11 Understanding 'value for money' in healthy ageing

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The economics of population ageing is inseparable from the economics of healthcare. Increases in healthcare spending seem inexorable, absorbing a greater and greater share of economies around the globe. Successful social adaptation to older population age structures will therefore bring an increasing policy focus on the need for healthy ageing and understanding the value of our resources devoted to medical care.

Any discussion about health spending should be accompanied by discussion of the social value of that spending – as measured by quality-adjusted health spending or the net value of medical care, terms I will discuss below. This focus on 'value for money' should become as automatic in policy debates about health expenditures as currently any discussion of longer lives soon leads to a focus on healthy life expectancy or quality-adjusted life years, and most discussion of per capita living standards goes beyond GDP to consider fuller metrics of wellbeing.[1]

In short, policymakers should focus on measuring and improving the 'value for money' of medical care. Developing methods for assessing quality improvement and the net value of chronic disease spending is especially critical for ageing societies, because in most countries healthcare spending for chronic diseases represents a large and increasing part of public and private budgets.

Economic value of improvements in longevity and preventive care

Multiple economic studies confirm the high value of improvements in longevity. For example, Jones and Klenow (2016) estimate that a consumption-equivalent measure

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[1] Fan et al. (2018) describe the many important metrics for development that have been proposed as alternatives, or supplements, to GDP per capita, and proposes a new measure that incorporate healthy life expectancy and dispersion of income: Alternative wellbeing measure=(GDP per capita)×(healthy life expectancy)×(median income)/(mean income). Accurate measurement of GDP requires taking account of quality, and it is even more important for measuring the value of specific health investments, social preparedness for ageing (Chen et al. 2018), and sustainable financing of longer lives (Eggleston and Mukherjee 2019).

of economic welfare that takes account of life expectancy and leisure shows a 20-fold increase over a century compared to a seven-fold increase for per capita incomes alone. Murphy and Topel (2006) estimate that cumulative gains in life expectancy over the 20th century were worth over $1.2 million to the representative American. The Lancet Commission on Investing in Health's Global Health 2035 report (Jamison et al. 2013) estimated the economic returns of universal reduction in avoidable deaths from infections and maternal and child health conditions to be $9-20 for each dollar invested (see Table 1, Panel A).

Quantifying the value of medical spending, however, differs from measuring the economic value of longer lives for at least two reasons: non-medical factors contribute to increases in longevity, and medical spending yields gains in quality of life as well as longevity. Medical treatments may extend years of vitality, postponing the onset of disability and chronic diseases, so that morbidity will be compressed in old age (Fries 1983). This could have great economic value, especially if extending the years of vitality enabled more people to work longer before reaching their frail years (Eggleston and Fuchs 2012, Coile et al. 2016). One study found that healthy life increased measurably in the US between 1992 and 2008, with the largest improvements coming from control of cardiovascular disease and vision problems (Chernew et al. 2017). Research in many countries suggests that older people are generally healthier than in previous generations, and middle-income countries in particular could reap large economic benefits from control of major chronic diseases (Bloom et al. 2019).

Large economic benefits also often flow from prevention, including appropriate child and adult vaccination (Stack et al. 2011, Bloom 2015, Kaslow et al. 2018) and screening. Investments in appropriate screening and treatment can not only improve quality of life and extend lives, but may also reduce the rate of growth of medical expenditures. For example, many cancers found at an earlier stage have much greater chances of survival as well as much lower treatment costs per year of life gained compared to cancer not diagnosed until later stages. Universal access to appropriate screening would be desirable even if prevention extends lives without saving money, as is often the case.

However, barriers to such programmes are often numerous, especially in low- and middle-income countries (LMICs), including lack of awareness among the population about the value of screening and incentives to focus on curative treatments rather than preventive services. Residents virtually never rally in the streets for better population health services or measures that will save many 'statistical lives' (Viscusi and Aldy 2003); they do become inflamed when a specific individual is denied hospital admission or life-saving treatment. Thus, health resources tend to flow towards curative care rather than prevention. Moreover, designing an appropriate universal screening

programme requires incessant, evidence-based policy adjustment, since the science of cost-effective screening is complicated and evolving. Consider, for example, the case of thyroid cancer. Considerable evidence suggests that increases in screening in many parts of the world have led to over-diagnosis and unnecessary surgeries (Vaccarella et al. 2016, Du et al. 2018).

Determining which services and technologies are unnecessary and which are of high value can be complicated. As a first step, medical spending needs to be tracked appropriately. Government agencies and advisory boards have promoted better ways of aggregating healthcare spending (Atkinson 2005, National Research Council 2010, OECD, Eurostat, and WHO 2011). The US Bureau of Economic Analysis developed a healthcare satellite account to track spending on specific medical conditions and construct new disease-based price indexes (Dunn et al. 2015). This effort contributes to a better understanding of healthcare spending in ageing societies, confirming that the seemingly inexorable increase in spending stems primarily from increasing cost per individual treated, not from the greater number of patients treated. The next step is to incorporate a measure of the value of condition-specific spending. Are we obtaining value for the money devoted to treating given diseases?

The economic value of medical care's contribution to better health outcomes

Medical spending per individual with a given condition has usually increased. But outcomes from care are also better. The quality-adjusted cost of care may actually have declined, as Cutler et al. (1998) found in their pioneering research on AMI (heart attacks). Many other studies of medical conditions ranging from depression to cataracts have found similar results (Cutler and McClellan 2001, Shapiro et al. 2001, Berndt et al. 2002, Highfell and Bernstein 2014, Dunn et al. 2018, Wamble et al. 2018; see also Table 1, Panel B).

Hall (2017) provides a review of the literature on quality-adjusted price indexes for specific medical conditions. She notes that adjustment for quality is even more important now that the US Bureau of Economic Analysis has created new price indexes for healthcare in its healthcare satellite account and must decide how to adjust those indexes for quality.

Determining the value of quality changes, such as improvements in survival, may seem a futile exercise in 'pricing the priceless'. But to reward value, we must first measure it. Often, health economists will measure value by assuming each additional year of life brings a given monetary value, such as $100,000.

Because the health benefits of medical care are difficult to aggregate across disparate services and diseases, focusing on management of a single important chronic disease allows researchers to develop metrics of quality improvement and value that are linked to rigorous clinical studies (e.g. avoided hospitalisations from reduction in predicted risk of heart attacks and strokes for patients with diabetes).

Recently, an international collaboration of researchers, of which I was one, studied quality adjustment for one disease of growing prevalence in ageing societies – type 2 diabetes – drawing on and extending earlier work (see Table 1, Panel C). A previous study of a small (613-patient) US sample found a positive net value of diabetes management between 1997 and 2005 in the range of $1,050 to $2,215 for $100,000 per life-year gained, and an extension with 821 patients covering 1991-2009 found a similar result (Eggleston et al. 2009, 2011; see Table 1).

Interestingly, the four-system study found similar results with a much larger and more diverse sample. In Eggleston et al. (2019), my co-authors and I analyse a large dataset of patient-level panel data between 2006 to 2014, linking medical spending to biomarkers for 123,548 individuals with type 2 diabetes in four different health systems: one in Europe (the Netherlands) and three in East Asia (Japan, Hong Kong, and Taiwan). We measure the net value of medical care by applying the 'cost-of-living' approach (Cutler et al. 1998) that has some kinship with the 'value of life years' approach in environmental and development economics (e.g. Nordhaus 2002). Net value is the present discounted monetary value of any improved survival between the baseline and final periods, holding age and duration of diagnosis constant at their baseline values ('modifiable risk'), net of the increase in annual real modifiable spending per patient.

Results suggest that the value of improved survival outweighs the added costs of care on average in each health system. For example, in a study of Japan (Chen et al. 2018), my co-authors and I find a positive value net of $2,595 for $100,000 value of a life-year (Figure 1). To compare net value across the four health systems and different patient samples, we standardised by age and sex to the WHO world standard population. After standardisation, mean net value ranged between $600 and $10,000 for a $100,000 value of a life-year. The net values remain positive when assuming only half of survival gains were due to medical care, even though we very conservatively attributed all medical spending to diabetes. Our finding that the quality-adjusted 'cost of living' medical price index for managing diabetes has been declining across all four health systems is robust to various sensitivity analyses accounting for selective survival, end-of-life spending, and a range of values for a life-year or percentage of survival benefits attributable to medical spending.

Figure 1   Mean net value of improved modifiable mortality risk among individuals
with diabetes in Japan

Source: Chen et al. (2018).

Figure 2   Net value by age group, relative to mean net value of individuals aged 60-
64 in each health system (Japan, Netherlands, Hong Kong, Taiwan)
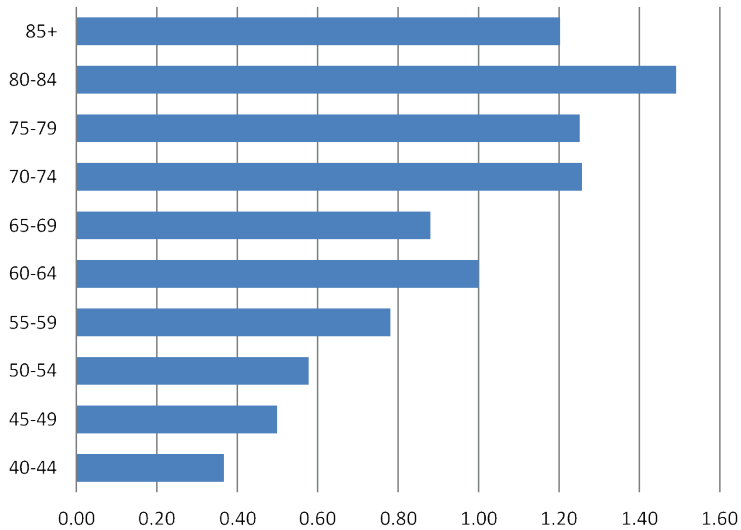
Source: Based on data from Eggleston et al. (2019).

Net value was positive for all age groups (Figure 2) – even among the relatively
young prime-age workers living with diabetes (age 40 and 50) who have relatively
small absolute risk of mortality, the monetary value of a small reduction in modifiable

mortality risk exceeded their increase in medical spending. Moreover, net value remains positive and significant for individuals well beyond traditional retirement ages. These results suggest the importance of continuing investments in treatments that deliver health outcomes of commensurate or higher value.

Most relevant for policy will be the ability to monitor and promote innovations that increase net value. For example, Skinner and Staiger (2015) document how small differences in the propensity to adopt effective technology lead to wide productivity differences across US hospitals. Other examples include comparing the net value of clinic- versus hospital-based care, and studying whether physicians who directly dispense medications to their patients improve patient adherence (Chen et al. 2018).

Taking account of quality change can lead to fundamentally different results on medical care productivity. For example, Romley et al. (2015) adjust for trends in the severity of patients' conditions and health outcomes when studying productivity growth among US hospitals in treating Medicare patients with heart attack, heart failure, and pneumonia during 2002–11. As in our study, they found that unadjusted productivity growth was negative (akin to a negative net value), whereas appropriate adjustment for quality changes suggested significantly positive rates of annual productivity growth (1.9%, 0.78%, and 0.62% for pneumonia, heart attack, and heart failure, respectively; see Table 1).

The fact that average quality-adjusted prices are declining does not obviate the need to address distorted payment incentives and market power that artificially inflate prices and their rate of growth, especially in health systems that foster competition and patient choice. Quality-adjusted price indices are complementary to, not a substitute for, research on policies such as antitrust enforcement, payment reform, the use of reference pricing, and incentivising cost-efficient referrals (Cooper et al. 2019).

Measuring the economic value of healthy ageing

In sum, confronting the challenges of ageing societies will require thinking carefully about the value of investments in new technologies for managing chronic conditions, and avoiding across-the-board cost control measures that stifle high-value care as much as low-value care. Focusing on other recent studies using US data, Dunn and Fernando (2019) discuss the challenges and importance of this line of research, emphasising that "these efforts are essential for understanding the trends in the medical care sector and our economy more broadly". More research on whether quality-adjusted price changes differ significantly across divergent health systems would be a valuable contribution to that effort.

Like addressing climate change, making high-value medical care affordable requires concerted policy efforts based on rigorous research. Cost control without measuring net value may foreclose or delay important breakthroughs. Healthy ageing to 100 and beyond will require being resiliently persistent in measuring the value of innovations for healthy ageing and rewarding those that deliver high net value. Financing equitable access to those innovations constitutes a profound challenge– but also an opportunity. Policymakers need not wait for global collective action to take steps now toward measuring and rewarding value.

Table 1   Research Studies Illustrating the Importance of Taking Account of Value When Studying Health Care Spending

Panel A: Illustrative Studies of Economic Value of Improvements in Longevity			
	Murphy and Topel (2006)	Jones and Klenow (2016)	Global Health 2035 report
Setting	US	US	Global
Measurement	Present value of 20thcentury gains in life expectancy for a representative individual	Value of improvement in survival and greater leisure	Universal reduction in avoidable deaths from infections and maternal and child health conditions
Results	Economic value over $1.2 million	20-fold increase over a century (compared to only 7-fold increase in income per capita)	Economic value of $9- 20 per dollar invested

Panel B: Selected Studies of Economic Value of Medical Care's Contribution to Better Health Outcomes					
	Cutler et al. (1998)	Cutler and McClellan (2001)	Berndt et al. (2002)	Highfell and Bernstein (2014)	Romley, Goldman, and Sood (2015)
Setting	US	US	US	US	US
Medical condition(s)	AMI (heart attack)	AMI, low-birthweight infants, depression, cataracts, breast cancer	Depression	30 chronic diseases	AMI, heart failure, pneumonia
Results	Value of improved quality greater than spending increases: quality-adjusted prices declining	Value of improved quality greater than spending increases (except for breast cancer, benefits and costs of similar magnitude)	Incremental cost of successfully treating an episode of acute phase major depression has generally fallen	Net value of treatment is positive and has grown, leading to better health outcomes at a lower cost per patient	Positive rates of annual productivity growth of 1.9%, 0.78%, 0.62% when take account of value of quality changes

Panel C: Case Study: Diabetes					
	Eggleston et al. (2009)	Eggleston et al. (2011)	Wamble et al. (2019)	Chen, Eggleston and Iizuka (2018)	Eggleston et al. (2019)
Setting	US (Mayo Clinic Rochester)	US (Mayo Clinic Rochester)	US (MEPS, GBD)	Japan (working ages)	Japan, Netherlands, Hong Kong, Taiwan
Years	1997-2005	1999-2009	1996-2015	2010-14	2006-14
Sample size	613	821	Aggregate data	7,432	123,548
Measure(s) of health outcomes: Did quality improve?	Improvement in fatal and non-fatal cardiovascular risks (from risk prediction model)		Improvement in health as measured in disability-adjusted life years	Improvement in all-cause mortality (from population-specific risk prediction model)	
Was net value positive? (assuming US$100,000 value of one year of healthy life) or other measure of value of medical spending	Positive net value: $1,050 (Outcomes model); $2,215 (UKPDS)	Positive net value ($9,094 for $200,000 value of a life-year)	$6,377 Incremental cost-effectiveness ratio ($560 increase in cost per person)	Positive net value:	Positive net value:

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