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chapter five

Comparing Population Health

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5.1 Why measure population health outcomes?

The 2000 World Health Report (*WHR2000*) identified three fundamental goals for a health system: improving the health of the population it serves; responding to the reasonable expectations of that population; and collecting funds to do so in a way that is fair (WHO, 2000). In this chapter, we focus on the first of these: improving population health. Before doing so, however, we summarize briefly the work that has taken place on this issue so far.

The authors of the *WHR2000* faced a challenge. They were required to estimate performance for all 191 of the WHO Member States, of which only about 60 had any data on causes of death. Consequently, the only measure of population health outcomes available to them was mortality, and even then it was necessary to produce estimates for many countries, based on empirical relationships with other measures, such as economic status (McKee, 2010). This determined their chosen definition of the health system, which they decided would include “all activities, whose primary purpose is to promote, restore and maintain health”. The actual indicator used was disability-adjusted life years, which incorporated a measure of morbidity, but again this was estimated for most countries.

This approach was the only one possible given the need to include so many countries. Although controversial, it has served as a basis for many of the subsequent developments in assessing health systems performance. It was also consistent with a considerable body of previous research on the performance of countries worldwide that had also used mortality-based measures of health outcome (although more often infant and under-five mortality), which are available from *Demographic and Health Surveys* for many countries without vital registration systems.

Other research has focused on high-income countries where more data are available, creating the potential for more sophisticated analyses that take advantage of the availability of information on deaths by cause to develop indicators that more closely relate to the delivery of health care as opposed to broader social and economic factors (Arah et al., 2006). One use of these data is to measure avoidable mortality, defined as deaths that should not occur in the presence of timely and effective care (Nolte & McKee, 2004).

Although avoidable mortality is clearly an advance on all-cause mortality, it too has a number of limitations, in particular, attribution of outcomes to particular policies or interventions, as will be discussed later. It is also limited in its definition of avoidable deaths, as it tends to limit them to deaths occurring below a specified age (now typically 75), thus denying the contribution of health care to reducing mortality at older ages. This is in large part because of the difficulty of assigning a single cause of death for those dying at old age while suffering from multiple disorders. Its focus on mortality also disregards the role of health care in reducing disability and discomfort.

Other work takes advantage of data on the process of care and the outcomes of specific interventions, mostly drawn from the growing volume of administrative data in some countries. An example is the OECD's HCQI project (Kelley & Hurst, 2006).

We begin this chapter by exploring the differing definitions of a health system. We then describe contemporary usage of population health measures; the strengths and limitations of existing measures; and the methodological challenges to employing them to assess health systems performance. We conclude by exploring potential areas for further research and, specifically, the scope for using the concept of avoidable mortality and tracer conditions, both of which offer a set of complementary mechanisms to compare health systems across countries and over time. Finally, we discuss what they cannot tell us about health systems and the potential unintended consequences of using them.

5.2 What is a health system?

The scope of what constitutes a 'health system' in a given setting varies. There are many activities contributing – directly or indirectly – to improving the population's health that, in different countries, may or may not be included in what is considered to be the health system. For example, it is not always clear how much a health system can be held responsible for promoting healthy lifestyles and reducing the prevalence of risk factors in the general population. Policies that affect population health are often outside the direct control of the health system, such as tobacco and alcohol policies. In addition, the boundary with other sectors within a country can be indistinct. This is typically a problem with social care, with boundaries often being determined by diverse administrative arrangements. There are also differences in how areas such as medical education and research are dealt with in comparisons, although work on National Health Accounts seeks to address these issues.

A further complication relates to the population covered by a given system. This may be determined by financial and/or organizational arrangements exemplified by multiple systems that vary in ownership. One example is the US health system, which represents a composite of multiple subsystems, comprising a mix of overlapping public and private elements, variously covering those in employment, older people (Medicare), those at the lower or no income scale (Medicaid), military personnel (Veterans Affairs), and others. Even in countries with nearly universal coverage, privately funded subsystems are common; for example, in the United Kingdom, about 10% of the British population have private insurance to supplement their coverage by the NHS (OECD, 2004).

Elsewhere, administrative territorial divisions within countries may also challenge the definition of what should be considered to be the health system. For example, following political devolution for the constituent countries of the United Kingdom in 1999, responsibility for the NHS in Northern Ireland, Scotland and Wales was transferred to subnational governments, while the Department of Health retained oversight of the NHS in England. This has led to increasingly diverging health systems in the four countries, while the Department of Health remains responsible for UK-wide health matters, such as the control of infectious diseases, and for representing UK health policy in international and European fora.

These issues add to the complexity of comparing health systems performance internationally and help to explain why *WHR2000* adopted a broad definition of a health system, which includes “all activities and structures that impact or determine health in its broadest sense within a given society” (WHO, 2000). Arah et al. (2006) more specifically distinguished between the health system and health care system, with the former closely resembling the one adopted by *WHR2000*. In contrast, the *health care* system is defined as the “combined functioning of public health and personal health care services” that are under the “direct control of identifiable agents, especially ministries of health” (Arah et al., 2006) (see Chapter 2 for more details). A related issue concerns the boundaries with sectors such as social care, which are often determined by diverse administrative arrangements and thus may or may not be included in the definition of the health (care) system.

To some extent, the definition of the health (care) system will depend on the question being asked. While it is important to recognize the various distinctions, it is equally important to realize that, in practice, concepts are likely to mean different things to different actors and that the precise boundaries of health (care) systems remain difficult to define, although it is important to keep in mind issues relating to sectoral boundaries, ownership and geography.

5.3 Broader determinants of population health

Variation in health outcomes such as mortality is often used to explain the success or failure of health systems. However, the reasons for diversity in health patterns between and within populations are multifaceted, reflecting a complex interplay of factors, ranging from underlying economic and political circumstances to more proximal risk factors, such as lifestyle-related determinants of

health, with health care also playing a role, as identified by the health field concept advanced by Lalonde (Lalonde, 1974).

Irrespective of how narrow (or broad) our definition of a health system is, it is essential to begin with an understanding of the range of influences on population health. Figure 5.1 (WHO, 2009), which is itself a greatly simplified representation of reality, indicates the complexity of interactions among different factors that contribute to the onset of, and ultimate mortality from, just one condition: ischaemic heart disease (IHD).

Some of these factors are clearly beyond the control of the health system, such as age and levels of income and education, although arguably health systems might indirectly exert influence to minimize the health impact of such factors through active engagement with other sectors in society with a more immediate impact on socioeconomic factors in particular. Similarly, changes in common behavioural risk factors for ill health, such as smoking, alcohol use and poor diet, through population-wide strategies tends to be outside the immediate control of health systems as they require close interaction and cooperation with other sectors (economy, education, etc.), although measures to address lifestyle factors such as smoking are usually, but not inevitably, initiated by

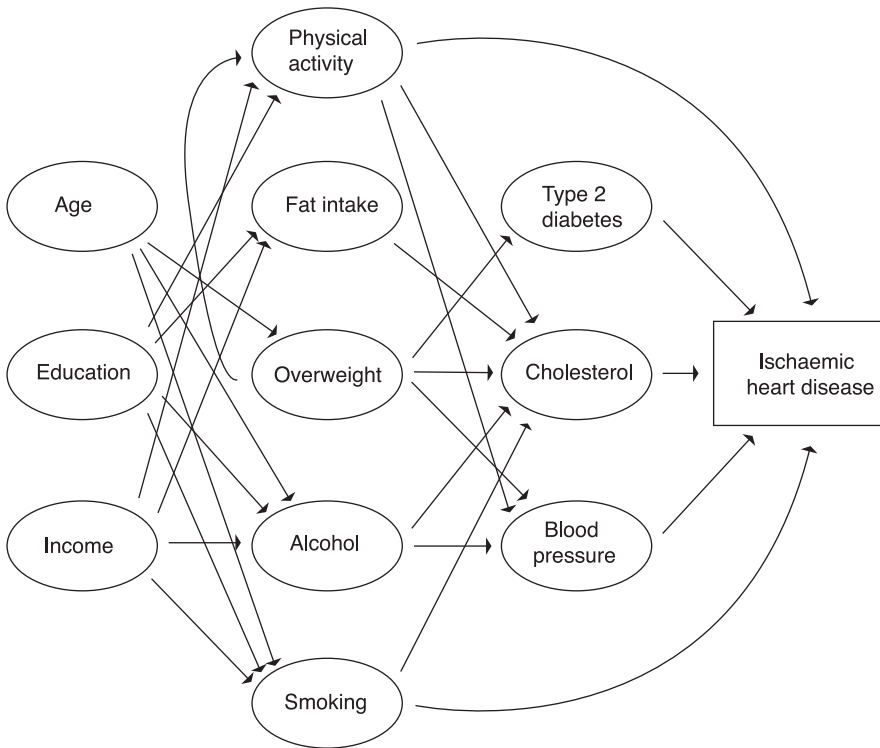


Figure 5.1 Major factors leading to ischaemic heart disease

Adapted from: WHO, 2009.

the health sector. Health professionals can also advocate for increases in taxes on cigarettes, or a ban on smoking in public places. It is equally possible to identify both individual and population-based measures to tackle the other intermediate risk factors identified in Figure 5.1.

Crucially, the health system, however broadly defined, cannot tackle these risk factors on its own; nor can it be held accountable for failure to reduce the resulting deaths that arise from a lack of action. This does not, however, absolve governments as a whole from responsibility, and it is possible to translate this model of disease causation into indicators of overall government performance on health. This is analogous to the way that commentators judge governments on their ability to achieve growth in gross national product (GNP); they are not expected to create growth directly by, for example, nationalizing manufacturing and services, but they are expected to create the conditions within which economic growth can take place. From this perspective, it is entirely appropriate to hold governments accountable for improvements in aggregate measures of health, such as life expectancy at birth, as well as for their implementation, or failure thereof, of evidence-based policies to reduce deaths from preventable causes and their corresponding risk factors. An obvious example of the latter is a ban on smoking in public places, which many European governments have introduced successfully, with rapid reductions in cardiovascular disease. However, this does not mean that a government must do everything itself. As the example in Box 5.1 shows, there is an important role for civil society, although ultimately, where others do not take action, governments must step in to advise, regulate or legislate where appropriate.

The implication of this brief discussion is that governments should be held to account for progress in the overall health of their populations, in exactly

Box 5.1 Sudden infant death syndrome prevention in the UK

In the United Kingdom, a national campaign to prevent sudden infant death syndrome (SIDS) was launched in 1991 by a voluntary organization, the Foundation for the Study of Infant Deaths, as a result of the Avon study. After attracting wide media publicity, the government responded by issuing a policy statement to health professionals, followed by a national leaflet accompanied by television and press advertising (McKee et al., 1996). Prior to this formal campaign, the Foundation for the Study of Infant Deaths had issued a press release about the Avon research (Fleming et al., 1990) showing the ninefold increase in the probability of prone sleeping among sudden infant deaths. This attracted considerable media attention and, together with the publication of research from the UK and other countries, some health professionals began to advise a change in sleeping position before the official campaign (Scott et al., 1993). A combination of several factors (accumulation of research, active voluntary group, media coverage and capacity to review health policy) resulted in an almost threefold decrease in deaths attributed to SIDS in the UK between 1990 and 1991 (FSID, 2011).

the same way as they are judged on economic progress. This must, however, be informed by an understanding of the locus of authority; there is little point in holding a national government to account for failure to implement policies that are, constitutionally, the responsibility of regional authorities.

In the next section we explore the strengths and weaknesses of various measures of population health as potential indicators of health system performance.

5.4 Common measures of population health

The most commonly used measures of population health, such as total mortality, life expectancy, premature or infant mortality, years of life lost, DALYs, capture generic information on population health. Although informative, these measures are unable to distinguish between the health care input and the contribution of other activities to population health status. This was circumvented by the adoption of a broad definition of a health system in *WHR2000* (WHO, 2000). However, as noted above, this is not a satisfactory solution.

We begin, however, by reviewing the mortality-based measures most commonly used in assessing population health. These measures have been categorized into two groups: generic and disease/age-specific indicators. This is followed by a brief overview of morbidity and summary measures, and their current and potential use for international comparisons. Table 5.1 summarizes the most common measures of population health (including broader determinants of health and risk factors), and demonstrates examples of indicators, their key methodological issues and potential policy uses.

Generic indicators

Generic indicators are used to summarize the total mortality experience in a given population over a specific period of time. The most common examples are life expectancy and age-standardized death rates (SDRs). Other indicators include less informative crude mortality rates and standardized mortality ratios (SMRs). Their greatest advantage is the availability and relative reliability of data (at least in high-income countries), as well as ease of calculation and analysis. However, the absence of data on cause of death constrains the scope to infer the contribution of health care. These indicators do not show the direct link between health system performance and population health, as they are often crude and depend on numerous other factors (Anell & Willis, 2000). As these indicators mask contributions of specific causes of death and risk factors, caution is needed when seeking to attribute observed changes to health care.

Age/disease-specific indicators

Infant mortality rate (the number of deaths in children within the first year of life per 1000 live births) is often used as an indicator of quality of health

Table 5.1 Common measures of population health

<i>Measurement category</i>	<i>Indicators (examples)</i>	<i>Data and methodological issues</i>	<i>Policy uses</i>
<i>Mortality</i>	<p>Generic mortality-based indicators:</p> <ul style="list-style-type: none"> – age-standardized death rates – life expectancy <p>Age-specific mortality indicators:</p> <ul style="list-style-type: none"> – infant, perinatal mortality <p>Cause-specific mortality indicators:</p> <ul style="list-style-type: none"> – age-standardized mortality from specific causes – IHD, cancer, etc.) <p>5-year survival:</p> <ul style="list-style-type: none"> – cancer <p>Summary measures: HALE, DALYs, YLL*</p> <p>Amenable mortality</p>	<p>Broad indicator of health</p> <ul style="list-style-type: none"> ● Mask contributions of specific causes ● Exclude morbidity ● Need further disaggregation by age and cause <ul style="list-style-type: none"> ● Susceptible to variations in recording and reporting practices ● Rely on precise definitions not always adhered to in practice (perinatal mortality) ● Are influenced by factors outside of health system (infant mortality) ● Are based on small numbers ● Complex interpretation of underlying causes <ul style="list-style-type: none"> ● Data quality and coding ● Capture influence of broader health determinants ● Need to be interpreted in context of risk factor and disease prevalence, and policies in other sectors <ul style="list-style-type: none"> ● Variations in coverage and diagnostic practices ● Lead-time bias ● Need to account for staging ● Has to be viewed alongside mortality and incidence rates <ul style="list-style-type: none"> ● Controversial methodology (age and disability weightings) ● Aggregate measure requiring further disaggregation ● Variations in list of amenable causes and age limits ● Time lags for outcomes of specific interventions 	<p>These are broad indicators of health service delivery and achievement of desired population health outcomes. While some reflect generic population health status (SDRs, life expectancy, DALYs), others (perinatal mortality, cause-specific mortality, survival, amenable mortality) allow more detailed analysis of specific outcomes of the quality of health care.</p> <p>Selected mortality-based indicators combined with supplementary techniques (such as tracer methodology) allow the exploration of the individual aspects of health service delivery process and highlight potential gaps and weaknesses.</p>

(Continued)

Table 5.1 Common measures of population health (*Continued*)

<i>Measurement category</i>	<i>Indicators (examples)</i>	<i>Data and methodological issues</i>	<i>Policy uses</i>
<i>Morbidity</i>	General health: – health surveys data	<ul style="list-style-type: none"> ● Reporting bias ● Non-specific to healthcare interventions 	At present, morbidity data are of limited use in assessing the contribution of health care to population health (see data and methodological issues), but there are great emerging initiatives to develop registries for specific conditions that focus on health outcomes and service delivery aspects.
	Incidence: – notifications	<ul style="list-style-type: none"> ● Variations in notification requirements and diagnostic practices 	
<i>Risk factors</i>	Prevalence: – registries	<ul style="list-style-type: none"> ● Coverage ● Representativeness 	These are predictors of future population health, rather than an indicator of health system performance, as many risk factors are a product of wider intersectoral policies.
	Health service utilization: – hospital statistics	<ul style="list-style-type: none"> ● Data quality (completeness, coding, recording) ● Coverage (often excludes private sector) ● Representativeness (only shows population who accessed health service) 	
	Demographic, socioeconomic, behavioural, environmental, etc.	<ul style="list-style-type: none"> ● Completeness and comparability of data ● Not always possible to measure exposure (environmental risks) ● Are not under direct control of a health system 	

DALYs: disability-adjusted life years; HALE: health-adjusted life expectancy; SDR: standardized death rates; YLL: years of life lost.

care. Worldwide, this is more widely available than all-age mortality (and thus life expectancy) as it is often taken from surveys (especially *Demographic and Health Surveys*). However, it is a poor measure of the contribution of health care as it combines neonatal and post-neonatal deaths, which have quite different causes. In the first four weeks of life mortality is more sensitive to the quality of medical care, while post-neonatal mortality is more strongly associated with socioeconomic factors (Leon, Vågerö & Olausson, 1992), and does not necessarily reflect the overall health system performance (Mathers, Salomon & Murray, 2003). The perinatal mortality rate (the number of stillbirths and deaths in the first week of life per 1000 live and stillbirths) is also frequently used as an indicator of health systems performance. Problems affecting comparisons include: the varying application of the definition of a live birth (although supposedly standardized), especially at low birth weights; the increase in multiple births (which are at greater risk) as a consequence of new treatments for infertility; the need to consider differences in patterns of birth weight; the very small numbers of deaths now occurring in high-income countries (making rates unstable in small populations); and variation in the application of prenatal screening for congenital anomalies (often linked to policies on abortion) (Richardus et al., 1998; Garne et al., 2001; van der Pal-de Bruin et al., 2002), although one study suggested that the last of these had been of limited importance in a longitudinal study of perinatal mortality in Italy (Scioscia et al., 2007). The interpretation of apparent differences among countries and over time is therefore problematic (Nolte & McKee, 2004).

Turning to older ages, age-standardized mortality rates by cause are easy to calculate and reliable data are available for all high- and many middle-income countries. However, despite the existence of a standardized system of disease classification (the International Classification of Disease (ICD)), some caution is required in both longitudinal and cross-sectional studies. First, there may be differences in interpretation of coding rules, especially those involving the treatment of multiple causes. These can change during the course of an ICD version. Second, although the classification is revised regularly, there may be interim changes, such as the introduction of codes for human immunodeficiency virus (HIV) disease during the 1980s when ICD-9 was used in most countries. Finally, different countries switch to new versions at different times and there may be differences in the effects of change among countries, making it necessary to undertake bridge coding exercises whereby a set of death certificates are coded using both old and new versions and then compared. Other issues include completeness of registration of deaths and, more often, of the population denominator, a growing problem with more mobile populations.

An example of a disorder that has been examined as an indicator of health care quality is IHD, one of the most frequent causes of premature mortality in industrialized countries (Nolte, Bain & McKee, 2009). It has been estimated that about 40–50% of the total reduction in IHD in Western countries can be attributed to improvements in specific medical interventions (Beaglehole, 1986; Kesteloot, Sans & Kromhout, 2006) with the remaining decline attributed to the decrease in prevalence of risk factors, such as smoking, high cholesterol and hypertension (some of which can also be attributed to medical intervention) (Bots & Grobbee, 1996; Ford et al., 2007). However, cross-national comparisons

of mortality rates from IHD have to be interpreted in the context of policies in other sectors (such as agriculture, which influences traditional dietary patterns) and of cultural differences (in diet, for example), which influence the levels of prevalence and risk factors in specific populations (Box 5.2). Thus, the complex epidemiology of IHD means that this indicator on its own may not necessarily identify weaknesses in health care, but may also capture other environmental and socioeconomic factors. Persisting high levels of mortality from IHD usually indicate systematic problems that cover the entire course of the disease – from primary prevention and health promotion to treatment.

In those cases where there are data on incidence and mortality, it is possible to calculate disease-specific survival. This is the average length of time that individuals survive following diagnosis. Survival rates are most frequently applied to cancer and have been influential in international and longitudinal

Box 5.2 Explaining differences in mortality trends from IHD

We have previously shown how the contribution of health care to changes in deaths from IHD remains contested and can be difficult to ascertain (Nolte, Bain & McKee, 2009). This can be illustrated by comparing research from the German Democratic Republic and Poland, both of which experienced substantial, and similar, declines in mortality in the 1990s (Nolte et al., 2002).

In Poland, this improvement has been largely attributed to changes in diet, with increasing intake of fresh fruit and vegetables, and reduced consumption of animal fat (Zatonski, McMicheal & Powles, 1998). The authors of that study judged the contribution of health care to be negligible. In contrast, the WHO MONICA project found a considerable increase in the intensity of treatment of acute coronary events in Poland between 1986–89 and the early 1990s (Tunstall-Pedoe et al., 2000). Yet a further complication is that a much higher proportion of deaths from IHD in Poland are sudden, compared with western European countries, so limiting the scope for health care to make a difference in the acute stage. This is a phenomenon that has also been noted in the neighbouring Baltic States and Russian Federation (Uusküla, Lamp & Väli, 1998; Tunstall-Pedoe et al., 1999) and has been related to binge drinking (McKee et al., 2001).

The eastern part of Germany also experienced a substantial decline in mortality from IHD but here research has focused more on health care. There is evidence of intensified treatment of cardiovascular disease during the 1990s (for example, an increase in cardiac surgery of 530% between 1993 and 1997 (Brenner, Altenhofen & Boqumil, 2000)). Although this may not necessarily translate into improved survival (Marques-Vidal et al., 1997), there has been a (non-significant) increase in the prevalence of those with a history of myocardial infarction among east Germans aged 25–69 years between 1990–92 and 1997–98 which, given the accompanying decline in mortality from IHD, suggests that there has been improved survival (Wiesner, Grimm & Bittner, 1999).

comparisons. However, there are a number of issues that must be taken into account. First, coverage by cancer registries is limited in many countries, either geographically (covering only certain regions in much of Europe (Coleman et al., 2008)) or in other ways (the American Surveillance Epidemiology and End Results (SEER) system systematically under-represents the African-American population with their poorer outcomes (Mariotto, Capocaccia & Verdecchia, 2002)). Second, calculation of survival is critically dependent on consistent approaches to diagnosis. Countries with extensive screening activities will inevitably detect cases earlier but, if this confers no survival benefit (as with prostate cancer), the survival will seem longer although the time of death is unchanged (lead time bias) (Desai et al., 2010). Countries with weak linkage systems may have a high proportion of Death Certificate Only cases, in which first registration takes place at death. This may artefactually shorten recorded survival. Ideally, stage at diagnosis is recorded to facilitate adjustment for some of these factors, but such data are often unavailable. Nonetheless, cancer survival data, if interpreted suitably cautiously, can offer insights into various aspects of cancer service quality: timeliness, technical competence and adherence to protocols (Jack et al., 2003).

International comparisons of cancer survival have shown substantial differences in performance among European countries (Verdecchia et al., 2007), suggesting variations in quality of care. However, this poses the question of why. Thus, it has been suggested that historically relatively poor cancer survival rates in the United Kingdom and Denmark may be because the gate-keeping function of primary care delays access to specialist investigation (Crawford, 2010) but also that there may be high levels of stoicism among the population, leading to late presentation (Anderson & Murtagh, 2007). This issue is not, however, resolved.

Dickman and Adami (2006) noted that, “in order to evaluate progress against cancer one must simultaneously interpret trends in incidence, mortality and survival” as none of the three measures is fully interpretable without knowledge of the other two. An example of combining this information is a recent study by Coleman et al. (2011), which shows how rapid improvements in survival following breast cancer in the United Kingdom, despite increasing incidence, are associated with an overall reduction in mortality (Figure 5.2).

Measuring morbidity

One of the principle limitations of the measures discussed above is their focus on mortality. One attempt to circumvent this was the work of Bunker, Frazier & Mosteller (1994) that assessed the “magnitude of relief in treated patients” with a range of conditions (unipolar depression, osteoarthritis, terminal cancers, asthma, cataract, etc.). They constructed a symptomatic measure of relief based on the incidence of each condition, the average age of those suffering from them, the number of treated patients, and the expected years of survival, into which they factored the years of disability prevented by therapeutic intervention (Bunker, 2001). The overall measure of improved physical or mental function, or prevented pain and suffering, is expressed in “potential years of relief

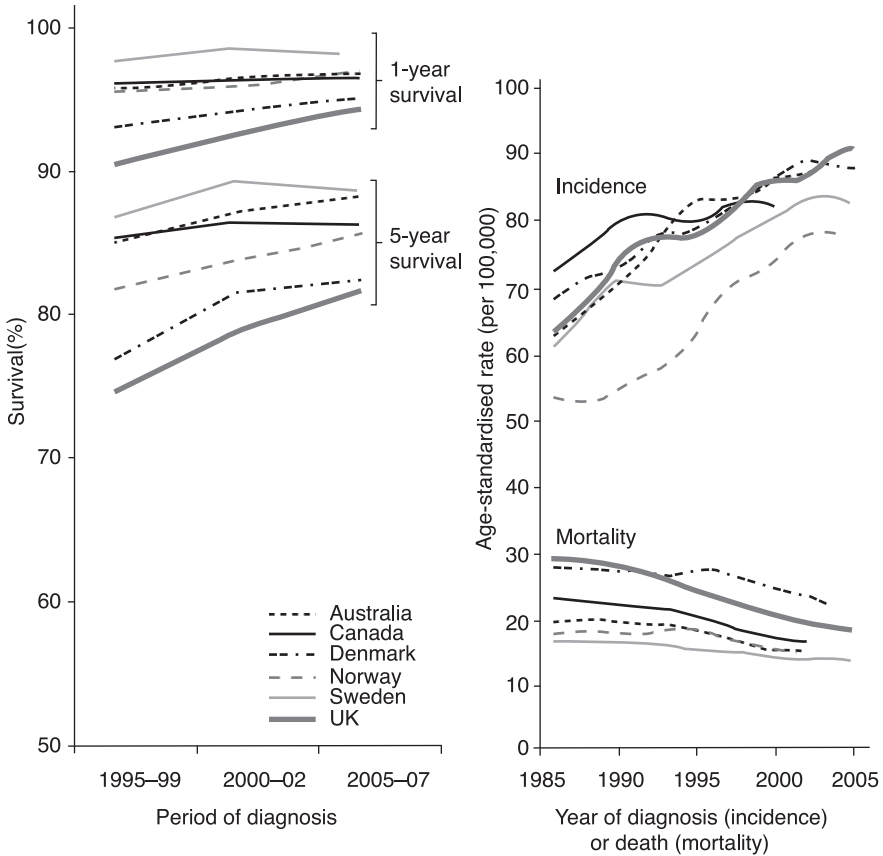


Figure 5.2 Breast cancer survival, incidence and mortality in Australia, Canada, Denmark, Norway, Sweden and the UK

Adapted from: Coleman et al., 2011.

per 100 patients". On average, the interventions achieved relief from approximately five years of poor quality of life per individual (Bunker, 2001). Although providing different and potentially useful results, this technique is based on the inventory approach for mortality described in the next section, and thus is subject to the same methodological problems (Nolte, Bain & McKee, 2009).

The main measures of morbidity are derived from self-reporting of perceived health status in population health surveys. Examples include the *World Health Survey*, *European Core Health Interview Survey* and various national surveys, such as the *Health Survey for England* and *US National Health Interview Survey*. These typically include a question on self-rated health (usually on a five-point scale, but sometimes on a four-point scale) but the results are not specifically related to health care interventions. They are also subject to potential bias, as those with higher expectations of health often record their health as worse than those with lower expectations, even when they are similar on objective measures. This can, however, be addressed by the use of anchoring vignettes, in which

respondents are asked to allocate a health status to an imaginary subject with a specified level of disability (King et al., 2004). While several countries have instituted regular surveys using relevant instruments, data are not necessarily comparable with similar surveys undertaken elsewhere, in particular when the data collection instrument cannot ensure cross-cultural equivalence. Where cross-national comparable instruments have been employed, these frequently tend to cover only a few countries, often building on small samples of uncertain representative power in participating countries. Elsewhere, surveys are not undertaken regularly, or perhaps only once, so data tend to become outdated (Nolte, 2010). Surveys also include a variety of disease-specific measures, some of which may be attributable to health care, such as blood pressure diagnosis and control. Within Europe, the New European Health Survey System (EHSS) promises to be a valuable source, while the *Survey of Health, Ageing and Retirement in Europe* (SHARE), along with the English Longitudinal Survey of Ageing, with which it is compatible, provide valuable data on older people. More detailed discussion of population-based surveys is provided in Chapters 7 and 11.

In some limited cases, the incidence of specific diseases may be useful in comparing health system performance. Thus, the OECD HCQI project includes the incidence of vaccine-preventable diseases (pertussis, measles, hepatitis B) in its set of indicators. The rationale for this is that the incidence of these diseases should be minimal in the presence of appropriate health care intervention (immunization). Variations in notification requirements and prevention practices can affect incidence rates for these conditions.

Routinely collected data on health service utilization, such as inpatient admissions or number of general practitioner (GP) consultations, while often cited as measures of performance, have a limited value. They are often based on unrepresentative samples of activity; may say only a little about those in need of care but not receiving it; and take no account of whether the activity is necessary.

Finally, there are a number of population-based disease registries, although typically established within the framework of research projects. However, not all registries cover entire populations or all population groups (see cancer survival above). In some cases these may be part of international initiatives so that the data are, to some extent, comparable across countries. They may also be quite unrepresentative of the countries in which they are located as they are likely to be based on centres of excellence.

Summary measures

Death rates in industrialized countries have now fallen to historically low levels, giving rise to ageing populations, often with substantial levels of disability. This has led to efforts to combine mortality and disability, with measures such as health-adjusted life expectancy (HALE) and DALYs. The advantage of summary indicators is their ability to combine the key elements of adverse health outcomes – mortality, morbidity and disability. Typically, summary measures of health are divided into two broad categories: health expectancies and health gaps.

Health expectancy is a measure of how long people can expect to live free of certain diseases or limitations to their normal activities (active life expectancy, disability-adjusted life expectancy, health-adjusted life expectancy, etc.). With this measure, less weight is assigned to years lived in less than full health. Healthy life expectancy has been used to establish the relationship between population health and health system inputs in 191 countries (Evans et al., 2001). A recent report of the Commonwealth Fund used healthy life expectancy at age 60 as one of three measures of productive and healthy lives in seven OECD countries (Australia, Canada, Germany, Netherlands, New Zealand, UK and the United States) as one of the measures demonstrating the ability of a health system to ensure long and healthy lives (Davis, Schoen & Stremikis, 2010).

Health gaps quantify the difference between a designated norm for the population (e.g. 75 years in good health) and actual levels of health. These are usually expressed as years of life lost (YLL), which do not include years lived with disability, or DALYs, which do.

The latter involve applying a weighting to years lived with disability so as to reduce their value. This is typically done in one of three ways. The first is the time-trade-off, in which respondents are asked to choose between remaining in a state of ill health for a period of time or being restored to perfect health but with a shorter life expectancy. The second is the standard gamble, where they are asked to choose between remaining in a state of ill health for a period of time or choosing an intervention which may either restore them to perfect health or kill them. The third is the visual analogue scale, in which they are asked to rate a state of ill health on a scale from 0 to 100, with 0 representing death and 100 representing perfect health. Other refinements include placing a higher value on a year of life lived at certain ages (typically between 10 and 55) and a lower value in childhood and old age. The advantage of this approach is “to combine information on mortality and non-fatal health outcomes to represent the health of a particular population as a single numerical index” (Murray & Salomon, 2002).

Key methodological issues facing those using summary measures of health status relate to conceptual differences in the approaches taken and data limitations (Etches et al., 2006). The definitions, measurement and weighting of disability as applied to particular health states are complex and have long been controversial. For example, some commentators have expressed ethical concerns about the way this methodology places a value on life (Gold, Stevenson & Fryback, 2002), exemplified by its use in the Global Burden of Disease project (Lopez et al., 2006).

A further issue, when extended beyond high-income countries, is that mortality data may not be available. In these cases, health outcomes are modelled based on known associations between mortality and other, typically economic, variables. All of these mortality-based measures of population health provide valuable information on the overall progress of nations but say relatively little about the contribution of health care.

At present, comparable health status data are not available for all countries, so existing summary measures of population health are typically based on estimates of the prevalence of various health states (Mathers et al., 2003). This makes it difficult to assess trends over time, as any observed variation may

simply reflect changes in data used to generate estimates. Thus, where levels of health are modelled using equations incorporating economic measures, booms or busts can create artificial changes in estimates of life expectancy or disease burden. A New Global Burden of Disease (2010) Study aiming to provide more continuity at corporability to health data across the globe and addressing some of the issues raised in preceding versions were released at the end of 2012.

Most of the indicators mentioned above are available in the public domain, from the WHO (European Health for All database, Global Health Observatory, Global Mortality Database), World Bank (World Development Indicators) or European Commission (Eurostat) websites.

In summary, mortality-based measures of population health are attractive due to their availability and accuracy, particularly for high-income and most of the middle-income countries. The data needed to construct generic mortality indicators are readily accessible in high-income countries and indicators are easy to calculate. Age/disease-specific rates can potentially indicate weaknesses in the health system. Morbidity data are generally less widely available or consistent, often relying on self-reporting and over-representing those who actively seek care. Summary measures of population health combine both mortality and morbidity information; however, the methodology (DALY weightings of health states and age) and validity of measures of health system performance remain controversial. Thus, of the common measures of population health, such as mortality (infant, perinatal, total), life expectancy, morbidity, or summary derivatives, only a select few are able to distinguish the components of the overall burden of disease that are attributable to health systems and those which result from factors arising elsewhere, while disease-specific indicators, such as mortality from IHD or cancer survival rates, can only reflect isolated elements of the overall service. Consequently, assessment of the performance of health care requires identification of the indicators of population health that directly reflect health care (see section 5.6). Differences in data collection and registration practices need to be understood when comparing these indicators across countries or time.

5.5 The contribution of health care to population health

There has been long-standing debate about whether health services make a meaningful contribution to population health (McKee, 1999). In the late 1970s, several authors argued that health care had contributed little to the observed decline in mortality that had occurred in industrialized countries over the preceding century or so. Among them was Thomas McKeown, who showed how much of the decline in mortality from tuberculosis (TB) in England and Wales between 1848–1854 to 1971 predated the introduction of immunization and effective chemotherapy (McKeown, 1979). He explained this decline by factors acting outside the health care sector, such as improvements in living conditions, behavioural change and, most importantly, changes in nutrition (McKinlay & McKinlay, 1977; Cochrane, St Leger & Moore, 1978; McKeown, 1979). Others, such as Illich, argued that developments in health care in the 1950s and 1960s were actually damaging to population health, introducing

the term iatrogenesis (physician-produced disease) (Illich, 1976). Illich was especially concerned with the role of medicine as a form of social control.

Recent writers have taken a more nuanced approach. They have noted how there has been a revolution in the therapeutic armamentarium since the 1960s. Thus, Mackenbach showed how the rate of decline in infectious disease mortality doubled in the Netherlands after the introduction of antibiotics in 1946, while mortality rates from common surgical procedures and perinatal conditions improved markedly after the 1930s (Mackenbach, 1996). However, even McKeown's example of TB has been revisited, with more recent work attributing part of the reduction in mortality that predated the introduction of antibiotics to public health interventions, such as the segregation of patients with active disease (Fairchild & Oppenheimer, 1998). Furthermore, a study of changes in age-specific mortality showed how, although the acceleration in the overall death rate was small, the first 10 years after introducing chemotherapy (1945–1955) were marked by striking year-on-year reductions in TB mortality rates among young people in England and Wales (Nolte & McKee, 2004).

At present, therefore, there is a general consensus that, while McKeown and others were broadly correct in pointing to a relatively limited role of curative medical measures in mortality decline prior to the mid-20th century (Colgrove, 2002), the scope of health care and its contribution to population health has progressed dramatically since the mid-20th century. Advances in the pharmaceutical and technology sectors have transformed acute fatal diseases into treatable or manageable conditions (such as infectious diseases and type 1 diabetes). These developments, along with more effective ways of organizing health care (such as introducing multidisciplinary stroke units or integrated screening programmes) and the implementation of evidence-based medicine, have ensured a growing contribution of the health care sector to population health.

This raises the question of how to quantify the contribution of health care to reduced mortality. This is rarely straightforward. In some cases, the impact of health care is self-evident: examples include vaccine-preventable diseases, antibiotic treatment of acute infections and the introduction of insulin for type 1 diabetes. However, more often, the impact of health care is less easily quantifiable. Thus, in the last 30 years, there have been substantial reductions in mortality from many chronic diseases; while health care has contributed to these reductions, there have also been declines in exposure to many common risk factors and, thus, the incidence of disease.

We begin by examining the key approaches that seek to quantify the contribution of health care to population health. These are the inventory approach and the production function approach (Buck, Eastwood & Smith, 1999; Nolte & McKee, 2004). Two others – avoidable mortality and the use of tracers – are described in more detail later in this chapter.

The inventory methodology examines selected health services and their influence on the burden of disease in a target population. McKinlay and McKinlay (1977) noted that much of the decline in mortality in the United States between 1900 and the early 1970s was due to falling deaths from infectious disease, and that at least some of this must have been attributable to medical interventions such as antibiotics and vaccines. They then calculated, for 10 infections,

the contribution to the overall mortality decline since 1900 made by reductions in deaths from these infections occurring after the relevant interventions had been introduced. As most of these interventions came about when death rates had already fallen substantially, they estimated that the interventions had contributed only about 3.5% of the total mortality decline. They rejected the idea that there were interventions that might have contributed to falls in any chronic diseases. More recent work by Bunker et al. (1994) sought to quantify the contribution of individual medical interventions to life expectancy and quality of life in the United States between 1950 and 1989, combining published evidence on the effectiveness of specific clinical preventive and curative interventions and data on the prevalence of the corresponding diseases. They estimated that about half of the 7–7.5 year gain in life expectancy observed could be attributed to these activities (Bunker, 2001). A different methodology was adopted by Wright and Weinstein (1998), stratifying the population into those with average or elevated levels of disease risk and those with established disease, and then measuring the impact of preventive and therapeutic interventions on gains in life expectancy. For instance, they estimated that a reduction of cholesterol to 200 mg/dl would result in between 50 to 76 months' gain in life expectancy in a 35-year-old person with elevated cholesterol (>300 mg/dl). In comparison, quitting smoking in a 35-year-old at average risk of cardiovascular disease would yield a 8 to 10 month gain in life expectancy. Cutler and McClellan (2001) looked at the cost of providing improved care, analysing the contribution of technology to five selected conditions and finding that four of them (heart attack, low birth weight, depression, cataracts) had yielded net monetary benefits.

Analyses based on an inventory approach provide essential information about the potential contribution of health care to population health. However, they rest on the assumption that the health gains reported in clinical trials translate directly to the population level (Nolte et al., 2011). This is not necessarily the case (Britton et al., 1999) as trial participants are often highly selected groups, typically excluding elderly people and those with comorbidities, even though these groups often dominate the population that will require treatment. Also, evaluations of individual interventions fail to capture the combined effects of integrated individualized packages of care (Buck, Eastwood & Smith, 1999), or indeed of the entire system, on population health. These findings thus provide only a partial insight into what health systems actually achieve in terms of health gain or how different systems compare (Nolte, Bain & McKee, 2009).

One other method is the production function approach. This typically uses regression analysis to examine how health care inputs (and other explanatory variables) affect a specific health measure (outputs). The findings of such analyses have produced mixed results. Earlier work failed to identify strong and consistent relationships between health care indicators (such as health care expenditure or number of doctors) and health outcomes (such as infant mortality rate or life expectancy), but found socioeconomic factors to be powerful determinants of health outcomes (Martini et al., 1977; Kim & Moody, 1992; Babazono & Hillman, 1994). However, more recent work suggests alternative conclusions. Significant inverse relationships have been established between health care

expenditure and infant and premature mortality (Crémieux, Ouellette & Pilon, 1999; Or, 2000; Nixon & Ulmann, 2006), and between the number of doctors per capita and premature and infant mortality, as well as life expectancy at age 65 (Or, 2001).

A related methodology involves comparisons of the ways in which health care systems are organized. A study by Elola, Daponte and Navarro (1995) categorized 17 health systems in Europe into National Health Service (NHS) systems (such as Denmark, Ireland, Italy, Spain and the United Kingdom) and social security systems (such as Germany, Austria and the Netherlands). This analysis concluded that countries with NHS systems achieve lower infant mortality rates than those with social security systems at similar levels of gross domestic product (GDP) and health care expenditure. On the other hand, van der Zee and Kroneman (2007) conducted a longitudinal analysis of trends in Europe from 1970 onwards. Their results suggest that the relative performance of the two types of system changed over time and that social security systems have achieved slightly better outcomes (in terms of total mortality and life expectancy) since 1980, when inter-country differences in infant mortality became negligible. The myriad of other factors involved makes such analyses almost impossible to interpret.

All these approaches have obvious limitations arising from data availability and reliability. However, the production function approach also fails to take account of lagged relationships, as noted by, for example, Gravelle and Blackhouse (1987). An obvious example is cancer mortality, where death rates often reflect treatments undertaken up to five years previously. Their cross-sectional nature is ill-equipped to address causality adequately, and such models often lack any theoretical basis that might indicate what causal pathways may exist (Buck, Eastwood & Smith, 1999). The complex pathway between increased inputs and health outcomes also means that there are likely to be many unrecognized confounders. Analyses undertaken so far tend to lack a sound theoretical basis and, in particular, provide little insight into the mechanisms involved. However, the greatest problem is that the majority of studies of this type employ indicators of population health (for example, life expectancy and total mortality) that are influenced by many factors outside the health care sector. These include policies in sectors such as education, housing and employment, where the production of health is a secondary goal. This raises concern that the observed relationships are due to confounding. An example of the potential pitfalls is provided by the fall in infant mortality in the two formerly divided parts of Germany in the 1990s that, on closer inspection, can be seen to be due to a fall in neonatal mortality in the east (most likely due in large part to improved health care) and in post-neonatal mortality in the west (which has different causes) (Nolte et al., 2000).

5.6 A way forward

The reason why the measures discussed in the previous sections are so often used for performance measurement is because they are available. It is important to ensure that any new performance indicators are driven by what is theoretically

meaningful, rather than simply available. As has been noted previously, the fundamental role of performance measurement is to provide the necessary information to support health system improvement (Smith, 2009). Capturing the differences in health system performance in a systematic and comparable way requires other approaches.

The next section of the chapter will discuss two complementary approaches – avoidable mortality and tracers, which have been used in recent years to capture information on different aspects of health systems.

Avoidable mortality

The concept of avoidable mortality was initially developed by Rutstein in the 1970s. It is based on a notion that certain deaths should not occur in the presence of timely and effective medical care (Rutstein et al., 1976). Later, Charlton et al. (1983) proposed a list of specific conditions amenable to health care. In time, this evolved to reflect new epidemiological research and advances in medical care. The concept was adopted by a wide range of researchers in Europe in the 1980s and early 1990s, as it was seen as a potential tool to assess the performance of health systems. The publication of the *European Community Atlas of Avoidable Deaths* and its subsequent editions in 1988, 1991 and 1997 served as a major stimulus for a series of analyses at national level across many of the high-income countries (Nolte & McKee, 2004).

This is, however, an area where there has been some confusion about terminology (Kamarudeen, 2010). Avoidable mortality, in its broadest sense, includes deaths considered to be avoidable by appropriate and timely medical care, as well as those preventable by population-based interventions. ‘Amenable mortality’ is often considered to be a subset of avoidable mortality, including only those conditions directly amenable to health care, “from which it is reasonable to expect death to be averted even after the condition develops” (Nolte & McKee, 2004). In contrast, ‘preventable’ deaths are usually taken to include deaths from conditions that can be prevented by population-based interventions but where the contribution of health care may be limited once the condition has developed. Examples include lung cancer, alcoholic liver disease and suicides. These can, however, be used as an indicator of overall government performance, as noted above.

In 2004, Nolte and McKee undertook a systematic review of the work on avoidable mortality then available, revised the list of causes of death considered to be amenable to health care, and applied this to 12 EU countries (Nolte & McKee, 2004). They adopted a definition of a health system that covered primary and hospital care, as well as primary and secondary prevention (including immunization and screening). The objective was to investigate the impact of health care on changing patterns of mortality and life expectancy in the 1980s and 1990s. Since the 1980s, all countries examined had experienced an increase in life expectancy, although the pace of improvement varied. For most of these countries, the greatest reductions in amenable mortality were achieved in the 1980s. During the 1990s, the decline slowed, particularly in the countries where mortality from amenable causes was already low, as in Northern

Europe. However, even there, amenable mortality still continued to fall, albeit at a slower pace.

Newey et al. (2004) demonstrated similar results for the older members of the EU. Notably, most of the countries that had joined the EU in 2004 experienced relatively small reductions in amenable mortality in the 1990s, at a time when their health systems were undergoing major reconfiguration, but the authors (correctly) predicted that several would begin to close the gap in the 2000s, once the major structural and economic reforms had become embedded.

In a subsequent analysis of 19 industrialized countries between 1997–1998 and 2002–2003 (Nolte & McKee, 2008), the largest reductions in amenable mortality were seen in many of the countries with the highest initial levels. However, the United States experienced hardly any reduction from its initial high level, so that it increasingly lagged behind other industrialized countries.

Other research by the same authors has shown how the USSR lagged increasingly far behind western Europe from the mid-1960s onwards, reflecting its failure to modernize its health care system to address the rising tide of chronic diseases (Andreev et al., 2003), while another study showed the acceleration in the rate of improvement of amenable mortality in China, Taiwan following the introduction of national health insurance in the 1990s (Lee et al., 2010). The importance of health care was also apparent from an analysis of trends in amenable mortality in New Zealand (Tobias & Yeh, 2009). This concluded that, over the preceding 25 years, improvements in health care contributed approximately one-third to the overall improvement in life expectancy. Together, these findings support the notion that improvements in access to effective care have a measurable impact in industrialized countries, and that the concept of amenable mortality may provide a valuable indicator of health system performance overall.

The precise composition of lists of causes deemed amenable to health care may not be of great importance. This is the conclusion of a recent report by the OECD (Gay et al., 2011) that compares the impact of two slightly different lists, by Nolte and McKee (2008) and Tobias and Yeh (2009). As Figure 5.3 shows, both produce similar results.

Amenable mortality does, however, suffer from a number of limitations. As an aggregate measure, it summarizes a wide range of causes of death, each reflecting different aspects of the health system. It is therefore necessary to break down the overall figures by cause and age to understand what is driving any change. This may be difficult where there are small numbers in particular groupings, as will be the case in all but the largest countries. Indeed, this is an increasingly important problem as deaths from many causes in those aged under 75 reach very low levels.

Second, aggregate data conceal variations within populations, which can be divided according to geographic, ethnic, socioeconomic and other parameters. Improvements for one group may conceal deteriorations for others (Nolte & McKee, 2008).

There are, however, some more fundamental problems with the concept that must be addressed (Nolte & McKee, 2004). One is the variable lag between

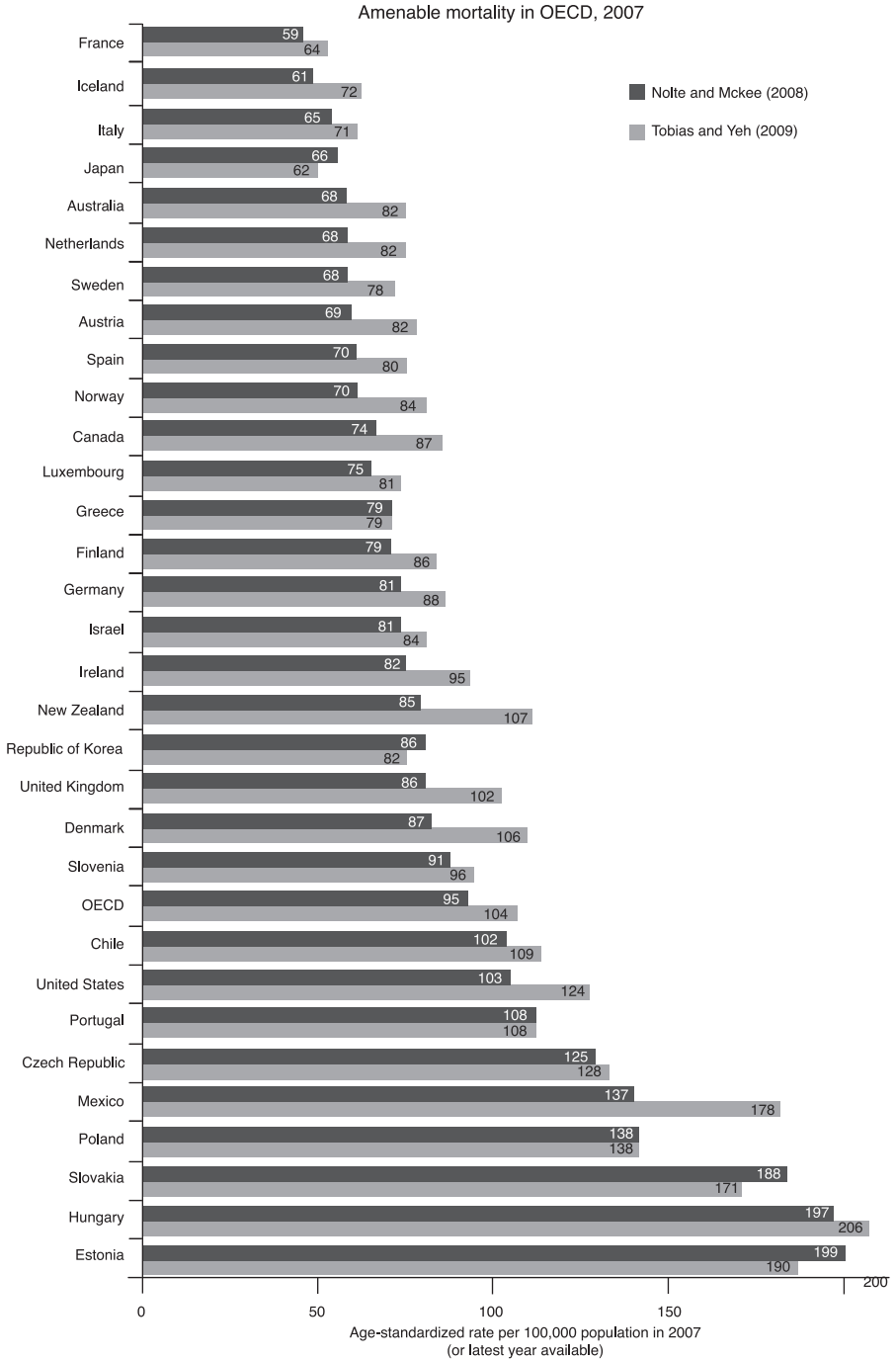


Figure 5.3 Amenable mortality in OECD countries, 2007

Adapted from: Gay et al., 2011.

medical intervention and mortality. In some cases this will be instantaneous, as in the case of resuscitation following cardiac arrest. Here, the outcome can reasonably be attributed to intervention in the same year. However, cancer survival is measured after five years and, while there is often a sharp reduction in survival at the time of treatment, there is a slower decline over several years. Thus, a death may be attributable to treatment decisions up to five years previously. In other cases the lag may be much longer. *Helicobacter* eradication therapy in a young person may save them from dying from stomach cancer several decades later.

Another concern is the changing incidence of disease. Deaths from amenable causes will decline if the incidence is falling regardless of any change in health care, and vice versa.

The original list of amenable causes included causes of death that could be prevented entirely by health care as well as those from which some deaths would be inevitable but this number could be minimized. The former is exemplified by vaccine-preventable diseases such as measles; the latter by IHD, where even in the best performing health care system, there will be some sudden and unobserved deaths. However, there are also many causes of death not considered to be amenable where, in some circumstances, health care can be life-saving. This is true of many cancers for which a small proportion may be identified early making curative treatment possible. An example is cancer of the pancreas. This begs the question what proportion of deaths from a specific cause should be preventable in order for the cause to be considered amenable. This issue has previously been addressed only implicitly.

One approach to doing so is to determine what has led to a reduction in avoidable deaths. In some cases, there will have been a single intervention. The term 'magic bullet' recalls the dramatic benefits of penicillin when it was first given to patients with severe staphylococcal infections in the 1940s. More often, health care will prevent deaths through a combination of interventions introduced incrementally, perhaps over decades. In these cases, it is necessary to look at changes in death rates over considerable time, introducing the problem of attribution as it is necessary to exclude other explanations for observed changes. This is, however, complicated by the limited evidence available. As noted above, randomized controlled trials often have limited external validity, as they frequently exclude both children and older people; those with comorbidities; and, historically, women. Hence, it will often be necessary to draw on natural experiments where it is possible to determine when new treatments were introduced. An example is the introduction of highly active antiretroviral therapy (HAART) for patients with acquired immunodeficiency syndrome (AIDS), where death rates fell very rapidly. In other cases, even where detailed data are unavailable, it may be possible to infer the impact of health care where there has been wider system change. An example is the political transition in Eastern Europe around 1990. The opening of borders to modern pharmaceuticals and ideas of evidence-based medicine made it possible to provide treatment that had been previously denied to sufferers from many chronic diseases. Thus, in countries such as Estonia, there was a rapid decline in mortality from stroke, almost certainly as a result of better treatment of hypertension, at a time

when such deaths were increasing in the neighbouring Russian Federation. It may also be necessary to look at historical evidence: conditions such as acute appendicitis became amenable to health care once the introduction of asepsis and anaesthesia made intra-peritoneal surgery possible in the late 19th century. The treatment of hypertension has a shorter history but has still been possible since the late 1950s.

In all previous studies, the definition of amenable deaths has had an upper age limit, reflecting the view that “everyone must die of something”. The age limit has increased over time, from 65 to 75, but this creates certain problems. The first is that it is explicitly ageist, as it devalues curative care for those aged over 75. The second is empirical: life expectancy in some countries now exceeds this figure and also there is growing evidence that many types of health care are very effective in older people. If, however, the definition of an amenable cause is one where health care can reduce the death rate by 50% or more, then there is no intrinsic reason to have an upper age limit. However, while conceptually attractive, this also poses problems of obtaining evidence, firstly because older patients are often excluded from trials and, second, because the absence of an observed decline in mortality at older ages at a time when an intervention was being introduced may simply mean that this population was not offered treatment.

Amenable mortality is a dynamic concept. Although most definitions still include infectious diseases such as measles, the numbers of deaths in high-income countries are negligible. In other words, success in tackling causes of death amenable to health care renders these causes obsolete as indicators of future progress. At the same time, new treatments are discovered that render once untreatable conditions treatable, justifying their inclusion in a new categorization. This clearly poses problems for longitudinal analyses.

Finally, the scope for reducing rates of avoidable mortality is greatest in the countries where initial levels are high. As a consequence, the ability to compare health system performance among developed countries is likely to be limited in the future, as the differences will be relatively small. Also, changes in coding of cause of death and in ICD versions may create artefactual discontinuities. It is also necessary to take account of changes in the incidence of underlying disease. For all these reasons, superficial comparisons of amenable mortality may be misleading (Desai et al., 2011). Yet, despite these limitations, the concept of avoidable mortality provides a potentially useful indicator of health system performance. It is, however, important to recognize that high levels should not be taken as definite evidence of ineffective health care, but rather as an indicator of potential weaknesses that require further investigation. These, and some of the earlier problems noted, can be illustrated by reference to renal cancer. In some countries, death rates are increasing and yet, paradoxically, data from cancer registries suggest that five-year survival rates are improving. Several factors must be considered. As this is a smoking-related cancer, the incidence is continuing to increase among women. There have also been advances in treatment, although of uncertain benefit. Finally, reported cancer survival is subject to lead-time bias as the greater use of abdominal imaging techniques in place of barium studies for intestinal problems is identifying many more early tumours.

The tracer concept

Many of the aggregate indicators discussed above say little about what must be done to improve the outcomes of health care so the policy implications are often unclear (Walshe, 2003). The challenge is to develop techniques that can capture performance in a systematic and comparable way. The use of tracer conditions is based on the premise that carefully selected health problems can provide insights into the performance of different elements within the overall health system (Nolte, Bain & McKee, 2006, 2009).

The concept was proposed initially by Kessner, who set out the six criteria for a condition to be used as a tracer (Kessner, Kalk & Singer, 1973):

1. *functional impact*, i.e. requires specific treatment, otherwise resulting in functional impairment;
2. *well defined and easy to diagnose*;
3. *sufficient prevalence* in the population to permit collection of adequate data;
4. *natural history which varies with utilization and effectiveness of health care*;
5. *available techniques of medical management* which are well defined for at least one of the following: prevention, diagnosis, treatment, or rehabilitation;
6. *known epidemiology*.

Over the past 30 years, the application of the tracer methodology has expanded slowly, as it has the potential to identify strengths and limitations of the entire health system. It is important to note that this approach does not assess the quality of care per se, but rather identifies potential strengths and weaknesses of the system's response to tracer conditions.

The process involves the collection of data from a variety of sources, including surveys and interviews with patients, providers and policy-makers. The assessment focuses on the inputs of care (physical, such as facilities and pharmaceuticals; human, such as trained health workers and empowered patients; knowledge, such as evidence-based guidelines; and social, such as social support and communication systems) and their integration.

The selection of health problems suitable for the tracer concept depends on the specific health system features requiring assessment. Thus, public health policies at the system level can be evaluated using vaccine-preventable conditions, while neonatal mortality can be adopted as a possible measure for assessing access to health care (Koupilová, McKee & Holcik, 1998; Nolte et al., 2000).

The increasing burden of chronic diseases, along with their complexity, makes them especially suitable for use as tracers, given that they require the coordinated input of multiple elements of the health system. Various studies have now used diabetes mellitus to evaluate health system performance measurement in high-, middle- and low-income settings (Hopkinson et al., 2004; Beran, Yudkin & de Courten, 2005; Nolte, Bain & McKee, 2006). Diabetes fits the criteria for a tracer condition, as it is well defined, fairly easy to diagnose (WHO, 1999) and common. Diabetes outcomes reflect a range of aspects of health system performance.

Crucially, albeit with some caution, the identification of failings in the provision of care for one chronic disorder can often highlight failings affecting

many others. McColl and Gulliford (1993) classify deaths from diabetes among young people as “sentinel health events” that should raise questions about the quality of health care delivery. Effective treatment prevents complications and disability, which is clearly illustrated by the countries with limited access to insulin (Yudkin & Beran, 2003) and by countries where health systems have collapsed (Telishevka et al., 2001).

Despite the availability of effective treatment for diabetes for almost a century, with an extensive evidence base for managing this disorder, there remains substantial variation across health systems in the standards of care people with diabetes receive. Examining a measure based on the ratio of mortality to incidence of diabetes in young people, Nolte, Bain & McKee (2006) found a 10-fold difference among 29 high- and middle-income countries.

A number of instruments are now available for use in tracer studies. The Rapid Assessment Protocol for Insulin Access (RAPIA) has been developed by the International Insulin Foundation as a functional evaluation tool (Yudkin & Beran, 2003). It provides a multilevel assessment of the different elements that influence access to insulin of patients in a given country. Beran, Yudkin and de Courten’s 2005 analysis using the RAPIA protocol in Mozambique and Zambia showed that, although insulin supplies were sufficient in these countries, their health systems did not permit appropriate distribution according to need, nor did they ensure adequate provision of additional equipment or the existence of training programmes for health care workers, all factors that increased the risk of misdiagnosis or failure to detect diabetes.

A similar approach was taken in Kyrgyzstan (Hopkinson et al., 2004) and Georgia (Balabanova et al., 2009). These studies identified key failings in integration (ineffective insulin distribution system, lack of necessary equipment, complex pathways) that prevented the delivery of quality care for diabetes patients despite the existing provision of the essential services (insulin supply, training of health professionals, financed care packages).

While these studies have obvious practical implications for the management of diabetes, the use of the tracer approach shows how, even though many inputs may be in place, there can still be critical gaps and a failure to integrate different aspects of the system. Although such studies focus on a single tracer, the problems they identify are often generic. Thus, diabetes can be seen as representative of a much larger group of complex chronic diseases that require long-term treatment by multidisciplinary teams and the active involvement of informed and empowered patients (Nolte et al., 2011).

5.7 Conclusion

Many of the existing measures of population health fail to distinguish the contribution of health care from extraneous factors and those that do suffer from a number of methodological problems. Some of these problems may be insurmountable; however, what is important is to understand them and take them into account when interpreting data, particularly in the context of comparing health systems. Thus, age-standardized mortality from selected causes, coupled with additional information on disease prevalence, incidence

and survival, can identify areas that justify in-depth investigation. However, such investigations must respect the many caveats that can affect cross-national comparability.

The concept of amenable mortality is no more than an indicator of potential problems. In international comparisons, it is subject to many methodological limitations and depends on achieving consensus on definitions and the choice of conditions included for analysis. It is a starting point; an accurate diagnosis and conclusions will require much more detailed and iterative examination of the data that contribute to it. The use of the tracer methodology may be part of this further enquiry.

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