



**Life expectancy and morbidity in Europe
(AGIR project – WP 1 on “Bio-demography”)**

Background note for the Madrid Meeting (February 25th 2002)

Namkee Ahn, Ricard Gènova, José A. Herce and Joaquín Pereira

Madrid, February 19th 2002

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1. Introduction

Individuals, on average, live longer and better as time passes by and yet illness and disability continue to be present at varying rates what translates into shorter lives, from the perspective of a healthy and active life, than indicated by unadjusted life expectancies. Poor health and impaired ability have not only implications for direct well-being of individuals but also considerable importance for areas such as the welfare state, the budget, labour markets and productivity. It also poses a continuous challenge for health authorities. Nowhere as in this realm, the complex issues dealt with by researchers and practitioners in the bio-medical, clinical, public health, social policy and economics fields intertwine.

In parallel with all that individual behaviours, both induced by policy or spontaneous, compound the challenge that face those eager to establish the facts, the figures and the analysis on this wide area. That is, life courses, and the phases within them, have changed dramatically everywhere in the last decades, some times in seemingly contradictory directions, putting both individual and collective balances on difficult terms or unstable equilibria.

Demography, or rather, many of the phenomena conventionally studied by demographers, are simply the expression of the above mentioned developments and for any single discipline it is not easy at all to produce proper explanations of the observed trends. Either we lack interdisciplinary synthesis powerful enough or our approach is too biased and/or specialised.

Reckoning with this difficulties our task in this part of the AGIR project is to gather comprehensive data for European countries related to the above discussed issues, treat this data to be used by other AGIR teams and perform harmonised estimations of health adjusted life expectancies. We are focusing data sets where purely demographic indicators can be related to health and ability (or disability) and other personal characteristics of the individuals or populations studied. This endeavour is not entirely related to the wider set of questions a demographer or a bio-demographer would pose to himself (Carey and Judge, 2001), but certainly addresses some of them while also stepping on more conventional ones.

2. Overview of the related literature

We are interested in biodemography in as much as some of its definitions and methods provide insight for the prospective analysis of the economic consequences of ageing, namely, health and pensions expenditure and retirement decisions. We want in particular to

explore the fact that individuals live longer and in better shape in order to, on the one hand, ascertain the prospects for longer active lives and, on the other, to push the arguments in favour of policies influencing work/retirement, public programmes and health related behaviours in Europe. Past developments, of course, are also of primary interest for us.

This section is thus devoted to a very general discussion of the issues that recent bio-demographic research has brought to the forefront. We do not restrict ourselves to those aspects immediately related to our objective under WP 1. On the contrary we think that a wider perspective will help us to draw a broader and more useful picture of the implications of present demographic trends for the labour market or the welfare state.

2.1. Longevity and the limit to life

As a result of continuous developments in public health, medical technology and care delivery protocols, individuals, on average, live longer and in better health. These developments, per se, would not rise the observed limit of human lives, but are actually allowing more and more individuals to approach this limit and yet we can count the number of those that have reached 120 years by the fingers of our hands, no one so far, since records have been kept, having lived longer than 122 years (and 164 days, Jeanne Calment, dead in 1997). Whether genetic science developments would allow a significant portion of individuals to live longer than that limit is still a matter of discussion, but for some scholars the knowledge and the technology needed for that is already around. A matter of discussion is also, and indeed, whether a limit exist at all for human life. As for the present state of art on this issue, rather than an indefinite limit there would be an indeterminate or, simply said, unknown limit (Carey and Judge, 2001). Further increases of life expectancy depend mostly of lower mortality at very old ages (Vaupel, 2001).

Different terms bear strong relationship with the term longevity. In particular the terms “mortality” and “senescence”. Mortality is the portion of individuals of age x that die before reaching age $x+1$. For Carey and Judge, “...senescence is a product of natural selection in its competition between survival and reproduction” (Carey and Judge, 2001, p. 16) and accounts for the fact that mortality rates are related to (increase with) age. Evidence of lower mortality rates at older ages, among not only insects but also humans, puts into question the conventional definition of senescence and leads to think that there is no limit to the human life.

Longevity, finally, is the time span that separates birth and death of a given individual. It is currently measured through different indicators: (i) life expectancy at birth, or after 30 days or at other ages; (ii) life endurance, or age at which 90 per cent of individuals in a given cohort are death, or median duration, if 50 per cent limit is taken; (iii) modal life duration, or age of the modal frequency in the distribution of deaths in a given year; (iv) maximum duration of life, or record age; etc. These different measures of longevity, however, do not always move in the same direction. Life expectancy is currently preferred.

Human longevity has many determinants and, to a certain extent, is influenced by evolution (Carey and Judge, 2001). Leaving aside biological and physiological determinants of longevity, three groups of factors immediately determine longevity: (i) socio-economic factors (income, education), (ii) physical fitness, sport and nutrition, and (iii) alcohol and smoking. In addition, there seems to be a positive feed-back of higher longevity. As for genetically determined or hereditary longevity, fathers' age at conception is negatively correlated with daughters' longevity and fathers' longevity has a non linear positive relationship with children's longevity (Gavrilov and Gavrilova, 2001), but a general hereditary pattern of longevity does not clearly emerges from the literature or, if at all, it shows a rather weak case for it (Carey and Judge, 2001). Among other "established facts", that of females living longer than males has been shown not to be necessarily always the case (insects, humans centuries ago).

Increases in longevity, however measured, are the norm everywhere. Centenary people accounted for 5 in every million in 1960, in developed countries, and for 50 per million in 1990 (Kannisto, 1994). Since 1950, one can actually speak of an "explosion of centenarians", particularly females. Higher longevity would rather be due to compression of morbidity¹ (rectangularisation of the survival curves) (Robine, 2001) at older ages than to an extension of the absolute limit of life. Local concentration of life duration around an old age (increasing with time) is also compatible with an increasing age of modal mortality also due to a less perceptible compression of morbidity. The issue here is to show clearly that greater longevity correlates with concentration of the distribution of life duration around certain ages. It seems that after removing certain causes of death from the data that concentration does not occur, individuals simply live longer due to an overall improvement in morbidity.

¹ Morbidity relates to a general state of broadly defined health (or lack of health). See *infra* for a more precise definition of morbidity

2.2. Morbidity

Morbidity is a term difficult to define with precision that tries to capture the many dimensions of sickness (illness, disability, handicap and other states of bad-being –physical, social and mental) (Murray and Chen, 1992). Given that continuous change in policies, medical research and practice, public health and other factors produce simultaneous changes in morbidity and mortality, advances in those fields should lead to less morbidity and to lower overall mortality. However, changing self-perceptions of morbidity by individuals or better measurements in observed morbidity have produced divergent evolutions in morbidity and mortality through time leading some scholars to characterise cases of increases in morbidity as statistical artifacts.

On the other hand, the difficulty of disentangling the factors and biases behind the observed comovements in morbidity (either perceived or observed) and mortality makes even more difficult to properly characterise “health transitions” which without doubt have occurred in the past decades in both developed and developing countries. The nature of these health transitions is thus still unclear (Murray and Chen, 1992). Note that research on “epidemiologic transitions” (Omran, 1971) can produce rather clear-cut answers as for the varying causes of death at different ages with time, while research on “health transitions” (Murray and Chen, 1992) faces the much more challenging task of explaining changes in such an elusive concept as morbidity. In the words of Murray and Chen (1992), “*Health transition* is a ... concept ... meant to capture the changing pattern of morbidity and mortality, the socioeconomic determinants of such change, and the response of the health care system.”

As we cannot dismiss every case of increased morbidity as a mere artifact due to the fact that people is either more aware of their health status or are better diagnosed about it, we should accept that it is actually possible to live longer and have poorer health although the conventional wisdom states that individuals are, almost everywhere, living longer and better from a wide health perspective (lower or improved morbidity).

2.3. Life courses

As mortality declines and life expectancies at different ages increase, many other aspects of individual and collective life are affected by that. Changes in the duration, organisation and quality of life courses have important implications for the labour market and the welfare state, for instance, increasing the capacity of individuals to a better performance

in the labour market when adults or their dependency from the pension or the health systems when old.

Life courses, from an economical point of view, may be coarsely divided into three phases: (i) childhood and education, (ii) active life in the labour market and (iii) retirement. Of course, many other landmarks of an individual life (forming a household, parenthood, etc.) are relevant for interdisciplinary research, and even a significant proportion of individuals never transit through the labour market, but these three phases could capture these features adequately if we adopt proper conventions. Thus, for most of individuals, one can locate the episodes forming an independent household for the first time and having a first child at the transition between phases (i) and (ii). One could equally adopt a household perspective to cope with the fact that some of its members do not work at all, etc. Average ages for this transition have been steadily increasing in the last few decades in developed countries.

Morbidity considerations, on the other hand, have historically set the transition age between phases (ii) and (iii) at 60 to 65 years, and have even given rise to the welfare state, more than one hundred years ago. At present, after a process of declining morbidity in the last decades, these considerations do not determine any more retirement ages that otherwise should be increasing. However, declining morbidity at pre and post-retirement ages opens a new window of opportunities both for individuals and for the welfare state. On the other hand, morbidity at older ages, of a type rarely experienced in the past, pose new problems for the health system.

It is our intention to fully document the changing ages at which these transitions within life courses have taken place in the past for European countries as an starting point for our contribution to the AGIR project.

2.4. Disability-free life expectancy

Once some form of morbidity is taken into account the analysis of how individuals perform the different tasks associated to different phases of their entire life courses takes on different perspectives, other disciplines (sociology, psychology and economics in particular) may greatly benefit from an interdisciplinary approach. This is our case within WP 1 of the AGIR project.

Disability adjusted life expectancy (DALE) indices provide, among other purposes, a convenient way to combine morbidity and mortality measures into a single measure

(Sullivan, 1971). Of course, morbidity is defined here in a limited way as there are many “concepts of health” that could be used to define a correspondingly large set of adjusted life expectancies (Robine et al, 1999 and 2001). Chapter 4 below is devoted to a detailed discussion of this point.

3. Data sources

Several data sources useful for this project are available in different countries. We refer in what follows mostly to Spanish sources. Similar data may be available for other countries.

Population

Population by sex and age for each year 1950-2000 from censuses. Projection for 2001-2050 from the Spanish National Statistics Institute.

Mortality Table

Available since 1900, each 10 years until 1970 and each 5 years since then. The last mortality table available is for 1996.

Disability Survey

Availability: There are two cross-section surveys (the 1986 survey now available and the 1999 survey to be available in March) carried out by Spanish National Statistics Institute.

Sample size: Nationally representative 79,000 households and 220,000 individuals (1999 survey).

Contents: perceived health status, anthropometry, disability and limitations in daily activities, accidents, illness and diseases, life habits, use of health care services, access to and consumption of medicine, and some demographic and socioeconomic information.

National Health Survey

Availability: There are 4 cross-section surveys available so far (1987, 1993, 1995 and 1997), and the survey done in 2001 is expected to be available soon (June of 2002).

Sample size: about 38,000 persons in 1987, 26,100 in 1993, and 8,400 in 1995 and 1997 each.

Contents: Perceived health status and morbidity, accidents, illness and diseases, use of medicines and health care services, habits (tobacco, alcohol and physical exercise),

anthropometry, basic socio-demographic characteristics, and physical capacity for those 65 or older.

European Household Panel Survey

Availability: There are 4 longitudinal waves available so far (1994-1997), and further waves are expected to be available soon.

Sample size: 70,000 households (about 7,200 for Spain) for EU.

Contents: Perceived health status, few more questions about health incidence and the use of health care services, rich information on household and their members' socioeconomic situation.

General comments

Data: Agreement should be reached at the meeting on what kind of data (information) would be ideal for what the project intend to do, the computation of healthy life expectancy in our case, based on proposals by the FEDEA team. Then, we must assess how far away are the available data from the ideal ones. This will serve as, kind of, confidence interval of our estimated healthy life expectancy measures. For each country we will evaluate this "confidence interval" and it will be considered in interpreting the estimated results for each country.

Cross-country comparison: Given the lack of homogeneous data sources across countries in computing health adjusted life expectancy, European Household Panel Surveys, which are supposedly more homogeneous data sources across countries, could be useful in checking indirectly the validity of the estimated HALE of each country. The idea is to use the health related information in EHPS (such as self-reported health status) which is not sufficient to measure comprehensive HALE but can be used to counter-check the consistency of the estimated HALE with other health related measures.

Trend and Projection: As it is well known, there is an intrinsic problem in using cross-section age profiles to estimate life-cycle profiles of mortality and morbidity. This problem is a serious one if we were living in a transition period regarding both health related environment (health care technology as well as environment) and health related behaviour of the population. The greater will be the bias in our cross-section estimates the faster or more profound the ongoing transition is. This issue is particularly pertinent in cross-country comparisons where countries might be in different stages of health or other transitions. It

might be useful to think of how to incorporate trends instead of using blindly cross-section profiles. The examination of the past trend using the surveys in different (sufficiently apart) years and the generation of synthetic cohorts will be a rough guideline in considering future trend. We may use also available European Household Surveys. Although it contains limited information on health, the longitudinal nature of the Survey could be a promising complement to other data sources. For example, we may examine the transition patterns in individual health status (and other available health measures) over the observed period and their determinants. Furthermore, we are able to do it by many socioeconomic characteristics which might give us some ideas about the health status of the population in the future.

4. Health Expectancies

4.1. Introduction

Mortality measures have been commonly used as population health indicators. The main reasons for this being that death is an objective event, not susceptible to interpretations, and that most populations have mortality registries. Thus, crude mortality rate, life expectancy at birth or at any other age, cause specific mortality rates, infant mortality rate or maternal mortality rate, amongst other indicators, have been used to characterise populations health status. However, this means that population health is estimated based on information about the ultimate consequence of health deterioration, that is, based on information about complete lack of health (death).

Mortality reduction and the increase in life expectancy as seen in the demographic and epidemiological transition curve prompts the question on whether this evolution implies a parallel improvement on population health, or if there is a comparatively more rapid reduction of morbidity levels or, on the contrary, it is due to an increase survival with increasing proportions of disabilities or diseases, specially chronic and degenerative diseases: does an increase in the amount of life also implies an increase in the quality of life?

In order to study this evolution new indicators are needed. These should not limit themselves to the impact of mortality but also incorporate other population health measures; this, in turn, requires the use of new information sources.

We refer as “summary measures of population health” to a group of indicators which combine information about fatal and non fatal consequences of diseases and injuries in a single value (Murray et al., 2000).

4.2. Concepts and definitions

Health expectancies are summary measures of population health which estimate the mean time (in years) that a person can expect to live in a specific health state. Health expectancies is the generic term used for any life expectancy lived in a specific health state, which includes good health (i.e. disability free) or poor health (i.e. disabled).

The health expectancy concept was proposed for the first time in the sixties by Sanders (1964) and a few years later Sullivan (1971) calculated a life table based on them. Since the late eighties, an international group called “REVES” has developed and promoted the concepts and methodology for the calculation of these indicators which are currently widely calculated and used by different countries, specially in industrialized countries, for the evaluation of population health status (Mathers et al., 1993). In a wider perspective, the WHO (2000) presented disability adjusted life expectancy estimates for each of its 191 member countries for 1999. In his World Health Report 2001, Health Adjusted Life Expectancy was presented for these same countries for the year 2000 (WHO, 2001).

When using health expectancies, the years lived are not equally considered independently of the health state as it occurs when calculating life expectancy, but the distinction is made between years lived in perfect health and years lived with some type of health problem. Health expectancy indicators thus constitute an attractive instrument for the long term follow up of population health tendencies. They can be easily interpreted as an extension of the life expectancy concept.

However, for them to be really useful, these indicators must be comparable between populations and through time. This means, on one hand, to use homogenous concepts and definitions of health and, on the other hand, to use comparable tools to reach the information about the population health status. Then, a key issue in health expectancies determination is the need to define what is understood by health, in other words, under what criteria the health status of a population is established. It is not surprise thus that there are as many possible health expectancy measures as health concepts (Robine et al., 1999)

The calculation of health expectancies involves decision making about several key issues which will determine the type of indicator obtained:

- a) The use of period or cohort mortality tables. In order to estimate HE we previously need to construct a population mortality table from which we can obtain life expectancies. Period tables (cross sectional) are normally used.

- b) Incidence or Prevalence perspective. Incidence data give information about entries in a particular health state per time unit (normally a calendar year). However, since exhaustive incidence data for every disease and lesion is not available in any population, estimates and models must be used. If they can define transition probabilities between different health states (including remission and death) the multi state table methodology can be used to calculate HE.
- c) Definition and measurement of Health States. These indicators also differ amongst them according to the criteria used to define health states: disability, activity restriction, self perceived or declared health, etc. Information sources differ in each case and the results can vary markedly.
- d) Method for evaluating time lived in health states other than perfect health., Some indicators (DFLE, DLE) can only distinguish between two health states (with/without disability, with/without bad health). Other indicators, however, use a range of health states or disabilities (i.e. mild, moderate, severe). In this case, the number of years lived in each one of these situations is weight out according to different criteria (i.e. if a year lived in good health values 1, one year lived with severe disability could value 0,3) in order to obtain a single synthetic indicator. These are the adjusted HE (by disability, perceived health state, etc.).
- e) Inclusion of social values in the indicator. The same as age weights, discount rates etc.

Murray et al. (2000) have proposed a minimum set of properties that summary measures of population health should have. This set of properties could probably vary depending on what they are used for. The most appropriate summary health measure to compare health in a population through time may not be the most appropriate one for establishing the contribution of different diseases, injuries or risk factors to the loss of health in a population.

There exists a common and shared idea about the health state of a population from which one can establish that a population is healthier than another or that health in a specific population is improving or deteriorating. For example, if two populations are identical in all aspects except for the fact that infant mortality rate is higher in one of them, we could expect

to all agree in saying that the population with the lower infant mortality rate has a better health. Based on this consensus, Murray et al. (2000) set some simple criteria to evaluate the synthetic health measures:

- 1) If age specific mortality is lower at any age, everything else being equal, then a summary measure should be better. All health adjusted life expectancies fulfill this criteria.
- 2) If age specific prevalence is higher for some health state worse than ideal health, everything else being equal, a summary measure should be worse.
- 3) If age specific incidence of some health state worse than ideal health is higher, everything else being equal, a summary measure should be worse.
- 4) If age specific remission for some health state worse than ideal health is higher, everything else being equal, a summary measure should be better.
- 5) If the severity of specific health state increases, everything else being equal, a summary measure should be worse.

Health expectancies calculated with prevalence data using Sullivan's method fulfil criteria 1 and 2 but not 3 and 4. Health expectancies calculated with incidence data and using the multistate table method fulfil criteria 1, 3 and 4 but not criterion 2. Finally, criterion 5 is not fulfilled in indicators which follow a dichotomous criterion (Healthy Life expectancy and life expectancy with/without...) but is fulfilled in those using a polychotomous perspective (adjusted health expectancies) (Mathers, 1999).

4.3. Calculation method

The two most frequently used methods for calculating health expectancy measures are Sullivan's method and Multistate table method.

Sullivan's method uses disability prevalence data or population health status data to distinguish between hypothetical years of life lived with or without disability for a fictitious cohort derived from a period mortality table. Health expectancies obtained with this method depend on how disability prevalence data or health states data was interpreted, dichotomously (DFLE) or polychotomously (DALE). Their main limitations are: Comparability between populations (can only be partially achieved using common standardized models of protocols and questionnaires); the lack of information about the transition or reversibility of different health states or disabilities; and that they offer stock

information, that is, accumulated results of the consequences of incidence of diseases and injuries which haven't necessarily occurred the same year that the survey took place. Thus, a person who declares a moderate disability due to lameness could suffer it as a consequence of an accident which took place 10 years ago or the year of the survey. On the other hand, another individual can currently present that same disability as the consequence of a disease –i.e. poliomyelitis- which has been eradicated years ago in our population and therefore cannot be a cause of new cases of lameness.

The main advantages of Sullivan's method lie in the simplicity of the calculations and the relative easiness to find the required information: it only requires a mortality table and cross sectional prevalence information on the study population. Population mortality tables only require for their calculation age distribution of deaths and of population, which are usually available for every population and often for many years back. Life tables are published, or are easy to calculate from age specific mortality data. Prevalence data can be obtained easily from health or disability cross sectional surveys which are regularly performed in developed countries and in some cases data can even be obtained from some census questionnaires. Therefore, Sullivan's method has been the most widely used to estimate health expectancy measures (see in Table 1 HE calculated using Sullivan's method with Spanish data from the National Health Survey, 1997).

Table 1								
Use of Sullivan Method to calculate Health Expectancy in good perceived health and bad perceived health. Spain, 1997. Both sexes.								
Age	Life table			% persons in	Years with		Life expectancy with	
	lx	nlx	ex	Bad health	Bad health	Good health	Bad health	Good health
0-4	100,000	497,232	78.79	14.7%	73,093	424,139	23.8	55.0
5-14	99,371	992,918	74.28	7.2%	71,490	921,428	23.2	51.0
15-24	99,203	989,699	64.40	15.7%	155,383	834,316	22.6	41.8
25-44	98,695	1,952,508	54.70	19.1%	372,929	1,579,579	21.1	33.6
45-64	96,140	1,848,692	35.85	42.0%	776,451	1,072,242	17.8	18.1
65-74	86,196	795,833	18.53	56.3%	448,054	347,779	10.8	7.7
75 +	70,950	801,677	11.30	60.6%	485,816	315,861	6.8	4.5

Sources: Spanish National Health Survey 1997. Ministry of Health. Population projections 1991-2050. INE. MNP (Vital Statistics). Deaths by age. INE.

Multistate table methods are based on incidence rates of disability and death, but includes transitions between health states in both directions (i.e., disability incidence rates and disability remission rates). In principle, this type of tables can be calculated for any number of health states desired. This is the methodology that experts recommend for the

calculation of HE, but is not the most used at all. The called double decrement method can be interpreted as a special case of multistate table for two health states with null remission rates.

4.4. Typology of HE indicators

According to the criteria cited before (prevalence-incidence, dichotomous-policothomous, definition of health or disability), in the 7th REVES meeting (1994) a health expectancies indicator typology was presented and discussed, keeping in mind the concepts of the International Disease Classification, the International Disabilities, Deficiencies and Handicap Classification and in the different surveys which deal with perceived health. Based on this typology (we weren't still able to reach the original document) the proceedings of the WHO Kobe Centre (Japan) project on "Global health expectancy research among older people" design a list of indicators of health expectancy (Table 2).

Term	Definition	Techniques used
Health expectancy	The average number of years an individual is expected to live in a given health state if the current pattern of morbidity and health state continues to apply.	A statistical abstraction based either on age-specific death rates and age-specific prevalence of health states (Sullivan method) or on age-specific transition rates between health states (multistate life table method).
Health expectancies	Health expectancy refers to the entire class of indicators expressed in terms of life expectancy in a given health state. Health states may be defined in terms of impairment, disability, handicap and self-rated health or other concepts	A statistical abstraction based on age-specific death rates and age-specific prevalence rates of health states (Sullivan method) or age-specific transition rates between health states (multistate life table method).
Life expectancy	The average number of years an individual is expected to live if the current pattern of mortality continues. Life expectancy is the sum of health expectancies in each of a complete set of health states and health-adjusted states.	A statistical abstraction based on age-specific death rates and number of person-years lived (Lx) using life table technique.
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.	A statistical abstraction based either on existing age-specific death rates plus age-specific disability prevalence (Sullivan method) or on age-specific disability transition rates (multistate life table method).
Life expectancy with disability	The average number of years an individual is expected to live with disability if current patterns of mortality and disability continue to apply.	A statistical abstraction based either on existing age-specific death rates and age-specific disability prevalence (Sullivan method) or on age-specific disability transition rates (multistate life table method).

Table 2 (continued) A typology of HE indicators		
Term	Definition	Techniques used
Handicap-free life expectancy	The average number of years an individual is expected to live without handicap if current patterns of mortality and handicap continue.	A statistical abstraction based either on existing age-specific death rates and age-specific handicap prevalence (Sullivan method) or on age-specific handicap transition rates (multistate life table method).
Independent life expectancy	The average number of years an individual is expected to live without loss of independence if current patterns of mortality and handicap continue to apply.	A statistical abstraction based either on existing age-specific death rates and age-specific handicap prevalence (Sullivan method) or on age-specific handicap transition rates (multistate life table method).
Dementia-free life expectancy	The average number of years an individual is expected to live free of dementia if current patterns of mortality and impairment continue to apply.	A statistical abstraction based either on existing age-specific death rates and age-specific impairment prevalence (Sullivan method) or on age-specific impairment transition rates (multistate life table method).
Life expectancy with dementia	The average number of years an individual is expected to live with dementia if current patterns of mortality and impairment continue to apply.	A statistical abstraction based either on existing age-specific death rates and age-specific impairment prevalence (Sullivan method) or on age-specific impairment transition rates (multistate life table method).
Perceived health expectancy	Health expectancy calculated on the basis of population data on perceived health status (usually self-rated on a scale of excellent/good/fair/poor).	A statistical abstraction based on age-specific death rates and age-specific perceived health state (Sullivan method).
Health-adjusted life expectancy	Health-adjusted life expectancy is weighted expectation of life, summed over a complete set of health states. Weight for health states range from zero (dead) to one (optimum health).	A statistical abstraction based on health expectancies in a number of discrete health states and explicit weights for each of the health states.
Disability-adjusted life expectancy	Disability-adjusted life expectancy is weighted expectation of life summed over health states defined in terms of disability.	A statistical abstraction based on health expectancies in disabled health state and explicit weights used for the specific health state.

4.5. Sources.

As one can see in the list, so many indicators on HE are possible to calculate. Differences depend on definition of health measure, and on the kind of data. To compute HE the following information is needed:

- a) **Mortality.** Life tables (habitually period life tables). If there are not published life tables, population by age and sex and deaths by age and sex are required to calculate the life table.
- b) **Health** of which: b.1) **Prevalence** data. Most common data on health states or disability prevalence comes from Health Surveys (i.e. National Health

Surveys, carried out in many countries) or Disability Surveys (based on the definitions and recommendations of International Classification of Impairments, Disabilities and Handicaps (ICIDH) or the recently appeared International Classification of Functioning, Disability and Health (ICF)). Some countries have also health-related questions posed in their census questionnaire. There are more than one questions posed in these surveys potentially useful to calculate HE. So, from this sources you can get age-specific perceived health state prevalence (proportion of population by health status), age-specific disability prevalence (proportion of population with disability), age-specific handicap prevalence (proportion of population handicapped), and so on. And this prevalences are also often disaggregated by level or severity, and b.2) **Incidence** data. Incidence data on health comes mainly from disease registers or from longitudinal surveys. Longitudinal surveys are still quite rare in most of countries. On the other hand, there aren't registers for the whole of diseases or health problems. So, there are no complete incidence data for all diseases or health problems in any country. Most of times it implies to use the partial data, the information from other populations and from the literature to model the complete incidence health puzzle from a few of pieces. That is why health expectancies calculated with prevalence data are more frequent than with incidence data.

Table 3 presents a list of sources on national surveys of UE countries with disability-related questions included in their questionnaire (about health conditions and activity limitations). It is not an exhaustive list, anyway, but it is a good point of depart. The list is taken from: Gudex and Lafortune (2000). In their paper, for every survey of the list there is a brief description of survey and a table with the questions related to disability and health.

Table 3
Country/Title/Contact/Population/Data Collection
Austria: Microcensus survey on physical disabilities/Austrian Central Statistical Office/All population; includes institutions/1995.
Belgium: Health interview survey/Scientific Institute of Public Health/All population/1997 and 2001.
Denmark: Danish health and morbidity survey/Danish Institute for Clinical Epidemiology/Population 16+/ 1987, 1994, 2000.
Finland: Health behaviour among Finnish adult population/National Public Health Institute/Population 15-64/1999, 2000 (annual).
France: National health interview survey/INSEE/All population; excludes institutions/1970, 1980, 1991, 2001-2.
France National disability interview/INSEE/All population; includes institutions/1998-2001.
Germany: National health examination and interview survey/Robert Koch Institute/Population 18-79 yrs; excludes institutions/1998.
Ireland: National health and lifestyle survey/Department of Health and Children/Population 18+ yrs; excludes institutions/1998; every 3 yrs.
Italy: Survey of health/National Institute of Statistics/All population; excludes institutions/1999-2000; every 4 years.
Netherlands: Health interview survey/Statistics Netherlands /All Population; excludes Institutions/Annual.
Portugal: Health interview survey/Ministry of Health/All Population; excludes institutions/1998/9;every 3 yrs.
Spain: Survey on disability, impairment and health status/National Institute of Statistics/All population/1999
Sweden: Survey of living conditions/Statistics Sweden/Population 16-84 yrs/Annual.
England: Health Survey For England/Department of Health/2+ yrs; England only/1995, 1996 (annual).
United Kingdom: Labour Force Survey/Office for National Statistics/Population Men 16-64 yrs; women 16-59 yrs, GB + N.Ireland/1998/99 (annual).
Great Britain: Disability in Great Britain survey/Office for National Statistics/All population; excludes institutions/1996.

There are at least one source common for all countries of UE. The European Community Household Panel (ECHP) is a survey based on a standardised questionnaire that involves annual interviewing of a representative panel of households and individuals in each country, covering a wide range of topics: income, health, education, housing, demographics and employment characteristic, etc. The first wave of the ECHP was conducted in 1994 in the then 12 EU Member States. The survey was based on a sample of some 60 500 households (about 170 000 individuals). Since then, Austria and Finland have joined the project. From the fourth wave onwards, similar cross-sectional information extracted from administrative registers and the national Living Conditions survey will be available for Sweden. Its great advantage is that provides a source of comparable data for the countries of UE.

Main questions posed on health and disability in ECPH are: “How good is your health in general?” [very good/good/fair/bad/very bad/missing] and “Are you hampered in your

daily activities by any chronic, physical or mental health problem, illness or disability?" [yes, severely/yes, in some extent/no/missing]

The answers of the second one have been used by Robine et al. (2001) to calculate Disability-Free Life expectancies in the UE countries (1994 survey, 12 countries) with the Sullivan method and life tables supplied by Eurostat. The authors value the advantages of this source, but also point out some problems of this source (different versions of questionnaire, different rate of response, lack of institutionalised population in the sample).

4.6. Projections

Projections of mortality (i.e. life expectancy) are normally quite reliable. We have for most countries many information on total, age-sex specific and cause specific trends for long time series. Observed trajectories in the past and present situation are generally good predictors of future level of mortality. In any case, this information is a strong base to formulate hypothesis on future behaviour.

Projection of health expectancies is, however, more uncertain. At the present time there aren't for any country information systems sufficiently developed to be able to make consistent hypothesis of the future evolution on morbidity, disability or health status in terms of prediction or forecast, that is, fixing the probable path the reality will pass by. Projections of health expectancies must be based, nowadays, in a scenarios design. The more reasonable strategy, in this situation, is to base these scenarios in the available models of relation between mortality and morbidity: compression of morbidity, expansion of morbidity and dynamic equilibrium (Robine et al, 1996).

The compression of morbidity defines an scenario with decreasing proportions of disability or bad health status. Health improves more rapid than mortality, because there are insurmountable limits to improve the human life span (rectangularisation of mortality curve).

Expansion of morbidity defines an scenario with increasing proportions of disabilities or diseases, specially chronic and degenerative diseases: the increase of life expectancy is obtained in exchange for worse population health (specially older population). To avoid deaths implies a higher survivorship, but also to increase the prevalence of bad health states and disability.

The dynamic equilibrium scenario defends an evolution with a decrease of mortality and an increase of prevalence of chronic diseases, but with milder consequences in disability and health status.

To a great extent, the information about health required and gathered for each country will devote themselves to illustrate the fulfilment of any of this models, and then to feed the arguments of the health projection hypothesis.

Some scholars have found problems to use HE calculated with Sullivan method for projections purpose (Crimmins et al., 1993), or to study the evolution and changes in population health expectancies or, finally, for producing evidence about the compression or expansion models (Barendreg et al., 1997). Other authors are not so critical with Sullivan method (Mathers and Robine, 1997). In most cases, however, Sullivan's is the only chance.

5. Main questions

Although the discussions of the meeting will contribute to set the list of substantive questions to be addressed within WP1 and its output for other work packages, we list below those questions that after our review seem to us be central both within WP1 and as contributing to other WPs.

- Improvement of existing HALE computations for EU countries. What precise definition or definitions of morbidity (health concepts) are we going to use? What data are we going to use for that? How to ensure maximum comparability? Projections.
- Not to be forgotten: Comprehensive measurement of (unadjusted) longevity for EU countries for as many as possible years (see definitions in paragraph 3 of Section 2.1).
- Comprehensive population and mortality series
- Firm steps into the most comprehensive characterisation and measurement of morbidity that available data permits for as many EU countries and years as possible.
- Comprehensive documentation of life courses for the longest possible period and number of EU countries.
- What data, besides the above, should WP1 produce for other WPs?: (i) data for the analysis of retirement patterns (decisions) in EU countries (health-related heterogeneity of agents, health adjusted life expectancies at pre-retirement ages, morbidity at pre-retirement ages, etc., (ii) data for the analysis of health expenditure sustainability, (iii) data for the analysis of age-related productivity of labour (at pre-retirement ages)

- We propose to analyse retirement decisions on the basis of individual consumption/leisure choices where health heterogeneity should be present and idiosyncratic retirement ages be the outcome. This would help to enlighten the current debate about delaying retirement age across the board.
- We propose to analyse health expenditure sustainability taking into account some cost/benefit balance of policies to induce pro-health behaviours, or the evaluate these policies undertaken in different countries in the recent past once comprehensive data on health adjusted life expectancies is available from WP1.

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