Aggregate studies of age and health expenditures

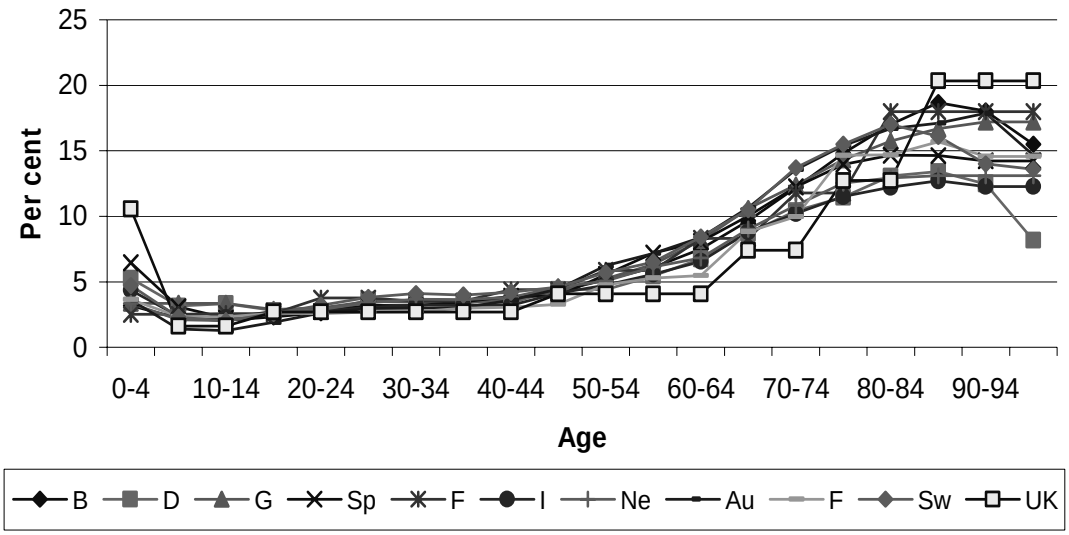
The majority of empirical studies examining the determinants of health expenditure have not found population ageing to be a significant factor in explaining the growth in expenditure.

Yet age-profiles of expenditure in most countries show that expenditure is higher for older age groups (figure 5.1). As discussed in chapter 6, there is also evidence that profiles have been relatively stable over time, implying that an ageing population will lead to increased pressure on health expenditure. Thus there appears to be an inconsistency between the data at the micro level and the data at the macro level.

This paper provides background on a range of these studies and discusses some of the factors that may explain this apparent inconsistency.

Figure 5.1 **European health expenditure[a]**

Health expenditure as a proportion of per capita GDP



a B=Belgium; D=Denmark; G=Germany; Sp=Spain; F=Finland; I=Italy; Ne=Netherlands; Au=Austria; F=France; Sw=Switzerland; UK=United Kingdom. Profiles are drawn using data from the year 2000 except France, 1997; Belgium, Denmark, Spain and United Kingdom, 1998; and Italy, 1999.

Data source: Bains (2003).

The literature

This section provides a brief guide to a sample of the literature. A range of empirical studies, including Culyer (1990), Gerdtham et al. (1992), Hitiris and Posnett (1992), Zwiefel et al. (1999), Richardson and Roberstson (1999), Moise and Jacobzone (2003) and Jönsson and Eckerlund (2003), have all found that ageing has not been a statistically significant factor in the growth of health expenditure (table 5.1). A partial exception is Karatzas (2000).

Variations in national income generally account for most of the cross country differences in health outlays. In his seminal article, Newhouse (1977) provides a comparison of health expenditures across some thirteen developed nations (circa 1972). Using a simple regression of per capita medical expenditures against per capita GDP, differences in the level of national incomes are able to explain 92 per cent of the variance in per capita health outlays. However, Newhouse undertook this analysis before ageing had any real momentum, and the residual, which was left unaccounted for, was unlikely to be explained by age-related factors at that stage.

Gerdtham et al. (1992) examined the determinants of health care expenditure using data from some twenty industrialised countries over a two decade period. Their regression attempts to control for a variety of both 'background' and 'institutional' influences, including income, demography and fiscal constraints. Dummy variables were used to distinguish between health care provider systems. For example, a dummy variable was used to make the distinction between those systems which employed patient reimbursement schemes rather than provider reimbursement schemes. Similar to other studies, Gerdtham et al. found GDP per capita to be a highly significant variable, while ageing (proportion of population over 75) was not. Even at more disaggregated levels of health expenditure — ambulatory care, in-patient care and pharmaceutical — ageing registered as insignificant. By contrast, health expenditures proved very responsive to even the broadest distinctions between provider arrangements.

Table 5.1 **The literature in brief**

Author	*Year*	*Nature*	*Notes*
Newhouse	1977	Cross national comparison of 13 developed nations, circa 1972	Compares per capita GDP with per capita HCE, and is able to attribute 92 per cent of the variance between HCE to per capita GDP differences across the nations studies.
Fuchs	1984	Qualitative and quantitative analysis	Examines trends in HCE, and age specific morbidity and mortality. Fuchs concludes that spending is a function of death, and aggregate expenditure has been rising with the number of persons approaching their final years.
Culyer	1990	Reviews the success and failures of the reform process of European nations battling rising health care requirements.	Concludes that given the strength of the relationship between HCE and income, growing expenditures are consequently beyond the reach of policy.
Newhouse	1992	Using a fixed weight expenditure profile, to compare health spending between 1950 and 1987 (USA).	Examines the role played by access to insurance, increased incomes, supplier induced demand, and low productivity growth of health services, concluding that these factors account for most of the rise in HCE.
Getzen	1992	Cross country study of real HCE growth between 1960 and 1990.	If income is included in the regression, ageing is not found to be significant, implying that rising HCE and rising ages are the result of an indirect relationship with other variables. Moreover, concludes that ageing affects only the allocation of expenditures, but will not substantially increase the total level of HCE.
Gerdtham, Josson and MacFarlan.	1992	Cross country study of the determinants of total HCE. Circa 1985.	Tests a variety of background and institutional variables. Background variables are mostly socio-economic, and include ageing and per capita income, as well as alcohol and tobacco consumption. Institutional variables refer to funding arrangements, access schemes etc.
Hitiris and Posnett	1992	Uses a sample of 560 cross sectional and time series observations from the OECD to test the determinants of health care spending.	Their results reaffirmed that the vast majority of expenditures on health are caused by income discrepancies. The impact of demographic variables was quite limited under all their model specifications, if even found to be significant.
Hansen and King	1996	Critical study of the econometric methods used in many of the above studies.	Suggests that standard time series models where HCE is a function of real per capita GDP and a selection of non-income variables may be misspecified. Finds variables in many OECD orientated models are not stationary, arguing that this violates an assumptions of an OLS regression.

Blomqvist and Carter	1997	Reviews methodological problems that arise from issues in the data.	
Lamers and Van Vliet	1998	Study of Dutch social insurance system.	Found that health outlays in the last year of life were some 15.3 times greater than costs than for those otherwise.
McCoskey and Selden	1998	Applies different tests to the concerns of Hansen and King.	Findings contradict Hansen and King.
Richardson and Robertson	1999	Uses Aust. SSDs in a cross sectional comparison to test for explanatory determinants of HC use. A short cross-nation survey of OECD countries in 1960, 1975 and 1995.	Compares the use of GP services per capita across the 186 Australian SSDs. After standardising for a number of statistically significant variables (inc. urban/rural, aboriginality, public hospitals etc), found the age/sex variable explains only 3 per cent of the cross sectional variance.
Zweifel, Felder and Meiers	1999	Uses Swiss HC data 1983-1994 to test if rising health costs can be explained by "closeness to death."	Although calendar age variables were statistically significant the respective coefficients were of little influence on the model. Quarters to death however, contained much more explanatory power.
Karatzas	2000	Time series test of US aggregate per capita real HCE, 1962-1989	Constructs a variety of models which include economic, health stock and demographic variables to predict per capita real health expenditure.
Felder et al.	2000	Uses the same data as Zweifel et al., adjusting for age, mortality, risk and wealth.	
Gerdtham and Lothgren	2000	Tests the data for stationarity and cointegration.	OECD health expenditure and GDP data from the period 1960-1997 proves to be non-stationary. The studies which have relied on this data set to reach their conclusions may have reached the wrong conclusions.
Salas and Raftery	2001	Questions Zweifel's methodologies and results econometrically	Identifies two particular problems with the Zweifel et al study: a) Study assumes HCE and time to death to be unrelated; and b) sample selectivity problems which they claim weren't properly controlled for.
Stooker et al	2001	Tests the determinants of health expenditures in the Netherlands, primarily as a function of years remaining.	Reaches similar conclusions to Zweifel et al. Significantly however, Stooker et al, attribute only 10 per cent of total health costs to the dying, arguing that any measures taken to reduce the costs of dying will have only a moderate impact on the total health budget.
Sheehan	2002	Cross country study of 20 OECD countries, 1989-1999	Tests for correlation between real health growth over the decade and growth in the proportion of over 65s. Reports a correlation coefficient of 0.04, and a number of countries reported highly counter intuitive results- suggesting that there is no relation between the two. Concludes that we are getting older later, rather than older younger.
Dow and Norton	2002	Explores the econometric	Building on the concerns of Salas and Raftery, Dow and Norton have additional

		methodologies of the paper by Zweifel et al	problems with Zewifel et al. They claim Zweifel et al.'s choice of model selection is a flaw in the study.
Chernichovsky and Markowitz	2003	Time series study of Israeli HCE from 1966 to 1998	Uses median age, doctors per 1000 persons, mean years of schooling and GNP per capita to explain HCE per capita. Coefficient on median age is insignificant.
Moise and Jacobzone (OECD)	2003	Cross country study of OECD member states, 1997	Finds little correlation between per capita HCE and percentage of population aged over 65.
Jönsson and Eckerlund (OECD)	2003	Cross country study of OECD member states, 1998, and includes a case study of Sweden	Replicates Newhouse 1977 with more recent data, but now attributes only 77 per cent of cross country comparison to differences in income.
Bains (OECD)	2003	Projects HCE to 2050 EU member states (excluding Luxemburg)	Projections map current age-sex-expenditure profiles against predicted pop changes. Ageing will increase public HCE as a percentage of GDP by between 0.7 and 2.3 percentage points.
Jacobzone	2003	Survey article	Demography, is a secondary factor in the overall increase of HCE. The key factor is technology and rising relative prices for medical inputs, combined with the intensity of medical care at older ages. Points to the high concentration of medical costs at the end of life, and argues that failure to account for this will tend to overstate any future predictions.
Jewell et al.	2003	Tests for structural breaks in the data.	Counter's the conclusions of other econometric criticisms, claiming that after structural breaks are controlled for, the data proves to be reliable and stationary.
Seshamani and Gray (UK)	2004	Longitudinal study of hospital costs in Oxfordshire UK	Finds a relationship between proximity to death, particularly the last year of life (but extending back 15 years), and hospital costs.

Chernichovsky and Markowiz (2000) found that for Israel — one of the fastest ageing populations in the developed world — only GDP per capita and mean years of schooling proved statistically significant.[1] While their testing of Israeli data does not reveal a significant age effect, they recognise that assuming a simple linear relationship between individual and aggregate spending may be oversimplified. The authors suggest that shifting mortality and morbidity over the period has caused age-specific shifts in the profile, making the relationship more complicated.

Karatzas (2000) tested a number of hypotheses of rising health care costs, modelling real per capita US health care expenditure over the period 1962-1989 with income, health stock and demographic variables. Karatzas constructed four models to explain rising health spending, each focussing on a different set of explanatory variables. One of his conclusions was:

> …what emerges from these exercises is that changes in the economic, demographic and health stock variables produce persistent changes in the per capital real healthcare, and these findings do not support the contention that the per capita real income is the only major determinant of per capita real health care spending. (pp. 1088-1089)

Karatzas' Equation 4, which is the only of the four models to incorporate ageing, returns an R^2 value of 0.98. According to his results, a one per cent increase in the proportion of over 65s in the economy will cause total per capita health expenditure to rise by 2.55 per cent. Importantly, the model itself is not completely removed from income issues, also including a statistically significant measure of income distribution (the ratio of nominal wages to nominal GDP). Notably, as health care spending data is disaggregated to finer levels (for example per capita government outlays and per capita pharmaceutical expenditure) ageing, plays a less prominent role as a statistical explanatory variable,.

Overall, while the studies sampled are not universal in their conclusion, in general, they do not find ageing to be a statistically significant determinant of health expenditure (particularly when income is also included in the model).

Why is ageing not showing up in the data?

Although it is difficult to be conclusive, there are a number of explanations as to why ageing has not been found to have a significant influence on health expenditure.

[1] Education is included as an indicator of economic development.

Accelerating ageing

In a climate of rapid income growth and technological advances, ageing has historically been a relatively minor issue for most countries. In Australia, the proportion of the population aged over 65 grew at an average annual rate of 0.7 per cent between 1960 and 1990 (see table 5.2). However, over this same period, the average annual rate of real GDP growth was 3.9 per cent. Relative to income growth, ageing has understandably played only a secondary role in driving health expenditures.

Table 5.2 shows the growth rate of people over 65 years over the periods 1960 to 1990 and 1999 to 2050 for 20 OECD countries. Of those listed, Japan recorded the fastest degree of ageing to 1990, with the proportion of over 65s growing annually at a rate of 1.7 per cent. Belgium and France, were the slowest over the period with a growth rate of only 0.4 per cent. Forecasting ahead, growth for all countries is expected to accelerate, with 16 nations achieving annual growth of over 2.0 per cent, including Finland and Japan at 4.4 per cent and 5.6 per cent respectively. Australia's rate of ageing is forecast to more than triple its recorded rate, rising to 2.6 per cent.

Thus, relative to the role of technology and demand, ageing may have been a relatively minor factor driving health expenditure. However, as ageing accelerates in the coming decades its significance is likely to increase.

Offsetting factors

With the modest level of ageing experienced in most countries to date, its impact may have been offset by other factors. The two factors commonly suggested include, compression of morbidity (falling age specific disability rates) and institutional rationing of health expenditure. Another is that ageing and death rates do not always move in the same direction.

Compression of morbidity

Chapter 2 suggested that disability rates are falling but this is unlikely to reduce future health expenditure because of more intensive medical treatment.

Table 5.2 **Annual growth of elderly population, as a proportion of total population, selected OECD countries**

Country	*1960-1990*[a]	*1999-2050*[b]
	per cent	per cent
Belgium	0.4	0.6
France	0.4	0.8
Austria	0.5	1.1
United Kingdom	0.6	1.7
Switzerland	0.7	2.0
New Zealand	0.5	2.0
Iceland	0.6	2.5
United States	0.7	2.5
Denmark	0.9	2.5
Australia	**0.7**	**2.6**
Sweden	1.0	2.6
Norway	0.9	2.6
Germany	1.0	2.8
Italy	1.0	3.3
Netherlands	1.0	3.4
Greece	1.0	3.7
Spain	1.1	3.7
Canada	1.0	3.8
Finland	1.4	4.4
Japan	1.7	5.6
Unweighted average	**0.9**	**2.7**

a Estimated from Getzen (1992) as the proportional change in per cent of total population aged over 65, 1960 to 1990. **b** Estimated from UN Division of Economic and Social Affairs, Population Division (1999); proportional change forecasted of per cent of total population aged over 60, 1999-2050

However, over the period covered by the majority of the studies, a greater proportion of the gains may have come from lifestyle changes or the use of relatively cheap medications. In a report for the Myer Foundation, Byles and Flicker (2002, p. 2) report that the dramatic increases in life expectancy since the late 1960s have been largely the result of:

> …declines in deaths due to heart disease, stroke and lung cancer… mostly due to a reduction in smoking, but also due to control of blood pressure and cholesterol and improvement in medical treatments.

Cutler (2001a) also attributes some of the reduction in disability in the US to reduced smoking and behavioural changes. To the extent that health of the elderly in the period from 1960 to 1990 improved from these factors it may have somewhat offset the modest impact of aging. However, the future extent of population ageing will preclude a similar effect.

Rationing

To some extent, the impact of ageing on the health expenditures may have been muted across the OECD, because of the public sector's significant influence in the market. Sticky policy mechanisms and institutional arrangements, including rigidities in expanding budgets with increased needs, may constrain spending.

Getzen (1992) argued that budget realities limit the impact of ageing on OECD public health expenditures. Getzen suggested ageing has not substantially increased the total health care bill, but only affects the allocation of expenditures:

> Ageing will increase the demand for health care, but adjustment to budgetary realities will limit that increase so the *structural*, or aggregate, effect of one person becoming older is not 200 percent or 500 percent of average per capita spending, as is assumed in age group projections, but more of the order of 5-50 percent… A clear robust negative empirical result, that ageing is *not* a significant cause of rising health care costs… may also strengthen the recognition that spending is a result of political and professional choices… (p. S103).

Similarly, Chernichovsky and Markowitz (2003, p. 7) stated:

> In the supply driven public system, the health budget grows at a given rate that may be quite independent of particular or age-specific health needs, but once established, the budget is redistributed according to socially defined needs of age-specific costs.

Health systems differ among countries, and change over time. As such, the degree of rationing is also likely to differ among countries and across time within countries. Thus, rationing is another factor that could obscure underlying demand pressure on health expenditure from ageing.

Rationing is a possible response by governments to future pressure on health expenditure from ageing. However, this would involve denial of care comparable to the standards applying in other countries. In effect, while there might be no fiscal gap associated with health care, there would be a treatment deficit.

Classification of health data

Jacobzone and Oxley (2002) present data on total care costs for the OECD. They define total care to include long-term care for the aged, as well as health care. They note that while increases in spending on these two categories are driven by somewhat different sets of factors:

> Nonetheless, the borders between these services are blurred: for example, because long-term care for the very dependent merges with hospital care and various kinds of ambulatory care may also help in keeping the elderly independent as long as possible.

Such blurring in classifications are evident in widely differing proportions of expenditure on health and long term care among developed countries. Sweden is a good case in point. Sweden is often cited as an example of why ageing may not have a significant impact on health costs. It spends less as a proportion of GDP on 'health care' than Australia (8.8 per cent compared to 9.1 per cent in 2001) yet has a greater proportion of over 65s. However, according to the OECD (2004b), Sweden spends 4.5 per cent of GDP on home care services for the elderly. It appears that significant health care provided in a home-setting may be included in this category, rather than as health care.

By contrast, the OECD data for Australia record only 0.3 per cent of GDP as publicly funded aged care. In Australia's case, high level residential care (comprising the majority of government aged care expenditure) is classified as health expenditure, in line with the World Health Organisation guidelines. To avoid double counting, such residential care is likely to be excluded from the OECD data base on aged care.

Combining health care and aged care expenditure, Sweden's expenditure was 11.1 per cent of GDP in 2001 compared with Australia's 9.3 per cent.

Overall, the blurring of the boundary between health care and aged care provides further reason to be careful when interpreting the results of studies that examine the links between ageing and 'health care'.

Divergence between ageing and death rates

As discussed in appendix C, the rate of ageing (for example, as measured by the proportion of the population over 65) and the crude death rate do not always move in sequence. For the last 20 years in Australia, the proportion of older people has been rising, but the crude death rate has been falling. A number of countries appear to show a similar pattern.

To the extent that health costs are related to the period before death (as suggested by Gray 2004), falling death rates would have reduced the historical impact of ageing.

However, as is also discussed in appendix C, Australia is entering a period where both ageing and the crude death rate both rise significantly.

Econometric issues

There is debate about the econometric methods of specific studies — such as Zwiefel's influential study on the costs of death (box 5.1) — and of the methods used in macroeconomic studies more generally.

Hansen and King (1996) raise the issue of 'stationarity' (or rather the lack of) in the data sets used by most studies. Loosely, time series data are stationary if the mean, variance and covariance do not change over time. Stationarity is one of the critical assumptions required when performing ordinary least square regression. Hansen and King survey the typical methodologies wherein real per capita health care expenditure is predicted as a function of real per capita income and other demographic or health stock variables. They argue that the:

> … results obtained may be misleading, or even completely spurious, if the variables employed are not individually, or collectively, stationary. (p. 130)

Testing by Hansen and King (1996, p. 130) found non-stationarity in approximately two thirds of the variables in data sets for health care expenditures, GDP, ageing and institutional provision across 20 OECD nations. No single country exhibited a data set entirely stationary in levels. Alternative testing for stationarity by both Blomqvist and Carter (1997) and Gerdtham and Lothgren (2000) reached the same conclusions.

While there is support for Hansen and King's results, it is not unanimous. Using a different set of tests, McCoskey and Selden (1998), and more recently Jewell et al. (2003) have obtained different results — finding that health care spending and GDP are stationary. As part of an ongoing debate, however, these results too have been met with claim and counter claim, making a definitive judgment difficult.

Jewell et al. (2003) identify the issue of structural breaks in the data. They argue that it is necessary to test for structural breaks, before asserting that health care expenditure and GDP are non-stationary sequences (or stationary for that matter):

> It is now well known that a structural break can be mistaken for non-stationarity. Therefore, it is possible that previous findings of non-stationarity in [health expenditures] and GDP may be due to the failure to allow for structural breaks. (p. 314)

Using the panel LM unit root test, Jewell et al were able to identify structural breaks in 12 of the 20 countries surveyed (the vast majority of which happened between 1973 and 1983) (Jewell et al. 2003, p. 319). These structural breaks occurred during or shortly after a recession. They note:

> … the business cycle might significantly impact health expenditures, since the government plays a major role in financing of [health expenditures] in most OECD countries. As such the structural breaks in [health expenditures] can be potentially

> influenced by significant fluctuations in the business cycle that directly impact government revenues. Close examination of the break points seems to support this conjecture, since many of the break points in [health expenditure] are consistent with recessionary periods. (p. 319)

Having correctly controlled for these structural breaks, their findings support both GDP and health spending as being stationary variables in most countries, around one or two breaks. Controlling for stationarity in this manner may overcome the problems identified by Hansen and King.

Conclusion

Many empirical studies find that ageing has not been a statistically significant factor influencing past growth in health expenditure. This may well be because the degree of ageing to date has been modest compared with what is projected to occur over the next 40 years.

The evidence about stable age-cost profiles over time (chapter 6) suggests that, all other things being equal, ageing must have contributed modestly to historical pressure on countries' health costs. That this is not evident in the data suggests that:

- nuances in the data and/or econometric issues have masked the effects of ageing; and
- that other factors — such as rationing, the importance of costs associated with death and improvements in health over the period in question — have meant that the impact of ageing has been muted.

In conclusion, the macro econometric studies alone do not provide strong evidence for rejecting the proposition that ageing will exert significant pressure on health expenditure in the future.

Box 5.1 **Debate on Zweifel et al 1999**

Zweifel et al. (1999) use data from two major Swiss private health care funds to test for a relationship between death and expenditures. Data from the two health care funds tracks the expenditure history of member decedents over the period 1983-1994. In their model age, gender and quarters to death are used to predict per capita total health care expenditure. Data from two samples returned significant coefficients on age variables (age of decedent and age of decedent squared) when testing the full sample of decedents, however, was insignificant when the sample was limited to just the over 65s. In addition the value of the ageing coefficients themselves suggested that ageing had only a minor influence on the health care costs recorded over the period.

The number of quarter year periods before death 'variable' yielded both statistically significant and sizeable coefficients leaving Zweifel et al. to conclude that the

> …relationship between age and HCE [Health Care Expenditure] is in fact a relationship between increasing age-specific mortality and the high cost of dying… (p486)

And therefore:

> …per capita HCE is not necessarily affected by the ageing of the population… Rather, an increase in the elderly's share of population seems to shift the bulk of HCE to higher age, leaving per capita HCE unchanged (p493).

The paper by Zweifel et al. has drawn substantial criticism for its method and data selection. The data pertains only to decedents and therein assumes no use for health care expenditure to actually prolong the time of death. Salas and Raftery (2001) ask that if there is no such relationship, then why is health care sought for in the first place? They argue:

> …it is clearly plausible that HCE in a given quarter does contemporaneously affect health status and thence closeness to death (p670).

In the regression estimates, Zweifel et al. assume health expenditure and time to death to be weakly exogenous. Salas and Raftery argue that they should have assumed the relationship to be endogenous, and that the conclusions reached by Zweifel et al. may be biased as a result. In response, Zweifel et al. (2001, p. 673) make the point that thus far, health economists have been unable to find a relationship between health care expenditure and measures of longevity.

Dow and Norton (2002), also raise concerns about the choice of model, stating that Zweifel et al.:

> …invoke the Heckit model for inappropriate reasons, derive the wrong marginal effects for their main tests of interest, and use an unsatisfactory test of the Heckit versus the two part model. (p. 2)