Dementia-Free Life Expectancy in France

Karen Ritchie, PhD, Jean-Marie Robine, PhD, Luc Letenneur, PhD, and Jean-François Dartigues, PhD

ABSTRACT

Objectives. Increasing concern with the quality of gains in life years has led to the development of a new synthetic indicator of population health:health expectancy. Until now, calculations have been made for physical disabilities only. A first estimate of mental health expectancy is presented: dementia-free life expectancy.

Methods. Sullivan's method was used to calculate dementia-free life expectancy for a random representative sample of 4134 persons over 65 years of age in the Bordeaux region of France. The diagnosis of senile dementia was made in two stages, based on *Diagnostic and Statistical Manual of Mental Disorders* (DSM-III-R) criteria.

Results. At 65 years of age, a person's dementia-free life expectancy is 16.9 years within a total life-expectancy of 17.7 years; it decreases with age in parallel with the decrease in total life expectancy so that life expectancy with dementia stays constant at 0.8 years. Although dementia prevalence increases with age, if the prevalence is adjusted for mortality, the largest number of persons with dementia are in their early eighties. At each age women have a higher dementia-free life expectancy.

Conclusions. Trends in dementia-free life expectancy are similar to those found in disability-free life expectancy. Because the dementia prevalence rates used in this estimate resemble a general model derived from meta-analysis, it can be assumed that similar results will be found in other Western countries with similar mortality rates. (*Am J Public Health.* 1994;84:232–236)

Introduction

Perhaps one of the most striking recent changes in the field of public health has been the appreciation that health is more than survival and that health care policy should look beyond extending life to assess the impact of disease both on the individual's capacity to lead a normal life and on the society that cares for the individual. This change in emphasis, in conjunction with the observation that increases in life expectancy appear to be accompanied by increases in the prevalence of chronic disease and disability, has led to widespread interest in the concept and calculation of "healthy life expectancy." Studies of health expectancy examine changes in mortality in relation to the prevalence of physical disease and disability, thus addressing the question of whether the years we have gained as a result of preventive and therapeutic health programs are years of good or poor health.

A large number of health expectancy calculations have now been made in both developed and developing countries[1,2]; however, these have all focused on the measurement of physical disability. Mental disorder has received little attention, although a strong motivating force for calculations of health expectancy has been the theory of Kramer, who predicted in 1980 a "coming pandemic of mental disorders and associated chronic diseases and disabilities."[3] Kramer's work, which is principally based on the results of population studies of senile dementia and schizophrenia, clearly targets mental disorder as the primary area of concern. Although the entire range of mental disorders has yet to be explored in the context of health expectancy calculations, life expectancy free of senile dementia (referred to here as dementia-free life expectancy) is perhaps the most urgent, as the prevalence of dementia increases with age[4] and considerable concern has been expressed by health professionals that increased life expectancy, particularly among the oldest of the old, will lead to an epidemic of senile dementia by the end of the century.

In France as in other Western countries, approximately 50% of long-stay hospital beds are presently occupied by elderly persons with senile dementia. This condition involves progressive and irreversible deterioration of all cognitive functions, with rapid loss of autonomy and independence. The burden for both professional and family caregivers is considerable: the average length of survival from dementia onset is 8 years,[5] no specific medical treatment is presently available, and persons with dementia have increased susceptibility to a wide range of physical disorders.[6] Progressive loss of language accompanied by failure to recognize family and friends lead to rapid social exclusion. If the aim of health expectancy calculations is to determine the quality of gains in life expectancy, then age-related intellectual deterioration cannot be overlooked; it will affect not only the elderly person but also the person's caregivers, who themselves will be at increased risk of both physical and mental ill health.[7]

Karen Ritchie and Jean-Marie Robine are with the French National Institute of Health and Medical Research (INSERM), Montpellier, France. Luc Letenneur and Jean-François Dartigues are with the Université de Bordeaux, INSERM, Bordeaux, France.

Requests for reprints should be sent to Karen Ritchie, PhD, INSERM Equipe "Vieillissement Cognitif," Centre Val d'Aurelle, Parc Euromédecine, 34094 Montpellier Cedex 5 France.

This paper was accepted June 23, 1993.

Given that functional loss is one of the principal consequences of dementia, it is reasonable to question the value of measuring dementia-free life expectancy independently of life expectancy without physical disability. There are several reasons for making such a distinction. First, there is the extent of the loss; senile dementia involves a rapid and global loss of function, and the services provided to physically disabled persons are often inappropriate. Elderly persons with senile dementia not only have difficulty in carrying out tasks but may attempt to perform tasks at inappropriate times. Admissions to long-term care thus tend to be related less to degree of functional loss than to problems of supervision.[7,8] In addition, persons with senile dementia are unable to appreciate the implications of their disorder or make decisions concerning their own care. Health services must therefore assume not only the physical care but also the decision-making functions of the person.

It is the aim of the present paper to provide a first estimation of life expectancy without irreversible progressive intellectual deterioration, or dementia-free life expectancy. The calculation is made for the French population in 1990. The data and methods of calculation used are described in sufficient detail to permit researchers in other countries to replicate the calculations where similar data is available.

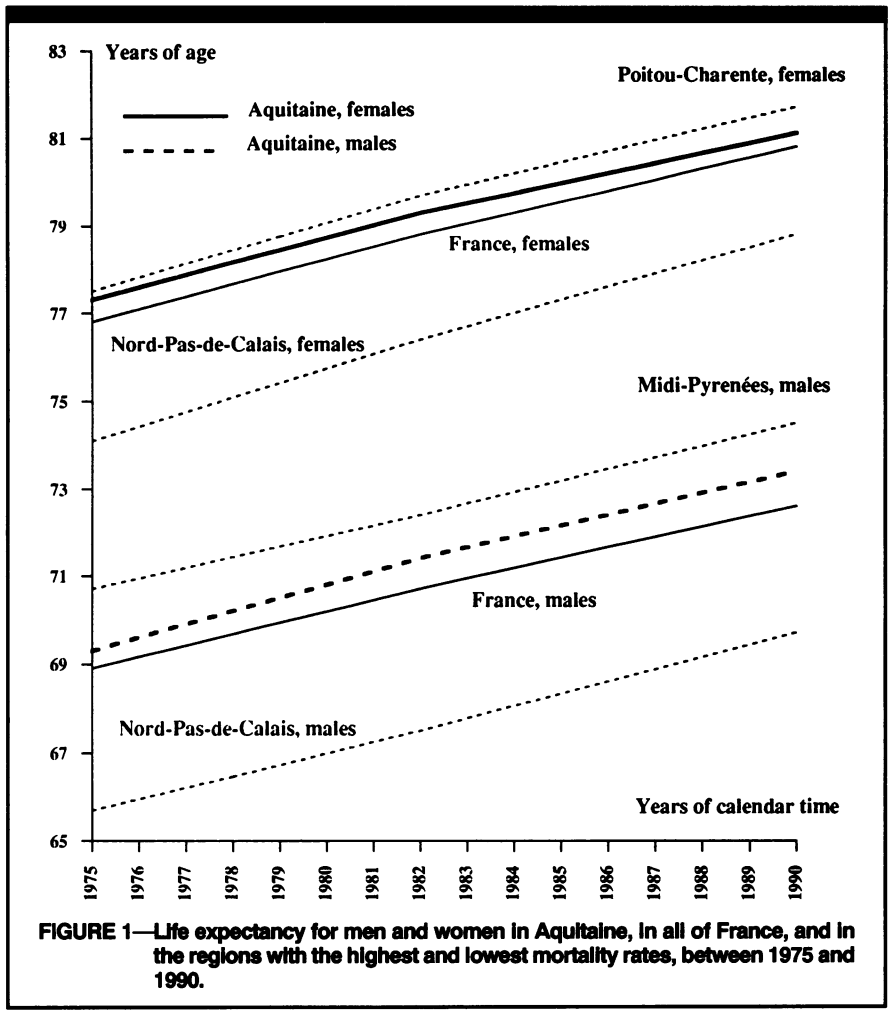

FIGURE 1—Life expectancy for men and women in Aquitaine, in all of France, and in the regions with the highest and lowest mortality rates, between 1975 and 1990.

Methods

Data Sources

Senile dementia prevalence data. Undoubtedly, the lack of interest in dementia-free life expectancy studies to date has been due largely to the difficulties inherent in the detection of senile dementia in the general population. These problems have been discussed in greater detail in relation to health expectancy studies in a previous communication.[9] The development of internationally recognized diagnostic criteria for senile dementia such as DSM-III-R[10] and ICD-9[11] have permitted epidemiologists since the 1980s to report relatively consistent prevalence rates for moderate to severe dementia of around 5% over age 65 across national boundaries.

There has, however, been considerable variation in the reported rates of mild dementia, which have ranged from 2.6% in Britain and Scandanavia[12] to 52.7% in Japan,[13] suggesting continued difficulty in the early recognition of the disorder. Epidemiological studies therefore tend at present to focus on moderate to severe dementia as the resultant prevalence estimates are more accurate and consistent than those for mild dementia. In a meta-analysis[4] of 13 general population studies conducted in Europe, the United States, Canada, and Asia, and employing internationally recognized diagnostic criteria of senile dementia, we were able to derive the following general logistic model of the relationship between age and prevalence:

$$\log_e(p) = -12.43(0.62) + 0.121(0.00785)\,\text{Age},$$

where $\log_e(p)$ represents the proportion of case. No significant differences were found among the 13 studies for either slopes or intercepts; studies using DSM-III-R criteria were found to provide the best fit.

The senile dementia prevalence data used for the present dementia-free life expectancy calculation come from a study of normal and pathological brain aging conducted in the Bordeaux region of France.[14] The project, known as PAQUID (Personnes Agées Quid), is a prospective study of a representative random sample from the electoral roll of 3777 persons older than 65 years living independently in two administrative departments of Aquitaine. The PAQUID study is supplemented by a random sample of 357 elderly persons living in institutions (the PAVIN [Personnes Agées Vivant en Institution] program). The institutionalized population is overrepresented, as the percentage of elderly persons living in institutions in the area is only 6%. A weighting system is therefore used in the calculation of prevalence rates to adjust for this overrepresentation. The samples are stratified by age, sex, and size of the community.

The diagnosis of dementia is made in two stages: systematic neuropsychometric screening of all subjects by a psychologist using DSM-III-R criteria, followed by confirmation of positive cases by a neurologist. The prevalence rates derived from this study show a good fit with the model derived from the meta-analysis, suggesting that the PAQUID–PAVIN data are consistent with rates reported

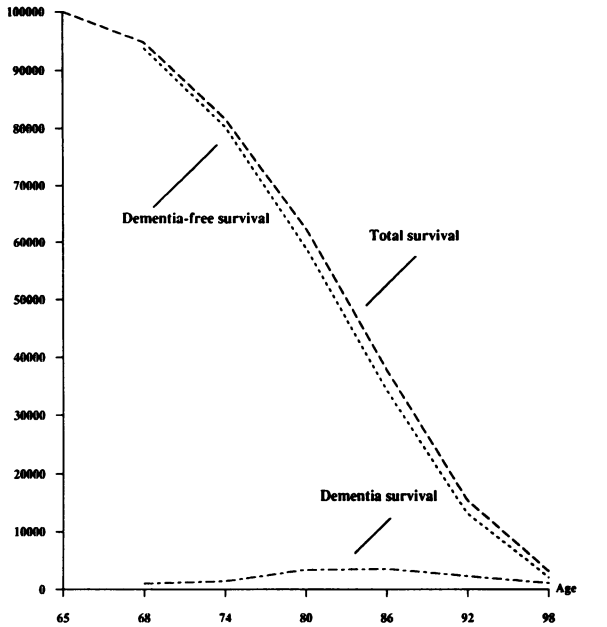

FIGURE 2—Proportion of dementia-free survivors and those with dementia, between the ages of 65 and 98 years, estimated for metropolitan France, 1988–1990 (both sexes combined).

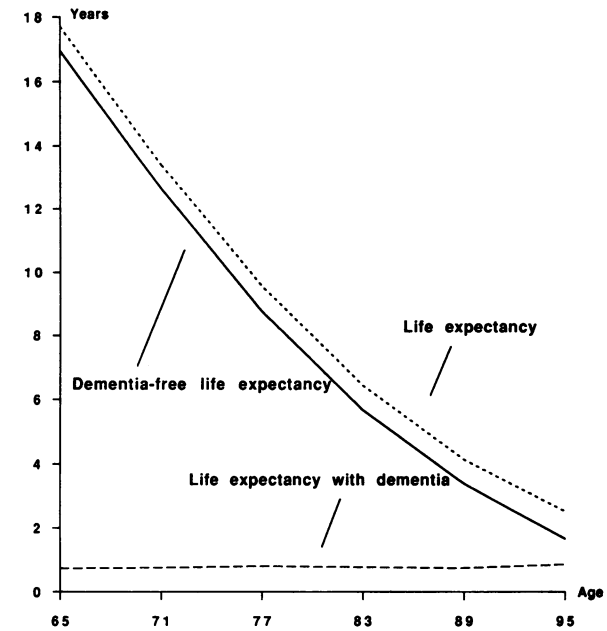

FIGURE 3—Dementia-free life expectancy for persons between the ages of 65 and 95 years, as calculated by Sullivan's method in comparison with total life expectancy and life expectancy with dementia, France, 1988–1990 (both sexes combined).

elsewhere. Although PAQUID and PAVIN are longitudinal studies, a complete data set is presently available only for the first year. These cross-sectional data were collected between January 1988 and October 1990. The prevalence estimates are for moderate to severe dementia; possible mild dementia has been excluded.

The observed percentage prevalence of senile dementia in Aquitaine is derived from the weighted combination of observations from PAQUID and PAVIN. The data were broken down by 6-year age groups because our previous meta-analysis indicated that senile dementia rates double every 6 years. The following prevalence rates were found (number of persons in each age group are given in parentheses for PAQUID/PAVIN): 1.06% between ages 65 and 70 years (953/35), 1.67% between ages 71 and 76 years (730/45), 5.41% between ages 77 and 82 years (659/77), 9.33% between ages 83 and 88 years (330/112), 15.01% between ages 89 and 94 years (97/71), and 34.13% between ages 95 and 100 years (11/16).

Mortality data. A life table for France for the years 1988 through 1990 for each year of age between 65 and 100 years for both sexes combined was provided by the National Institute for Statistics and Economic Studies.[15] After each census the Institute also publishes mortality data for each of the regions of France. Provisional life expectancies at birth are presently available for the years 1989 and 1990 combined[16,17]; from these data we were able to ascertain that life expectancy in the Aquitaine region is one of the highest in France, for both men and women. This is seen in Figure 1, which situates Aquitaine in relation to France as a whole and in relation to the regions with the lowest life expectancy (Nord-Pas-de-Calais) and the highest life expectancy (Poitou for women and Midi-Pyrenées for men).

If mortality rates remain stable, Aquitaine's current rates reflect the situation for the whole of France in about 3 years. For the purposes of this study, the Institute has also provided us with provisional mortality quotients for the Aquitaine region at 1-year intervals from 65 to 97 for both sexes combined calculated from the 1989 and 1990 data. Both national and regional mortality data are therefore combined with the regional senile dementia prevalence data. While it is desirable to combine mortality and morbidity data from the same region, the larger numbers obtained from the national estimates are likely to be less subject to sampling bias. We are also primarily interested in the calculation of national estimates. Mortality rates are summarized in a single figure, that of life expectancy at age 65 years (or mean duration of life after age 65 years). This is the mean of the ages at death of a fictitious generation of persons older than 65 years within the mortality conditions in France and Aquitaine.

Calculation Methods

Sullivan's method[18] has been chosen for the estimation of dementia-free life expectancy. It is the only method that permits the use of prevalence data in the calculation of health expectancies, a characteristic that accounts for the method's widespread use.[1] As a result of its popularity it is probably the method whose limits and biases are best understood. The principle behind Sullivan's method is very straightforward. From a period life table a calculation is made of the number of years lived between different ages by a fictitious cohort living all its life in the conditions of the period. Then the observed prevalence rates at each age or by age group are used to estimate the number of years lived with or without the specific morbid condition.

Results

For persons in metropolitan France aged 65 years between 1988 and 1990, life expectancy for both sexes combined is 17.7 years, giving a mean age at death of 82.7 years. The proportion of nondemented survivors after age 65 also decreases regularly in parallel with the number of survivors (see Figure 2). The

proportion of survivors is 75% at 76 years, 50% at 83 years, and 25% at 88 years; the proportion of nondemented survivors is estimated at 75% at 75 years, 50% at 82 years, and 25% at 87 years. There is thus a gap of just under a year for the entire length of the survival curve. The proportion of demented survivors in relation to the total number in the initial cohort increases from 1% at 68 years to reach a plateau of 3.5% at 80 through 86 years, then decreases steadily to 2.5% at 92 years and almost 1% at 98 years. This observation, illustrated in Figure 2, is due to a decrease with age due to mortality concurrent with the increase with age of the number of persons becoming demented. The maximum number of survivors in the population with dementia are found between the ages of 80 and 86 years (Figure 2); that is, the modal or largest number of persons with dementia are in their mid-80s. We might conclude from this that although the prevalence of dementia increases with age, when we adjust for mortality we see that the greatest burden in terms of health care provision will be for persons in their early 80s.

At 65 years dementia-free life expectancy is 16.9 years, within a total life expectancy of 17.7 years; at 77 years, dementia-free life expectancy is 8.7 years within a total life expectancy of 9.6 years; and at 89 years, it is 3.4 years within a total life expectancy of 4.2 years. As for the proportion of survivors, dementia-free life expectancy decreases regularly with age in parallel with the decrease in total life expectancy, with the rather curious result (see Figure 3) that life expectancy with dementia (not to be confused with average duration of survival of persons who become demented) does not vary with age after 65 years but stays constant at around 0.8 years. Between 65 and 95 years the survivors at each age have a continual expectation of living 0.8 years with dementia.

Life expectancy without dementia takes up 96% of life expectancy at 65 years, 91% at 77 years, and 81% at 89 years. At 95 years, life expectancy without dementia still represents only 67% of life expectancy, a figure that is probably artificially low owing to small numbers. This suggests that the proportion of life years spent in dementia grows with the number of years lived; however, the calculation of the regression line for each 6-year age group indicates that we would have to go beyond 170 years of age before dementia represented the totality of residual life expectancy. In other words, contrary to the fears commonly expressed by geriatricians, it is highly unlikely that all persons will be demented even at a very advanced age.

TABLE 1—Dementia-Free Life Expectancy and Dementia-Free Life Expectancy as a Proportion of Life Expectancy[a] from age 65, France, 1988–1990, and the Aquitaine Region, 1989–1990

Age, y	Dementia-Free Life Expectancy, y	Dementia Life Expectancy, y	Total Life Expectancy, y	Proportion of Life Expectancy Dementia-Free, %
Men, France				
65	14.8	0.6	15.4	96.4
71	11.0	0.6	11.5	95.2
77	7.6	0.6	8.2	92.6
83	5.0	0.6	5.6	89.4
89	3.1	0.6	3.7	84.5
95	2.3	0.0	2.3	100.0
Men, Aquitaine				
65	15.2	0.6	15.8	96.3
71	11.2	0.6	11.8	95.2
77	7.7	0.6	8.3	92.5
83	4.9	0.6	5.5	89.3
89	3.0	0.6	3.6	84.2
95	2.1	0.0	2.1	100.0
Women, France				
65	18.8	0.9	19.7	95.4
71	13.9	0.9	14.9	93.7
77	9.5	1.0	10.5	90.8
83	6.0	0.9	6.9	87.1
89	3.5	0.9	4.4	80.4
95	1.6	1.0	2.6	60.8
Women, Aquitaine				
65	19.1	0.9	20.1	95.3
71	14.2	1.0	15.1	93.6
77	9.7	1.0	10.7	90.9
83	6.1	0.9	7.0	87.2
89	3.5	0.8	4.3	80.8
95	1.4	0.9	2.3	60.8
Overall, France				
65	16.9	0.8	17.7	95.8
71	12.6	0.8	13.4	94.2
77	8.7	0.8	9.6	91.4
83	5.6	0.8	6.4	87.7
89	3.4	0.8	4.2	81.2
95	1.7	0.8	2.5	66.8
Overall, Aquitaine				
65	17.3	0.8	18.1	95.7
71	12.9	0.8	13.7	94.2
77	8.9	0.8	9.7	91.4
83	5.7	0.8	6.5	87.8
89	3.4	0.8	4.1	81.4
95	1.5	0.8	2.3	66.8

[a]As estimated by Sullivan's method.

Values of dementia-free life expectancy and dementia-free life expectancy as a proportion of life expectancy are given in Table 1 for ages 65 through 95 by 6-year age groups, for men and women and for both Aquitaine and France as a whole. As for disability-free life expectancy, it can be seen that at each age women have a higher dementia-free life expectancy. The results suggest that the gains in life years made by women will not be only years of dementia, nor will they be all years of good mental health; rather, women will experience the same mixture of good and poor mental health as men.

As noted above, current mortality conditions in Aquitaine appear to reflect the situation in France as a whole in about

3 years' time. If this is indeed the case then it may be predicted that there will be a future tendency in France toward an increase in dementia-free life expectancy at age 65, but that dementia-free life expectancy as a proportion of life expectancy will fall slightly (assuming dementia prevalence rates remain relatively stable).

Discussion

The calculation of dementia-free life expectancy represents a synthesis of progress made over the last 10 years in four fundamental areas of health science: (1) the elaboration of the concept of health to include quality of life and the impact of disease on society; (2) improvements in the diagnostic algorithms relating to dimensional chronic disabilities; (3) the development and validation of research instruments suitable for population research; and (4) the construction of synthetic indicators for the description of the global health status of populations.

From this study we are able to appreciate the global burden of senile dementia in Aquitaine in 1989/90, and probably for the whole of France in the coming years, given that dementia prevalence rates are not likely to differ significantly between Aquitaine and the rest of France. As the data provided by PAQUID and PAVIN closely resemble the general model of dementia prevalence derived from our previous meta-analysis of 13 recent studies, we can probably assume that the dementia-free life expectancy values found in this analysis will be approximately the same in other developed countries with similar mortality rates. The present analysis applies only to moderate and severe dementia. In public health terms, this is perhaps not too great a loss, as persons with mild dementia have only occasional difficulties that do not prevent them from living independently and the need for health service intervention for this group is negligible.

Conclusions

Like many other health expectancy studies, ours has of course been limited by the nature of the data available. As PAQUID and PAVIN are longitudinal studies, it will be possible in future years to calculate the computed period prevalence of dementia by which a fictitious cohort may be subject to the morbidity conditions occurring between consecutive rounds of the study (that is, incidence by age). As Brouard and Robine[19] have pointed out, this would provide a far more accurate estimation. The more recent calculation methods described in the literature have largely been developed to take into account the transience of disability and the multiplicity of outcomes possible. In the case of senile dementia this need is less pressing, as senile dementia is irreversible and no specific medical treatment is presently available. Furthermore, by directly combining disease prevalence with mortality, Sullivan's method implicitly takes into account the reversibility of health states.

As PAQUID and PAVIN also provide data on other aspects of health status (in particular activities of daily living and social support), future calculations may also provide estimates of life expectancy without social isolation and without loss of activities of daily living. Such estimates will permit the examination of their interrelationship with dementia-free life expectancy. Future calculations may also take possible etiological factors into account; for example, it may be possible to calculate dementia-free life expectancy for persons with different levels of education or with exposure to different risk factors. It is hoped that the present study will be used by other workers in the field of health evaluation to produce estimates of dementia-free life expectancy, thus providing a basis for international comparisons. □

Acknowledgments

The authors wish to thank Michel Isnard, INSEE, for providing them with recent and as yet unpublished mortality data for use in the calculations reported here.

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