibly be held accountable. The needs emerge from the population, and providers of care just do their best to meet them with the resources available. For providers of care the aging zombie supports financial expansion, and distracts from evaluation and accountability.

But there is another group, perhaps less obvious but for that reason more dangerous, who benefit from keeping the zombie walking (Northcott, 1994). If relentless demographic trends make universal public health care systems "unsustainable" – then they cannot be sustained. Their collapse is inevitable. What will replace them? Private or mixed public/private financing systems in which those with more resources get more care, and those with less get less. "Sustainability" might be achieved by reducing the overall level and cost of care, or simply by reducing *public* expenditure, and letting the total go where it will. Either way, the cuts falling on the less well off (who are often also less well).

The preference of the healthy and particularly of the wealthy for private financing of health care is readily understandable. Public systems require people to contribute more or less according to their income levels, regardless of their needs, and provide care according to needs, not according to income level. So the healthy and wealthy pay for more than they get, and the unhealthy and unwealthy get more than they pay for. To the extent that financing is privatized, those with more resources do not have to pay for care for those with less, and if they need care, they can buy themselves a (perceived) higher standard of care again without having to pay for a similar standard for others.

So far the potential beneficiaries of privatization have had limited success in mobilizing wider public support for their preferred policies. Within the context of this continuing campaign, however, the apocalyptic demography scenario seems to offer an "objective" argument for the unsustainability of universal public

financing systems. After all, the aging bulge has not yet hit us, and we're already in trouble! A shift to a more mixed financing system, with a greater level of private payment, can then be portrayed as not merely a policy choice, but an inevitability. "Resistance is useless!"

The usefulness of demographic arguments in this continuing clash of economic interests may thus provide the explanation for their continuing vitality. But the actual evidence is absolutely clear. Whatever the trends in health care expenditures, and whatever the "sustainability" of particular financing arrangements (public or private), we have nothing to fear from the aging of the population, only from those who continue to promulgate the fiction.

REFERENCES

Arnst C (1998), *Is Good Marketing Bad Medicine,* Business Week, 4/13, 62-63.

Barer ML, McGrail KM, Cardiff K, Wood L and Green CJ (2000), Tales from the Other Drug Wars, Centre for Health Services and Policy Research, Vancouver.

Barer ML. Evans RG. Hertzman C and Lomas J (1987), *Aging and health care utilization: new evidence on old fallacies,* Social Science & Medicine, 24(10):851-62.

Barer ML, Evans RG and Hertzman C (1995), *Avalanche or Glacier. Health Care and the Demographic Rhetoric,* Canadian Journal on Aging, 14(2):19-224.

Barer ML, Evans RG, Hertzman C and Johri M (1998), Lies, Damned Lies, and Health Care Zombies: Discredited Ideas that Will Not Die, HPI Discussion Paper 10, Health Policy Institute, The University of Texas-Houston, Health Science Center, March.

Baumol W and Bowen WG (1966), Performing Arts - the economic dilemma, New York: Twentieth Century Fund.

Boulet JA and Grenier G (1978), Health expenditures in Canada and the impact of demographic changes on future government health insurance program expenditures, Discussion Paper #123, Ottawa, Economic Council of Canada.

Chen J and Millar WJ (2000), *Are recent cohorts healthier than their predecessors?*, Health Reports, 11(4):9-24, Spring.

CIHI (2000), National health expenditure trends: 1976-2000, Canadian Institute for Health Information, Ottawa.

Clark DO, Von Korff M, Saunders K, Baluch WM and Simon GE (1995), *A Chronic Disease Score with Empirically Derived Weights*, Medical Care, 33(8): 783-795.

Denton FT and Spencer BG (1975), *Health-care Costs When the Population Changes*, Canadian Journal of Economics, 7(1):34-48, February.

Evans RG, Barer ML, Stoddart GL and Bhatia V (1994), Who Are the Zombie Masters, and What Do They Want? Toronto: The Premier's Council on Health, Well-being and Social Justice, June.

Evans RG (2001), *Financing Health Care: Taxation and the Alternatives*, in Mossialos E, Dixon A and Figueras J (Eds.), Funding Health Care: Options for Europe, Buckingham: Open University Press, forthcoming.

Foot DK (2000), [untitled review of Peterson, 1999] Canadian Public Policy 42(4):498-500, December.

Fries JF (1980), *Aging, natural death, and the compression of morbidity*, New England Journal of Medicine. 303(3):130-5, Jul 17.

Gee EM and Gutman GM (2000), The Overselling of Population Aging: Apocalyptic Demography, Intergenerational Challenges and Social Policy Don Mills, Ont.: Oxford.

Henripin J (1994), *The Financial Consequences of Population Aging*, Canadian Public Policy, 20(1):78-84, March.

Hill MN, Levine DM, and Whelton PK (1988), *Awareness, Use, and Impact of the 1984 Joint National Committee Consensus Report on High Blood Pressure*, American Journal of Public Health, 78(9):1190-193.

HSURC (1998), *Hospital and Home Care Study*, Health Services Utilisation and Research Commission, Saskatoon.

Maclure M, Dormuth C, Naumann T, McCormack J, Rangno R, Whiteside C and Wright JM (1998), *Influences of Educational Interventions and Adverse News About Calcium-channel Blockers on First-line Prescribing of Antihypertensive Drugs to Elderly People in British Columbia*, The Lancet. 352, 943-78.

Martel L and Bélanger A (1999), *An analysis of the change in dependence-free life expectancy in Canada between 1986 and 1996,* in Report on the Demographic Situation in Canada. Current Demographic Analysis Statistics Canada, Ottawa, pp 164-183.

McAlister FA, Teo KK, Lewanczuk RZ, Wells G, and Montague TG (1997), *Contemporary Practice Patterns in the Management of Newly Diagnosed Hypertension*, Canadian Medical Association Journal, 157(1):23-30.

McGrail KM, Evans RG, Barer ML, Sheps SB, Hertzman C and Kazanjian A (2001), *The quick and the dead: 'Managing' inpatient care in British Columbia hospitals, 1969-1995/96*, Health Services Research, forthcoming.

Michael P, Phillips C, and Mulrow C (2000), *Use of lipid lowering drugs for primary prevention of coronary heart disease: meta-analysis of randomised trials.* BMJ, 321: 983-986.

Mintzes B (2000), *The truth, the half-truth and nothing like the truth*, in Barer ML, McGrail KM, Cardiff K, Wood L and Green CJ (Eds), Tales from the Other Drug Wars, Centre for Health Services and Policy Research, Vancouver.

Morgan SG (2001), *An Index Approach to Drug Expenditure Decompositions*, Health Policy Research Unit (discussion paper), Centre for Health Services and Policy Research, Vancouver, BC, April.

Northcott HC (1994), *Public perceptions of the population aging "crisis"*, Canadian Public Policy 20(1):66-77.

Newhouse JP (1977), *Medical-Care Expenditure: A Cross-National Survey*, Journal of Human Resources, 12(1) (Winter): 115-25.

Pascali MV (1995), Controlling expenditures for physicians' services: An evaluation of British Columbia's cost containment policies, 1979-1991. Doctoral dissertation (Health Services and Policy Analysis), University of California at Berkeley.

Peterson PG (1999), Grey Dawn: How the Coming Age Wave Will Transform America and the World New York: Times Books.

Robson WPB (2001), *Will the Baby Boomers Bust the Health Budget?*, C.D. Howe Institute Commentary 148, Toronto: Renouf Publishing.

Roos NP (2000), *The disconnect between the data and the headlines*. Canadian Medical Association Journal, 163(4):411-2, Aug 22.

Savoie I, Wright JM, Maclure M (1998), *Lipid lowering therapy*, Joint Health Technology Assessment Series. BCOHTA, Vancouver. 1998:4J.

Savoie I (2000), *Lipid lowering drugs*, in Barer ML, McGrail KM, Cardiff K, Wood L and Green CJ (Eds), Tales from the Other Drug Wars, Centre for Health Services and Policy Research, Vancouver.

Statistics Canada (1999), *How healthy are Canadians?*, Health Reports, special issue, 11:3, Winter.

Steinberg EP, Gutierrez B, Momoni A, Boscarino JA, Neuman P Deverka P (2000), *Beyond Survey Data: A Claims-Based Analysis of Drug Use and Spending by the Elderly*, Health Affairs, 19(2):198-211.

Thomas L (1971), *The technology of medicine*, New England Journal of Medicine, 284:1366-68.

Van Tielen R, Payes F and Genart J (1998), *The demographic impact on ambulatory pharmaceutical expenditure in Belgium*, Health Policy, 45:1-14.

Woods Gordon Management Consultants (1984), *Investigation of the impact of demographic change on the health care system in Canada – Final Report*. (Prepared for the Task Force on the Allocation of Health Care Resources (Joan Watson, chairman), Toronto: Woods Gordon.

Wright CJ, Cardiff K, Kilshaw M (1997), *Acute Medical Beds: How Are They Used in British Columbia?*, Health Policy Research Unit 07:D, Centre for Health Services and Policy Research, Vancouver, BC, April.

Wright JM, Lee CH, and Chambers GK (1999), *Systematic Review of Antihypertensive Therapies: Does the Evidence Assist in Choosing a First-line Drug?*, Canadian Medical Association Journal, 161(1), 25-32.

SEDAP RESEARCH PAPERS

Number	Title	Author(s)
No. 1:	Population Aging and Its Economic Costs: A Survey of the Issues and Evidence	F.T. Denton B.G. Spencer
No. 2:	How Much Help Is Exchanged in Families? Towards an Understanding of Discrepant Research Findings	C.J. Rosenthal L.O. Stone
No. 3:	Did Tax Flattening Affect RRSP Contributions?	M.R. Veall
No. 4:	Families as Care-Providers Versus Care-Managers? Gender and Type of Care in a Sample of Employed Canadians	C.J. Rosenthal A. Martin-Matthews
No. 5:	Alternatives for Raising Living Standards	W. Scarth
No. 6:	Transitions to Retirement: Determinants of Age of Social Security Take Up	E. Tompa
No. 7:	Health and Individual and Community Characteristics: A Research Protocol	F. Béland S. Birch G. Stoddart
No. 8:	Disability Related Sources of Income and Expenses: An Examination Among the Elderly in Canada	P. Raina S. Dukeshire M. Denton L.W. Chambers A. Scanlan A. Gafni S. French A. Joshi C. Rosenthal
No. 9:	The Impact of Rising 401(k) Pension Coverage on Future Pension Income	W.E. Even D.A. Macpherson
No. 10:	Income Inequality as a Canadian Cohort Ages: An Analysis of the Later Life Course	S.G. Prus
No. 11:	Are Theories of Aging Important? Models and Explanations in Gerontology at the Turn of the Century	V.L. Bengtson C.J. Rice M.L. Johnson
No. 12:	Generational Equity and the Reformulation of Retirement	M.L. Johnson

SEDAP RESEARCH PAPERS

Number	Title	Author(s)
No. 13:	Long-term Care in Turmoil	M.L. Johnson L. Cullen D. Patsios
No. 14:	The Effects of Population Ageing on the Canadian Health Care System	M.W. Rosenberg
No. 15:	Projections of the Population and Labour Force to 2046: Canada	F.T. Denton C.H. Feaver B.G. Spencer
No. 16:	Projections of the Population and Labour Force to 2046: The Provinces and Territories	F.T. Denton C.H. Feaver B.G. Spencer
No. 17:	Location of Adult Children as an Attraction for Black and White Elderly Migrants in the United States	K.-L. Liaw W.H. Frey J.-P. Lin
No. 18:	The Nature of Support from Adult *Sansei* (Third Generation) Children to Older *Nisei* (Second Generation) Parents in Japanese Canadian Families	K.M. Kobayashi
No. 19:	The Effects of Drug Subsidies on Out-of-Pocket Prescription Drug Expenditures by Seniors: Regional Evidence from Canada	T.F. Crossley P. Grootendorst S. Korkmaz M.R. Veall
No. 20:	Describing Disability among High and Low Income Status Older Adults in Canada	P. Raina M. Wong L.W. Chambers M. Denton A. Gafni
No. 21:	Parental Illness and the Labour Supply of Adult Children	P.T.Léger
No. 22:	Some Demographic Consequences of Revising the Definition of 'Old' to Reflect Future Changes in Life Table Probabilities	F.T. Denton B.G. Spencer
No. 23:	Geographic Dimensions of Aging: The Canadian Experience 1991-1996	E.G. Moore D. McGuinness M.A. Pacey M.W. Rosenberg

SEDAP RESEARCH PAPERS

Number	Title	Author(s)
No. 24:	The Correlation Between Husband's and Wife's Education: Canada, 1971-1996	L. Magee J. Burbidge L. Robb
No. 25:	The Effect of Marginal Tax Rates on Taxable Income: A Panel Study of the 1988 Tax Flattening in Canada	M.-A. Sillamaa M.R. Veall
No. 26:	The Stability of Self Assessed Health Status	T.F. Crossley S. Kennedy
No. 27:	How Do Contribution Limits Affect Contributions to Tax-Preferred Savings Accounts?	K. Milligan
No. 28:	The Life Cycle Model of Consumption and Saving	M. Browning T.F. Crossley
No. 29:	Population Change and the Requirements for Physicians: The Case of Ontario	F.T. Denton A. Gafni B.G. Spencer
No. 30:	Nonparametric Identification of Latent Competing Risks and Roy Duration Models	G. Colby P. Rilstone
No. 31:	Simplified Estimation of Multivariate Duration Models with Unobserved Heterogeneity	G. Colby P. Rilstone
No. 32:	Structural Estimation of Psychiatric Hospital Stays	G. Colby P. Rilstone
No. 33:	Have 401(k)s Raised Household Saving? Evidence from the Health and Retirement Study	G.V. Engelhardt
No. 34:	Health and Residential Mobility in Later Life: A New Analytical Technique to Address an Old Problem	L.M. Hayward
No. 35:	2 ½ Proposals to Save Social Security	D. Fretz M.R. Veall
No. 36:	The Consequences of Caregiving: Does Employment Make a Difference	C.L. Kemp C.J. Rosenthal
No. 37:	Fraud in Ethnocultural Seniors' Communities	P.J.D. Donahue
No. 38:	Social-psychological and Structural Factors Influencing the Experience of Chronic Disease: A Focus on Individuals with Severe Arthritis	P.J. Ballantyne G.A. Hawker D. Radoeva

SEDAP RESEARCH PAPERS

Number	Title	Author(s)
No. 39:	The Extended Self: Illness Experiences of Older Married Arthritis Sufferers	P.J. Ballantyne G.A. Hawker D. Radoeva
No. 40:	A Comparison of Alternative Methods to Model Endogeneity in Count Models. An Application to the Demand for Health Care and Health Insurance Choice	M. Schellhorn
No. 41:	Wealth Accumulation of US Households: What Do We Learn from the SIPP Data?	V. Hildebrand
No. 42:	Pension Portability and Labour Mobility in the United States. New Evidence from SIPP Data.	V. Andrietti V. Hildebrand
No. 43:	Exploring the Effects of Population Change on the Costs of Physician Services	F.T. Denton A. Gafni B.G. Spencer
No. 44:	Reflexive Planning for Later Life: A Conceptual Model and Evidence from Canada	M.A. Denton S. French A. Gafni A. Joshi C. Rosenthal S. Webb
No. 45:	Time Series Properties and Stochastic Forecasts: Some Econometrics of Mortality from the Canadian Laboratory	F.T. Denton C.H. Feaver B.G. Spencer
No. 46:	Linear Public Goods Experiments: A Meta-Analysis	J. Zelmer
No. 47:	Local Planning for an Aging Population in Ontario: Two Case Studies	L.M. Hayward
No. 48:	Management Experience and Diversity in an Ageing Organisation: A Microsimulation Analysis	T. Wannell M. Gravel
No. 49:	Resilience Indicators of Post Retirement Well-Being	E. Marziali P. Donahue
No. 50:	Continuity or Change? Older People in Three Urban Areas	J. Phillips M. Bernard C. Phillipson J. Ogg

SEDAP RESEARCH PAPERS

Number	Title	Author(s)
No. 51:	Intracohort Income Status Maintenance: An Analysis of the Later Life Course	S.G. Prus
No. 52:	Tax-Preferred Savings Accounts and Marginal Tax Rates: Evidence on RRSP Participation	K. Milligan
No. 53:	Cohort Survival Analysis is Not Enough: Why Local Planners Need to Know More About the Residential Mobility of the Elderly	L.M. Hayward N.M. Lazarowich
No. 54:	Unemployment and Health: Contextual Level Influences on the Production of Health in Populations	F. Béland S. Birch G. Stoddart
No. 55:	The Timing and Duration of Women's Life Course Events: A Study of Mothers With At Least Two Children	K.M. Kobayashi A. Martin-Matthews C.J. Rosenthal S. Matthews
No. 56:	Age-Gapped and Age-Condensed Lineages: Patterns of Intergenerational Age Structure Among Canadian Families	A. Martin-Matthews K. M. Kobayashi C.L. Rosenthal S.H. Matthews
No. 57:	The Relationship between Age, Socio-Economic Status, and Health among Adult Canadians	S.G. Prus
No. 58:	Measuring Differences in the Effect of Social Resource Factors on the Health of Elderly Canadian Men and Women	S.G. Prus E. Gee
No. 59:	APOCALYPSE NO: Population Aging and the Future of Health Care Systems	R.G. Evans K.M. McGrail S.G. Morgan M.L. Barer C. Hertzman