Indicators of "premature" and "avoidable" mortality

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Executive Summary

The aim of this report, produced in response to a referral by the DGS and the DREES, is to clarify the definition of "premature" and "avoidable" mortality indicators. These concepts were developed in the United States in the early 1980's. D.D. Rutstein published a list of sentinel events for which no death should occur in a country with effective health care. This approach was then applied at a population level on the basis of geographical mortality analyses. W. Holland co-ordinated the publication of a series of European atlases of "avoidable" mortality based on causes of death amenable to available, effective and known interventions.

The indicators of "premature" and "avoidable" mortality were used from the 1990's onwards in successive Health in France reports ["La santé en France"] by the HCSP. "Premature" mortality was defined as all deaths occurring before the age of 65. "Avoidable" mortality was defined based on a breakdown of "premature" mortality into three components: causes of death linked to high-risk behaviours, causes of death linked to the healthcare system and other causes of death. The comparison of France's situation with that of its neighbours highlighted the importance of taking these indicators into account when monitoring public health policies. France is characterised by significantly higher rates of "premature" death, while at the same time mortality levels for seniors are highly favourable. Where "avoidable" mortality is concerned, indicators related to high-risk behaviours are unfavourable in France, while the opposite is seen for indicators related to the healthcare system.

A validated definition of "avoidable" mortality indicators has recently been called for in many countries. These calls fall within a broader context of growing interest in the development of methods for evaluating the quality and effectiveness of healthcare systems. The UK's Office for National Statistics (ONS) has therefore initiated various research projects including, in particular, a very precise literature review and extensive consultation with public healthcare professionals, with the aim of making "avoidable" mortality indicators available for routine yearly publication. After examining the different selections of causes of death, and in spite of the difficulty in reaching a consensus on the concept of "avoidable" mortality, these studies led to well argued recommendations regarding which causes of death should be taken into consideration. In parallel, other methodological studies were conducted on these concepts and on the selections of causes of death (OECD, Eurostat, the European AMIEHS project, etc.). Compared to the first lists suggested, the newly defined selections of causes of death are much broader for all indicator types.

Based on a review of the methodologies and results of these international studies, this report makes a number of recommendations regarding the definition, use and interpretation of "premature" and "avoidable" mortality indicators. These indicators are intended to be used in a broad context of piloting and monitoring public health policies and actions. They must be able to contribute to different types of analyses (sociodemographic disparities, spatial disparities, etc.), and at different levels (sectoral, regional, national, international, etc.), but they are not primarily intended to provide operational and practical indicators for participants in the field. Moreover, and as requested, this response to the

referral only covers mortality indicators. To assess the impact of preventative actions or the quality and effectiveness of the healthcare system, they must necessarily be complemented with other types of indicators (morbidity, disability, perceived health, etc.).

The main conclusion of the report is that, despite a number of limitations relating to their definition and their interpretation, these "premature" and "avoidable" mortality indicators are important indicators and of use in the context of monitoring public health laws. Two complementary indicators must be distinguished: "avoidable mortality related to prevention" and "avoidable mortality related to the healthcare system". The selection of causes of death to be included in each of these two indicators should be based on the studies recently conducted by the UK's ONS and should be subject to a consensus between countries of the European Community. These "avoidable" mortality indicators should nevertheless be interpreted with caution, taking into account a number of limitations. In particular, neither evolutions nor prevalence levels and incidence of diseases are taken into account. These indicators should therefore be regarded as general indicators, useful in the detection of issues relating to the effectiveness of healthcare or prevention systems, but complementary, more refined analysis methods are required to carry out precise investigations into determinants or to interpret trends. In particular, it is important to approach the different causes or categories of causes forming the different types of avoidable death separately.

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Context

DGS and DREES referral (6 August 2012) to the High Council of Public Health (deadline 1st half of 2013) as part of the redesign of monitoring of indicators associated with ancillary objectives to the 2004 Public Health Act:
Indicators of "premature" and "avoidable" mortality:
"The aim is to clarify and redefine, if necessary, these indicators. More specifically, what threshold(s) to apply for qualifying a death as premature? And which causes to select for avoidable deaths, by clarifying in particular the implications for preventative actions and the organisation of healthcare. This work shall be based in particular on international studies produced since the definitions were adopted by the HCSP in 1994. "

Preliminary comments

* As requested, this response to the referral only covers mortality indicators. To assess the impact of preventative actions or the quality and effectiveness of the healthcare system, they must necessarily be complemented with other indicators (morbidity, disability, perceived health, etc.). In particular, to understand the weight of health problems such as mental, sensory or musculoskeletal disorders.

* This contribution, based on a literature review and recent advances on the subject, mainly covers "avoidable" mortality indicators. The discussion on "premature" mortality is less debated and mainly concerns the pragmatic but poorly supported choice of an age limit (which we suggest setting at 75 years).

* The indicators presented are intended to be used in a broad context of piloting and monitoring public health policies and actions. They must be able to contribute to different types of analysis (sociodemographic disparities, spatial disparities etc.), and at different levels (sectoral, regional, national, international, etc.). But their primary aim is not to provide practical, operational indicators for participants in the field.

This report was validated by the Executive Committee of the HCSP on 6 February 2013.

1. History of the concept of avoidable mortality

1.1 Definition of the concept and first European atlases of avoidable mortality

A number of studies published in the 1970's concluded to the limited role played by the healthcare system in explaining the drop in mortality observed in developed countries, in particular by infectious diseases (7,21,25,33-35). One of the arguments raised was that the decline in mortality due to specific disorders that benefited from therapeutic innovations, or more broadly from progress in the healthcare system, had in fact occurred before the implementation of these innovations. For example, the drop in mortality due to tuberculosis was observed before the spread of the vaccine and of antibiotics. The decrease in mortality was further explained by the more global role of implemented social and health policies, such as nutrition, hygiene and education. These conclusions have, however, been criticised, or at least assuaged, by demonstrating that, although mortality had decreased earlier than expected, the implementation of these therapeutic innovations had led to an accelerated rate of its decrease (29). Another point raised was that the conclusions, based on observations relating to the first half of the twentieth century, could not be transposed to more recent times, because the health of the overall population had greatly improved, with, in particular, a broad progress since the date of these studies in the availability of effective care and medicinal drugs for the most common chronic diseases.

In the same context, other authors have taken an interest in the development of more precise and more specific methods for measuring the quality of medical care. A group of researchers from the University of Harvard, co-ordinated by David D. Rutstein as part of the *Preventable and Manageable diseases working group*, suggested the development of medical care quality indicators by totalling the cases of premature and avoidable deaths, diseases and disabilities (44-46). With this aim, Rutstein published a list of sentinel events for which, in a country with effective health care, no death should occur. For each event, the age groups for which these causes were particularly "avoidable" were also defined.

Rutstein's concept of premature and avoidable death was revived in the 1980's and applied at a population level on the basis of geographical analyses of mortality (5). The spatial analysis of avoidable death was intended to highlight areas where the healthcare system appeared deficient in order to prevent deaths. In the late 80's, Walter Holland co-ordinated a large, concerted, European action, "*The EC concerted action project on health services and avoidable deaths*", with the aim of developing atlases of avoidable mortality in Europe (16). Three European atlases were successively published over the periods of 1974-1978, 1980-1984 and 1985-1989 (17-20). These atlases were based on a selection of causes of death, which individualised a number of disorders related to the functioning of the healthcare system in widest broad sense (curative care, but also primary and secondary preventative care). The main selection criterion was that each disorder had to be amenable to known, available and effective interventions. Furthermore, specific age limits were applied to each of these (under 65 years in most cases). Table 1 shows the selected groups of causes, along with their corresponding age ranges. This selection includes different types of pathologies (cancers, cardiovascular or respiratory diseases, infections etc.). The list relating to the first atlas included 17

groups of causes of death; this list evolved between the first and third atlas. The causes included in a second stage were ischaemic heart disease; breast, skin and testicular cancers; leukaemias, intestinal infections, peptic ulcers and congenital cardiovascular defects. The selection of each of these groups of causes was justified by presenting available interventions and types of care. The first two atlases also included a complementary list of causes relating to primary prevention (lung cancer, liver cirrhosis and transport accidents), which were not included in the third atlas.

Table 1 - European atlas of "avoidable" mortality 1974-1989 – selection of causes of death – Holland (17-20)

Causes of death		Age ranges
Infections	- Tuberculosis, typhoid	5-64
	- Pertussis , intestinal infections	0-14
	- Tetanus	0-64
	- Measles	1-14
	- Osteomyelitis	1-64
Cancers	- Breast	25-64
	- Skin	35-64
	- Uterus	15-64
	- Testicle	0-64
	- Hodgkin's	5-64
	- Leukaemias	0-44
Cardiovascular	- Hypertensive diseases and CVA	35-64
	- Rheumatic heart disease	5-44
	- Ischaemic heart disease	35-64
Respiratory	- All	1-14
	- Asthma	5-44
Miscellaneous "surgery"	- Peptic ulcer	25-64
	- Appendicitis, lithiasis, hernias	5-64
Children-pregnancy	- Maternal and perinatal mortality	All ages
	- Congenital heart disease	1-14
"**Primary prevention**"	- Lung cancer	5-64
	- Liver cirrhosis	15-74
	- Transport accidents	All ages

1.2 Studies carried out in different countries following publication of the European atlases of avoidable mortality

Further to the concerted European action, various studies based on the concept of avoidable mortality were carried out at a national level in a number of participating countries (such as geographical, temporal or socio-economical analyses). The aim was often to verify the relationship between avoidable mortality levels and healthcare system characteristics. Mackenbach summarised the methods used (selection of causes of avoidable death, analysis methods, etc.) and the results (30). These studies usually highlighted the major influence of socio-economical factors in comparison to healthcare system characteristics as explanatory factors in variations of avoidable mortality. However, the approach generally used (ecological analysis) was unable to reach a conclusion with regard to causality. In addition, the healthcare system characteristics considered remained very general and rather unspecific (density of doctors, density of hospitals, etc.). Analyses of French data led to a similar conclusion: very weak link between avoidable mortality and healthcare system characteristics after socio-economical factors have been controlled for (24). Mackenbach's summary also highlighted a great diversity of methodology and little consensus with regard to the definition of avoidable mortality (e.g. avoidable by primary prevention *versus* avoidable by the healthcare system), the selection of causes and the age ranges defined for each type of indicator.

Debate surrounding the definition of the indicators and the selection of avoidable causes of death continued in other European studies (3,49,52). Many variations in terminology exist for the concept of avoidable mortality, and these can sometimes be difficult to translate from English into French, in particular to distinguish healthcare system related indicators from prevention related indicators[1]. Some authors have suggested the use of gradation ("*partly amenable*"), or the application of weightings for each selected cause depending on the type of determinant (primary (%), secondary (%) and tertiary (%) prevention) (50).

David D. Rutstein, followed by other authors, also proposed defining indicators specific to sectors of the healthcare system; for example for occupational diseases (32,36,47), other potential areas of application being in-hospital mortality or mortality due to infectious diseases (if effective vaccines or treatments exist).

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[1] "preventable vs. treatable conditions, primary prevention vs. secondary prevention indicators, amenable to (avoidable through) primary prevention by reducing incidence, amenable to early detection and treatment, amenable to improved treatment and medical care, premature deaths that should not occur in the presence of timely and effective health care, conditions for which clinical interventions exist…"

2. Use of "premature" and "avoidable" mortality indicators in the monitoring of public health policies in France

2.1 Definition of the indicators and selection of the causes in the State of Health in France reports

Since the early 2000's, the concepts of premature and avoidable mortality were subject to a number of presentations and analyses in France but, in contrast to aforementioned works, mainly covering avoidable mortality linked to primary prevention (11,22,23,26,27,42). During this period, atlases or geographical analyses of mortality were also published, both at French and European levels, which integrated, in parallel to the traditional classification of the major causes of death, some premature mortality indicators (28,48). Interest in Rutstein's original concept of sentinel events also led to the implementation in France of confidential investigation methods performed with clinicians, with the aim of assessing the degree of avoidability of deaths (in particular, maternal mortality (4) and anaesthesia-related mortality (6)).

Simultaneously, the notions of "premature" and "avoidable" mortality indicators were used in the successive *Health in France* reports ("La santé en France") produced by the HCSP from the mid-1990's (12-15). These indicators were then used as cross-sectional indicators in the *The State of Health of France's Population* reports ("L'état de santé de la population en France"), co-ordinated annually by the DREES between 2006 and 2011 as part of the monitoring of objectives relative to the public health laws (8).

The 1994 *Health in France* report by the HCSP used the premature mortality indicator defined as all deaths occurring before 65 years. The applied age limit was not given any specific justification but corresponded to the retirement age threshold. The report also defined the concept of avoidable mortality for the first time in an official document. It was presented based on a three-way breakdown of premature mortality: avoidable mortality related to individual risks, avoidable mortality linked to the healthcare system and other causes of premature mortality (representing 35%, 18% and 47% of premature mortality, respectively, at that time). Table 2 presents the evolution of avoidable mortality concepts throughout the different reports. It is particularly interesting to note the evolution in designation of the indicator related to high-risk behaviour: "avoidable mortality linked to individual risks", became "avoidable mortality linked to lifestyle", then "avoidable mortality linked to high-risk behaviours" and in the latest reports "avoidable mortality linked to primary prevention practises". The first designations were criticised because of the attached stigmas. The designation of the indicator related to the healthcare system has not evolved much, but it is of note that this indicator is no longer used in the latest reports (further to a decision to await a consensus on its definition). Table 3 presents the selection of causes of death included in these two indicators. The selection relating to high-risk behaviours was created in the context of the first report and has not evolved much since (except for the addition of accidental falls). This is an "expert opinion" list initiated by the report's authors, without

any further justification of the choices made. The "healthcare system" selection is on the other hand based on the selection used in atlases previously published by Holland.

Table 2 – Indicators of "avoidable" mortality used in the successive reports on the State of Health in France.

	High-risk behaviours (under 65 years)	Healthcare system (under 65 years)
"Health in France" HCSP 1994 (12)	""Avoidable" mortality linked to individual risks" Causes of death mainly linked to an individual high-risk behaviour.	""Avoidable" mortality linked to the healthcare system" Causes of death in which the healthcare system or screening play an important role, but where individual behaviour still has an influence.
"Health in France" HCSP 1996 (13) "Health in France" HCSP 1994-1998 (14)	""Avoidable" mortality linked to lifestyle" Causes of death where the frequency could be reduced primarily by acting on individual behaviours (tobacco, alcohol, dangerous driving etc.)	""Avoidable" mortality linked to the healthcare system and screening" Causes of death where the frequency could be reduced through better management by the health care system (including through screening activities), possibly reinforced by an action on individual behaviours.
"Health in France" HCSP 2002 (15)	Same as above	Same as above
"The state of health of the population in France" DREES 2006-2011 (8)	""Avoidable" mortality linked to primary prevention practises" Causes of death which could be avoided by reducing high-risk behaviours such as tobacco smoking, alcoholism or dangerous driving.	The indicator is mentioned but not used (problems with definition)

Table 3 – Selection of the causes of death included in the indicators of "avoidable" mortality in the successive reports on the State of Health in France.

	High-risk behaviours (under 65 years)	Healtcare system (under 65 years)
Report "Health in France" HCSP 1994 (12)	cancers of the lung - larynx cancers of the UADT (including oesophagus) alcohol psychosis and alcoholism road accidents suicide, AIDS	*Based on Holland's list (1988 and 1991)* ischaemic heart disease cerebrovascular and hypertensive disease perinatal mortality, maternal death breast cancer, uterine cancer, Hodgkin's disease testicular cancer, skin cancer, leukaemia, digestive ulcers, appendicitis, abdominal hernia tuberculosis, asthma, influenza infections (typhoid fever, pertussis (whooping cough), tetanus, measles)
"Health in France" HCSP 1996 (13) "Health in France" HCSP 1994-1998 (38)	Same as above	Same as above
Report "Health in France" HCSP 2002 (14)	Same as above + accidental falls	Same as above
"The state of health of the population in France" DREES 2006-2011 (15)	Same as above + accidental falls	Indicator is not used

2.2 Emphasis on avoidable mortality indicators linked to high-risk behaviours.

The importance of taking into account "premature" and "avoidable" mortality indicators when monitoring public health policies was first highlighted, in a very convincing way, in a comparison between France's situation and that of other comparably developed countries. Analysis during the 1980's and 90's of mortality levels according to age in various countries of Western Europe clearly highlighted a paradoxal situation in France (27). The rates of premature deaths (defined as all deaths occurring before 65 years) were generally far higher than in the other countries (this being especially true for men but also, to a lesser degree, women). In contrast, mortality levels were extremely favourable for older people in France (death rate after 65 years); this was also conveyed in terms of life expectancy (life expectancy after 65 years was higher than in the other countries for both men and women).

The data in Tables 4 and 5 (comparison of the situation in 16 European countries) illustrate the fact that this situation continues into recent times (year 2010). For men (Table 4), the level of "premature" mortality remains high in France compared to other Western European countries. France is surpassed only by Finland and Portugal. The death rates are 20% higher in France than in the United Kingdom, and 55% higher than in Sweden. For women (Table 5), the level of premature mortality is average compared to the other countries, whereas a highly favourable situation is observed for the overall female mortality level (highest life expectancy together with Spain). These data are in strong contrast with the situation in France for deaths after 65 years. For men, France has much lower death rates (together with Switzerland and Greece). For women, the lowest rates are observed in France. This highly favourable situation also translates into a better life expectancy after 65 years in France compared to the other countries.

Tables 4 and 5 present a ranking of countries according to the avoidable mortality indicator linked to primary prevention practises as defined in the *Health in France* reports ("L'état de santé en France") (see Table 3). These data highlight an even more unfavourable situation for France than with "premature" mortality: France has the highest male death rates (ahead of Finland and Portugal) and comes in third for female death rates (behind Denmark and Portugal). The differences between countries are significant. To illustrate, the rates of "avoidable" deaths for men are 60% higher in France than in the United Kingdom, and almost two times higher than in Sweden. It is also noted that the gap between France and the other countries has tended to increase during the years 2000.

Another specific point is that, if the various components of "avoidable" mortality linked to primary prevention are considered separately, France appears in an unfavourable position whatever the cause of death, whereas for many other countries, the situation varies depending on the cause of death considered. Table 6 illustrates this situation for men. France ranks first for lung cancer, second for upper aerodigestive tract cancer (behind Portugal) and suicide (behind Finland), fourth for transport accidents and seventh for chronic liver diseases.

The French situation presents some other significant characteristics. The ratio of avoidable mortality to overall premature mortality is higher in France: for men, it is 35% compared to 24% in Sweden and 26% in the United Kingdom; for women, France also ranks first together with Denmark (23% and 24%), whereas the lowest percentages (15%) are observed in Greece, Portugal and Italy. Comparing avoidable and premature mortality indicators also highlights a high excess mortality for men in France, as well as significant geographical disparities.

It is on the basis of such comparative data portraying this specifically French situation that the analysis and monitoring of premature and avoidable mortality indicators were considered a priority in the successive Health in France reports.

Table 4 - Standardised mortality rates (per 100,000) - Year 2010
Premature mortality, mortality avoidable by primary prevention and mortality after 65 years.
Males

"Premature" mortality (< 65 years)		Mortality "avoidable by primary prevention" (< 65 years)		Mortality at 65 years and over	
Finland	272.9	**France**	**92.2**	Denmark*	5,047.2
Portugal	268.2	Finland	87.0	Portugal	4,949.4
France	261.3	Portugal	85.1	Finland	4,653.6
Denmark*	243.8	Austria	82.1	Luxembourg	4,651.2
Austria	237.3	Denmark*	78.2	Netherlands	4,538.3
Germany	232.9	Germany	72.1	Germany	4,450.7
Greece	228.6	Spain	67.7	Austria	4,442.5
United Kingdom	213.6	Greece	63.9	Ireland	4,400.1
Spain	211.1	Luxembourg	62.3	Norway	4,390.2
Ireland	197.8	Ireland	56.2	Sweden	4,259.0
Luxembourg	187.6	United Kingdom	55.8	Italy*	4,252.5
Italy*	184.7	Italy*	54.2	United Kingdom	4,229.0
Norway	183.8	Switzerland	53.9	Spain	4,129.1
Netherlands	179.2	Netherlands	51.4	**France**	**3,971.5**
Sweden	169.2	Norway	49.0	Switzerland	3,924.3
Switzerland	167.0	Sweden	40.1	Greece	3,253.5

Source: Eurostat (9)
* Year 2009

Table 5 - Standardised mortality rates (per 100,000) - Year 2010
Premature mortality, mortality avoidable by primary prevention and mortality after 65 years.
<u>Females</u>

"Premature" mortality (< 65 years)		Mortality "avoidable by primary prevention" (< 65 years)		Mortality at 65 years and over	
Denmark*	151.6	Denmark*	36.8	Greece	4,328.9
United Kingdom	135.7	Netherlands	28.0	Denmark*	3,688.0
Netherlands	128.1	**France**	**27.3**	Portugal	3,249.2
Germany	123.4	Germany	27.2	United Kingdom	3,158.3
Finland	120.4	United Kingdom	26.7	Germany	3,121.7
Ireland	120.0	Austria	26.5	Ireland	3,118.0
France	**119.8**	Finland	26.5	Netherlands	3,094.2
Luxembourg	119.7	Norway	25.2	Norway	3,044.2
Austria	117.6	Ireland	24.1	Sweden	3,039.0
Norway	116.8	Luxembourg	23.5	Austria	2,947.1
Portugal	114.8	Switzerland	23.0	Finland	2,928.5
Sweden	105.6	Sweden	19.6	Luxembourg	2,813.4
Greece	105.4	Portugal	17.2	Italy*	2,744.6
Switzerland	101.9	Italy*	16.0	Switzerland	2,623.8
Italy*	100.4	Spain	15.8	Spain	2,530.9
Spain	93.4	Greece	14.5	**France**	**2,380.2**

Source: Eurostat (9)
* Year 2009

Table 6 - Standardised mortality rates (per 100,000) - Year 2010
Components of avoidable mortality by primary prevention.
Under 65 years - <u>males</u>

Lung cancer		UADT cancer		Chronic liver diseases		Suicide		Transport accidents	
France	**31.0**	Portugal	12.4	Finland	24.1	Finland	25.1	Greece	18.9
Spain	30.1	**France**	**10.6**	Austria	16.5	**France**	**20.3**	Portugal	11.6
Greece	29.0	Germany	8.6	Denmark*	14.6	Ireland	18.7	Italy*	11.4
Portugal	25.5	Austria	7.8	Germany	13.1	Austria	17.3	**France**	**9.6**
Austria	22.2	UK	7.7	Portugal	13.0	Sweden	15.2	Austria	9.0
Germany	21.2	Netherlands	7.4	UK	12.7	Luxembourg	14.7	Finland	8.4
Luxemb	21.1	Spain	7.3	**France**	**11.0**	Switzerland	14.2	Denmark*	7.7
Netherlands	20.3	Denmark*	7.1	Luxemb	10.6	Norway	14.1	Spain	7.6
Italy*	20.1	Switzerland	6.5	Spain	8.9	Denmark*	13.7	Norway	7.1
Denmark*	18.4	Ireland	5.7	Ireland	6.8	Germany	13.3	Ireland	6.3
Switzerland	15.8	Luxemb	5.2	Italy*	6.6	Netherlands	12.2	Luxembourg	6.3
Ireland	15.5	Finland	4.3	Switzerland	5.9	United Kingdom	10.2	Germany	6.3
UK	15.4	Italy*	4.3	Greece	5.4	Portugal	9.9	Switzerland	5.8
Finland	14.7	Norway	3.3	Sweden	4.7	Spain	7.8	United Kingdom	5.1
Norway	14.2	Sweden	2.9	Netherlands	3.7	Italy*	7.4	Netherlands	4.9
Sweden	8.8	Greece	2.3	Norway	3.4	Greece	4.8	Sweden	4.2

Source: Eurostat (9)
* Year 2009

2.3 Ranking of countries according to the performance of their healthcare system

Previous analyses only covered avoidable mortality related to primary prevention. This avoidable mortality indicator is the one that has been chiefly used in France up until now, in particular for comparison against other countries. At the international level though, and in particular in the English-speaking countries, it is the indicators of avoidable mortality related to the healthcare system that are more widely used.

In the early 2000s, the WHO produced a report ranking 191 countries according to the performances of their healthcare system (54). The criteria used were broad and varied and aimed to gain an understanding of three areas of performance: improvement of health in the population, responsiveness of the system compared to people's expectations and fairness of the healthcare system funding. The state of health was measured for each country using Disability Adjusted Life Expectancy (DALE). DALE gives a more global indication of the state of health than life expectancy, and introduces the concept of quality of life by integrating data on the limitation of activity within a population (55). According to the WHO's ranking, France comes in first. But the methodology used and the reliability of the resulting classification were strongly criticised, including by public health officials in France (2). The main criticisms concerned the very feasibility of a single ranking made up from a large number of indicators, the method of calculating the indicators and the lack of data for guaranteeing the robustness of the results (weightings based on expert opinions in the absence of data). This approach was later dropped by the WHO.

In the early 2000s, Nolte and McKee also took an interest in ranking countries according to the impact of their healthcare system (37). They reclaimed the concept of avoidable mortality by updating a group of causes of death similar to the one used previously by Holland. The main changes, based on an analysis of the literature (38), concerned the selection and the treatment of certain causes and the choice of age ranges (usually under 75 years). In particular, due to the existing uncertainty relating to the contribution of the healthcare system towards the reduction in premature mortality from ischaemic heart disease, Nolte and McKee suggest the use of two distinct ranking systems: (i) without accounting for ischaemic heart disease, (ii) accounting for 50% of them. They compared countries according to the two types of ranking and according to the DALEs used in the WHO reports (Table 7). According to the avoidable mortality indicator that excludes ischaemic heart disease, France comes out with a very favourable ranking (lowest death rate together with Sweden and Norway). Taking into account 50% of ischaemic heart diseases reinforces France's position further (top place). In contrast, Portugal, the United Kingdom and Ireland have the poorest rankings. Based on DALE, France also tops the ranking ahead of Sweden and Spain. France's ranking therefore does not change much with the various indicators chosen. This is not the case for other countries whose ranking can vary greatly depending on the indicator used. For example, the United Kingdom's ranking is better with DALE than with avoidable mortality, whereas, in contrast, Denmark, Germany and Norway's rankings drop when using DALE.

Table 7 – Comparison of three indicators: avoidable mortality related to the healthcare system excluding ischaemic heart disease, including 50% of ischaemic heart disease and Disability Adjusted Life Expectancy (DALE)

Avoidable mortality related to the healthcare system (a)					Disability-adjusted Life Expectancy	
excluding ischaemic heart disease			including 50% of ischaemic heart disease			
Portugal	113.0		UK	133.6	Portugal	14
UK	91.1		Portugal	132.1	Denmark*	13
Ireland	81.9		Ireland	129.3	Ireland	12
Austria	72.8		Finland	109.6	Germany	11
Greece	72.3		Austria	106.9	Finland	10
Netherlands	71.2		Greece	98.5	Austria	9
Denmark	69.4		Netherlands	97.3	Norway	8
Italy	68.9		Denmark	97.2	UK	7
Finland	66.5		Germany	95.9	Netherlands	6
Spain	66.1		Italy	88.1	Greece	5
Germany	64.2		Norway	87.5	Italy	4
France	**62.7**		Spain	84.1	Spain	3
Norway	56.9		Sweden	79.6	Sweden	2
Sweden	50.6		**France**	**75.1**	**France**	**1**

(a) standardised mortality rates
Source: Nolte and McKee (37) and WHO (54)

3. Recent developments and international studies on avoidable mortality indicators

Despite the various studies mentioned above, the concept of avoidable mortality as an indicator of the performance of the healthcare system did not draw much attention from the health authorities during the 1990's and the 2000's (37). The situation is changing however, and many countries are experiencing an increasing demand for the development of methods to assess the quality and effectiveness of healthcare systems. In this context, a number of institutions and researchers are taking a renewed interest in the development of avoidable mortality indicators. These include, in particular, the studies recently initiated by the Office of National Statistics (ONS) in England and by the OECD.

3.1 Development of avoidable mortality indicators to be published yearly by the ONS in England

The approach taken by the ONS and initiated in 2011 is particularly interesting both in terms of its objective and in terms of methodology (40). The ONS wanted an indicator of avoidable mortality related to the healthcare system, which could be routinely published once a year. This indicator had to be simple, reliable and reproducible, and had to allow a variety of analyses (sociodemographical, geographical, temporal, etc.). To this end, the ONS initiated various research projects and, in particular, a very precise literature review (definition of concepts and selection of causes). It also broadly consulted public healthcare professionals in England in order to reach a consensus on the definition of avoidable mortality. The literature review focused primarily on the selection of causes of death suggested in the United Kingdom by Nolte and McKee (39, 53) and in New Zealand and Australia by Page and Tobias (41, 51). Nolte and McKee devised a selection directed solely at avoidable mortality related to the healthcare system, whereas Page and Tobias have suggested two separate lists (healthcare system and prevention). After analysis of these different suggestions, and in spite of the difficulty in finding a consensus on the concept of "avoidable" mortality, the ONS reached a final decision on two definitions:

- mortality avoidable through the healthcare system ("*amenable mortality*"): a death is avoidable through the healthcare system if, in the light of medical and technical knowledge on the date of this death, all or most of deaths from the cause considered (subject to age limits if appropriate) could be avoided through a good quality healthcare system,

- avoidable mortality from high-risk behaviours ("*preventable mortality*"): a death from high-risk behaviours is preventable if, in light of the understanding of the determinants of health on the date of this death, all or most of deaths from the cause considered (subject to age limits if appropriate) could be prevented by public health interventions (actions), in a very broad context.

The ONS also defines a third "avoidable mortality" indicator, which simultaneously takes into account one or the other of the above definitions (each death only being counted once).

Based on these definitions, a selection of causes of death relating to the two concepts of avoidable mortality was decided upon by the ONS (Table 8). This selection is based on the various lists proposed and devised by the abovementioned authors and on the result of the consultation with professionals. The reference to the date of death is made to enable the selection of causes to evolve over time. The selection also takes into account recent developments both in the healthcare system and in public health actions and the conclusions of the European AMIEHS project, the main results of which are presented below. Some criteria were systematically applied during the selection: sufficient number of deaths from the cause considered (more than 100 per year) and absence of significant problems in classifying the deaths (as per the rules of the International Classification of Diseases). A list of arguments was established to justify the choices (scientifically established relationship with healthcare system operation, age limits, etc.). The ONS points out that these lists were established in the specific context of the United Kingdom's healthcare system at a given date, and that they must be updated every three years. A same cause of death can appear simultaneously in the "healthcare system" and "high-risk behaviours" lists, an innovation compared to previous selections. This is the case for tuberculosis; AIDS; hepatitis C; colorectal, skin, breast and cervical cancers, diabetes, ischaemic heart disease, influenza and adverse events to treatments. Compared to the first lists proposed by Holland in the 1980's, the selections of causes of death were much broader, regardless of the type of indicator. The "healthcare system" list has grown to include AIDS, hepatitis C, colorectal, bladder and thyroid cancers, diabetes, epilepsy, influenza, pneumonia and adverse events from treatments. The "high-risk behaviours" list has also grown significantly (from the three causes that were lung cancer, liver cirrhosis and transport accidents) to include colorectal, breast, skin and cervical cancers, diabetes, ischaemic heart disease, influenza, COPD and adverse events from treatments. Selected age ranges have also been modified, with a cut-off rising from 65 to 75 years (except for diabetes, leukaemia, AIDS and accidents).

Table 9 shows the number and weight of the causes of death corresponding to the ONS selection applied to the French data in 2010 (both sexes combined). For the selection "Avoidable deaths related to healthcare use", the most frequent causes were ischaemic heart disease (21%), colorectal cancer (15%), breast cancer (14%) and cerebrovascular diseases (14%). These 5 causes represent 64% of the whole selection. For the selection "Avoidable deaths linked to high-risk behaviours", the most frequent causes were accidents (24%), lung cancer (18%), suicide (18%), ischaemic heart disease (9%), alcohol-related causes (8%), colorectal cancer (6%) and breast cancer (6%). These causes represent 83% of the whole selection.

It is also interesting to note the impact that an alternative choice of age cut-off can have on the overall number of deaths and on the weight of the various causes selected. Thus, the limitation of all age groups to 64 years decreases the number of deaths corresponding to Table 9 (France 2010) from 45,294 (deaths occurring before 74 years) to 25,989 (deaths occurring before 64 years) for healthcare use and, from 106,371 to 58,601 for prevention. This change has little impact on the weight of the various causes relating to "healthcare" but a great impact on the "prevention" indicator: the weight of

accidents decreases (24% to 15%), whereas the weight of suicide (10 to 14%) and alcohol (8 to 12%) increases significantly.

Table 8 – Selection of avoidable causes of deaths (ONS 2011)

Causes of death	CIM10 – codes	Age	"Healthcare system"	"Prevention"
Infections - tuberculosis - "infections" selection - hepatitis C - AIDS-HIV	A15-A19,B90 A38-A41,A46,A48.1,B50-54,G00,G03 J02,L03 B17.1,B18.2 B20-B24	0-74 0-74 0-74 Total	* * * *	* * *
Cancers - UADT - stomach - colorectal - liver - lung - skin - mesothelioma - breast - cervix - bladder - thyroid - Hodgkin's disease - leukaemia - benign tumours	C00,C14,C15 C16 C18-C21 C22 C33-C34 C43 C45 C50 C53 C67 C73 C81 C91,C92.0 D10-D36	0-74 0-74 0-74 0-74 0-74 0-74 0-74 0-74 0-74 0-74 0-74 0-74 0-44 0-74	 * * * * * * * * *	* * * * * * * * *
Endocrinal disease - diabetes -	E10-E14	0-49	*	*
Drug-related disorders - alcohol (except violent deaths) - drugs	F10,G31.2,G62.1,I42.6,K29.2,K70,K73, K74 (except K74.3-K74.5),K86.0 F11-F16,F18-F19	0-74 0-74		* *
Neurological disorder - epilepsy	G40-G41	0-74	*	
Cardiovascular diseases - rheumatic heart disease - hypertensive disease - ischaemic heart disease - deep vein thrombosis - cerebrovascular disease - aortic aneurysm - dissection	I01-I09 I10-I15 I20-I25 I26,I80.1-180.3,180.9,182.9 I60-I69 I71	0-74 0-74 0-74 0-74 0-74 0-74	* * * * *	 * * *
Respiratory disease - influenza - pneumonia - chronic obstructive pulmonary disease (COPD) - asthma	J09-J11 J12-J18 J40-J44 J45-J46	0-74 0-74 0-74 0-74	* * *	* *
Digestive diseases - ulcers - appendicitis, lithiases, hernias cholecystitis, pancreatitis	K25-K28 K35-K38,K40-K46,K80-K83,K85, K86.1-K86.9,K91.5	0-74 0-74	* *	
Urogenital diseases - nephritis - urinary calculus – prostatic hyperplasia	N00-N07,N17-N19,N25-N27 N13,N20-N21,N35,N40,N99.1	0-74 0-74	* *	
Infant and maternal mortality - perinatal mortality - Congenital malformations	P00-P96,A33 Q00-Q99	Total 0-74	* *	
Unintentional accidents - transport accidents - accidents	V01-V99 W00-X59	Total Total		* *
Intentional accidents - suicides and undetermined intentions - homicides - complications from medical acts	X60-X84,Y10-Y34 X85-Y09,U50.9 Y60-Y69,Y83-Y84	Total Total Total	 *	* * *

Source: ONS (40)

Table 9 – Number of deaths – France – both sexes – 2010
According to the selections of causes of avoidable deaths (ONS 2011)

ONS avoidable cause	age	"Healthcare syst."		"Prevention"	
		number	%	number	%
Tuberculosis	0-74	139	0.3%	139	0.1%
Sel "infections"	0-74	1453	3.2%		0.0%
Hepatitis C	0-74	293	0.6%	293	0.3%
AIDS	Total	500	1.1%	500	0.5%
UADT cancer	0-74		0.0%	3072	2.9%
Stomach cancer	0-74		0.0%	2237	2.1%
Colorectal cancer	0-74	6725	14.8%	6725	6.3%
Liver cancer	0-74		0.0%	4303	4.0%
Lung – trachea cancer	0-74		0.0%	19,619	18.4%
Skin cancer (melanoma)	0-74	1069	2.4%	1069	1.0%
Mesothelioma cancer	0-74		0.0%	460	0.4%
Breast cancer	0-74	6498	14.3%	6498	6.1%
Cervical cancer	0-74	563	1.2%	563	0.5%
Bladder cancer	0-74	1820	4.0%		0.0%
Thyroid cancer	0-74	180	0.4%		0.0%
Hodgkin's cancer	0-74	167	0.4%		0.0%
Leukaemia	0-44	178	0.4%		0.0%
Benign tumours	0-74	212	0.5%		0.0%
Diabetes	0-49	233	0.5%	233	0.2%
Alcohol	0-74		0.0%	8859	8.3%
Drugs	0-74		0.0%	216	0.2%
Epilepsy	0-74	896	2.0%		0.0%
Rheumatic heart disease	0-74	387	0.9%		0.0%
Hypertensive disease	0-74	1275	2.8%		0.0%
Ischaemic heart disease	0-74	9511	21.0%	9511	8.9%
Deep vein thrombosis	0-74		0.0%	1415	1.3%
Cerebrovascular disease	0-74	6171	13.6%		0.0%
Aortic aneurysm - dissection	0-74		0.0%	920	0.9%
Flu	0-74	76	0.2%	76	0.1%
Pneumonia	0-74	1489	3.3%		0.0%
COPD	0-74		0.0%	1871	1.8%
Asthma	0-74	346	0.8%		0.0%
Ulcers	0-74	245	0.5%		0.0%
Append, lithiases, hern, chole......	0-74	446	1.0%		0.0%
Nephritis	0-74	1042	2.3%		0.0%
Urinary calculus - prostatic hyperplasia	0-74	32	0.1%		0.0%
Perinatal	Total	1457	3.2%		0.0%
Congenital defects	0-74	1420	3.1%		0.0%
Transport acc	Total		0.0%	4194	3.9%
Other accidents	Total		0.0%	21,640	20.3%
Suicides and undetermined intentions	Total		0.0%	10,997	10.3%
Homicides	Total		0.0%	490	0.5%
Complications of medical acts	Total	471	1.0%	471	0.4%
Total Avoidable		45,294	100.0%	106,371	100.0%

Source: ONS (40) – Inserm CépiDc

3.2 The European AMIEHS project: analysis of the validity of avoidable mortality indicators related to the healthcare system

The European AMIEHS project "*Avoidable mortality in the European Union - towards better Indicators for the effectiveness of health systems*" (1,31,43) took place between 2008 and 2011. The project was co-ordinated by JP Mackenbach in the Netherlands and involved 7 countries (Germany, England, Spain, Estonia, France, the Netherlands, Sweden). The aim was to analyse the validity of avoidable mortality indicators as a measure of the effectiveness of the healthcare systems. The method involved studying, over the 1970-2005 period and for each of the countries, the concordance between the expected date that the introduction of specific therapeutic innovations would have an effect on mortality and the observed date of decreased mortality for the corresponding causes. Fourteen groups of causes were selected using the criteria of an observed decrease in mortality in the United Kingdom over the study period and scientific evidence of the effect of the healthcare system on the occurrence of these causes. A Delphi method was also used to gather the general opinion of a group of experts on the relationships between "healthcare system" and "evolution of mortality". Consideration of the healthcare system was restricted to treatments and secondary prevention (screening), and no age groups were specifically taken into account. The causes meeting the criteria were HIV-AIDS, colorectal cancer, uterine cancer, testicular cancer, Hodgkin's disease, rheumatic heart disease, hypertension, ischaemic heart disease, heart failure, cerebrovascular diseases, gastric ulcers, kidney failure, congenital heart disease and perinatal complications.

For most causes, and for whichever country considered, results show poor concordance between the observed date of reduced mortality and the expected date in relation to the introduction of specific innovations or interventions. The only significant exceptions concern HIV-AIDS (antiretroviral drugs) and cerebrovascular diseases (treatment of hypertension, disease management etc.). Relationships are also observed, though less significant, for colorectal cancer, leukaemia, hypertension and rheumatic and ischaemic heart disease.

The study authors concluded that healthcare system advances have certainly contributed in part to the reduction in mortality, but in a far more diffuse and gradual manner than expected. The results demonstrate in particular that the average time lag between the introduction of a therapeutic innovation and a significant reduction in mortality is 7 years. This time lag means it is difficult for statistics based on avoidable mortality to provide an immediate measure of the impact of a medical innovation. Furthermore, the results demonstrate that the mortality levels before and after the effect of the introduction of therapeutic innovations rank identically from country to country, which suggests that other variation factors, unrelated to these innovations, strongly influence the mortality level (for example, the overall socio-economical or sanitary context of each country). The general conclusion is that the analysis was unable to validate, with a sufficient level of proof, the hypothesis of significant relationships between avoidable mortality indicators and progress in the healthcare system. These indicators must therefore be used with caution when used as indicators of the effectiveness of the healthcare system, in particular in the context of international comparisons. The differences in

mortality between countries are more a result of variations in the incidence of diseases and their risk factors rather than in the performance of the healthcare systems. Indicators of avoidable mortality may prove useful in the identification of possible areas for improvement in the healthcare system, but great care should be taken if they are to be used to monitor the efficacy of healthcare systems or policy over time.

One of the main limitations of the AMIEHS project concerns the difficulty in collecting, with sufficient reliability and precision, historical data by country covering the period when innovations were introduced (medicinal products, screening, access to healthcare, etc.). Furthermore, the context of the study is strongly "Anglo-Saxon" (selection of causes based on reduced mortality, literature references on the scientific evidence of the impact of therapeutic innovations, etc.). Another significant difficulty that limits the interpretation of results is that the analyses could not be adjusted for disease incidence and risk factors. It should also be noted that the AMIEHS approach is potentially very "historical" and does not enable the assessment of recent differentials in the quality of healthcare systems. Indeed, if there is sufficient hindsight to prove that the introduction of an innovation has noticeably reduced mortality in several countries, then this innovation is more than likely already widely used in industrialised countries. As a result, mortality levels for the corresponding causes of death will probably only have low discriminating power in terms of performance of healthcare systems. An approach that is more strongly based on the latest knowledge and innovations should have greater discriminating power in differentiating the quality of health care systems.

3.3 Current interest of the OECD in a classification of countries according to avoidable mortality indicators related to the healthcare system

The OECD insists on the importance of evaluating the performance of healthcare systems, and in a recent report attempted to rank countries according to avoidable mortality indicators (10). The difficulties in this type of exercise are mentioned first; in particular the fact that the state of health depends on others factors besides medical interventions (socioeconomic factors, health practises, environmental factors, etc.). All of these factors interrelate with those linked to the healthcare system. The specific weight attributable to the healthcare system is therefore difficult to ascertain. The OECD's study is based on two lists of causes of death similar to those used by the ONS (Nolte-McKee (39) and Tobias-Yeh (51)). The main differences between the two lists concern:

- whether or not to include certain causes of death (bladder, thyroid and skin cancers, benign tumours, certain infections, adverse events from treatments, etc.),

- the choice of age limits (for infectious diseases, uterine cancer, diabetes, respiratory diseases, asthma, COPD, etc.),

- and for some causes, whether to only consider a proportion of deaths as avoidable; both lists only include 50% of ischaemic heart disease, but the Nolte-McKee selection considers all cerebrovascular diseases (vs. 50% for Tobias-Yeh), all deaths by diabetes occurring before 50 years (vs. 50% of diabetes cases of all ages for Tobias-Yeh).

The OECD analyses the impact of these selections on the generated ranking of countries. The hierarchy of European countries does not vary much between the two lists. France comes out with the lowest death rates, together with Italy, Sweden and the Netherlands. Eastern European countries (in particular, Estonia, Hungary and Poland) are found at the opposite end. The order of the countries does not vary much with the type of avoidable death cause. Thus, for the communicable disease group, the lowest death rates were found in Sweden, Finland and Italy, and the highest in Estonia and Poland. For non-communicable diseases, France, the Netherlands, Italy and Spain top the ranking, and Eastern European countries are once again at the bottom of the ranking. The report also highlights the main characteristics of avoidable mortality (present regardless of the selection made): significant country-to-country variations, excess male mortality, decline over time (1997-2007) but at varying paces depending on the country (stronger decline in Ireland and the United Kingdom, and slower decline in Spain, Greece, Luxembourg, with France being in the slower decline group). Results also show the specificity of avoidable mortality indicators compared to more general indicators (that do not take into account the causes of deaths), such as life expectancy and potential years of life lost.

The OECD's general conclusion is that, in addition to their attractive conceptual nature, avoidable mortality indicators add specific information compared to general indicators when it comes to measuring the performance of healthcare systems. These data are easy to mobilise and allow comparisons between countries. The main limitations mentioned are that data are not taken into account concerning the incidence of diseases, the healthcare system resources effectively available and the evolution of the quality of life.

3.4 Current Eurostat studies for the creation of "satellite lists" of causes of death

Eurostat is expected to publish in 2013 the results of the "satellite lists" Task Force, which was set up at the end of 2012. The objective of this task force is to decide upon a number of lists of causes of death relating to important public health issues for which monitoring indicators are necessary at the European level. These lists feature groupings corresponding to the two concepts of avoidable mortality (related to the healthcare system and related to prevention). The method of work consists of considering the specific demands of various European organisations (DG Sanco, OECD, WHO, etc.) relative to each indicator and the pre-existing lists. The objective is to seek a consensus on the value or not of the grouping, on its feasibility given available data and on the selection of causes to integrate into each list.

4. Recommendations

1. Despite a number of limitations relating to their definition and their interpretation, the indicators of premature and avoidable mortality are important indicators, useful to consider in the context of monitoring public health laws.

These indicators have indeed proven to be:

- specific compared to other more general indicators such as life expectancy or potential years of life lost,

- easy to calculate and mobilise compared to other more complex indicators such as disability-free life expectancy.

2. The definition and selection of causes of avoidable deaths should be subject to a consensus by countries of the European Community

It will be important to refer to the avoidable mortality indicators defined in the Eurostat "satellite list" Task Force, the results of which will become available during the course of 2013. The yearly publication of these indicators by Eurostat would make data available for comparing France to other countries and to follow changes. It should be noted, however, that opinions diverge with regard to this potential of avoidable mortality indicators for country-to-country comparisons, and with regard to the potential for interpretation of differences in terms of performance variations of healthcare systems. Critics of the feasibility of a common indicator argue that healthcare system characteristics as well as their levels of accessibility vary from country to country, which necessarily interferes with the selections considered.

3. Two complementary avoidable mortality indicators should be taken into account:

- "avoidable mortality related to prevention": all causes of death which, in light of determinants of health on the date of death, could, for the most part, have been avoided through preventative actions in a very broad sense (subject to age limits if appropriate).

- "avoidable mortality related to the healthcare system": all causes of death which, in light of the medical and technical knowledge on the date of death, could, for the most part, have been avoided due to the good quality of the healthcare system (subject to age limits if appropriate).

These definitions are directly based on those of the UK's ONS (40).

The terms remain necessarily very poorly specific (e.g. good quality of the healthcare system).

The method of selection only takes one cause of death into account (the underlying cause of death).

4. The selection the causes of death to be included in each of the two indicators should be based on recent studies by the UK'sONS. The selections of causes of death should be finalised as part of a Task Force of experts and users (Delphi method), and taking into account the results of the Eurostat "satellite lists" Task Force.

The ONS selection ((40) and Tables 8 and 9) originated from a very comprehensive approach: literature review, comparative analyses of existing selections of causes, consultations with experts.

Some causes can be simultaneously included in both indicators.

Whether the impact of screening actions has a place is open to debate (to be included in which of the two indicators?)

An important decision will have to be made concerning whether all or only a portion of deaths should be taken into account for certain causes (e.g. all or 50% of ischaemic heart disease, cerebrovascular diseases or diabetes).

Another important decision will be whether or not to include all violent deaths without applying an age limit when, for other causes, the 0-74 year limit is usually applied.

There is currently no consensus on which selections to adopt. However, the approach should be pragmatic. The limitations of the design of this type of indicator are known (all deaths in a category are considered avoidable, no information on the clinical history of the disease, or on co-morbidities, etc.) The "avoidable" mortality indicator therefore remains necessarily very "general". On the one hand, it underestimates the number of deaths in so far as some causes of death are excluded even though they may be dependant on healthcare system operation or on the impact of certain risk factors. On the other hand, it overestimates them in so far as all deaths corresponding to a pathology are included. In this context, the aim is to reach a consensus on "acceptable" selections. It is not the absolute level of the death rate corresponding to the selections made that is of primary importance, but rather the possibility to monitor changes over time with these indicators, to analyse the demographic and socio-spatial disparities within a population and to compare France to other countries.

The analyses demonstrate a relative robustness of the ranking by country with respect to the choice of selection.

<u>5</u>. The age limit of premature mortality and "avoidable" mortality indicators should be 75 years (with some exceptions for some causes of avoidable mortality).

Depending on the authors or institutions, the age limit can be either 65 years (Eurostat) or 75 years.

The limit of 75 years, which is used more and more, better matches the progress in life expectancy.

The ONS' avoidable mortality indicators generally use 75 years albeit with some exceptions (all ages for AIDS and violent deaths, 0-44 years for leukaemia and 0-49 years for diabetes).

Choosing variable limits according to population groups (e.g. life expectancy of men and women) would complicate calculations and interpretations.

Another value of using age limits is that it directs analyses towards better quality data (the concept of initial cause of death is more complex to grasp in older people).

This limitation does not mean that deaths in older population should be considered as unavoidable, or treatments as ineffective.

<u>6</u>. The selection of causes of deaths and age limits should evolve over time (they are dependant on the evolution of technological progress, treatments, prevention policies, availability and effectiveness of interventions)

The OECD concludes (unlike other authors) that indicators of avoidable mortality are more appropriate for comparing countries at a given time than for following trends over time. And as noted previously, the AMIEHS project concludes to a 7-year average time lag between the introduction of a therapeutic innovation and a significant reduction in mortality.

The ONS recommends that selections be updated every 3 years.

7. For each indicator, the analysis should be based on the aggregate level of causes of death (all causes included), but also the level of separate causes included in the selections; specific indicators for certain areas of the healthcare system should be developed.

Some authors question the difficulty of using and interpreting of aggregate indicators.

The level of an aggregate indicator can be heavily dependent on some high-weight causes (for example, cardiovascular diseases in the "healthcare system" indicator).

As mentioned already, the concept of avoidable mortality was originally presented by Rutstein as a management tool with the notion of sentinel event (the occurrence of a single death potentially conveying a deficiency in the healthcare system).

5. General conclusion

This analysis mainly covers the concepts of avoidable mortality, the evolution of their definition and the suggested selection of causes, their uses and their limitations. The concept of premature mortality is not elaborated on or discussed much in the literature consulted. Avoidable mortality indicators, such as developed in France and taken into account in the various State of Health reports, do however integrate by design the notion of premature mortality. Interest in these indicators did indeed originate from observations of the poor situation in France in terms of premature mortality (defined as all deaths occurring before 65 years). To improve its interpretation and analysis, premature mortality was then broken down into three components: avoidable mortality related to high-risk behaviours, avoidable mortality related to the functioning of the healthcare system and other causes of premature mortality.

It is important to clearly explain the meaning of the terms used, as they can lead to confusion. For example, the concept of avoidable mortality related to the healthcare system (defined by the ONS by the term "*amenable mortality*") does not aim to assess the impact of iatrogenic diseases or hospital-acquired infections, but rather to cover those diseases which, given the expected effectiveness of available care, should not lead to death. Similarly, avoidable mortality related to high-risk behaviours ("*preventable mortality*" for the ONS) covers those causes for which public health interventions exist that aim to reduce them and are known to be effective.

Indicators of premature and avoidable mortality must be regarded as general indicators that are of use in detecting issues relating to the effectiveness of healthcare or prevention systems; however complementary, more refined analysis methodologies are required to carry out precise investigations into relative determinants or to interpret changes. In particular, it is important to approach separately the different causes or categories of causes forming the different types of avoidable death.

The interpretation of these "avoidable" mortality indicators must remain cautious and take into account a number of limitations. The prevalence and incidence of diseases are not considered. Yet, mortality can be high in a country because prevalence is high, even if the healthcare system is effective. Likewise, mortality can increase simply because the incidence of a disease progresses, even as the healthcare system remains effective. Variations in mortality also depend on socio-economic factors, which can mask the impact of healthcare system effectiveness.

As such, these concepts are not likely to respond directly to the request expressed in the referral to clarify "the implications for preventative actions and the organisation of healthcare". Indeed, interpreting only the evolutions of these mortality indicators is often complex. For example, observing a positive impact of road accident prevention on mortality can mask a negative impact on other indicators such as an increase in disabilities. More refined analyses of the issues identified by these general indicators, designed as identification tools, remain necessary.

Other complementary indicators and methodologies should be used in combination with avoidable mortality indicators to assess the effectiveness of the healthcare system. Using indicators such as Potential Years of Life Lost (PYLL), which takes into account age at the time of death, would contribute to better highlighting the role played by the different causes of premature deaths. Measuring

the impact of high-risk behaviours should also be based on the calculation methodology that uses fractions attributable to the different risk factors (alcohol, tobacco, etc.). Likewise, mortality indicators do not take into account the impact of changes in terms of quality of life, therefore analyses should be complemented with data taken from indicators such as disability-free life expectancy. More generally, the assessment of the quality of the healthcare system should be able to rest more and more on the results of pairings performed between large databases (causes of death, PMSI, SNIIRAM, etc.).

And finally, one component of "avoidable" mortality that is more difficult to grasp also needs to be taken onto consideration: that related to living conditions in the broad sense, including working conditions, housing, income, access to education, transport (more complex indicators that fall within an inter-sector approach to health).

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Glossary

- AMIEHS : *Avoidable mortality in the European Union - towards better Indicators for the effectiveness of health systems*

- CépiDc-Inserm : Centre d'épidémiologie sur les causes médicales de décès (French national center of epidemiology on medical causes of death)

- CVA: Cerebrovascular accident

- COPD: chronic obstructive pulmonary disease

- DGS: Direction générale de la santé (French Health Directorate)

- DG Sanco: Directorate General for Health and Consumer Affairs.

- DREES: Direction de la recherche, des études, de l'évaluation et des statistiques (French Directorate for Research, Studies, Evaluation and Statistics)

- DALE: Disability-adjusted Life Expectancy

- HCSP: Haut Conseil de la santé publique (French High Council for Public Health)

- K (for cancer in Table 9)

- OECD Organisation for Economic Co-operation and Development

- WHO: World Health Organization

- ONS: Office for National Statistics (UK)

- PMSI: Programme de médicalisation des systèmes d'information (programme for medicalization of information systems)

- SG-HCSP: secrétariat général du Haut Conseil de la santé publique (general secretariat of the French High Council for Public Health)

- AIDS: acquired immunodeficiency syndrome

- SNIIRAM: système national d'information interrégimes de l'assurance maladie (French national cross-scheme information system for health insurance)

- UADT: upper aerodigestive tracts

- HIV: Human Immunodeficiency Virus