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Measuring 'avoidable' mortality: methodological note

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Measuring 'Avoidable' Mortality

Methodological note

By Lucia Kossarova, Walter Holland, Ellen Nolte and Martin McKee

Summary

'Avoidable' mortality has been proposed as a measure of performance of the health system and as a measure of quality of health care service delivery. Several researchers have updated the concept, defining 'avoidable' mortality as deaths from causes that should not occur in the presence of timely and effective interventions. This offers a means of understanding the effectiveness of health systems in maintaining and improving population health. This indicator can be disaggregated into treatable and preventable mortality providing policy relevant information on the performance or quality of the health care system in detecting and treating selected conditions, and the success of broader health policy in preventing disease and promoting health.

This methodological note reviews the existing evidence and elaborates the definition and construction of the 'avoidable' mortality indicator (e.g. selection of causes of death and age limits) as set out in the literature, including a summary of the available empirical evidence. While the concept of 'avoidable' mortality has advantages, it also has some the limitations that will be discussed further. In particular, there are challenges in undertaking cross-country comparisons. The benefits of this approach will be considered together with the methodological challenges involved.

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I. Introduction

Quality of care and health system performance are complex concepts with numerous dimensions. Research over recent decades points to the fact that definitions of quality vary widely and there is not one indicator which can be used alone to reflect the performance of any system. Indicators may capture different aspects of the structure of the system, its processes or ultimately, the outcomes – the three approaches that can be taken to evaluate the health system, as proposed by Donabedian in the 1970s (Donabedian, 2005 reprint of Donabedian`, 1966). The measure of 'avoidable'[1] mortality is one of many outcome indicators which can be used to evaluate the performance of the health system.

The application of the concept of 'avoidability' dates back to at least the early 20th century when, in the United Kingdom, in 1928 confidential enquiries were made into maternal deaths to first identify errors and areas where improvements could be made to avoid unnecessary deaths (Holland, 2009); in the United States similar enquiries were carried out in the early 1930s and also led to important reductions in maternal mortality rates (New York Academy of Medicine. Committee on Public Health Relations, 1933). The World Health Organization in a report describing the methods of investigation of maternal mortality and morbidity stated that while there is no formal proof of the effectiveness of such enquiries 'the lessons derived will enable health care practitioners and health planners to learn from the past' (Holland, 2009; World Health Organization, 2004).

The concept of 'avoidable' deaths was proposed by Rutstein and colleagues in 1976 (Rutstein et al., 1976). The group outlined the method of measuring the quality of medical care[2] that counts cases of unnecessary disease, disability and untimely deaths. Rutstein and colleagues (1976) defined *medical care* in its broadest sense as "the application of all relevant medical knowledge, the basic and applied research to increase that knowledge and make it more precise, the services of all medical and allied health personnel, institutions and laboratories, the resources of governmental, voluntary and social agencies, and the co-operative responsibilities of the individual himself".

[1] The literature on 'avoidable' mortality variously uses the terms 'avoidable mortality', 'amenable mortality', 'treatable mortality' or 'preventable mortality'. It is beyond the scope of the note to discuss the reasoning behind this variation in terminology (see Nolte and McKee 2004 for further discussion). While recognising the differences between these terms, for simplicity we here use the term 'avoidable' throughout.

[2] Rutstein and colleagues (1976) defined "quality" as the effect of care on the health of the individual and of the population (outcome). Improvement in the quality of care should be reflected in better health.

Their list included around 90 conditions which they considered as sentinel health events. When selecting the conditions, they "assumed that if everything had gone well, the condition would have been prevented or managed". As Rutstein and colleagues acknowledged, "the chain of responsibility to prevent the occurrence of any unnecessary disease, disability, or untimely death may be long and complex; the failure of any single link may precipitate an unnecessary undesirable health event." As a result, often it may be difficult to establish who is responsible. For example, they cited deaths from diphtheria, measles and poliomyelitis for which the responsibility may lie in the state which may not have provided the necessary funding, the health officer who did not implement the program, the medical society that opposed community clinics, physician who did not immunize the patient, the religious views of the family, or the mother who did not care to bring her child for immunization (Rutstein et al., 1976). However, they thought that in each death considered unnecessary and untimely the physician has the "initial and also some continuing responsibility". Similar examples can be derived for many other conditions.

It was Rutstein's work that provided the basis for the concept and was followed by numerous publications which applied the concept empirically, reviewed the list of conditions, adjusted the definition of medical care and its scope, as well as the age limits. These will be described in this methodology note together with the most important issues relevant for the application of the indicator in the European Union countries. The note draws on the extensive review prepared by Nolte and McKee (2004) and summarizes some of its main findings.

First, the history of the concept will be discussed, followed by a summary of the empirical evidence to see how the measure has been applied to date. It will then discuss the limitations of the measure. Finally, implications for using the measure on an aggregate level for monitoring and comparing health systems in the European Union will be discussed and recommendations will be made.

II. The Concept

After the initial work carried out on maternal mortality in the early 20th century, and Rutstein and colleagues' extension of the concept of 'avoidable' mortality in 1976, the concept and application of the indicator continued to be expanded (Table 1). Interestingly there was no attempt to use Rutstein's methodology in the United States (Holland, 2009). Charlton and colleagues (Charlton, Hartley, Silver, & Holland, 1983) in the United Kingdom narrowed the concept by excluding conditions which were considered to be outside the scope of medical care, e.g. road traffic accidents, tobacco

policy. They were the first to apply 'avoidable' mortality empirically at the population level and to examine national and international trends (Nolte & McKee, 2004), as well as the importance of disease incidence and social factors. At the same time they introduced an upper age limit for some conditions at 65 years.

In 1986 a major project was undertaken in the European Community which resulted in the publication European Community Atlas of 'Avoidable Death' under the EC Concerted Action Project on Health Services and 'Avoidable Deaths' (Holland, 1988, 1991, 1993, 1997). This project extended the work of Charlton and colleagues (1983) and used a definition of health services, which were interpreted to include primary care, hospital care and collective health services such as screening and public health services, e.g. immunisation. The original list also included conditions whose control mainly depended on primary prevention or health policies, which were outside the direct control of health services, e.g. lung cancer, liver cirrhosis or motor vehicle accidents; these were excluded from the most recent edition (Nolte & McKee, 2004).

Table 1. Development of the concept of 'avoidable' mortality

Authors	Definition of Health Services	Number of conditions	Contribution	Upper age Limit
Rutstein et al. 1976	Includes "application of all relevant medical knowledge, the basic and applied research to increase that knowledge and make it more precise, the services of all medical and allied health personnel, institutions and laboratories, the resources of governmental, voluntary, and social agencies, and the co-	Over 90 conditions as 'sentinel health events'	Conditions divided into: i) even a single death justifies immediate enquiry (split to preventable/treatable) ii) not every single case is preventable or manageable but where appropriate care should be associated with lower incidence of that condition (split to preventable/treatable) Stresses that for each unnecessary untimely death the physician has the initial and some continuing responsibility.	None

Authors	Definition of Health Services	Number of conditions	Contribution	Upper age Limit
	operative responsibilities of the individual himself"			
Charlton et al. 1983	Excludes conditions which considered to be outside the scope of medical care (primary care, hospital care, public health programmes)	14 disease groups	First to apply concept empirically at the population level to analyse area variation in mortality in England & Wales (1974-78) Examines national and international trends between 1956 and 1978.	65 for some conditions and less for others
Poikolainen and Eskola 1986,1988	Excludes conditions which depended mainly on efforts outside the health services (e.g. lung cancer)	Extend by more than 70 amenable and 20 partly-amenable conditions	Analyse trends in Finland between 1969 - 1981 Drew up explicit list of "not amenable" conditions	Age limit set for all conditions; 65 for some conditions and less for others
European Community Atlas (Holland) 1988/91; 1993; 1997	Health care services include primary care, hospital care and collective health services such as screening and public health programmes, e.g. immunisation. Initially also includes conditions whose control depends on primary prevention (health) policies with action outside the direct control of	1st edition/1st volume of 2nd edition: 17 disease groups 2nd volume/ 2nd edition: expands by 8 conditions where role of health services in the reduction of mortality less certain 3rd edition: combination of causes from previous editions (total of 16)	Conditions that "provide warning signals of potential shortcomings in health care delivery" and conditions for which at least a proportion of deaths can be prevented. Stimulated a range of country –specific studies. Apply a range of causes of deaths.	Age limit set for all conditions; In the last edition: 65 for some conditions and less for others

Authors	Definition of Health Services	Number of conditions	Contribution	Upper age Limit
	health services; these were later excluded.			
Mackenbach, 1980s	Used a more restricted definition of medical care as "the application of biomedical knowledge through a personal service system"; exclude conditions for which effective intervention is outside the direct control of medical care system, including many forms of primary prevention	Based on EC project	Link trends in mortality to specific innovations in medical care	Could not identify clear evidence for age limits except for a few conditions
Westerling, 1992, 1993 & 1996	Indicators reflecting the outcome of medical care and those mainly reflecting the effect of national health policy	Based on Rutstein and EC project	First explicit comparison of "preventable conditions" vs "treatable conditions" and empirical application	65
Simonato, 1998	Primary prevention, reduction of exposures (includes measures outside the health services); secondary prevention, early detection	Based on Rutstein, Charlton and EC project and additional new causes	Presents the following differentiation: 1) amenable to primary prevention 2) amenable to early detection and treatment 3) amenable to improved treatment and medical care	65

Authors	Definition of Health Services	Number of conditions	Contribution	Upper age Limit
	and treatment; and tertiary prevention, improvement in treatment and medical care			
Tobias and Jackson, 2001	The concept of avoidability was extended to cover not only causes of death amenable to therapeutic intervention but also those responsive to individual and population-based preventive interventions	56 conditions Broadened list of conditions by reviewing literature of advances in health care since 1980s	Distinguishes 3 categories: (primary/secondary/tertiary prevention) with relative weights for each derived through expert consensus. Substantially broadened list of potentially "'avoidable'" conditions.	75
Nolte & McKee, 2004	Health care services include primary care, hospital care and collective health services such as screening and public health programmes, e.g. immunisation.	34 conditions Based on Charlton et al., Tobias and Jackson, Mackenbach	Updates list based on most recent advances in medical knowledge and technology Conditions selected considered indicators of the impact of health care	75

Source: Based on (Nolte & McKee, 2004 and Charlton et al., 1983; Holland, 1997; Poikolainen & Eskola, 1988; Simonato, Ballard, Bellini, & Winkelmann, 1998; Tobias & Jackson, 2001; Westerling, 1993)

Several country specific analyses resulted from the EC Atlas carried out by participating researchers, as well as in non-participating countries (Nolte & McKee, 2004). However, studies used different lists of 'avoidable' conditions, with varying age limits and methods of analysis. Lack of suitable data or insufficient numbers of deaths for some of the conditions may explain the differences in the methods applied (Mackenbach, Bouvier-Colle, & Jougla, 1990). In the 1980s Mackenbach and colleagues analysed the possible contribution of medical care innovations to mortality changes by analysing trends in

mortality from selected conditions and found that "although the exact contribution of medical care innovations to changes in mortality cannot be determined, the impact of medical care on post-1950 mortality in the Netherlands could well have been substantial" (Mackenbach, Looman, Kunst, Habbema, & van der Maas, 1988). They used a stricter definition of medical care defining it as "the application of biomedical knowledge through a personal service system" building on Rutstein's list of conditions.

Further work has focused explicitly on differentiating and comparing levels of 'avoidable' mortality attributable to the health care system and to wider health policies usually not within the direct control of health services. While this distinction had been made in earlier publications (Holland, 1986; Rutstein et al., 1976), this time conditions were clearly split as indicators for the different areas of health care (Westerling, 1993; Westerling, Gullberg, & Rosén, 1996; Westerling & Smedby, 1992). Tobias and Jackson (2001), following an expert consensus exercise in New Zealand, partitioned the relative avoidability of death from conditions into proportions which are avoidable by primary, secondary, and tertiary actions (Tobias & Jackson, 2001). For example, avoidability of deaths from asthma was partitioned into primary, secondary and tertiary interventions with weights 0.1, 0.7, and 0.2, respectively, while tuberculosis received weights of 0.6, 0.35 and 0.05, respectively. According to this approach, death from tuberculosis is considered, largely, avoidable by primary prevention while death from asthma is primarily avoidable by secondary prevention through early detection and treatment. However, the usefulness of broader concept is limited because it is mainly to "measure the theoretical scope for further population health gain, not what may be considered feasible given current technology, available resources and competing values" (Nolte & McKee, 2004). Finally, the work of Nolte & McKee (2004) looked at 'avoidable' mortality and changing life expectancy in the European Union in the 1980s and 1990s using an updated list of conditions taking into consideration advances in medical knowledge and technology.

III. Empirical Evidence

As shown by Nolte and McKee (2004) numerous studies have applied the concept of 'avoidable' mortality empirically. As noted above, these studies vary in the selection of conditions deaths of which are considered avoidable by health care, definitions of medical care and/or health services and age limits so limiting comparability of findings (Nolte & McKee, 2004). While some only looked at trends in 'avoidable' mortality others attempted to identify factors that might explain these trends or any variations. Given that the indicator is assumed to measure the effectiveness of health services, it might be expected that variations in 'avoidable' deaths could be linked to health care inputs;

however, of those studies that did attempt to establish such link, most tended to capture only quantity but not the quality of health services and, perhaps unsurprisingly, could not establish a clear association between health care input and (population) health outcome. Nolte and McKee (2004) reviewed over 70 studies and grouped them into three categories as follows:

- Studies that examine the variation geographically. These suggest that there is little association between geographical variation in 'avoidable' mortality and differences in quality or quantity of health services, as measured by routine data; geographical variations seem to be more closely related to socioeconomic conditions.
- Studies that examine variation between social groups. These suggest that population groups classified as being at social disadvantage because of ethnicity or socioeconomic characteristics tend to be at higher risk of death from 'avoidable' conditions.
- Studies that examine variation in 'avoidable' mortality over time. These tend to show consistent declines in 'avoidable' mortality that have been more rapid than declines in mortality from causes not considered 'avoidable'.

IV. Limitations of the concept of 'avoidable' mortality

Nolte and McKee (2004) have highlighted several limitations of the concept of 'avoidable' mortality that require attention if it is to be used for measuring the effectiveness of health services. Understanding these limitations is important, especially if the measure is to be routinely utilized at the European level.

- **The association between 'avoidable' mortality and health care inputs**

'Avoidable' mortality was originally intended to assess the quality of care (Holland & Breeze, 1985) but has also been used to measure the contribution of health systems to population health. Many authors have attempted to explain observed variations in 'avoidable' mortality using a range of potential explanatory variables of which health care resources has been one. However, given the weak association between variations in 'avoidable' mortality and measures of health care provision (Kunst et al., 1988; Mackenbach, Kunst, Looman, Habbema, & van der Maas, 1988), some authors have questioned the usefulness of this indicator to measure the quality and effectiveness of health care services (Carr-Hill, Hardman, & Russell, 1987). It is important to clarify that most of the variables studied to explain variations in 'avoidable' deaths such as health expenditure, number of health staff or hospital beds, presence of health care facilities tend to only capture quantity but not quality of care (Nolte & McKee, 2004). At the

same time, evidence from analyses undertaken in the former communist countries of central and eastern Europe (Koupilová, McKee, & Holcik, 1998; Nolte, Scholz, Shkolnikov, & McKee, 2002; Telishevska, Chenet, & McKee, 2001; Velkova, Wolleswinkel-van den Bosch, & Mackenbach, 1997) supports the link between health care resources and outcomes as measured by mortality. Overall, the weak or absent association with health care inputs may be attributable to (i) the use of variables which are measurable but not necessarily important; and/or ii) a time lag between changes in resources and changes in mortality and others (Nolte & McKee, 2004). However, the more frequently observed association with adverse socioeconomic factors has focused attention to timely access to medical care (Nolte & McKee, 2004).

- **Interpreting trends in 'avoidable' deaths over time**

When interpreting observed trends in 'avoidable' mortality over time it is necessary to take account of a number of factors. Changing mortality from a given condition considered 'avoidable' might be due to changes in the incidence of the disease which can result from changes in behavioural and environmental risk factors. Therefore, it is important to understand the course of particular conditions and changes in medical interventions to be able to attribute changes in mortality to medical care.

- **Selection of 'avoidable'' conditions and the attribution of health outcomes**

The selection of conditions in which death should be considered 'avoidable' by appropriate health care has differed by study and may have been determined by data availability, definition of medical care and whether a given condition is considered to be preventable or treatable. Some have questioned the inclusion of some 'avoidable' conditions as performance indicators of health services (Walsworth-Bell & Allen, 1988). Yet it is important to note that when the concept was first applied by Charlton, they stressed that aggregate analyses are insufficient and "do not provide definitive evidence that a particular services is wrong" (Holland & Breeze, 1985). Rather, findings should be seen as giving a first indication that there may be a problem in the health care system and it should be further investigated. Attributing health outcomes solely to health care services will only be possible for some conditions. Yet for many others mortality will result from the combination of environmental, nutritional, genetic and social factors, as well as health services. These have to be investigated.

- **The changing concept of avoidability**

As mentioned earlier, many studies apply some version of the original Rutstein list of conditions, Charlton's or the conditions selected for the EC Project. However, given the

advances that have been made in medical care, it is likely that there are now additional conditions that may be considered to be 'avoidable' as effective prevention or treatment has become available. At the same time, some conditions which have been used earlier may no longer be a good indicator. Therefore, depending for which period the analysis is being carried out, the changing concept of avoidability must be taken into consideration, since advances in medical care should continuously be considered.

- **Contribution of 'avoidable' conditions to overall mortality**

In some countries deaths from certain 'avoidable' conditions occur rarely. Therefore, deriving conclusions about the quality of health care based on small numbers was not considered entirely appropriate (Westerling & Smedby, 1992). Yet today when age limits have been raised to reflect rising life expectancies, this criticism may no longer apply (Nolte & McKee, 2004).

- **Underlying disease incidence and disease severity at presentation**

In general, the extent to which health care services can help the patient depends on the severity of symptoms he or she presents with; patients may present too late because of factors affecting their health seeking behaviour. Disease incidence may explain a large proportion of regional or national variations in mortality and might be taken into consideration, even though this is often not possible due to lack of data. However, it can be argued that incidence is irrelevant, since services should be planned to take "need" into account – thus areas or populations with greater frequency of the disease studied should have more provision than areas/populations with a lower frequency (Charlton et al., 1983). As Charlton and colleagues note (Charlton, Holland, Lakhani, & Paul, 1987), "there is no reason for more deaths to occur from conditions such as acute appendicitis or hernia in areas where the condition may be more common".

- **Cause of death certification and coding**

Nolte & McKee (2004) note that, in any analysis that uses cause of death data, differences between countries on the indicator of 'avoidable' mortality may be, at least in part, because of differences in diagnostic patterns, death certification and coding of causes of death (Kelson & Farebrother, 1987). Also, assigning a single underlying cause of death for a person who has been suffering from multiple chronic conditions, particularly among older people, is often difficult and subject to variation even if the rules of certification and coding are well-understood and clearly formulated. Mortality data is also likely to underestimate the burden of disease for low-fatality conditions such as diabetes or other chronic disorders (Jougla et al., 1992; Ruzicka & Lopez, 1990). Thus, interpreting mortality statistics requires careful consideration of their limitations,

and where possible, efforts should be made to improve their quality (Charlton in Hansluwka, Lopez, Porapakkham, & Prasartkul, 1986). This is particularly true for cross-country comparisons and caution must be exercised in the interpretation of results and conclusions.

- **Focus on mortality**

It is important to acknowledge that focusing only on mortality may not always be the most appropriate indicator for measuring the effectiveness of the health care system (Holland & Breeze, 1985). Especially, because health care also has non-health outcomes such as its impact on the general wellbeing of the society or alleviation of the risk of impoverishment as a consequence of the disease (Buck, Eastwood, & Smith, 1999). Activities which focus on relieving pain or improving quality of life will also not be captured by this measure (Holland & Breeze, 1985).

- **Negative consequence of medical care**

Finally, most studies of 'avoidable' mortality have not addressed the potential negative impact of medical care. *Iatrogenesis* or medical errors, negligence and adverse effects have only recently become the focus of policy makers' attention (Nolte & McKee, 2004). Estimates for the United States suggest that up to 98,000 deaths annually may result from medical errors (Kohn, Corrigan, & Donaldson, 1999). In the United Kingdom, since 2001 the National Patient Safety Agency also monitors information about incidents which may have led to harming a patient or even death. However, incidents continue to be under-reported because the reporting and feedback environment is still one of "naming and shaming" (Cassidy, 2009; Health Committee, 2009; Healthcare Commission, 2008).

V. Issues to consider and recommendations

Given the existing evidence and the limitations, using 'avoidable' mortality as an indicator of population health at the EU level should be undertaken with a careful consideration of how it is used, by whom and for what purpose. To date the indicator was intended to point towards areas which require further investigation into health service provision and not as an absolute measure of outcome. However, aside from the systematic literature review undertaken by Nolte and McKee (2004) that also included an attempt to establish an 'up to date' list of conditions that may be considered 'avoidable' in the presence of timely and effective contemporary care, fairly little work has been done to advance the original concept of individual enquiries into preventable deaths and most studies are examples of descriptive epidemiology. Rutstein et al. (1976) noted that "the search for underlying preventive or therapeutic inadequacies is an essential step in

the complete application of the method". This involves, as a first step, the aggregate analysis of trends; and second should involve the identification of underlying causes and appropriate follow up.

Identifying the causes of death to be considered 'avoidable' by timely and effective health care

Apart from maternal and perinatal mortality, there are few examples of systematic investigation, at local or national level, to identify the possible causes of failure of health care and what can be done to improve outcomes (Holland, 2003). It is this type of follow up that should be encouraged in the EU countries. To date, when data was used to improve services, it often resulted in identifying and a culture of blaming the individual practitioner rather than considering system deficiencies; other 'side-effects' tend to include inappropriate policy responses, lack of resources, lack of coordination of care as well as individual errors (Holland, 2009).

For these reasons, it is highly recommended that systematic investigations of 'avoidable' deaths are carried out, following existing and sound methodologies. Methods of enquiry have been proposed for maternal mortality and summarized in the 2004 World Health Organization Report (World Health Organization, 2004). The WHO Report (2004) provides a range of approaches the applicability of which depends on the level of investigation, i.e. facility, community, district, regional or national level (Table 2).

TABLE 2: Methods of enquiries at the different levels

Level	**Outcome - 'Avoidable' Death (maternal mortality or other)**
Community	Verbal autopsy (community based death reviews)
Facility or groups of facilities	Facility based death review
District/regional/national	Confidential enquiry into death

Source: Adopted from WHO (2004)

Confidential enquiries are most appropriately undertaken at the local level. They comprise a systematic multi-disciplinary anonymous investigation of all or a representative sample of deaths occurring at an area, district, regional or national level; they aim to identify the numbers, causes and avoidable or remediable factors associated with deaths so identified (Lewis, 2003). Through lessons learned from each death and through aggregating the data, they provide evidence of where the main problems lie and what can be done in practical terms. Thus, confidential enquiries have the potential to

highlight the key areas requiring recommendations for health sector and community action and can so guide the improvement of clinical outcomes (World Health Organization, 2004). Certainly, it will not be possible to prevent all deaths for a given condition considered 'avoidable' but confidential enquiries are likely to provide detailed information on the extent of deaths that have occurred because of weaknesses or failures of the relevant system and so point to appropriate interventions to improve the quality of care and reduce such deaths in the future.

Selection of conditions

The selection of conditions to be considered 'avoidable' and monitored will depend on the definition and scope of health services which are to be evaluated and by which stakeholder. The definition can include public health policies (e.g. tobacco control, road safety, and alcohol policies), activities of health authorities as well as activities directly attributable to medical treatment at the primary, secondary and tertiary level. Conversely, the definition of health services can be more restrictive, including only those activities which are directly attributable to health care providers (primary, specialist and hospital care) and collective health services such as immunisation and screening. Such a definition would thus not include conditions whose 'avoidability' is more closely related to wider intersectoral policies such as traffic injuries.

At present the "AMIEHS" project - Avoidable mortality in the European Union: towards better indicators for the effectiveness of health systems – aims to develop an agreed definition of 'avoidable' mortality for Europe, and to derive a set of validated 'avoidable' mortality-based indicators of the effectiveness of health systems which can be used in routine surveillance systems. A systematic review of the literature to assess the extent to which different causes of death can now be considered 'avoidable' by preventive and curative health care interventions is being carried out. As part of the project, it will be verified whether the introduction of medical innovations coincided with measurable declines in mortality in seven European countries, using in-depth information on the introduction of each innovation in these countries, and taking into account possible data artefacts caused by successive revisions of ICD codes. Based on these findings, a group of experts will be consulted on the conditions which should be considered as valid 'avoidable' mortality indicators. The project also includes an examination of appropriate age ranges for each condition.

The findings of this project will form a great contribution in terms of systematizing the evidence on the preventability or treatability of conditions considered 'avoidable'

although it is likely that the causes originally selected already more than 20 years ago in the context for the EC 'Atlas on Avoidable Deaths' mentioned earlier are likely to form a key component of 'avoidable' conditions, such as tuberculosis. It is important to note that deaths for many of these conditions, although, in theory, 'avoidable', are likely to continue occurring in EU countries because of variation in the use and implementation of the existing medical knowledge or the organization of the health systems among countries. Overall, unnecessary deaths are likely to result from untimely diagnosis, inappropriate treatment, lack of coordination or communication among different levels of care, inefficient distribution of resources or other aspects of health care provision not measurable unless case by case systematic enquires are undertaken into the causes of deaths on the country level.

Data issues

Mortality data is routinely collected in all the European Union countries. However, in order to be able to monitor 'avoidable' death rates and make international comparisons, detailed data on mortality by ICD codes on the regional level needs to be made available. Standardisation of data collection, diagnosis and coding, both between and within countries is necessary. Furthermore, appropriate analyses of comparability both between and within countries is needed on all these aspects at regular intervals. Care must be then taken to ensure the appropriate certification and coding of multiple causes of deaths, e.g. diabetes and arthrosclerosis.

Since 1994, Eurostat has been collecting regional mortality statistics from member states for a total of 65 individual or groups of causes of death. This data cover several of the conditions that have been considered as 'avoidable' such as selected treatable cancers, ischaemic heart disease and cerebrovascular disease (Appendix 1). However, much of the Eurostat mortality data set is not sufficiently disaggregated to allow for detailed analysis of 'avoidable' mortality. Thus, Eurostat data will not allow separate monitoring of conditions such as Hodgkin's disease (C81), appendicitis (K35-38), epilepsy (G40-G41), or medical errors resulting in patient death (Y60-69, Y83-84). If 'avoidable' mortality is to be monitored at European level drawing on Eurostat data , it will be necessary for Eurostat to collect mortality data that are sufficiently disaggregated."

Key recommendations for policy and action

When using 'avoidable' mortality as an indicator of health system performance the following key recommendations should be considered:

- 'Avoidable' mortality is intended to point towards weaknesses or failures of the health system which require further investigation and not as an absolute measure of health care quality.
- The measure of 'avoidable' mortality has a number of limitations which should be thoroughly considered by stakeholders if the indicator is to be routinely utilized as an indicator of the effectiveness of health services.
- Conditions to be monitored will depend on the definition and scope of health services which are to be evaluated and by whom. The "AMIEHS" project is aiming to develop an agreed definition of 'avoidable' mortality for Europe and to derive a set of validated 'avoidable' mortality-based indicators which can be used in routine surveillance systems across European countries.
- It is fundamental to identify interventions at each level of the health system for indicators of 'avoidable' mortality to ensure action. Designing an indicator to measure health system performance and collecting information without an appropriate follow up is futile. This process is supported by the "AMIEHS" project which will develop validated and agreed indicators that will describe the intervention/s and/or polices that have contributed to falling mortality from a given condition considered 'avoidable'.
- Once aggregate analysis of 'avoidable' mortality has been carried out, in depth systematic investigation of the underlying reasons for observed trends should follow according to existing and sound methodologies. In depth analysis of local and central level policies will be required, as well as an excellent understanding of how services targeted at the selected condition are being delivered and coordinated, starting from prevention, through diagnosis and treatment and management of the disease.
- A suitable monitoring system is required to determine the effectiveness of any intervention. Then 'avoidable' mortality indicators have again to be monitored to see whether expected reductions in mortality rates have materialized as a result of the actions taken.
- Detailed regional and national level data on deaths by ICD codes should be made available by Eurostat to allow for cross-country analysis at the European level.
- At the same time, steps should be taken towards standardizing diagnostic patterns, death certification, coding (e.g. multiple causes of deaths) and reporting procedures.

Overall, based on the trends in 'avoidable' deaths countries should be encouraged to actively take steps towards reducing mortality rates by improving the timeliness and

effectiveness of medical services. At the same time, other measures both at the population and individual level should be monitored to provide a comprehensive understanding of health outcomes and performance of the health system in the country. As Charlton and colleagues (1983) noted, "it would be incorrect to judge the health services performance of health authorities solely on the basis of reported 'avoidable' mortality, since these indicators are intended merely to provide warning signals of possible shortcomings in health-care delivery".

Appendix 1

Eurostat list of conditions and their use in some lists of 'avoidable' deaths

Eurostat List of Causes of death	**ICD 10**	**EC/ Holland**	**Nolte & McKee**
Infectious and parasitic diseases	A00-B99		
Tuberculosis	A15-A19,B90	**X**	**X**
Meningococcal infection	A39		
AIDS (HIV-disease)	B20-B24		
Viral hepatitis	B15-B19		
Neoplasms	C00-D4		
Malignant neoplasms	C00-C97		
Malignant neoplasm of lip, oral cavity, pharynx	C00-C14		
Malignant neoplasm of oesophagus	C15		
Malignant neoplasm of stomach	C16		
Malignant neoplasm of colon	C18		**X**
Malignant neoplasm of rectum and anus	C19-C21		**X**
Malignant neoplasm liver and the intrahepatic	C22		
bile ducts	C25		
Malignant neoplasm of pancreas	C32-C34		
Malignant neoplasm of larynx and	C43	**X**	**X**
trachea/bronchus/lung	C50	**X**	**X**
Malignant melanoma of skin	C53	**X**	**X**
Malignant neoplasm of breast	C54-C55	**X**	**X**
Malignant neoplasm of cervix uteri	C56		
Malignant neoplasm of other parts of uterus	C61		
Malignant neoplasm of ovary	C64		
Malignant neoplasm of prostate	C67		
Malignant neoplasm of kidney	C81-C96		
Malignant neoplasm of bladder	D50-D89		
Malignant neoplasm of lymphatic/haematopoietic	E00-E90		
tissue	E10-E14		**X**
Dis. of the blood(-forming organs),	F00-F99		
immunological disorders	F10		
Endocrine, nutritional and metabolic diseases	F11-F16,F18-F19		

Eurostat List of Causes of death	**ICD 10**	**EC/ Holland**	**Nolte & McKee**
Diabetes mellitus	G00-H95		
Mental and behavioural disorders	G00-G03		
Alcoholic abuse (including alcoholic psychosis)	I00-I99		
Drug dependence, toxicomania	I20-I25	**X**	**X**
Diseases of the nervous system and the sense	I30-I33,I39-I52		
organs	I60-I69	**X**	**X**
Meningitis (other than 03)	J00-J99	**X**	**X**
Diseases of the circulatory system	J10-J11	**X**	**X**
Ischaemic heart diseases	J12-J18	**X**	**X**
Other heart diseases	J40-J47		
Cerebrovascular diseases	J45-J46	**X**	
Diseases of the respiratory system	K00-K93		
Influenza	K25-K28		
Pneumonia	K70, K73-K74		
Chronic lower respiratory diseases	L00-L99		
Asthma	M00-M99		
Diseases of the digestive system	M05-M06,M15-		
Ulcer of stomach, duodenum and jejunum	M19		
Chronic liver disease	N00-N99		
Diseases of the skin and subcutaneous tissue	N00-N29	**X**	**X**
Diseases of the musculoskeletal	O00-O99		
system/connective tissue Rheumatoid arthritis	P00-P96		
and osteoarthrosis	Q00-Q99		
Diseases of the genitourinary system	Q00-Q07	**X**	**X**
Diseases of kidney and ureter	Q20-Q28		
Complications of pregnancy, childbirth and	R00-R99		
puerperium	R95		
Certain conditions originating in the perinatal	R96-R99		
period	V01-Y89		
Congenital malformations and chromosomal	V01-X59		
abnormalities	V01-V99		
Congenital malformations of the nervous system	W00-W19		
Congenital malformations of the circulatory	X40-X49		
system	X60-X84		
Symptoms, signs, abnormal findings, ill-defined	X85-Y09		
causes	Y10-Y34		
Sudden infant death syndrome	A00-Y89		
Unknown and unspecified causes			
External causes of injury and poisoning			
Accidents			
Transport accidents			
Accidental falls			
Accidental poisoning			
Suicide and intentional self-harm			
Homicide, assault			
Events of undetermined intent			

Eurostat List of Causes of death	ICD 10	EC/ Holland	Nolte & McKee
TOTAL All causes of death			

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