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Health Expectancies in OECD countries

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Mathers CD. (1997) Health Expectancies and DALYs: Toward Consistency of Measures.

Robine, JM, Mathers, CD, Romieu, I. (1997) Rational Description of Health Expectancies.

Romieu I, Robine JM. (1997) Health Expectancies in OECD countries.

The report provides a study of the conceptual framework underlying health expectancy calculations, an analysis of the calculations conducted in OECD countries, and a discussion of the policy relevance of these measures.

Six annexes provide more information on definitions and classifications of health expectancy measures (Annex 1) and methods of calculations (Annex 2), as well as the crude results of calculations (Annexes 3, 4, 5, and 6).

Contents:

Health Expectancy in OECD countries

1. Introduction

In the past, the measurement of life expectancy at different ages, the rate of infant mortality, and the distribution of the causes of death according to the principal chapters of diseases were adequate to assess populations' health status and to determine national public health priorities in most countries. OECD currently collates data of this type in its health status chapter of OECD Health Data such as life expectancy at birth, at 40, at 60, and at 65, infant mortality and potential years of life lost (PYLL), according to ICD categories.

However, during the last twenty years, important changes in population demographics and the health care sector have occurred, highlighting the need for a new type of indicator to assess better the evolving dynamics of population health. Among these changes, we can note the lengthening of life expectancy due to the fall in mortality at older ages; the increasing concern about the quality of the years lived, particularly, at very old ages; the continuous increase in health care expenditures and the volume of the staff in the health sector; the growth in the diagnostic and therapeutic technology; and the simultaneous reduction of economic growth across countries. Gains in life expectancy for the older population have raised concerns among policymakers. With the extension of longevity, the older population is more likely to suffer from impairments and disabilities which in turn, will decrease their quality of life. With this increase burden of disease on society, the question is how much will these gains in life expectancy impact demand and needs for various social and health care services.

To address these changes, the measure of health expectancy has emerged as indicator that will provide more information on the dynamics of population health such as functional status, disability level, and quality of life rather than just length of life. The health expectancy concept will also assist policymakers in answering the question of whether the lengthening in life expectancy is accompanied or not with an increase in time lived in ill health and disability. Initially, the notion of health expectancy was developed in the United States in 1964 [Sanders, 1964] and the first method of calculation was proposed in 1971 [Sullivan, 1971].

In the mid-1980s, the OECD gradually introduced health expectancies into its statistical publications [OECD, 1986]. A table was devoted to them in "OECD Health Systems, Facts and Trends 1960-1991", published in 1993 [OECD, 1993], and is now annually updated in the series "OECD Health Data" [OECD, 1995, 1996, 1997].

Since 1989, researchers working on the development of these calculations established an international research network called REVES (Réseau Espérance de Vie en Santé / International

Network on Health Expectancy and the Disability Process). In 1997, a first estimate of health expectancy (generally, a disability-free life expectancy) is available in 23 out of the 29 OECD Member states, that is, Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, the Republic of Korea, Spain, Sweden, Switzerland, the United Kingdom and the United States. In addition, the number of Member countries which have chronological series of health expectancy, is increasing; to date, Australia, Canada, Denmark, Finland, France, Germany, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, the United Kingdom and the United States each have calculated a series of data to follow the evolution of their respective population's health status.

Health expectancies are increasingly being used in industrialised countries to assess the evolution of populations' health status, in particular that of older people. However, it must be noted that these indicators do not always allow for direct international comparisons. Disability and perceived health data which are collected via national health surveys and provide the major part of the information necessary for the health expectancy calculations are not considered comparable due to the specific characteristics of the national health surveys - for instance, the question formulation, administration of survey, and response rates.

Calculations of health expectancies can also assist in assessing health differentials between men and women and the inequalities between the different socio-economic categories or across geographic regions. In addition, calculations have been conducted to estimate the potential gain in health expectancy through the elimination of diseases and diverse pathologies. These estimates of contribution of specific diseases and disease groups to for instance, prevalence of disability and life expectancy make it possible to understand what might be the main causes of disability and handicap and then, from the policymaker's perspective, define public health priorities.

In this report, we will study the conceptual framework of health expectancies, analyse the main results of the calculations worked out in OECD countries, and discuss the policy relevance of these indicators.

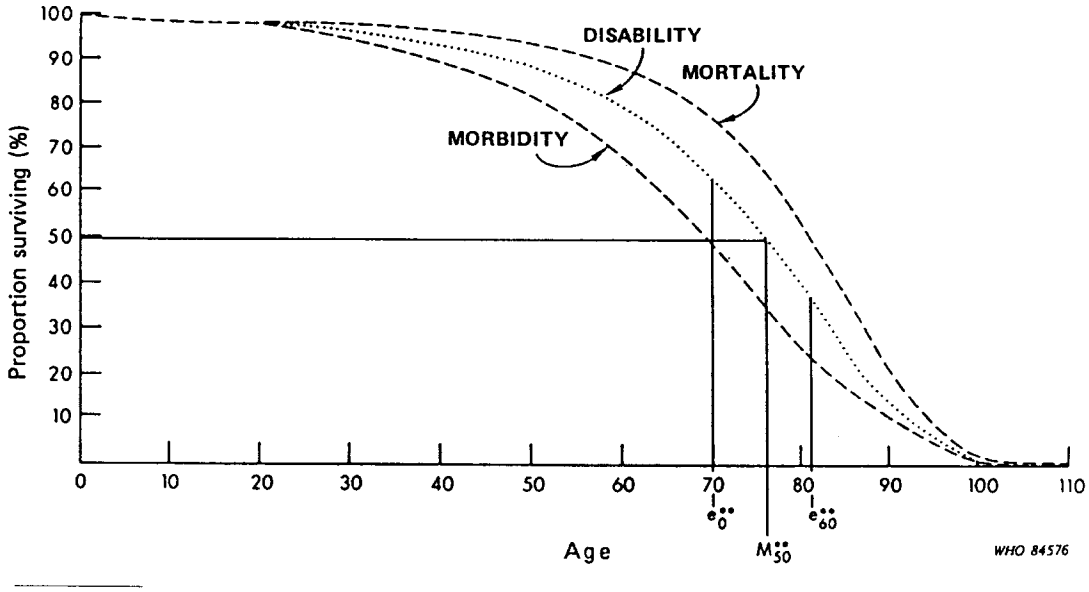
2. Conceptual framework

2.1 General Model of Health Transitions

The calculation of health expectancies is based on a general model of health transitions which was proposed to the World Health Organisation (WHO) by a group of experts in epidemiology of ageing in 1984. This initial model, which distinguished between total survival, disability-free survival and survival without disabling chronic disease [WHO, 1984], led to the calculation of life

expectancy (LE), disability-free life expectancy (DFLE), and life expectancy without chronic disease.

Figure 1: **General model of health transitions [WHO, 1984]:** The observed mortality and hypothetical morbidity and disability survival curves for females in the United States of America in 1980.



e_0^{**} and e_{60}^{**} are the number of years of autonomous life expected at birth and at age 60, respectively.
M_{50}^{**} is the age to which 50% of females could expect to survive without loss of autonomy.

This model is relevant in simultaneously assessing the evolution of mortality, morbidity and disability conditions. Thus, estimates can be made as to whether any of the the different health scenarios proposed are occuring: pandemic of chronic diseases and disabilities [Gruenberg, 1977; Kramer, 1980], compression of morbidity [Fries, 1980, 1989], contradictory evolutions including the scenario of dynamic equilibrium [Manton, 1982], or postponement of all morbid events (diseases, disabilities and mortality) at older ages [Strehler, 1975].

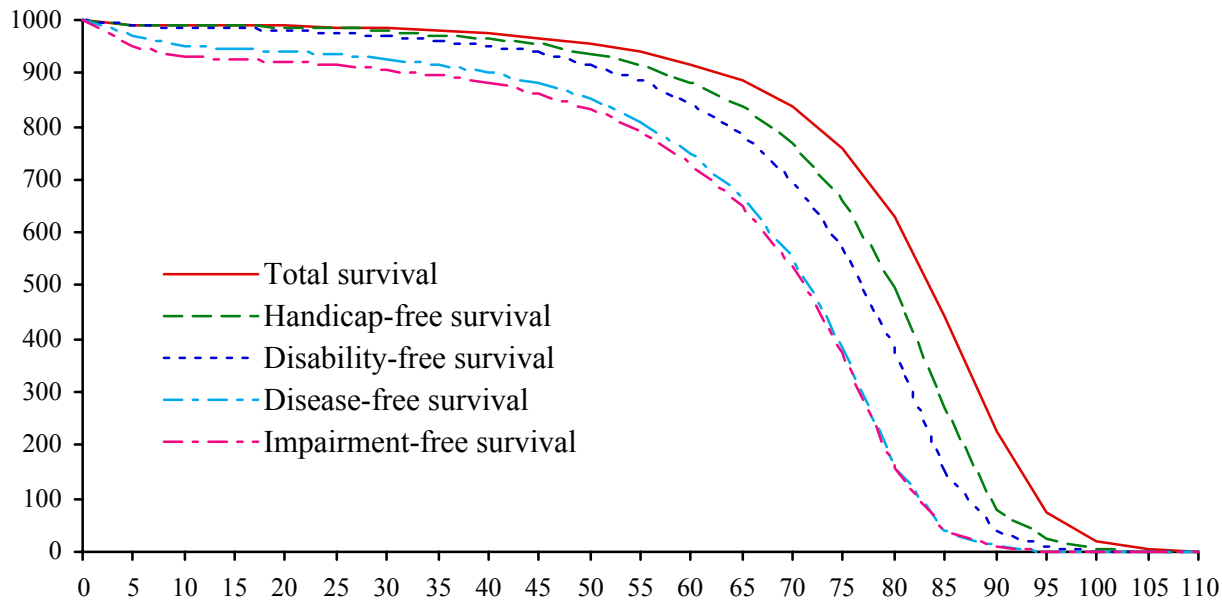
Based on this model, three indicators - life expectancy (LE), disability-free life expectancy (DFLE), and life expectancy without chronic disease - are calculated and make up a family of indicators. These indicators can be interpreted independently from each other or according to each other. This property is explained by the fact that all these indicators are derived from complex life tables - that is, extension of standard life tables to morbidity and disability - by breaking up life expectancy into complementary series of health expectancies. Thus, whatever the studied distribution of health states may be, the sum of complementary health expectancies is always equal to total life expectancy (LE). For example, disability-free life expectancy (DFLE), plus life expectancy with disability (LEWD) is equal to total life expectancy (DFLE + LEWD = LE). Additionnaly, disability-free life expectancy divided by total life expectancy (DFLE / LE) provides the proportion of years lived without disability.

2.2 Concepts of health used in the calculation of health expectancy indicators

A health expectancy is clearly defined as the combination of a life expectancy with a concept of health making it possible to distribute the years lived according to the health state in question. Consequently, there are as many possible health expectancies as health concepts. Since the initial model, several improvements have been proposed which increase the type of health information integrated to the family of health expectancies. For example, we can introduce the following notions: physical, mental or social well-being [UN, 1946], models of disease consequences [WHO, 1980] and disability processes [Nagi, 1976; Pope and Tarlov, 1991], models of performance for daily living activities [Katz et al., 1963; Lawton and Brody, 1969; Johnson and Wolinsky, 1993] or; successful ageing [Rowe and Kahn, 1987].

Physical, mental or social well-being : the definition of health by the World Health Organization - "*Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*" [UN, 1946] - introduces the notion of perceived health and provides a reference framework for the calculation of life expectancy in good health.

Figure 2: Application of the concepts of the International Classification of Impairments, Disabilities, and Handicaps [WHO, 1980] to the general model of health transitions (adjusted on the total survival curve observed in women, in France, 1986-1988)



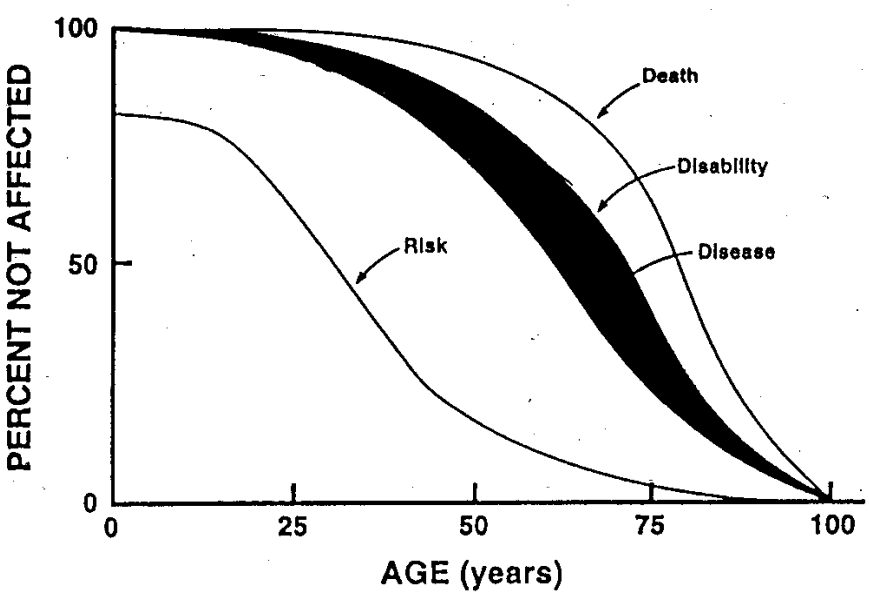
Consequences of disease and disability processes: the introduction of the concepts of the International Classification of Impairments, Disabilities, and Handicaps [WHO, 1980] distinguishes between disease-free survival, impairment-free survival, disability-free survival and handicap-free survival [Robine et al., 1997], (Figure 2).

Physical independence: The introduction of models of performance for daily living activities (ADLs) makes it possible to calculate life expectancy without loss of independence, known as 'active life expectancy' [Katz et al., 1983].

Moreover, several levels of severity can be introduced for any of the concepts described above. Several authors distinguish between several levels of disability, in particular severe disability, resulting in the separate calculation of life expectancy without severe disability and disability-free life expectancy, all levels combined [Robine et al. 1997]. This will be explained more fully in Section 3.5.

Successful ageing: Taking into account models of successful ageing, combined with the introduction of a new curve called "survival without significant risk factor damage" [Manton, 1989] or more simply "risk" [Rowe, 1990] enables us to make a distinction, among survivors without chronic disease or disability, between those presenting significant risks to develop chronic diseases with ageing, what we call "normal ageing", and those presenting only low risks, what we call "successful ageing" [Rowe and Kahn, 1997], (Figure 3).

Figure 3: Application of successful ageing concepts [Rowe and Kahn, 1987] to the general model of health transitions [Rowe, 1990]



These models enable one to introduce such notions as survival without loss of autonomy [Grimley-Evans, 1983], survival without loss of robustness, or survival without loss of vitality (high functioning level).

2.3 The classification system developed by REVES:

In light of the increase in the number of concepts used to calculate health expectancy, there was a clear need to clarify the different concepts used. In 1994, REVES proposed a classification system

of health expectancies based on the concepts of the WHO international classifications of diseases and their consequences [WHO, 1980, 1992], on those of perceived health and on those of adjustments on health [Robine et al., 1994], (see Annex 1).

Table 1 : Classification system of health expectancies developed by REVES, 1994

	Concepts	Health expectancies
ICD-10	Disease	With or without disease - With or without dementia
ICIDH	Impairment	With or without impairment
	Disability	With or without functional limitation With or without activity restriction
	Handicap	With or without handicap With or without physical independence handicap - (Independent) Active life expectancy With or without mobility handicap With or without occupational handicap With or without other handicap
	Perceived health	In good health / in bad health
	Health-adjusted	Health-adjusted

Source: Robine et al., 1994

With the classification system developed, we can thus distinguish between life expectancies with or without disease (senile dementia-free life expectancy proposed by Ritchie in 1991, for example), life expectancies with or without impairment, life expectancies with or without disability, and life expectancies with or without handicap (active life expectancy, for example). We can also distinguish life expectancies in good or bad perceived health.

Any other carefully defined concept of health, allowing one to distribute the years lived, can be used to calculate a specific health expectancy. The flexibility of health expectancies makes it possible, for example, to calculate life expectancies within or outside institutions (nursing home...), life expectancies with or without loss of autonomy (or physical independence). Carrière and Légaré propose the computation of life expectancy without net handicap [Carrière and Légaré, 1995], whereas Chen and Wilkins propose the computation of life expectancy with unmet needs for help in ADLs and IADLs [Chen and Wilkins, 1995].

In addition, there has been recent developments on variations in life expectancies in good health - not based on the perceived health status data - such as, good mental health expectancy [Perenboom and van de Water, 1997]. New developments and applications of different health concepts will most likely lead to further revisions and new additions to the current classification system.

2.4 The methods of calculation

Three different methods of calculation of health expectancies exist, according to the data available: (i) the observed prevalence life table method (the Sullivan method); (ii) the double decrement life table method; (iii) and the multistate life table method (see Annex 2).

The Sullivan method is the most often used method since it relies on data which is currently available. Its limits are increasingly better understood and simulations provide a useful means of assessing its imprecision [Mathers and Robine, 1997]. Even if it would be preferable that all calculations be made with the multistate method - and this will naturally occur as period data estimates become available - the Sullivan method provides a useful indicator which can be used, as long as its limitations are understood.

3. Analysis of the main results

Health expectancy calculations have been carried out in 48 countries in the world, of which 23 out of the 29 OECD countries, principally using the observed prevalence life table method (the Sullivan method).

Table 2: Health expectancy calculations in OECD countries and in the remaining part of the world

	countries	countries with calculations	
	n	n	%
OECD countries	29	23	79,3
Non OECD countries	162	25	15,4

The results of the calculations vary greatly when they are not compared within the specific classification levels [Robine et al, 1994]. After reviewing the data in context of the REVES classification system, the results on the whole are more consistent when comparing across countries. (See Annex 3). Even within classification levels, there may be variation in the wording of questions related to the concept of disability and handicap used in the calculation. Nevertheless, some values stand out, as active life expectancy for Finland (See Annex 3, Table 2). This variation may be due to errors in classification of the different measures, although we have based our classification on all the available information from each country.

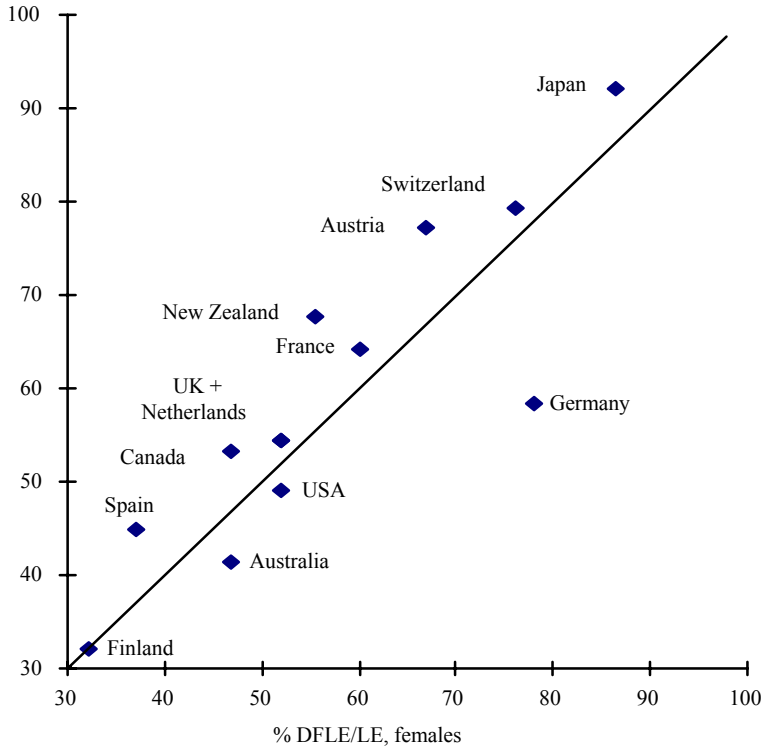
Annex 3 presents the most recent national results in four sets of tables of the main 'positive' health expectancies by sex at age 0 and at age 65, except for dementia-free life expectancy - which is

reported at ages 65 and 85. Countries appear in a table only if these values are available. It is important that results not only be presented at birth, but also at higher ages in order to illustrate the changes in health status and shift between years of life in good health and ill health over a lifetime. While the presentation of results at birth is obvious, the choice of a higher age is arbitrary. Age 65 may, however, be considered a reasonable compromise, as detailed prevalence data are not always available for higher than 65 age groups. For the countries presented in this study, complementary results for other ages may often be found in the original sources.

3-1 Gender differentials

The wide differential between sexes found in analysis of life expectancy is not reproduced with the estimates of health expectancy. Most studies indicate that life expectancy and positive health expectancy (e.g., handicap-free, disability-free, etc.) are longer for females, and that the proportion of positive health expectancy to total life expectancy is slightly lower for females. (see Graph 1).

Graph 1: Proportion of "Disability"-free life expectancy (% DFLE) in OECD countries: Males versus Females at age 65



Results from studies using data from repeated wave surveys have suggested that the greater proportion of years lived with disability or handicap by women may be explained by the relatively higher survival of women after the development of these disabilities or handicaps [Robine, 1989; Robine and Ritchie, 1991; Mor et al., 1994].

3-2 Socio-economic and socio-demographic differentials

To date, socio-economic variables have been included in studies from 8 countries: Austria, Belgium, Canada, Finland, the Netherlands, Sweden, the United Kingdom (London), and the United States. All studies except one from the United States [Guralnik et al., 1993; Land et al., 1994] have demonstrated that social inequalities in health are much greater than has been shown by differential mortality: **not only do the poorest and the least educated live not as long, but they also experience a greater part of their life with disability or handicap** [Katz, 1983; Wilkins and Adams, 1983a, 1983b; Nault et al., 1996; Crimmins et al., 1989; van den Bos and van der Maas, 1993; Crimmins and Saito, 1993; Wilkins et al., 1994; Guralnik et al., 1993; Boshuizen et al., 1994; van Oyen et al., 1994; Valkonen et al., 1994; Petterson, 1994, Doblhamer and Kytir, 1996; Hayward and Heron, 1996].

This was first observed in Canada by Wilkins and Adams [Wilkins and Adams, 1983a, 1983b], according to income levels. These authors have shown that the gap in life expectancy between the richest and poorest sections of the community increases from 6.3 years for overall life expectancy to 14.3 years for occupational handicap-free life expectancy (see Table 3).

Table 3: Occupational handicap-free life expectancy in Canada, by sex and income level, 1978

	At birth			
	Male		Female	
Income levels	LE	HE	LE	HE
Lowest	67.1	50.0	76.6	59.9
Second	70.1	57.9	77.6	61.8
Third	70.9	61.1	78.5	64.3
Fourth	72.0	62.6	79.0	63.5
Highest	73.4	64.3	79.4	67.5
Total	70.8	59.5	78.3	63.6
Differences highest / lowest	6.3	14.3	2.8	7.6

Source: Wilkins and Adams, 1983a.

A selection of tables from recent studies are presented, aiming to illustrate the different repartition criteria used: educational levels, ethnic groups, and marital status.

Finnish and Dutch studies point to socio-economic inequalities by means of calculations of life expectancies and health expectancies for several educational levels (See Tables 4 and 5). The conclusions are similar: the higher the educational level, the higher the life expectancy and 'positive' health expectancy.

Table 4: General handicap-free life expectancy at age 65 in Finland by sex and level of education, 1986

	At birth				At age 65			
	Male		Female		Male		Female	
Levels of education	LE	HE	LE	HE	LE	HE	LE	HE
Basic	-	-	-	-	13,4	3,7	17,4	5,5
Secondary	-	-	-	-	14,6	5,5	18,6	5,9
Higher	-	-	-	-	15,8	8,6	19,4	9,0
All	-	-	-	-	13,6	4,4	17,6	5,7
Differences higher / basic	-	-	-	-	2,4	4,8	2,0	3,6

Source: Valkonen et al.,1994

Table 5: Healthy life expectancy in the Netherlands for males by social class (measured by level of education at age 18), 1990

	At birth				At age 65			
	Male		Female		Male		Female	
Levels of education	LE	HE	LE	HE	LE	HE	LE	HE
Low	72.2	51.6	-	-	13.3	7.2	-	-
Middle	74.7	59.0	-	-	15.0	8.6	-	-
High	76.7	64.2	-	-	16.4	10.6	-	-
Differences high / low	4.5	12.6	-	-	3.1	3.4	-	-

Source: Boshuizen et al., 1994

The calculations comparing different ethnic groups in the United States [Hayward and Heron, 1996], show dramatic differences at the discount of black population and at great benefit for Asian populations (See Table 6).

Table 6: Occupational handicap-free life expectancy in USA, by sex and ethnic group, 1990

	At age 20			
	Male		Female	
Ethnic Group	LE	HE	LE	HE
White Non-Hispanic	54,6	46,7	61,0	51,5
Black	47,4	38,6	51,2	39,3
Asian/PI	59,4	52,9	65,0	55,8
Native American	53,1	40,0	61,2	45,7
White Hispanic	49,9	43,3	58,6	49,8
Dif Black / Asian	12,0	14,3	13,7	16,5

Source: Hayward and Heron, 1996.

Studies of health expectancy according to marital status [Nault et al, 1996] (Table 7) or studies based on the indicator of working life expectancy demonstrate similar results concerning the disparities in inequalities [Hayward and Grady, 1990].

Table 7: Health-adjusted life expectancy in Canada, by sex and marital status, at age 30, 1991

	At age 30			
	Male		Female	
Marital status	LE	HE	LE	HE
Unmarried	40,8	34,6	50,5	42,2
Widowed	41,4	36,1	50,6	42,5
Divorced	43,4	37,0	49,9	41,3
Married	47,8	42,0	53,4	45,5
Dif Unmarried / Married	7,0	7,4	2,9	3,3

Source: Nault et al., 1996.

Preliminary calculations of trends in disability-free life expectancy by socio-economic status have been presented at the last REVES meetings by Petterson [Petterson, 1995] for Sweden, by Cambois [Cambois, 1997] for France, and by Crimmins [Crimmins et al., 1997] for the United States.

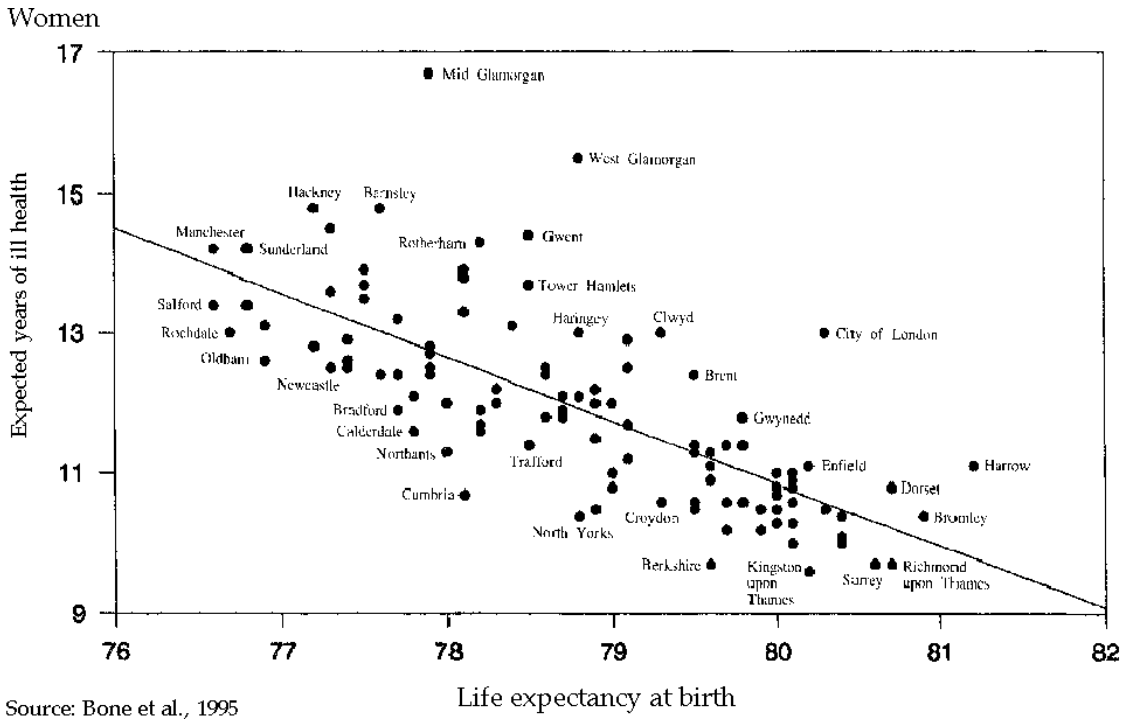
3-3 National geographic comparisons

Several countries have computed estimates in order to make geographic comparisons across provinces (Canada, [Wilkins and Adams, 1983a; Wilkins and Adams, 1983b; Wilkins, 1991]); states or territories (Australia, [Mathers, 1991]); regional and local authority areas (United Kingdom, [Bone et al, 1995]); autonomous communities (Spain, [Regidor et al., 1995]); and community size (Canada, [Wilkins and Adams, 1983a; Wilkins and Adams, 1983b]). Annex 4 presents the results for Australia, Canada, Spain, and the United Kingdom. A study of the trends in disability-free life expectancy across regions is currently being conducted in France [Robine et al., 1998].

As with differences in life expectancy, differences in health expectancy across different geographic areas in the same country, are quite large. Graph 2 illustrates the area variations using data for the United Kingdom. British researchers have computed expected years of ill health for numerous local areas, using data from the 1991 census. These calculations show that the local area with the shortest life expectancies also have the largest expected number of years in ill health. Whatever the causes of these area variations, it is more and more evident that there may be a very strong relationship between short life expectancy and amount of morbidity.

In all the situations studied and presented here based on gender, socio-economic status and geographic differentials, life expectancy and disability-free life expectancy are positively associated and there is poor evidence concerning a hypothetical trade-off between quantity and quality of life.

Graph 2: Life expectancy at birth and expected years of ill health, local authorities in England and Wales, women, 1991



Source: Bone et al., 1995

3-4 Causes of handicap, disability and mortality

Theoretically, potential gains in disability-free or handicap-free life expectancies can be calculated after the elimination of various pathologies. Based on this calculation, a ranking of the causes contributing to mortality and prevalence of morbidity (disability or handicap) can be drawn. Seven studies of this type have been undertaken to date for 5 countries (Australia, Canada, the Netherlands, the United Kingdom, and the United States). These studies have demonstrated an important effect produced by the elimination of locomotion disorders [Colvez and Blanchet, 1983; van de Water et al., 1992], of limb and joint disorders [Wilkins, 1994], of osteo-articular diseases [Dillard, 1983], of musculoskeletal system diseases [Bone et al., 1995], of arthritis and back complaints [Nusselder et al., 1996] and of accidents [Dillard, 1983; Mathers, 1992; van de Water et al., 1992; Bone et al., 1995]. In OECD countries, these causes are among the main ones behind cardio-vascular diseases in importance. (See Annex 5)

The results presented for the Netherlands in 1987-88 [Nusselder et al., 1996] conclude that while the elimination of fatal diseases leads to an increase in health expectancy, it may also lead to an increase in life expectancy with disability, thus increasing the burden of disability to society. On the other hand, the elimination of disabling non-fatal diseases results in a decline in life expectancy with disability.

Thus, it has been shown that the suppression of certain causes of morbidity such as cancer, would strongly increase life expectancy and also life expectancy with disability. On the other hand, the suppression of diseases which are not fatal, such as arthritis, would strongly increase disability-free life expectancy without changing total life expectancy, and therefore would strongly decrease life expectancy with disability [Nusselder et al., 1996]. Between these two extremes, the suppression of diseases which are both fatal and disabling, such as heart diseases, would increase life expectancy and disability-free life expectancy in various proportions.

Several authors have also developed calculations based on a group of specific pathologies as 'major coronary events' [Egidi and Frova, 1997], or on one particular morbid condition as stroke or hip fracture [Herman et al., 1996; 1997]. Some research teams have undertaken more complex analysis of possible links between morbidity and disability [Robine et al., 1996b; Hayward et al., 1995].

There are several possible extensions to the calculations of gains in health expectancies. For example, the successive elimination of disability or handicap at different ages of life would assist in the evaluation of the contribution of each year of life to years lived in ill health. In the case of health-adjusted life expectancy (HALE), it can assist in assessing the contribution of one or another health attibute to "equivalent years of perfect health" lost [Wolfson, 1996].

3-5. Chronological Series of Health Expectancies

Several time series of handicap-free or disability-free life expectancy have now been produced for several OECD countries (see Table 8). A chronological series consists of at least two cross-sectional health surveys using the same measure of disability and handicap and comparable samples allowing comparisons over time. When the series from OECD countries are juxtaposed, they cover a period that extends over more than 30 years. Annex 6 is a compilation of the chronological series of health expectancies available for OECD countries, by sex at age 0 and at age 65.

In 1991, in a first attempt to assess the health status of populations, the American, English and Australian studies were divided into four levels according to severity of handicap or disability: very severe handicap or disability, severe to very severe, moderate to very severe, mild to very severe handicap or disability. This classification permitted a more careful distinction of the trend in handicap or disability according to the degree of severity through the computation of the corresponding indicators [Robine et al., 1991]. Most authors now distinguish between life expectancy without severe handicap or severe disability and life expectancy without handicap or disability, all levels combined. Handicap-free or disability-free life expectancy most often means: all levels of handicaps or disabilities combined. The Japanese series are made of the values for

1975, 1980, and 1985 [Nanjo and Shigematsu, 1987 ; Gunji and Hayashi, 1987]. We have added the value for 1990 computed by Inoue et al. [1997] as the data used seem comparable.

Two series of mental health expectancy are now available: one for the Netherlands, from 1989 to 1995 [Perenboom and van de Water, 1997] and one of dementia-free life expectancy for Northern California in the United States, 1971-79 and 1980-88 [Sauvaget et al., 1997a]

Table 8: Countries for which chronological series are available.

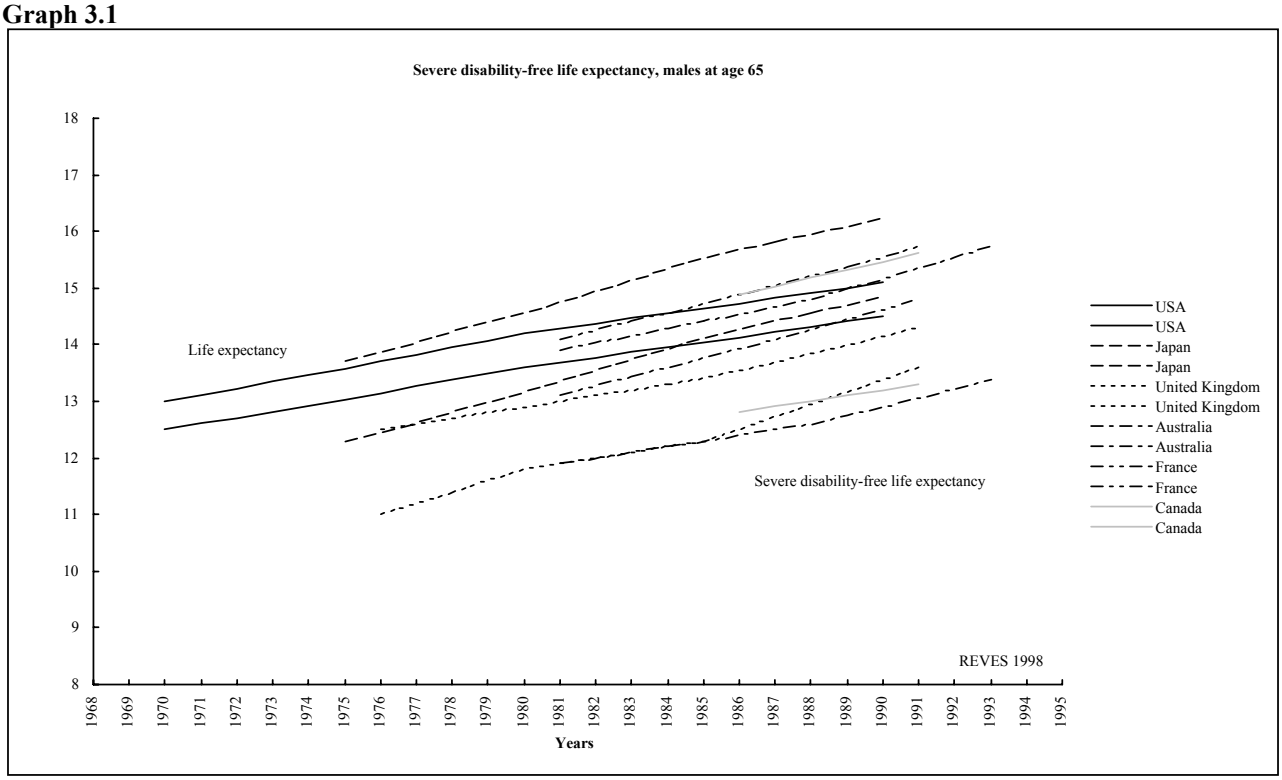
Countries	Reference	Available years
Australia	Mathers, 1996	1981, 1988, 1993
Canada	Wilkins et al, 1994	1986, 1991
	Carrière and Légaré, 1997	1986, 1991
Québec	Wilkins et al, 1995	1987, 1992
Denmark	Bronnum-Hansen, 1998	1987,1994
Finland	Sihvonen, 1994	1978, 1986
France	Robine and Mormiche, 1993	1981, 1991
	Robine et al., 1996a	
Germany	Bruckner, 1997	1986, 1989, 1992, 1995
Japan	OECD, 1976	1966 to 1970
	Koizumi, 1985	1965 to 1979
	Nanjo and Shigematsu, 1987 and	
	Inoue et al. 1997	1975, 1980, 1985, 1990*
	Gunji and Hayashi, 1987	1974 to 1985
City of Sendai	Tsuji, 1993	1970, 1990
Netherlands	Perenboom et al, 1993	1983 to 1990
	Perenboom and van de Water, 1997	1989 to 1995
New Zealand	Davis and Graham, 1997	1981, 1992-93
Norway	Grotvedt and Viksand, 1994	1975, 1985
Spain	Regidor et al., 1995	1986, 1991
Sweden	Petterson, 1994	1975-80, 1981-85, 1986-90
United Kingdom	Bebbington, 1991; Bone et al., 1995	1976, 1981, 1985, 1988, 1991, 1992
United States	U.S. Dep. of HEW, 1969	1958 to 1966
	McKinlay et al, 1989	1964, 1974, 1985
	Colvez and Blanchet, 1983	1962 to 1976
	Crimmins et al, 1997	1970, 1980, 1990
	Manton and Stallard, 1994	1982-1984, 1982-1989
Northern California (KPMCP)	Sauvaget et al, 1997a	1971-79, 1980-88
New York State	Tu, 1990	1980, 1986

* See text

Graphs 3 and 4 present the compared evolutions of life expectancy and disability-free life expectancy in a selection of OECD countries. These graphs have been plotted using a log-linear extrapolation of the available values in the series. Information on the series used is available in Annex 6 which provides tables of values by country and classified according to the REVES classification system. Additionally, Annex 6 provides author's denomination and original sources where one can find more information on the data and the method used.

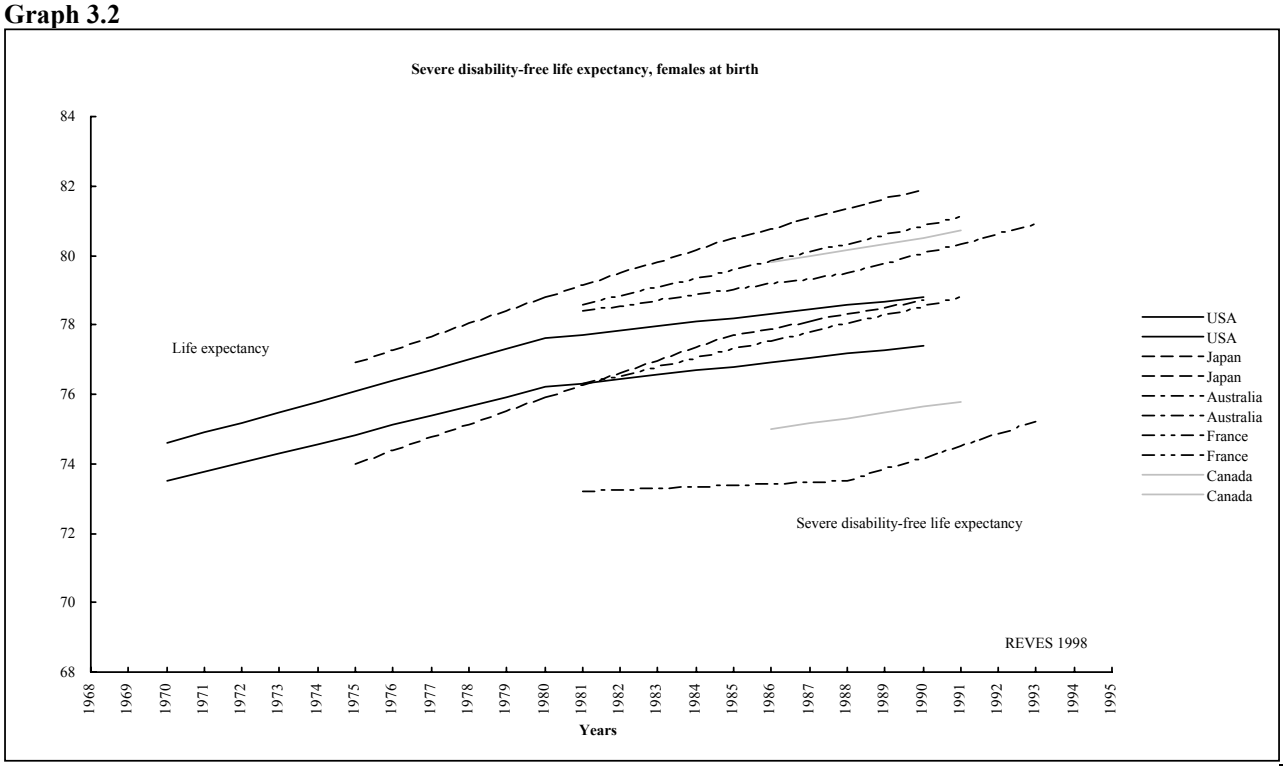
Graph 3: Evolution of life expectancy and life expectancy without *severe* disability in various OECD countries.

Graph 3.1



Sources: Crimmins et al., 1989, 1997 ; Inoue et al., 1997 ; Bone et al., 1995 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Wilkins et al., 1994.

Graph 3.2



Sources: Crimmins et al., 1989, 1997 ; Inoue et al., 1997 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Wilkins et al., 1994.

Graph 3.1 and 3.2 present the evolution of total life expectancy and life expectancy without severe disability at age 65 in men in six OECD countries - Australia, Canada, France, Japan, United Kingdom, and United States - the series ranging from 1970 (as concerns the oldest) to 1993 (for the most recent) and the evolution of total life expectancy and life expectancy without severe disability at birth in women in five OECD countries - Australia, Canada, France, Japan, and United States - the series ranging from 1970 (as concerns the oldest) to 1993 (for the most recent). Life expectancy without severe disability roughly progresses in parallel with total life expectancy in both groups (females at birth and males at 65), which means that the number of years lived with severe disability is roughly stagnating and even shows a decrease in United Kingdom, for instance.

This result can be verified whatever the country or the period of time studied or the indicator of severe disability considered, for example, institutionalization in the United States, institutionalization or confinement to house for France, personal help or supervision required or impossibility to perform basic tasks in relation with self care, mobility and verbal communication as regards Australia.

Graph 4.1 juxtaposes the evolution of total life expectancy and life expectancy without disability - all disability levels combined - at age 65 in men in eight OECD countries - the United States of America, United Kingdom, Finland, Australia, France, New Zealand, Germany, and Canada - the series ranging from 1970 to 1995. The analysis of the first series demonstrates that life expectancy without disability - all levels combined - is stagnating. However, the series across countries differentiate over time. For instance, the Canadian, Finnish, New Zealander and British series still suggest that disability-free life expectancy is stagnating, whereas the American, French, and German series show that disability-free life expectancy is now increasing, while the Australian series goes on decreasing.

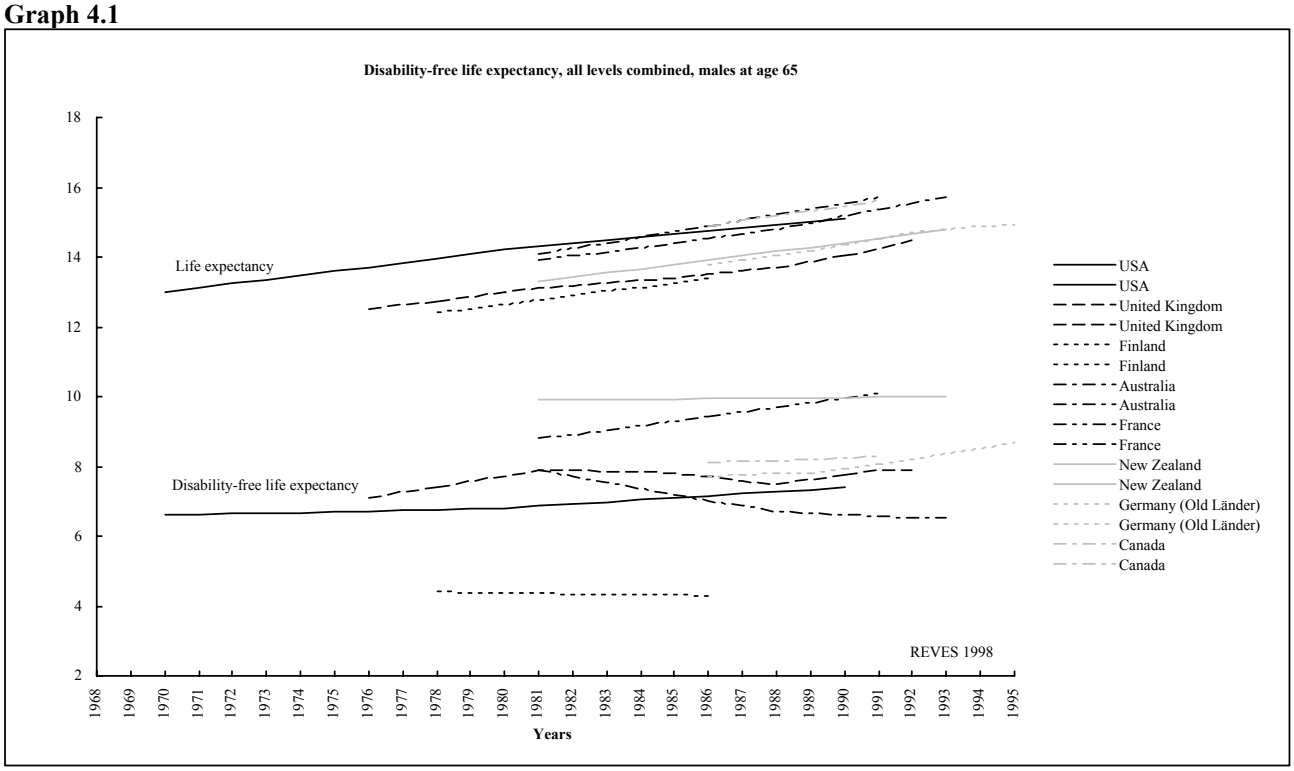
Graph 4.2 juxtaposes the evolution of total life expectancy and life expectancy without disability - all disability levels combined - at birth in women in six OECD countries - Australia, Canada, France, Germany, the United Kingdom, and the United States - the series ranging from 1970 to 1995. Similar conclusions can be drawn as to those from Graph 4.1. One can notice the high values for German disability-free life expectancies in women. These figures are based on self reported 'certified handicap levels', which are a prerequisite for being eligible for social benefits in Germany [Bruckner, 1997][1].

The graphs concerning the compared evolution of life expectancy and disability-free life expectancy for men at birth and for women at age 65 are given in Annex 6.

[1] These relate mostly to labor force participation, which is still substantially low for women in Germany.

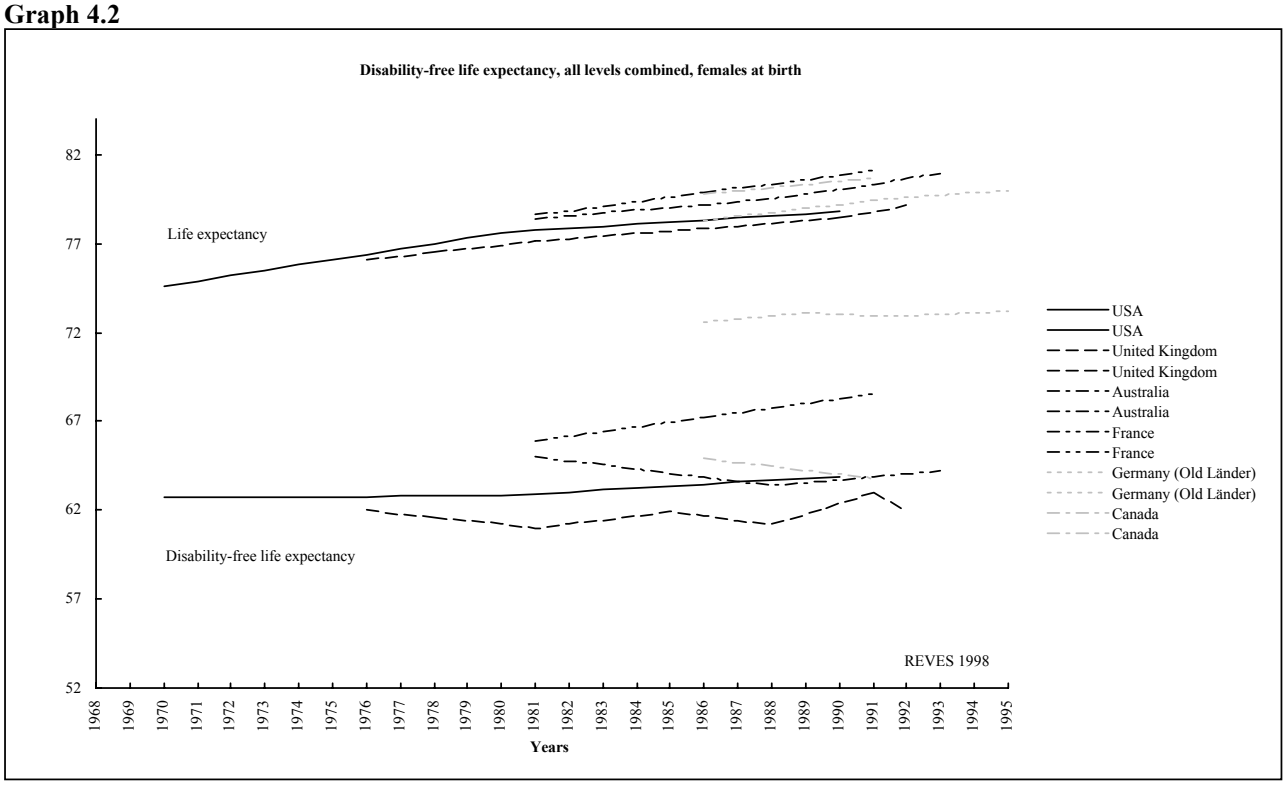
Graph 4: **Evolution of life expectancy and disability-free life expectancy - *all disability levels combined* - in various OECD countries.**

Graph 4.1



Sources: Crimmins et al., 1989, 1997 ; Bone et al., 1995 ; Sihvonen, 1994 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Davis and Graham, 1997; Brückner, 1997 ; Wilkins et al., 1994.

Graph 4.2

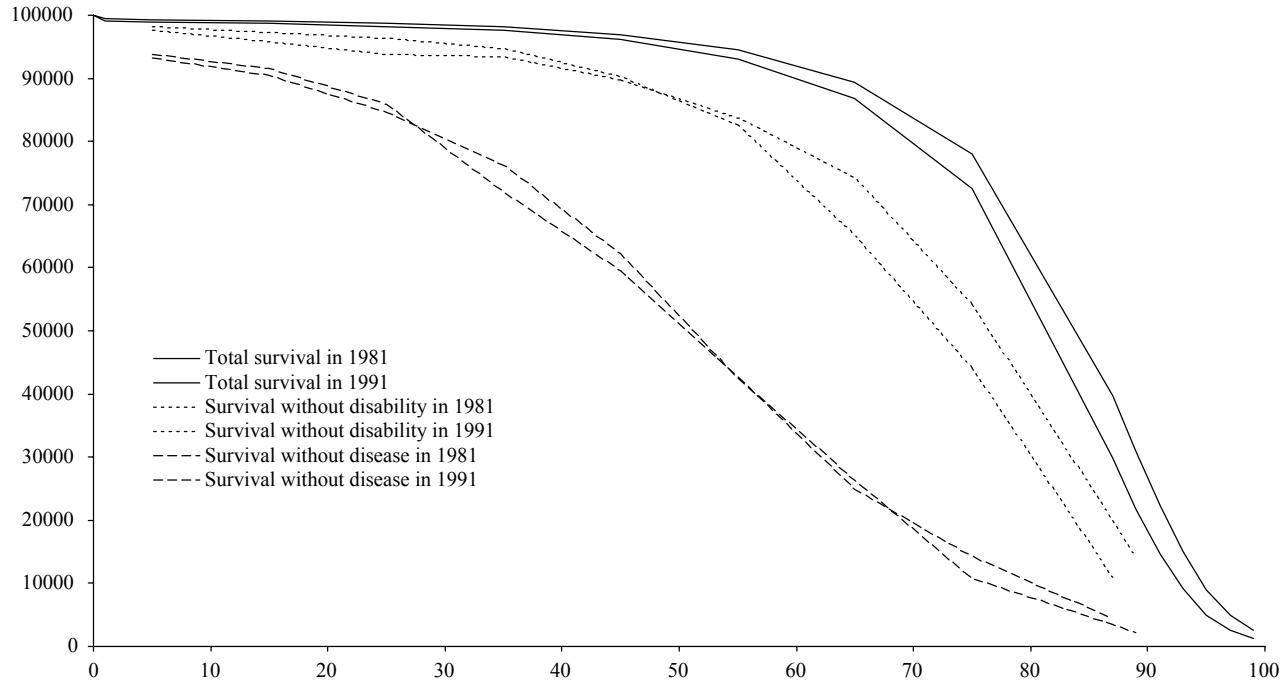


Sources: Bone et al, 1995 ; Brückner G, 1997 ; Crimmins et al, 1997 ; Mathers, 1996 ; Robine and Mormiche, 1994 ; Wilkins et al 1994.

To summarize, it is apparent from the data available, that the increase in life expectancy is not accompanied by an increase in the time spent with severe handicap or severe disability. The results indicate at worst **a pandemic of light and moderate, but not of severe handicaps or disabilities**. These results, therefore, tend to confirm the theory of *'dynamic equilibrium'* which partly explains the increase in life expectancy by a slowing down in the rate of progression of chronic diseases [Manton, 1982]. Thus, although the decline in mortality can lead to an increase in the prevalence of handicaps or disabilities, these handicaps or disabilities are less severe.

In France the general model of health transitions [WHO, 1984] has been used to compare the evolutions of life expectancy, disability-free life expectancy and life expectancy without chronic disease. The results show that the increase in life expectancy between 1981 and 1991 has been accompanied with a parallel increase in disability-free life expectancy, and that life expectancy without chronic disease has remained constant (See Graph 5). This apparent contradiction in the evolutions of morbidity and disability again illustrates the theory of dynamic equilibrium proposed by Manton in 1982: with the decline in mortality, the prevalence of chronic diseases increases, but the diseases are less severe [Robine et al., 1996a].

Graph 5: Survival without disease and survival without disability (WHO model, 1984) France, 1981-1991, females



Source: Robine et al.,1996a

3.6 Development of mental health expectancies

The development of dementia-free life expectancies initiated by Ritchie [Ritchie, 1991] has been conducted in 10 OECD countries (Australia [Ritchie et al., 1994a], Belgium [Roelands et al., 1994],

Denmark [Jagger et al.,1998], France [Ritchie et al., 1994b], Japan [Sauvaget et al., 1997b], the Netherlands [Perenboom et al., 1996], Spain (Catalonia) [Jagger et al.,1998], Switzerland [Herrmann and Michel, 1996], United Kingdom [Jagger et al.,1998], the United States [Sauvaget et al., 1997a]), though only 4 of the calculations are presented at a national level (See Annex 3).

In parallel with dementia-free life expectancies, other types of mental health expectancies are now being developed such as depression-free life expectancy and life expectancy in good mental health. [Jagger et al.,1998].

4. Policy relevance of health expectancy indicators: discussion of characteristics

Health expectancies offer a positive assessment of the time spent in different health states, similar to life expectancy which provides a positive indication of human longevity. They provide positive indications on populations' health, on their vitality or on their quality of life. Health expectancies can be considered a family of indicators where each can be analysed independently or according to each other [Robine and Michel, 1992]. They can be added to each other: for example, the sum of disability-free life expectancy plus life expectancy with disability is equal to total life expectancy. The subtraction of life expectancy with moderate disability from life expectancy with "all levels of disability combined" gives the value of life expectancy with severe disability. They can also be presented, for example, as a ratio of disability-free life expectancy to total life expectancy - generally expressed in percentage, indicating the part of life expectancy lived without disability.

Health expectancies can also assist in establishing public health priorities when potential gains are calculated. Gains in health expectancies make it possible to classify priorities according to the survival or health criteria retained in the calculation, leaving significant choice to public health authorities, by providing them with all the elements necessary for arbitration between longevity, duration of life without disability and duration of life with disability.

Health expectancies permit direct comparisons of the different groups that make up the population whatever the criteria of distribution used may be: sexes, socio-professional categories, regions, etc, as, in their calculation, the years lived are reported to the number of survivors, which make them independent from the size and the age structure of the populations from which the data come.

If it is useful or required, a weighting system similar to that of DALYs can be introduced into the calculation of life expectancy, to take into account the severity of the disability the years are lived in. Thus, we obtain a life expectancy adjusted on disability or disability-adjusted life expectancy (DALE). By generalizing and by introducing any weighting system into the calculation of life expectancy, taking the health state in which the years are lived into account, we obtain a health-adjusted life expectancy (HALE) [Mathers, 1997a; Wolfson, 1996]. Summing up the different complementary health expectancies into a single value, health-adjusted life expectancy (HALE) is a

global synthetic indicator. By means of the weighting system, the calculation of health-adjusted life expectancy (HALE) reduces life expectancy (LE) to its equivalent in years of perfect health.

Significant questions regarding the validity of health expectancies, as those on the validity of the Sullivan method to assess a particular period value, have been clearly identified [Mathers and Robine, 1997]. Health expectancies essentially rely on the calculation of life expectancy and its reference framework, which has been under construction for three centuries [Dupâquier and Dupâquier, 1985]. In particular, they benefit from a clear distinction between the period calculations and the calculations for real cohorts. They also benefit from an important number of theoretical works on the problem of the calculation of potential gains in life expectancy by suppression of the different causes of death [see, for example, Keyfitz, 1978; Tsai et al., 1978; Schatzkin, 1980; Manton et al., 1980; Olshansky, 1985 and 1987]. Finally, they benefit from the existence of an international research network which has been devoted to them since 1989, REVES, and from the publication of numerous scientific articles devoted to their calculation or use [REVES, 1997b].

As a rule, the calculations of health expectancies are based on observed data: period life tables, results of population censuses, and results of various surveys (Living conditions, Health, Disability, Labour force...)[1]. This explains why, on the one hand, estimations of health expectancies are presently available for about fifty countries only and why, on the other hand, these estimations are not directly comparable from a country to another. In fact, the national characteristics of the different surveys, in terms of protocol, questionnaire or question formulation make international comparisons difficult. **This is the major weakness of the present calculations of health expectancy**.

Standardization of disability data should become a priority. A first objective could be the harmonisation of the definition and the measure of disability according to severity levels in the general population. For the most severe states, a consensus should not be too difficult to find as almost all the countries use activities of daily living limitations (ADL) measures to calculate severe disability (i.e. to eat, dress, wash, ...). The extension of this approach to other types of activities is worth being explored in order to standardize the measure of less severe disability levels (i.e. mobility, domestic activities, professional or school activities).

Conclusion

To summarize, health expectancy appears to be a relevant and meaningful indicator for use in policymaking. In particular, it permits the assessment of whether the increase in life expectancy is accompanied or not with a compression of morbidity or with an expansion of disability.

[1] However, when the data necessary to the methodological works devoted to health expectancies and its calculation methods were not available, they have been simulated (Mathers and Robine, 1997).

Based on the data available, it appears across countries, that the increase in life expectancy is not accompanied with an increase in the time lived in severe disability.

The synthesis of the results shows that it is more and more obvious that there is a very strong relationship between short life expectancy and amount of morbidity. However, there is poor evidence concerning an hypothetical trade-off between quantity and quality of life. In all the situations studied (gender, socio-economic status and geographic differentials), life expectancy and disability-free or handicap-free life expectancy are positively associated.

Distinguishing between gains in mortality and gains in morbidity or disability, the calculations of potential gains in health expectancy demonstrate whether the elimination of one or another pathology would compress or expand prevalent morbidity. Thus, the calculations worked out show that the elimination of osteo-articular diseases would result in important gains in health expectancy, comparable to those resulting from the elimination of cardiovascular diseases. The elimination of osteo-articular diseases would significantly increase disability-free life expectancy without influencing total life expectancy, and thus it would decrease the burden of disease.

Nevertheless, health expectancies have not become a routine indicator of the health status of the population as they are not comparable across countries. The standardization of the concepts and questionnaires related to disability and handicap used to calculate health expectancies would resolve this problem. Direct comparisons across countries would then be as easy as the comparisons of life expectancies are today.

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Annex 1

Health expectancy indicators: Definitions and classification

1. Definition of the main health expectancy indicators

The first indicator proposed was disability-free life expectancy [Sullivan, 1971], followed by active life expectancy [Katz et al., 1983]. The introduction of concepts from the International Classification of Impairments, Disabilities, and Handicaps (ICIDH) [WHO, 1980] enables us to differentiate among impairment-free, disability-free, and handicap-free life expectancies. Until now, disability-free life expectancy (DFLE) has been the most frequently used expression, often without explicit reference to the WHO-ICIDH concepts and sometimes as the generic term for health expectancies.

Health expectancy is a general term referring to the entire class of indicators expressed in terms of life expectancy in a defined state of health. Health expectancies are hypothetical measures and indicators of the current health and mortality conditions. Health expectancies include both "positive" and "negative" health states, which may be defined in terms of impairment, disability, handicap, self-rated health, or other concepts. The sum of health expectancies in a complete set of complementary health states should always equal to total life expectancy [Mathers et al., 1994].

The REVES classification system is based on the concepts principally relating to (a) the ICD framework, (b) the consequences of diseases (ICIDH framework) with subdivisions as proposed by the REVES committee on conceptual harmonization, (c) perceived health and (d) quality-adjustment.

According to the ICD framework:

- *Disease-free life expectancy*, the average number of years an individual is expected to live free of disease if current patterns of mortality and morbidity continue to apply. A well known example of a specific disease-free life expectancy is dementia-free life expectancy.

- *Dementia-free life expectancy* is a specific disease-free life expectancy, as dementia is a medical diagnosis. It reflects the average number of years an individual is expected to live without senile dementia if current patterns of mortality and morbidity continue to apply. A calculation using the loss of cognitive function would of course result in an impairment-free life expectancy.

According to the ICIDH framework, health expectancies are differentiated into:

- *Impairment-free life expectancy*, the average number of years an individual is expected to live free of impairment if current patterns of mortality and impairment continue to apply.

- *Disability-free life expectancy*, the average number of years an individual is expected to live free of disability if current patterns of mortality and disability continue to apply.

- *Handicap-free life expectancy*, the average number of years an individual is expected to live free of handicap if current patterns of mortality and handicap continue to apply. The ICIDH distinguishes between seven main dimensions of handicap: orientation, physical independence,

mobility, occupation, social integration, economic self sufficiency and other handicaps. The REVES classifisation system distinguishes independent life expectancy, mobility handicap-free life expectancy and occupational handicap-free life expectancy. When the handicap is assessed in a global manner, the indicator is reported as a general handicap-free life expectancy. However, one should realize that handicap is - next to the presence of disabilities - to a large extent determined by the environment one lives in. Therefore differences in (cultural) environment will always have to be taken into account when making geographical (for instance international) comparisons.

According to the REVES committee on conceptual harmonization [Chamie, 1990], the ICIDH disability-free life expectancy should be differentiated into:

- *Functional limitation-free life expectancy*, the average number of years an individual is expected to live free of functional limitation if current patterns of mortality and disability continue to apply. Functional limitations mean restrictions in abilities, for instance, to bend forward and pick up something, or the ability to walk.

- *Activity restriction-free life expectancy*, the average number of years an individual is expected to live free of activity restriction if current patterns of mortality and disability continue to apply. Activity restrictions mean problems in the performance of complex normal human activities like cooking and dressing.

According to Katz et al. [Katz et al., 1983] and subsequent authors:

- *Active life expectancy* was built to measure independence through the calculation of the average number of years an individual is expected to live without restrictions in a number of activities of daily living (ADL) or instrumental activities of daily living (IADL) if current patterns of mortality and ADL/IADL problems continue to apply. So, given the intention of these authors, active life expectancy is an example of a specific handicap-free life expectancy. Although meant to be an indicator of independent life, the fact that active life expectancy is built with activity restriction data, will always make it difficult to classify. Dependency is not necessarily reflected by the number of inabilities. One could imagine more direct assessments of dependency through one or two general questions leading to other indicators of independent life expectancy.

Perceived health expectancy is a generic term for health expectancies calculated for health states defined using population data on perceived health status [Mathers et al., 1994]. So:

- *healthy life expectancy*, or life expectancy in good health, is the average number of years an individual is expected to live in a health state defined as the "favorable part" part of the distribution of perceived health status (usually self-rated on a scale of the form *excellent/good/fair/poor*, or alternatively, *very good/good/fair/bad/very bad*).

Health-adjusted life expectancy is a generic term for a weighted expectation of life summed over a complete set of health states. Weights for health states typically range from zero (death) to unity (optimal health). Health-adjusted life expectancy is a statistical abstraction based on health expectancies in a number of discrete health states and explicit weights for each of those health states. The weights may be empirically derived, based on expert opinion, or arbitrarily chosen [Mathers et al., 1994].

Historic indicators without any explicit reference to the WHO - ICIDH conceptual framework and which cannot be classified according to classification system are referred to as "unclassified disability"-free life expectancy. Thus:

- "*Unclassified disability*"-free life expectancy is the average number of years an individual is expected to live free of "disability" (generic or historic term) if current patterns of mortality and "unclassified disability" continue to apply. This indicator is a combination of mortality and morbidity data without reference to any distinguishable section of the ICIDH.

The REVES classification system is summarized in table 1. Because some conceptual points need more clarification and because ICIDH is currently being revised, a further evolution of it is expected.

Table 1 : Classification system of health expectancies developed by REVES, 1994

	Concepts	**Health expectancies...**
ICD-10	Disease	With or without disease - With or without dementia
ICIDH	Impairment	With or without impairment
	Disability	With or without functional limitation With or without activity restriction
	Handicap	With or without handicap With or without physical independence handicap - (Independent) Active life expectancy With or without mobility handicap With or without occupational handicap With or without other handicap
	Perceived health	In good health / in bad health
	Health-adjusted	Health-adjusted

Source: Robine et al., 1994

Annex 2

Health expectancies: methods of calculation

The principle of the calculation of health expectancy was postulated as early as 1964 [Sanders, 1964] and a first method of calculation was proposed in 1971 by Sullivan [Sullivan, 1971]. Three different methods of calculation of health expectancies exist: (i) the observed prevalence life table method (the Sullivan method); (ii) the double decrement life table method; (iii) and the multistate life table method.

The main advantage of the *observed prevalence life table method* (the Sullivan method) lies in the separate collection of mortality and disability data and in the ready availability of the data necessary for the calculation. Basic cross-sectional surveys are sufficient to collect the observed prevalence of disability within the population; however the indicator obtained is not really a period indicator. The problem with this method lies in approximating the period prevalence by the observed prevalence of disability.

The *double decrement life table method* is based on the observation, during the study period, of the occurrence of two events corresponding to two possible outcomes: mortality and disability. The simplified method used by Katz et al. [Katz et al., 1983] results from using the probabilities of survival without disability directly observed at the end of the study period. This implies that the two outcomes studied are irreversible. The advantage of this method is that it really provides a *period indicator* based on data that are not too difficult to collect. The main drawback lies, as for the method following, in the non-separated collection of the mortality and disability data; the accuracy of the mortality data depending on the size and the representativeness of the study sample.

The *multistate life table method* has been proposed by Rogers et al. [Rogers et al., 1989] in order to take *the recovery of lost functions* into account and return to a state of good health. The advantage of this method - based on transitions between states of health - is that it gives a period indicator that takes the *reversibility of disability* into account. The specific drawback of the multistate life table method arises from the scarceness of adequate data. Data requirements for multistate methods are considerable and there are very few countries where national data are available or likely to be available for some time. Biases are introduced when the gaps between successive waves of longitudinal studies are too long, thus failing to capture a part of the flows between health states during the inter-survey period. Some researchers are developing discrete-time Markov chain models and microsimulation techniques to compute active life expectancy. These new methods aim in particular to accommodate different time intervals between interviews for the different respondents [Laditka and Wolf, 1995]

The observed prevalence life table method uses cross-sectional disability and mortality data, whereas the double decrement and multistate life table methods depend upon longitudinal data sets. There are enormous financial and political implications in the choice between these two data collection strategies, with cross-sectional being much more likely to have been conducted in most countries. However, longitudinal data and multistate methods are essential for projecting the health of populations.

The Sullivan method is very simple and has been discussed by many authors [Robine, 1989]. The years lived between the various ages by the population of a life table are qualified on the basis of the institutionalization rate (generally provided by a census) and the prevalence rate of permanent and temporary limitation of activity (from national health or disability surveys). Once the table is modified, the period life expectancy is calculated in the traditional manner, according to various states of functional disability. So, one can obtain a series of health expectancy values including *disability-free life expectancy* and *life expectancy with disability*.

Taking the survivors (b) in a life table (see Table 1), the number of years lived between two ages (c) is first calculated. Rates of prevalence of disability (d) are then used to calculate the number of years lived with disability. By substracting these from the number of years lived between two ages (c), the number of years lived without disability is obtained (e). The cumulative total of these years (f) is then computed from any given age x (a) and related to the total number of survivors (b) at that age to obtain disability-free life expectancy (g). For example, the total number of years without disability from age 65 upwards is thus 1,153,013.2 in Table 1. This total is divided by the number of survivors aged 65 to estimate DFLE at age 65: 1,153,013.2 (f) divided by 89,347 (b), i.e. 12.9 years.

Table 1: Disability-free life expectancy by the Sullivan method: France, 1991, female (simplified estimation computed with long term disability only).

Age x (a)	Survivors Sx (b)	Years lived between x and x+a (c)	Prevalence of disability between x and x+a (d)	Years lived without disability between x and x+a (e)	Years lived without disability from x (f)	Long term DFLE from x (g)
0	100,000	496,176.5	0.0097	491,366.7	7,075,234.3	70,8
5	99,242	496,287.5	0.0242	484,295.5	6,583,867.6	66.3
10	99,158	495,323.9	0.0253	482,791.8	6,099,572.1	61.5
15	99,076	495,697.5	0.0419	474,927.3	5,616,780.3	56.7
20	98,911	493,614.3	0.0358	475,933.2	5,141,853.0	52.0
25	98,685	492,480.1	0.0631	461,390.7	4,665,919.8	47.3
30	98,401	491,880.8	0.0395	472,470.2	4,204,529.1	42.7
35	98,051	488,648.7	0.0548	461,869.0	3,732,058.8	38.1
40	97,583	486,446.6	0.0632	455,709.6	3,270,189.9	33.5
45	96,876	481,630.4	0.0867	439,895.1	2,814,480.3	29.1
50	95,854	476,093.8	0.1068	425,246.1	2,374,585.2	24.8
55	94,400	467,568.3	0.1221	410,472.8	1,949,339.2	20.6
60	92,336	454,383.5	0.1508	385,853.2	1,538,866.4	16.7
65	89,347	436,686.7	0.1885	354,389.6	1,153,013.2	12.9
70	84,952	408,481.5	0.2740	296,546.1	798,623.6	9.4
75	78,000	363,545.5	0.3455	237,955.9	502,077.5	6.4
80	66,522	290,185.4	0.4675	154,519.8	264,121.6	4.0
85	48,434	297,869.1	0.6320	109,601.8	109,601.8	2.3

Source: Robine and Mormiche, 1994

In 1973, it was proposed that a weight be introduced in the calculation in order to obtain a single value, the weighted life expectancy [Berg, 1973] or the value-adjusted life expectancy [Bush et al.,

1973], which should make it possible to measure the social value of future gains in life expectancy [Robine, 1992].

A first calculation of health expectancy has now been carried out for nearly 50 countries [REVES, 1997a], principally using the Sullivan method. The limits of this method are increasingly well understood and simulations provide a useful means of assessing its imprecision [Mathers and Robine, 1997]. Even if calculation methods are no longer a problem, it would obviously be preferable that all calculations be made with the multistate method. This will naturally occur as period data estimates become available and up till this time, the Sullivan method will provide a useful indicator which can be used, as long as its limitations are understood.

Annex 3

Results of reclassified national health expectancy calculations

1: Health expectancies according to the International Classification of Diseases (ICD-10)

1-1 Disease-free life expectancy

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
Life expectancy without chronic disease								
France, 1991 [1]	72,9	48,7	81,2	49,0	-	-	-	-
Norway, 1985 [2]	72.6	38.9	79.0	37.9	14.3	3.8	18.2	3.7
Life expectancy free from major coronary event and cancer (fatal diseases)								
Italy, 1990 [3]	74.1	70.8	80.7	77.0	-	-	-	-
Life expectancy free from fatal and chronic non fatal disease								
Italy, 1990 [3]	74.1	56.1	80.7	55.9	-	-	-	-

Sources: [1] Robine et al., 1996a ; [2] Grotvedt L and Viksand G, 1994 ; [3] Egidi and Frova, 1997

1-2 Dementia-free life expectancy

	At age 65				At age 85			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
Belgium, 1991 [1]	14.0	13.1	18.3	16.1	4.5	3.3	5.6	3.3
France, 1988-90 [2]	15.4	14.8	19.7	18.8	-	-	-	-
Australia, 1990 [3]	-	-	-	-	4.9	3.9	6.0	4.7
Netherlands, 1993 [4]	14.5	14.0	19.0	17.7	4.6	3.7	5.8	3.3

Sources: [1] Roelands et al., 1994; [2] Ritchie et al., 1994b; [3] Ritchie et al., 1994a; [4] Perenboom et al., 1996

2: Health expectancies according to the framework of the ICIDH

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
2-1 General handicap-free life expectancy								
Finland, 1986 [1]	-	-	-	-	13.4	4.3	17.4	5.6
France, 1991 [2]	72.9	63.8	81.1	68.5	15.7	10.1	20.1	12.1
Netherlands, 1991-92 [3]	74.2	61.4	80.2	63.5	-	-	-	-
United Kingdom, 1992 [4]	73.7	59.7	79.2	61.9	14.5	7.9	18.3	9.5
2-2 Independent life expectancy								
Canada, 1991 [5]	-	-	-	-	15,6	13,3	19,7	15,4
Finland, 1986 [6]	-	-	-	-	13.4	2.5	17.4	2.4
Korea, 1984 [7]	-	-	-	-	12.9	9.0	15.0	9.4
Norway, 1985 [8]	-	-	-	-	14.4	13.3	18.2	16.9
United Kingdom, 1991 [9]	-	-	-	-	14.3	13.6	18.1	16.9
USA, 1983 [10]	-	-	-	-	14,4	11,9	18,6	13,6
2-3 Mobility handicap-free life expectancy								
France, 1991 [11]	72.9	71.7	81.1	78.8	15.7	14.8	20.1	18.1
Japan, 1990 [12]	75.9	74.2	81.9	78.7	16.2	14.9	20.0	17.3
Korea, 1989 [13]	66.7	65.5	74.9	73.1	11.9	11.3	16.0	14.8
United Kingdom, 1991 [14]	-	-	-	-	14.3	13.2	18.1	15,2
USA, 1980 [15]	70.1	68.4	77.6	74.6	14.2	13.2	18.4	16.3
2-4 Occupational handicap-free life expectancy								
Canada, 1978 [16]	70.8	59.2	78.3	62.8	14.4	8.2	18.7	9.9
Germany*, 1995 [17]	73,8	64,2	80,0	73,2	14,9	12,2	18,7	14,9
USA, 1987 [18]	71.5	59.9	78.4	64.3	14.8	8.9	18.7	10.9
2-5 Other handicap-free life expectancy								
Australia, 1993 [19]	75.0	62.4	80.9	66.9	15.7	8.4	19.5	10.3
2-6 Activity restriction-free life expectancy								
Austria, 1992 [20]	72.9	69.0	79.4	72.4	14.9	11.5	18.3	12.3
Canada, 1991 [21]	74.3	60.7	80.7	63.8	15.6	8.3	19.7	9.2
Netherlands, 1990 [22]	73.9	60.4	80.1	59.9	14.4	9.0	19.0	8.0
Korea, 1989 [23]	66.7	60.5	74.9	63,8	11.9	8,4	16.0	9,8
Switzerland, 1988-89 [24]	74.0	67.1	80.9	72.9	15.4	12.2	19.6	14.9
2-7 Functional limitation-free life expectancy								
Australia, 1993 [25]	75.0	58.4	80.9	64.2	15.7	6.5	19.5	9.1
Netherlands, 1986-88 [26]	73.5	64.1	79.9	65.1	-	-	-	-
New Zealand, 1992-93 [27]	-	-	-	-	14.8	10.0	18.4	10.2
Spain, 1986 [28]	73.2	61.6	79.6	63.6	15.0	7.0	18.4	6.9
United Kingdom, 1985 [29]	71.7	63.6	77.5	66.5	-	-	-	-
2-8 “Unclassified disability”-free life expectancy								
Italy, 1980 [30]	70.6	66.8	77.4	72.2	-	-	-	-
Poland, 1988 [31]	67.1	59.8	75.7	62.6	-	-	-	-

Author's denominations and sources:

[1] *Life expectancy without limiting or extremely limiting long-standing illness*, Valkonen, 1994

[2] *Espérance de vie sans incapacité,* Robine and Mormiche, 1993

[3] *General handicap-free life expectancy (Including "intermittently"),* Boshuizen and van de Water, 1994

[4] *Healthy life expectancy calculated from GHS (Long standing illness question),* Bone et al., 1995

[5] *Life expectancy free of severe disability*; Wilkins et al., 1994

[6] *Life expectancy free of ADL-Index #3 (all items),* Valkonen, 1994

[7] *Life expectancy free of personal activities of daily living problems*, Lamb and Andrews, 1991

[8] *Able to dress, undress etc.,* Grotvedt and Viksand, 1994

[9] *Life expectancy with the ability to perform ADLs,* Bone et al., 1995

[10] *Active life expectancy*, Manton and Stallard, 1991

[11] *Espérance de vie sans incapacité sévère*, Robine and Mormiche, 1993

[12] *Life expectancy free of bed disability*, Inoue et al., 1997

[13] *Life expectancy without bed-ridden condition*, Lee, 1997

[14] *Life expectancy with the ability to get out of doors without help,* Bone et al., 1995

[15] *Expectation of life free of bed disability,* Crimmins et al., 1989

[16] *Disability-free life expectancy*, Wilkins and Adams, 1983a and b

[17] *Disability-free life expectancy*, Brückner, 1997

[18] *Expected years of life with activity limitation*, Stoto and Durch, 1991

[19] *Handicap-free life expectancy,* Mathers, 1996

[20] *Disability-free life expectancy*, Kytir, 1994

[21] *Life expectancy free of any disability*, Wilkins et al., 1994

[22] *Activity restriction-free life expectancy*, Boshuizen and van de Water, 1994

[23] *Life expectancy without daily activity restriction*, Lee, 1997

[24] *Disability free life expectancy,* Spuhler et al., 1991

[25] *Disability-free life expectancy,* Mathers, 1996

[26] *Gezonde levensverwachting*, van Ginneken et al.,1992

[27] *Ability to use stairs,* Davis and Graham, 1997

[28] *Esperanza de vida libre de incapacidad*, Sociedad Espanola de Salud Pùblica y Administracion Sanitaria, 1993

[29] *Expectation of life without disability,* Bebbington, 1992

[30] *Life expectancy without disability*, Egidi and Verdecchia, 1988

[31] *Disability-free life expectancy,* Haber and Dowd, 1994

*For ex Federal Republic of Germany.

3: Health expectancies according to the concept of perceived health

3-1 Life expectancy in good perceived health

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
Belgium, 1989-90 [1]	-	-	-	-	14.2	12.4	18.4	15.7
Finland, 1986 [2]	-	-	-	-	13.4	9.6	17.4	11.6
Germany, 1995 [3]	73.8	62.4	80.0	64.2	14.9	9.4	18.7	10.5
Italy, 1983 [3]	71.6	64.3	78.2	68.3	-	-	-	-
Netherlands, 1990 [4]	73.8	60.0	80.1	60.2	14.4	9.3	19.0	9.1
Norway, 1985 [5]	72.6	69.0	79.0	74.1	14.3	12.4	18.2	15.2
Spain, 1991 [6]	73.3	54.5	80.5	53.3	15.4	6.9	19.2	7.1

Author's denominations and sources:

[1] *Espérance de vie en bonne santé*, Roelands and Van Oyen H, 1995

[2} *Life expectancy without self-rated poor or very poor health.* Valkonen, 1994.

[3] *Life expectancy in good health*. Egidi, 1990.

[4] *Life expectancy in good self-reported health,* Vademecum gezondheidsstatistiek Nederland 1994, 1994

[5] *Life expectancy with very good, good or fair health,* Grotvedt and Viksand, 1994

[6] *Esperanza de vida en buena salud,* Regidor et al., 1995

4: Health-adjusted life expectancies

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
	4-1 Disability-adjusted life expectancy							
Canada, 1991[1]	74.3	69.1	80.7	73.8	15.6	12.6	19.7	15.1
	4-2 Health-adjusted life expectancy							
Canada, 1990-92 [2]	-	-	-	-	15.7	12.9	19.9	15.4

Author's denominations and sources:

[1] *Quality-ajusted life expectancy,* Wilkins et al., 1994

[2] *Health-adjusted life expectancy*, Wolfson, 1996

Annex 4

Health expectancies by region

1: Health expectancies by regions

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
1. General handicap-free life expectancy								
United Kingdom, Standard regions, 1991 [1]								
North	72,3	61,2	77,8	65,5	13,6	7,5	17,3	9,3
Yorks & Humberside	72,7	62,2	78,3	66,0	13,9	7,8	17,8	9,4
East Midlands	73,5	63,7	78,9	67,4	14,3	8,5	18,1	10,1
East Anglia	75,0	66,2	80,1	69,5	15,1	9,5	18,8	11,2
South East	74,7	66,4	79,9	69,6	15,0	9,5	18,7	11,2
Greater London	73,1	63,9	79,3	67,7	14,5	8,9	18,6	10,7
South West	74,6	65,6	80,2	69,4	15,1	9,5	19,0	11,3
West Midlands	73,0	63,3	78,5	66,8	14,0	8,2	18,0	9,9
North West	72,1	61,2	77,7	65,2	13,6	7,6	17,3	9,3
Wales	73,1	60,4	78,9	64,9	14,1	7,4	18,1	9,4
2 Activity restriction-free life expectancy								
Canada, Provinces, 1986 [2]								
Canada	73,0	61,3	79,8	64,9	14,9	8,1	19,2	9,4
Atlantique	72,8	58,8	79,6	62,6	14,5	7,0	19,0	8,3
Quebec	72,0	62,4	79,5	66,3	14,1	8,6	18,9	10,2
Ontario	73,5	61,3	79,8	64,6	14,9	8,1	19,1	9,0
Prairies	73,0	60,8	80,1	64,2	15,0	7,6	19,8	9,4
C.-B.	74,0	61,7	80,4	65,6	15,8	8,6	19,8	10,0
Differences Quebec/Canada	-1,0	+1,1	-0,2	+1,4	-0,8	+0,5	-0,3	+0,8
3. Functional limitation-free life expectancy								
Australia, States and Territories, 1998 [3]								
New South Wales	72.6	58.2	78.9	63.4	14.5	6.8	18.3	8.6
Victoria	73.6	58.2	79.8	63.0	14.9	6.3	18.9	8.3
Queensland	73.3	58.7	79.8	64.8	15.0	7.0	19.2	9.6
South Australia	73.6	60.1	80.3	64.3	15.0	7.9	19.0	9.0
Western Australia	73.8	57.8	80.1	63.2	15.0	5.8	19.0	8.0
Tasmania	72.5	57.9	78.7	61.3	14.5	6.5	18.4	7.0
Northern Territory	64.8	51.6	71.2	56.5	13.9	-	16.8	-
Austr. Capital Territory	74.4	61.6	80.3	62.3	14.8	8.4	18.8	7.0
Differences ACT / NT	9.6	10	9.1	5.8	0.9	-	2.0	-
Spain, autonomous communities, 1986 [4]								
Spain	73,2	60,8	79,6	62,6	-	-	-	-
Andalucia	71,8	59,1	78,7	60,0	-	-	-	-
Aragon	73,9	62,0	79,7	61,4	-	-	-	-
Asturias	72,3	62,3	79,7	66,9	-	-	-	-
Baleares	71,2	61,9	78,6	65,7	-	-	-	-
Canarias	72,5	60,8	78,7	61,1	-	-	-	-
Cantabria	73,5	61,3	80,4	64,4	-	-	-	-
Castilla-La Mancha	74,6	60,8	79,4	61,1	-	-	-	-
Castilla y Leon	75,0	63,4	78,9	65,9	-	-	-	-
Cataluna	73,8	61,3	80,1	62,2	-	-	-	-
Comunidad Valenciana	72,9	61,2	78,8	63,7	-	-	-	-
Extramadura	72,8	60,7	79,0	61,4	-	-	-	-
Galicia	72,6	61,9	79,4	65,4	-	-	-	-
Madrid	74,2	59,9	81,3	60,2	-	-	-	-
Murcia	72,9	61,9	78,6	66,9	-	-	-	-
Navarra	73,9	62,7	79,8	65,2	-	-	-	-
Pais Vasco	72,4	60,7	78,1	61,4	-	-	-	-
La Rioja	73,0	57,8	79,6	51,8	-	-	-	-

Author's denominations and sources:

[1] *Healthy life expectancy;* Bone et al., 1995

[2] *Espérance de vie en santé*; Wilkins, 1991

[3] *Disability-free life expectancy*; Mathers, 1991

[4] *Esperanza de vida libre de incapacidad*; Regidor et al., 1995

Annex 5

Gains in health expectancy by elimination of causes

1: Increase in functional limitation-free life expectancy and in total life expectancy in Australia between age 0 or age 65 and age 85, resulting from elimination of major causes of morbidity, by sex, 1988

	Between age 0 and 85						Between age 65 and 85					
	Male			Female			Male			Female		
Increase in:	LE	HE	Rk	LE	HE	Rk	LE	HE	Rk	LE	HE	Rk
Cause of morbidity suppressed (ICD-9)												
Infective disease (1)	0.08	0.27	11	0.06	0.39	10	0.03	0.07	11	0.03	0.17	11
Neoplasms (2)	3.09	1.64	3	2.83	1.53	5	1.99	0.85	5	1.47	0.62	5
Endocr / metab / nutrit.(3)	0.24	0.50	9	0.23	0.48	9	0.12	0.24	7	0.16	0.27	8
Mental disorders (5)	0.16	0.82	8	0.11	1.24	7	0.06	0.22	8	0.07	0.59	6
Nervous system (6)	0.20	1.54	4	0.19	2.04	4	0.10	1.05	3	0.10	1.35	3
Circulatory system (7)	4.72	4.00	2	3.75	3.18	1	3.77	2.93	1	3.37	2.55	1
Respiratory system (8)	0.77	1.34	6	0.54	1.00	8	0.66	0.73	6	0.36	0.37	7
Digestive system (9)	0.36	0.37	10	0.29	0.37	11	0.19	0.17	9	0.19	0.23	10
Genito-urinary system (10)	0.08	0.09	13	0.13	0.17	13	0.08	0.05	12	0.10	0.10	12
Skin & subcutaneous (12)	0.01	0.05	14	0.01	0.10	14	0.00	0.02	13	0.00	0.05	13
Musculoskeletal (13)	0.03	1.52	5	0.06	2.82	3	0.02	0.93	4	0.04	1.94	2
Congenital conditions (14)	0.23	1.23	7	0.23	1.28	6	0.00	0.10	10	0.00	0.26	9
Perinatal conditions (15)	0.30	0.26	12	0.25	0.23	12	0.00	0.00	14	0.00	0.01	14
Injuries (17)	1.78	6.16	1	0.74	2.90	2	0.15	2.16	2	0.11	0.96	4

Source: Mathers, 1992.

2: Change in total life expectancy, disability-free life expectancy, life expectancy with disability, and percentage of life free of disability due to the elimination of the specific disease, the Netherlands, 1987-88

	Male at age 65				Female at age 65			
Disease	LE	DFLE	LED	% DFLE / LE	LE	DFLE	LED	% DFLE / LE
At baseline	14.2	6.9	7.3	48.9	18.8	6.2	12.6	33.1
Chronic nonspecific lung disease	0.3	0.5	-0.2	2.2	0.1	0.2	-0.1	1.0
Heart disease	3.1	1.5	1.6	0.0	2.7	0.9	1.8	0.0
Cancer	2.7	0.9	1.8	-2.3	1.9	0.4	1.5	-1.2
Diabetes mellitus	0.1	0.0	0.1	-0.1	0.3	0.3	0.0	1.0
Arthritis/back complaints	0.0	0.7	-0.7	5.0	0.1	1.0	-1.0	5.3
Migraine / severe headache	0.0	0.1	-0.1	0.4	0.0	0.1	-0.1	0.4
Other neurological diseases	0.1	0.1	0.0	0.3	0.1	0.1	0.0	0.3

Source: Nusselder et al., 1996

3: Baseline and estimated change in life expectancy and health-adjusted life expectancy at birth, due to the elimination of disease and injury groups, Australia, 1993

	Male			Female		
	LE (yrs)	HALE (yrs)	HALE/ LE %	LE (yrs)	HALE (yrs)	HALE/ LE %
At baseline	74,98	70,86	94,5	80,85	74,74	92,4
Change due to the elimination of:						
Infectious and parasitic disease	0,29	0,30	0,04	0,06	0,08	0,03
Neoplasms	3,46	2,64	- 0,54	2,45	2,13	- 0,16
Endocr / metab / nutrit disorders	0,28	0,30	0,05	0,22	0,32	0,14
Blood disorders	0,03	0,02	0,00	0,02	0,03	0,01
Mental disorders	0,18	0,54	0,48	0,09	0,68	0,73
Nervous system / sense organ disorders	0,25	0,81	0,76	0,18	1,13	1,19
Circulatory system disorders	5,81	5,01	- 0,60	2,48	2,67	0,45
Respiratory system disorders	0,86	0,92	0,14	0,44	0,65	0,30
Digestive system disorders	0,34	0,33	0,02	0,19	0,22	0,05
Genito-urinary system disorders	0,12	0,10	- 0,01	0,09	0,13	0,05
Complications of pregnancy / childbirth	0,00	0,00	0,00	0,00	0,003	0,00
Skin & subcutaneous tissue disorders	0,01	0,02	0,01	0,00	0,02	0,02
Musculoskeletal disorders	0,03	0,42	0,52	0,04	1,63	1,96
Congenital anomalies	0,19	0,27	0,12	0,18	0,23	0,08
Perinatal conditions	0,23	0,22	0,01	0,17	0,17	0,02
Symptoms, signs, ill-defined conditions	0,09	0,12	0,05	0,06	0,09	0,04
Injury and poisoning	1,47	2,05	0,86	0,50	1,02	0,68

Source: Mathers, 1997b.

Annex 6

Chronological series of health expectancy

Chronological series

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
USA	**Occupational handicap-free life expectancy, 1962-1976 [1]**							
1962	66.8	56.8	72.5	60.8	-	-	-	-
1965	66.6	57.0	73.8	63.4	-	-	-	-
1966	66.5	56.6	73.8	63.4	-	-	-	-
1969	66.6	57.0	74.2	63.6	-	-	-	-
1972	67.2	56.8	74.7	63.4	-	-	-	-
1974	67.9	56.5	75.1	62.3	-	-	-	-
1976	68.7	57.1	75.8	62.7	-	-	-	-
USA	**Occupational handicap-free life expectancy, 1970-1990 [2]**							
1970	67.0	56.5	74.6	62.7	13.0	6.6	16.8	9.1
1980	70.1	57.2	77.6	62.8	14.2	6.8	18.4	9.3
1990	71.8	58.8	78.8	63.9	15.1	7.4	18.9	9.8
USA	**Institutionalization-free life expectancy, 1970-1990 [2']**							
1970	67.0	66,4	74.6	73,5	13.0	12,5	16.8	15,7
1980	70.1	69,5	77.6	76,2	14.2	13,6	18.4	16,9
1990	71.8	71,1	78.8	77,4	15.1	14,5	18.9	17,4
USA	**Mobility handicap-free life expectancy, 1965-1980 [3]**							
1965	66.8	65.2	73.7	71.4	12.9	12.1	16.2	14.9
1970	67.0	65.5	74.6	72.1	13.0	12.1	16.8	15.1
1980	70.1	68.4	77.6	74.6	14.2	13.2	18.4	16.3
USA	**Occupational handicap-free life expectancy, 1964-1985 [4]**							
1964	66.8	59.2	73.7	65.5	12.8	6.6	16.2	10.2
1974	68.1	59.2	75.8	65.3	13.4	7.2	17.5	10.7
1985	71.2	51.9	78.2	57.9	14.6	10.5	18.6	13.4
Japan	**Mobility handicap-free life expectancy, 1975-1990* [5]**							
1975	71.7	69.3	76.9	74.0	13.7	12.3	16.6	14.7
1980	73.4	70.9	78.8	75.9	14.6	13.2	17.7	15.8
1985	74.8	72.6	80.5	77.7	15.5	14.1	18.9	17.1
1990	75.9	74.2	81.9	78.7	16.2	14.9	20.0	17.3
Norway	**Chronic disease-free life expectancy, 1975-1985 [6]**							
1975	71,9	39,1	78,0	39,6	14.0	3,8	17.2	3,7
1985	72,6	38,9	79,0	37,9	14.3	3,8	18.2	3,7
Norway	**Independent life expectancy, 1975-1985 [6']**							
1975	-	-	-	-	14.0	13.3	17.2	16.1
1985	-	-	-	-	14.4	13.3	18.2	16.9
United Kingdom	**General handicap-free life expectancy, 1976-1991 [7]**							
1976	70.0	58.3	76.1	62.0	12.5	7.1	16.6	8.6
1981	71.1	58.7	77.1	61.0	13.1	7.9	17.1	8.5
1985	71.9	58.8	77.7	61.9	13.4	7.8	17.3	9.2
1988	72.4	58.5	78.1	61.2	13.7	7.5	17.6	8.7
1991	73.2	59.9	78.7	63.0	14.2	7.9	17.9	9.8
1992	73.7	59.7	79.2	61.9	14.5	7.9	18.3	9.5

Chronological series, continued

	At birth				At age 65			
	Male		Female		Male		Female	
Countries	LE	HE	LE	HE	LE	HE	LE	HE
United Kingdom	**Independent life expectancy, 1976-1991 [7']**							
1976	-	-	-	-	12.5	11.0	16.5	13.0
1980	-	-	-	-	12.9	11.8	16.9	15.0
1985	-	-	-	-	13.4	12.3	17.4	15.5
1991	-	-	-	-	14.3	13.6	18.1	16.9
Finland	**General handicap-free life expectancy, 1978-1986 [8]**							
1978	-	-	-	-	12.4	4.4	16.2	5.1
1986	-	-	-	-	13.4	4.3	17.4	5.6
Finland	**Healthy-life expectancy, 1978-1986 [8']**							
1978	-	-	-	-	12.4	8.2	16.2	9.7
1986	-	-	-	-	13.4	9.6	17.4	11.6
Australia	**Functional limitation-free life expectancy, 1981-1993 [9]**							
1981	71.4	59.2	78.4	65.0	13.9	7.9	18.1	10.1
1988	73.1	58.4	79.5	63.4	14.8	6.7	18.7	8.6
1993	75.0	58.4	80.9	64.2	15.7	6.5	19.5	9.1
Australia	**Severe handicap-free life expectancy, 1981-1993 [9']**							
1981	71.4	68,5	78.4	73,2	13.9	11,9	18.1	13,8
1988	73.1	69,9	79.5	73,5	14.8	12,6	18.7	13,7
1993	75.0	71,6	80.9	75,2	15.7	13,4	19.5	14,8
France	**Chronic disease-free life expectancy, 1981-1991 [10]**							
1981	70,4	48,3	78,6	49,1	-	-	-	-
1991	72,9	48,7	81,2	49,0	-	-	-	-
France	**General handicap-free life expectancy, 1981-1991 [11]**							
1981	70.4	60.8	78.6	65.9	14.1	8.8	18.3	9.8
1991	72.9	63.8	81.1	68.5	15.7	10.1	20.1	12.1
France	**Mobility handicap-free life expectancy, 1981-1991 [11']**							
1981	70.4	68.9	78.6	76.3	14.1	13.1	18.3	16.5
1991	72.9	71.7	81.1	78.8	15.7	14.8	20.1	18.1
Netherlands	**Healthy life expectancy, 1981-1990 [12]**							
1981	72.7	56.9	79.3	58.0	14.0	8.1	18.5	7.8
1982	72.8	56.0	79.4	58.9	14.0	7.1	18.5	8.6
1983	72.9	58.6	79.5	60.9	14.0	8.4	18.6	9.5
1984	73.0	58.3	79.6	59.8	14.0	7.9	18.7	8.6
1985	72.9	59.0	79.6	60.9	14.0	8.4	18.6	10.0
1986	73.2	59.8	79.7	60.7	14.1	8.4	18.8	9.4
1987	73.5	59.8	80.0	61.5	14.3	8.5	19.0	10.0
1988	73.6	60.3	80.2	61.8	14.4	8.6	19.0	9.3
1989	73.7	59.5	80.0	60.8	14.4	8.3	18.9	8.9
1990	73.9	60.0	80.1	60.2	14.4	9.3	19.0	9.1
Netherlands	**Activity restriction-free life expectancy, 1983-1990 [12']**							
1983	72.9	60.1	79.5	60.8	14.0	8.0	18.6	7.4
1984	73.0	56.9	79.6	54.6	14.0	7.7	18.7	5.7
1985	72.9	58.4	79.6	56.8	14.0	7.6	18.6	6.8
1989	73.7	61.1	80.0	60.3	14.3	9.1	18.9	7.5
1990	73.9	60.4	80.1	59.9	14.4	9.0	19.0	8.0

Chronological series, continued

Countries	At birth				At age 65			
	Male		Female		Male		Female	
	LE	HE	LE	HE	LE	HE	LE	HE
New Zealand	**Functional limitation-free life expectancy, 1983-1990 [13]**							
1981	-	-	-	-	13,3	9,9	17,1	10,5
1992-93	-	-	-	-	14,8	10,0	18,4	10,2
Canada	**Activity restriction-free life expectancy, 1986-1991 [14]**							
1986	73.0	61,3	79.8	64,9	14.9	8,1	19.2	9,4
1991	74.3	60,7	80.7	63,8	15.6	8,3	19.7	9,2
Canada	**Independent life expectancy, 1986-1991 [14']**							
1986	73.0	70,5	79.8	75,0	14.9	12,8	19.2	14,9
1991	74.3	71,5	80.7	75,8	15.6	13,3	19.7	15,4
Canada	**Health-adjusted life expectancy, 1986-1991 [14"]**							
1986	73.0	68.5	79.8	73.6	14.9	12.1	19.2	14.8
1991	74.3	69.1	80.7	73.8	15.6	12.6	19.7	15.1
Canada (Québec)	**Activity restriction-free life expectancy, 1987-1992 [15]**							
1987	72,3	64,0	79,8	68,2	14,4	10,6	19,1	12,7
1992	74,2	65,9	81,1	68,8	15,5	11,5	20,1	13,2
Canada (Québec)	**Independent life expectancy, 1987-1992 [15']**							
1987	72,3	70,4	79.8	76,3	14,4	13,0	19,1	16,0
1992	74,2	72,4	81,1	78,1	15,5	14,0	20,1	17,6
Spain,	**Healthy life expectancy, 1986-1991 [16]**							
1986	73.2	54.0	79.6	51.4	15.0	6.4	18.4	5.8
1991	73.3	54.5	80.5	53.3	15.4	6.9	19.2	7.1
Germany	**Healthy life expectancy, 1986-1995 [17]**							
1986	71.8	63.7	78.3	67.1	13.8	10.2	17.6	12.1
1989	72.5	-	79.0	-	14.2	-	18.0	-
1992	73.2	64.0	79.6	66.0	14.7	9.9	18.5	11.0
1995	73.8	62.4	80.0	64.2	14.9	9.4	18.7	10.5
Germany	**Occupational handicap-life expectancy, 1986-1995 [17']**							
1986	71.8	62.2	78.3	72.6	13.8	7.7	17.6	14.5
1989	72.5	62.7	79.0	73.1	14.2	7.8	18.0	14.8
1992	73.2	63.3	79.6	72.9	14.7	8.2	18.5	14.6
1995	73.8	64.2	80.0	73.2	14.9	8.7	18.7	14.6

* The Japanese series are made of the values for 1975, 1980, and 1985 [Nanjo and Shigematsu, 1987 ; Gunji and Hayashi, 1987]. We have added the value for 1990 computed by Inoue et al. [1997] as the data used seem comparable.

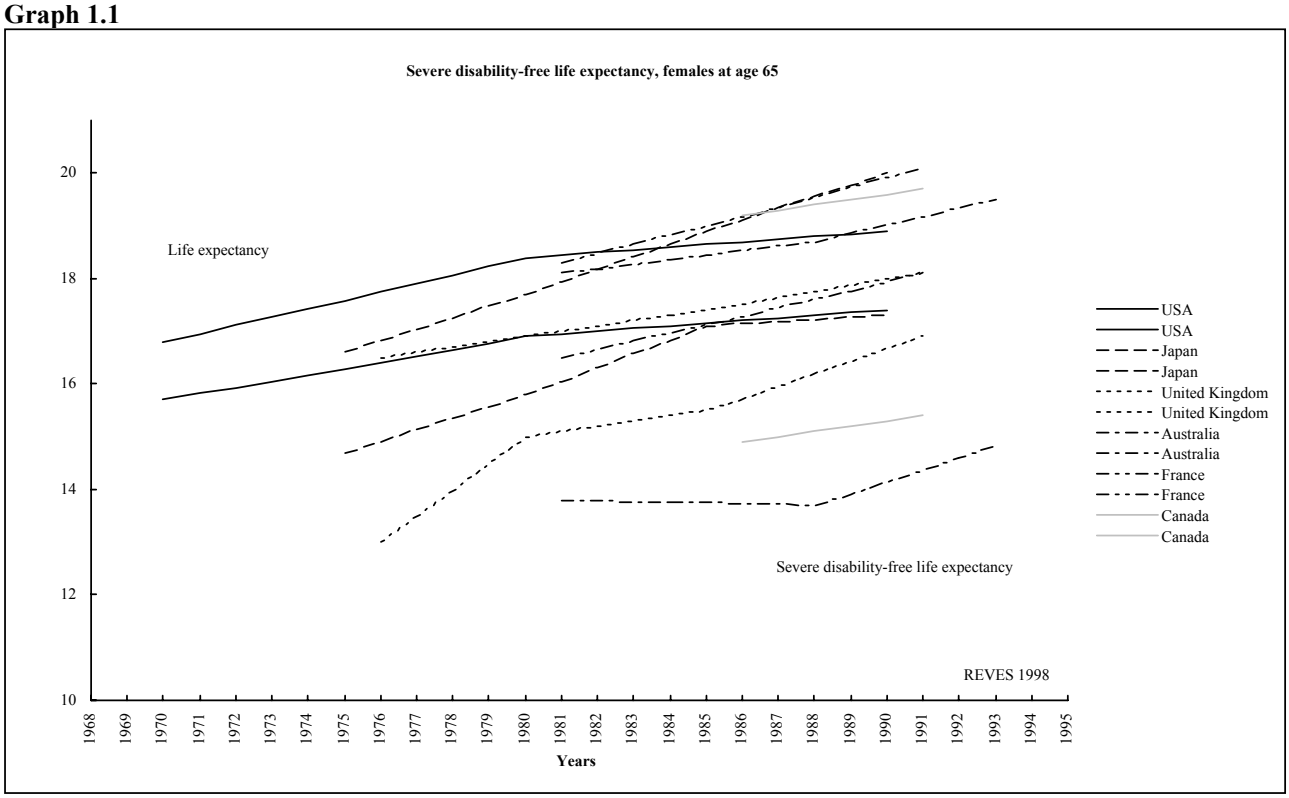
Author's denominations and sources:

[1] *Espérance de vie sans restriction d'activité*, Dillard, 1983
[2] *Expectation of life free of disability*, Crimmins et al., 1997
[2'] *Expectation of life free of institutionalization*, Crimmins et al., 1997
[3] *Expectation of life free of bed disability*, Crimmins et al., 1989
[4] *Life expectancy free of disability*, McKinlay et al., 1989
[5] *Life expectancy free of bed disability*, Inoue et al., 1997
[6] *Life expectancy without chronic disease*, Grotvedt and Viksand, 1994
[6'] *Life expectancy able to dress/undress etc*., Grotvedt and Viksand, 1994
[7] *Healthy life expectancy*, Bone et al., 1995
[7'] *Life expectancy with the ability to perform ADLs*, Bone et al., 1995
[8] *Life expectancy without limiting or extremely limiting long-standing illness*, Valkonen, 1994
[8'] *Life expectancy in good self-assessed health*, Valkonen, 1994
[9] *Disability-free life expectancy*, Mathers, 1991, 1996

[9'] *Severe handicap-free life expectancy*, Mathers, 1991, 1996
[10] *Espérance de vie sans maladie chronique*, Robine et al., 1996a
[11] *Espérance de vie sans incapacité*, Robine and Mormiche, 1994
[11'] *Espérance de vie sans incapacité sévère*, Robine and Mormiche, 1994
[12] *Healthy life expectancy*, Perenboom et al., 1993
[12'] *Disability-free life expectancy*, Perenboom et al., 1993
[13] *Life expectancy without problems using stairs*, Graham and Davis, 1997
[14] *Life Expectancy free of any disability*, Wilkins et al., 1994
[14'] *Life Expectancy free of severe disability*, Wilkins et al., 1994
[14''] *Disability-adjusted life expectancy*, Wilkins et al., 1994
[15] *Espérance de vie sans perte d'autonomie fonctionnelle*, Wilkins et al., 1995
[15'] *Espérance de vie sans perte d'autonomie fonctionnelle lourde*, Wilkins et al., 1995
[16] *Esperanza de vida en buena salud*, Regidor et al., 1995
[17] *Healthy life expectancy*, Brückner, 1997.
[17'] *Life expectancy free of severe handicap*, Brückner, 1997.

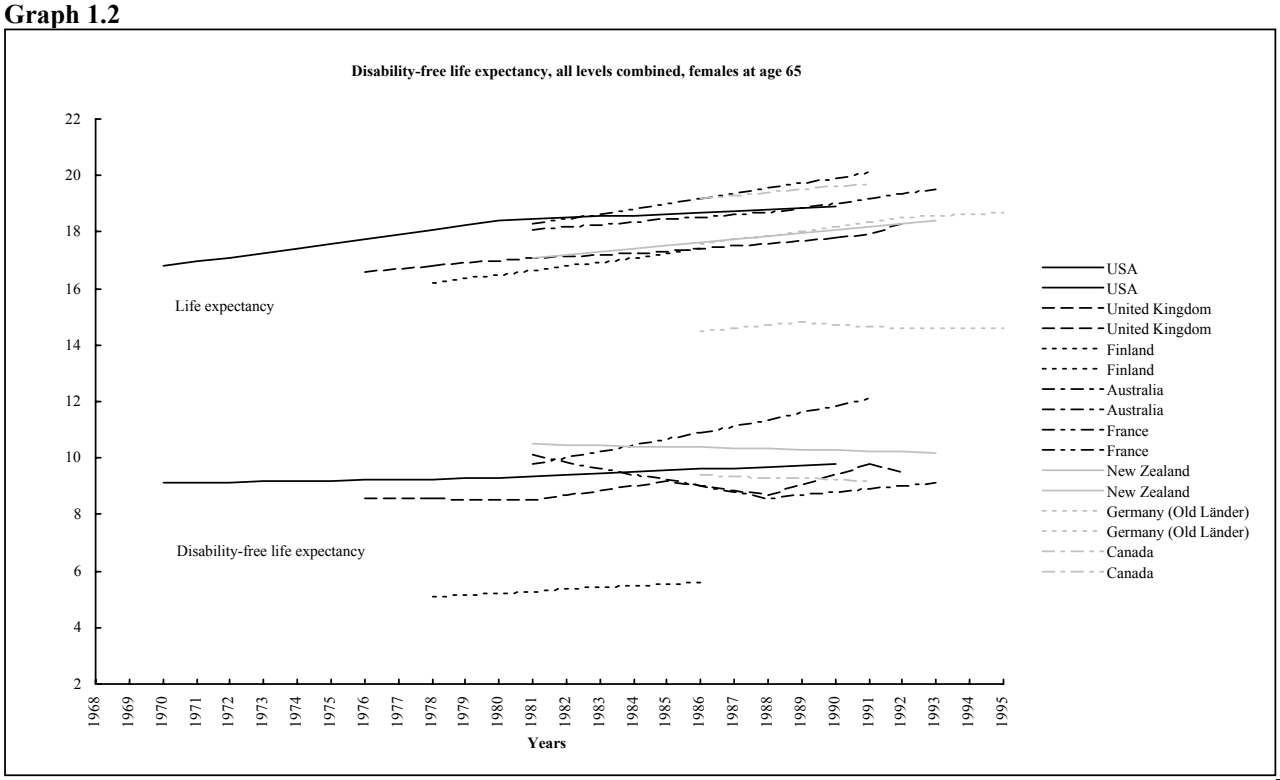
Graph 1: Evolution of life expectancy and life expectancy without *severe* disability or without disability *all levels combined* in various OECD countries, females at age 65.

Graph 1.1



Sources: Crimmins et al., 1989, 1997 ; Inoue et al., 1997 ; Bone et al., 1995 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Wilkins et al., 1994.

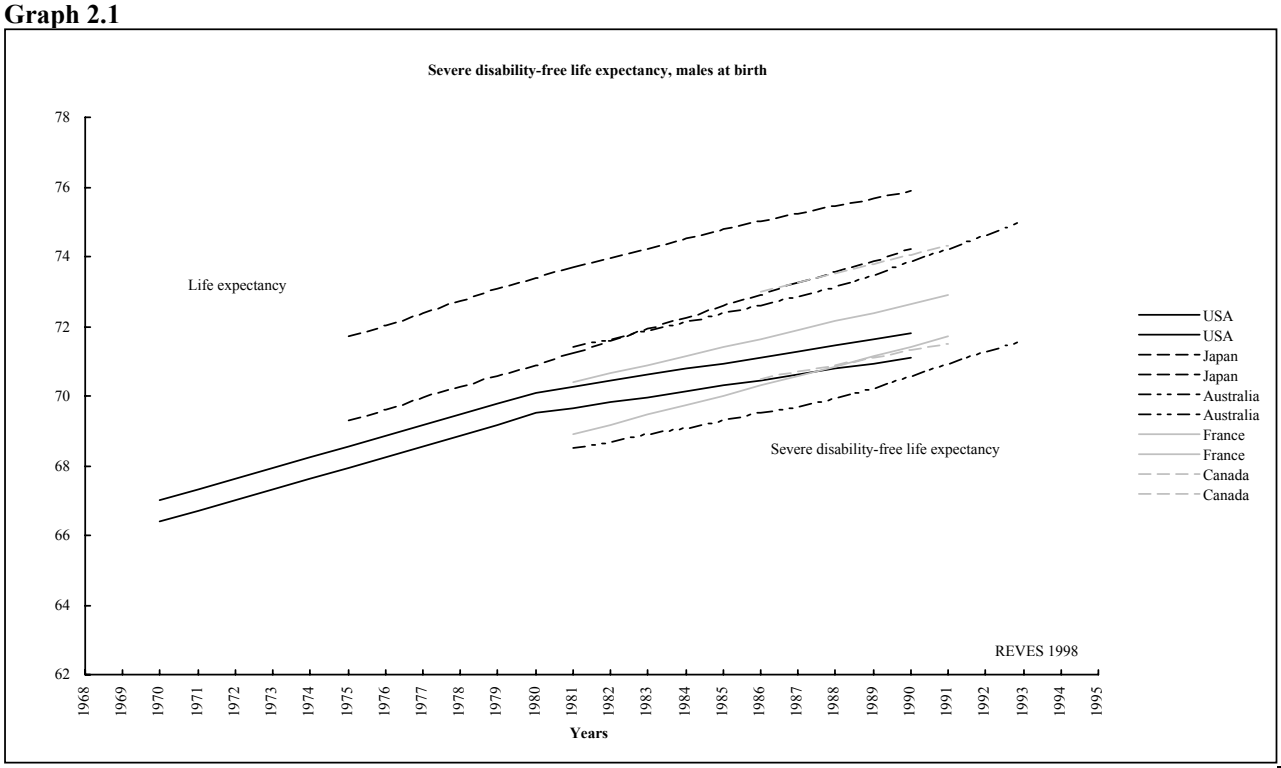
Graph 1.2



Sources: Crimmins et al., 1989, 1997 ; Bone et al., 1995 ; Sihvonen, 1994 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Davis and Graham, 1997 ; Brückner, 1997 ; Wilkins et al., 1994.

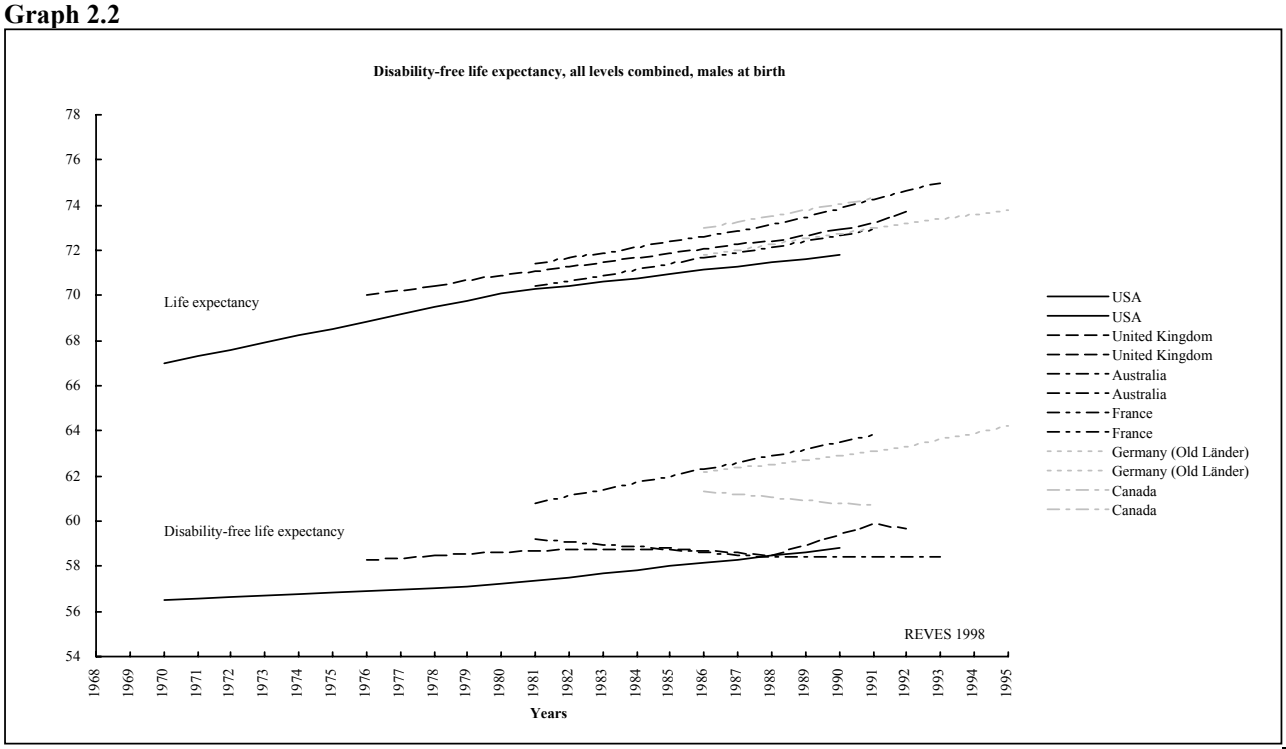
Graph 2: Evolution of life expectancy and life expectancy without *severe* disability or without disability *all levels combined* in various OECD countries, males at birth.

Graph 2.1



Sources: Crimmins et al., 1989, 1997 ; Inoue et al., 1997 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Wilkins et al., 1994.

Graph 2.2



Sources: Crimmins et al., 1989, 1997 ; Bone et al., 1995 ; Mathers, 1991, 1996 ; Robine and Mormiche, 1994 ; Brückner, 1997 ; Wilkins et al., 1994.