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# Health expectancy calculations: a novel approach to studying population health in Bulgaria

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*The measurement of life expectancy in terms of either good or poor health is a novel approach to studying the health of the population in Bulgaria. The pilot study reported here — carried out among people aged  $\geq 60$  years in a middle-sized Bulgarian town — was designed to obtain information on the years of functional restrictions expected among the elderly. In accordance with the answers to a series of questions (recommended by WHO), subjects were categorized as disabled, handicapped, or having different states of perceived health. The indicators “disability-free life expectancy”, “handicap-free life expectancy” and “healthy life expectancy” (based on self-perceived health) were calculated according to Sullivan’s method. The results show, for example, that 8.0 of the 16.0 years that men aged 60 years may expect to live, on average, will be free of disability. For men aged 80 years the figures are 1.3 of 5.5 years. For women at 60 years and 80 years the results are 7.3 and 0.5 disability-free years of 19.2 and 7.3 expected life years, respectively. Similar results were found for handicap-free life expectancies and healthy life expectancies. At all ages, the proportion of life in a condition free of disability, free of handicap, or in perceived good health is substantially lower for women than for men. Women may expect to live longer, but a greater proportion of their life will be spent in poor health. The approach presented here for measuring the health status of the elderly may be helpful as an aid to planning medical and social care and for the development of public health policies.*

## Introduction

For many years, life expectancy in almost every country has slowly but steadily been increasing. On the other hand, a rise in chronic disease and disability, especially among the elderly, has also been observed in many countries. This gives rise to an important question: Does the observed increase in life expectancy concur with decreasing morbidity or are the additional years spent in a prolonged state of illness and dependency? In response to this question three theories have been proposed: there will be an increase in morbidity (1–3); a reduction in morbidity is achievable (4, 5); and finally there is the dynamic equilibrium theory, which assumes that the increase of morbidity caused by ageing in the population is balanced by better health in younger generations (6). Unfortunately, studying traditional indicators such as life expectancy and morbidity rates separately does not provide the answer because these measures

do not give a sufficiently integrated description of the health status of the population.

As a consequence, increasing efforts have been focused on constructing a novel health indicator that takes into account both mortality and morbidity. This concept of an integrated health indicator was first proposed by Sanders in 1964 (7). In 1971, Sullivan developed a simple computational technique for a “health expectancy index”, showing how many years people could expect to live in good health (8, 9). During the past decade, researchers in various countries have tried to measure health along these lines. In 1989, an international network on health expectancy and the disability process (*Réseau espérance de vie en santé*; REVES) was set up to interpret observed values of health expectancy and to promote the harmonization of calculations (10–12). Recently, a group from Bulgaria joined this network and — in close cooperation with it — is trying to clarify the situation in this country, thereby contributing to the process of international comparison of the development of population health.

## Materials and methods

With the intention of estimating health expectancy in Bulgaria, a pilot investigation was undertaken in

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December 1992 in the town of Svishtov. The study included non-institutionalized persons aged  $\geq 60$  years, in practice almost the complete population of that age. For each age group, a random sample was taken of about 30% of the total recorded in the population register. Data on the sample size are given in Table 1.

The sample drawn in Svishtov reasonably represents the demographic and social composition of the Bulgarian population, although the number in the highest age groups is slightly under-representative. While the total number of people we included in the investigation (1390) is quite high, it can still be regarded as a pilot study, since it is the first of its kind in Bulgaria.

At a meeting in Geneva in 1990, the REVES network agreed that the principal guidelines to be followed in constructing a health expectancy measure should be in accordance with the conceptual framework of the International Classification of Impairments, Disabilities and Handicaps (ICIDH) (13). Later, the network produced a classification system, based on ICIDH for different types of health expectancies (14, 15). The following types of health expectancy were calculated: disability-free life expectancy (DFLE); handicap-free life expectancy (HFLE); and healthy life expectancy (HLE), based on perceived health as experienced by the respondents.

The interviews were undertaken during house visits carried out by students specially trained for this purpose. Functional status was measured by the person's own assessment of independence or dependence in carrying out the basic activities of daily living. The questionnaire used in this study was constructed according to the recommendations of the WHO/Netherlands Central Bureau of Statistics (NCBS) consultation for developing common methods and instruments for health interview surveys (16). This questionnaire (see Table 2) covers the following aspects of functional status: perceived health, long-

term disability, short-term disability and handicap. The results for short-term disability are not presented here, because there are some indications that these questions (questions 2 and 3, Table 2) may have been misunderstood by a number of respondents.

Data about long-term disability — henceforth referred to as disability — were obtained from a 10-item indicator covering the following: locomotion, transfer, dressing, washing, feeding, toilette, continence, hearing and seeing (questions 7–16, Table 2).

Data used to measure handicap came from questions 4–6, Table 2, which dealt with mobility, and were classified as follows: light handicap (confined to house); moderate handicap (confined to chair); and severe handicap (confined to bed). The answers were weighted as proposed by the WHO/NCBS consultation group (16). This arbitrary weighting system indicates that one-third of the years with light handicap are regarded as being spent in poor health; for moderate handicap the corresponding proportion is two-thirds; and for severe handicap, the complete period is taken as spent in poor health.

Perceived health was determined as being poor for those respondents who replied that their general state of health was "fair", "bad" or "very bad" (question 1, Table 2).

Health expectancies were calculated using the method developed by Sullivan (7, 8). The point of departure was the abridged life tables for the Bulgarian population, by sex, as constructed for 1992, in particular the number of person-years lived in the various age intervals (" ${}_nL_x$ " column). For this study, only life expectancies for the age-group  $\geq 60$  years were relevant. The years lived in the various age intervals were divided into years spent in good and in poor health. The years with poor health are the product of the prevalence of poor health (calculated separately for disablement, handicap and perceived poor

Table 1: Population of Svishtov aged  $\geq 60$  years, by sex and age group, and the proportions of these groups that were included in the study sample

Age (years)	Population size:			% of population in sample:		
	Males	Females	Total	Males	Females	Total
60–64	666	741	1 407	25.1	38.6	32.2
65–69	562	641	1 203	32.4	37.4	35.1
70–74	312	407	719	41.7	35.4	38.1
75–79	143	230	373	27.3	30.9	29.5
80–84	106	155	261	39.6	31.6	34.9
$\geq 85$	69	103	172	26.1	21.4	23.3
Total	1 858	2 277	4 135	31.1	35.7	33.6

Table 2: Questions and response categories used in the functional status interview

Question	
1	How is your health in general?
2	Think about the 2 weeks ending yesterday. Have you cut down on any of the things you usually do about the house, at work or in your free time because of illness or injury? How many days was this in all during these 2 weeks? On how many of these days were you in bed for all or most of the day?
3	Think about the 2 weeks ending yesterday. Have you cut down on any of the things you usually do about the house, at work or in your free time because of an emotional or mental health problem? How many days was this in all during these 2 weeks? On how many of these days were you in bed for all or most of the day?
4	Are you permanently confined to bed, even though there may be help to get you up?
5	Do you sit in a chair (not a wheelchair) all day even though there may be help to walk?
6	Are you confined to your house?
7	What is the furthest you can walk on your own without stopping and without severe discomfort?
8	Can you get in and out of bed on your own?
9	Can you get in and out of a chair on your own?
10	Can you dress and undress on your own?
11	Can you wash your hands and face on your own?
12	Can you feed yourself, including cutting up food?
13	Can you get to and use the toilet on your own?
14	Do you ever lose control of your bladder?
15	Is your hearing good enough to follow TV programmes at a volume others find acceptable? If not, can you follow TV programmes with the volume turned up?
16	Can you see well enough to recognize a friend at a distance of 4 m (across a road)? If not, can you see enough to recognize a friend at a distance of 1 m (at arm's length)?
Response categories to questions:	
1	Very good, good, fair, bad, very bad
2-6	Yes/no, number of days
7	Only a few steps, more than a few steps but less than 200 m, 200 m or more
8-13	Without difficulty, with some difficulty, only with some help
14	No/yes: at least once a week, less than once a week, at least once a month, less than once a month
15-16	Yes/no

health) and the years lived in the various age groups. In this way a new series of  ${}_nL_x$ -values was generated, which can be used to construct new life tables showing the number of years that people can be expected to live with disability, handicap or perceived poor health, respectively. The number of years in good health is obtained by subtracting the number of years in poor health from the total life expectancy.

## Results

The response to the questionnaire was almost 100%. Only 12 respondents refused to answer some of the questions and these individuals were eliminated from the data set.

Data on the expectation of life in the various states of health obtained from the survey are shown in Table 3 and Fig. 1. Table 3 presents further life expectancy (LE), DFLE, HFLE, and HLE. For each of these types of health expectancy, the so-called "healthy life percentages" are also given, which show the proportion of life that may be expected to be spent free of disability (DFLP), free of handicap (HFLP), and in good health (HLP).

The results show that men at all the ages investigated have a lower expectation of life than women.

At age 60 years, women may expect to live on average 3.2 years longer than men. This excess decreases with age and is practically insignificant at  $\geq 85$  years of age. This contrasts markedly with the results for DFLE: in this instance, at all ages, women have a lower expectation of life free of disability than men. For example, at 60 years of age men may expect to live, on average, for a further 16.0 years, of which 8.0 years will be spent free of disability. Women at 60 years have an average life expectancy of 19.3 years, of which 7.3 years will be spent without disability. The DFLE of 0 years for females aged  $\geq 85$  years should be regarded with some reservation, since the number of respondents sampled in this age group was rather small. The differences between the two sexes are even more prominent in respect of healthy life percentages. For all age groups, the proportion of life spent in a disability-free condition is substantially lower for women than for men. Women may on average live longer, but a greater proportion of their life is spent in disablement. For both males and females, HLP decreases with age.

For both sexes, the number of years with handicap are substantially fewer than those with disability (Fig. 1). HFLE is therefore much higher than DFLE: at 60 years of age it is 14.1 years for men and 15.4 years for women. Although women in the first three

Table 3: Life expectancy (LE), disability-free life expectancy (DFLE), handicap-free life expectancy (HFLE), healthy life expectancy (HLE) and the respective healthy life percentages (DFLP, HFLP and HLP),<sup>a</sup> by sex and age, Svishtov, Bulgaria, 1992

Sex/age (years)	LE (years)	DFLE:		HFLE:		HLE:	
		Years	DFLP	Years	HFLP	Years	HLP
<b>Males</b>							
60	16.0	8.0	49.7	14.1	88.2	6.9	43.0
65	12.8	5.6	43.5	10.9	84.6	5.2	40.4
70	10.0	3.3	33.2	8.2	81.2	3.5	35.1
75	7.6	2.3	29.8	5.8	76.9	2.3	30.8
80	5.5	1.3	22.7	3.9	70.8	1.4	24.9
≥85	4.0	0.4	11.1	2.2	55.6	0.9	22.2
<b>Females</b>							
60	19.2	7.3	38.3	15.4	80.4	6.2	32.6
65	15.2	4.7	30.9	11.7	76.6	4.1	26.7
70	11.7	2.5	21.6	8.3	70.9	2.5	21.6
75	8.6	1.1	12.3	5.6	65.6	1.6	18.9
80	6.1	0.5	7.7	3.5	56.7	0.9	15.3
≥85	4.2	0.0	0.0	1.9	45.5	0.6	13.6

<sup>a</sup> Calculated with LE, DFLE, HFLE and HLE values before rounding off.

age groups presented have a higher HFLE than men, the proportion of life without handicap is lower (see HFLP in the HFLE column in Table 3).

The results based on the perception of individuals of their own health are notable. Fig. 2 presents the years expected in perceived good health and the

years lived without disability for men and women. Both indicators are comparatively similar for both sexes, although below 70 years of age people are somewhat less optimistic and over 70 years of age somewhat more optimistic about perceived health compared with DFLE.

Fig. 1. Life expectancy (LE) and expected years without disability, with disability, and with handicap (and disability) for a) males and b) females, Svishtov, Bulgaria, 1992.

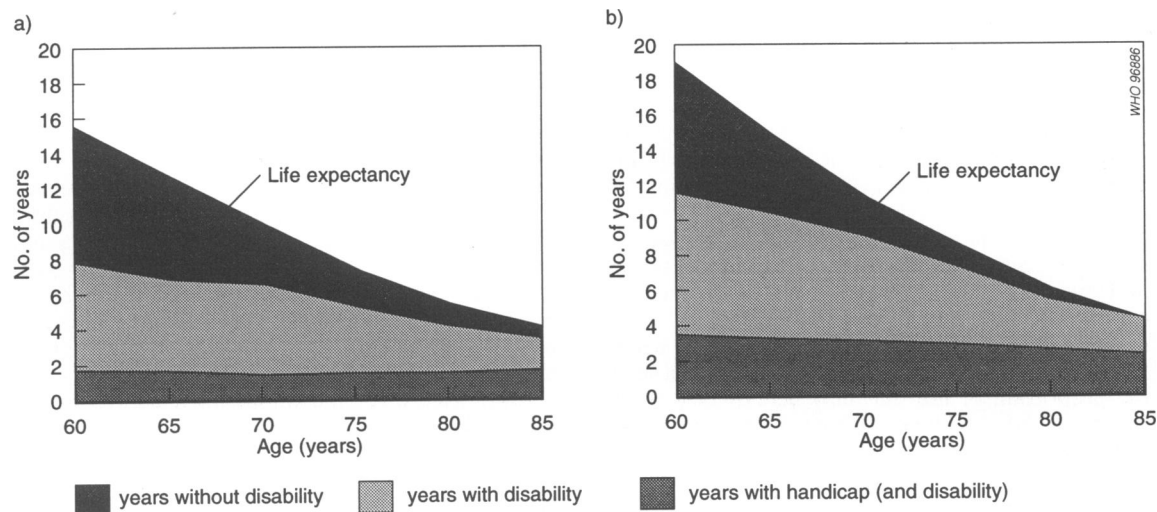
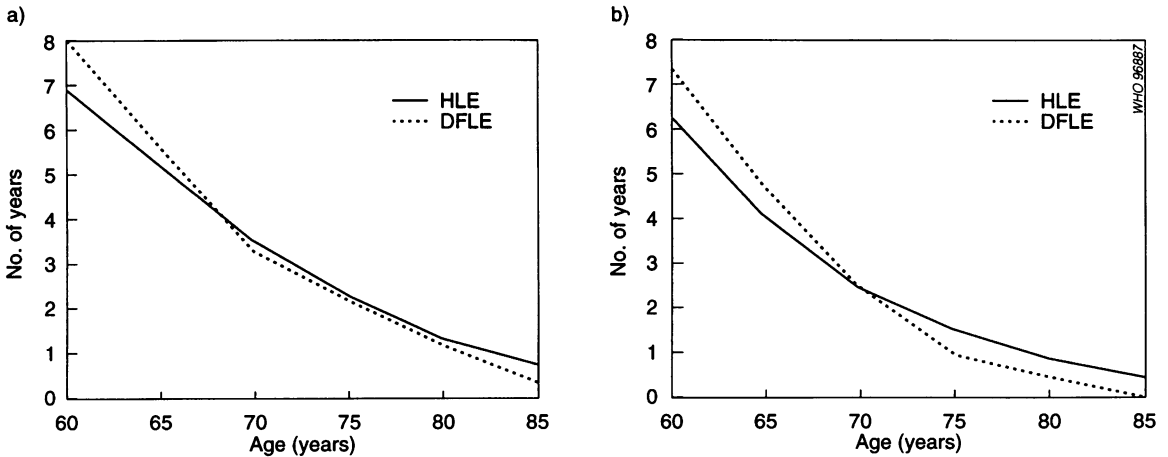


Fig. 2. Healthy life expectancy (HLE), calculated from data on perceived health, and disability-free life expectancy (DFLE) for a) males and b) females, Svishtov, Bulgaria, 1992.



## Discussion

This study was a pilot investigation limited to a single middle-sized Bulgarian town, which although demographically and socially reasonably close to the average cannot be taken as completely representative of the whole country. Nevertheless, the results give an indication of the health of the population in Bulgaria, as measured by the health expectancy indicator. In this respect, the study can be seen as a milestone. Although of limited proportion, it is the first health interview survey to be carried out in Bulgaria and as far as we are aware, the first health expectancy calculations carried out in Eastern Europe.

In the main, the results do not differ much from those found for other countries. A socially very important finding is the difference between males and females. Although women have higher life expectancies, their expected healthy proportion of life is significantly lower than that of men, a finding which has been observed in many other countries (14, 15, 17).

A substantially greater number of years are free of handicap than free of disability. This is as expected and is in accordance with the definitions of disability and handicap in ICIDH, and arises partly because not all disabilities lead to handicap. In addition, the measurement of handicap in this study was restricted to three cases only (confinement to house, chair, and/or bed). In addition, a weighting system for the severity of the handicaps was applied, which is reflected in our results. According to this system,

being lightly or moderately handicapped for 1 year does not result in the loss of a full year of health, but in only one-third or two-thirds of a year, respectively. That women of all age groups are expected to live, on average, about twice as long in a handicapped state as men arises to some extent because women live longer, but is also due to the higher prevalence of handicaps among women.

A close similarity between the outcomes for DFLE and HLE has also been reported for the Netherlands (17). Use of only this one question about perceived health may therefore be meaningful in situations where administration of a complete questionnaire is not feasible. This would probably give a reasonable first impression about the number of years spent with disability, i.e. long-term disability. However, as the time spent with short-term disability is generally very small compared to that with long-term disability, there would probably also have been a fairly close resemblance between HLE and DFLE had it been possible to include short-term disability data in the calculations.

The pilot study presented here was of a cross-sectional design. The number of respondents in the highest age groups was rather small: for the group of females aged  $\geq 85$  years, for example, all respondents appeared to be disabled, which should not be generalized for the Bulgarian population. Caution should therefore be exercised in drawing too many conclusions from this study. In future, oversampling the older age groups seems appropriate, as has already been carried out in the second phase of the

Svishtov study, in December 1993. A third phase is being planned. With such a set of cross-sectional investigations, it will, in principle, be feasible to undertake a trend analysis. The Sullivan method could be used for such a trend study provided the changes in mortality and incidences are moderate and gradual (18). Studies such as this — although on a larger scale and more representative of the overall situation in Bulgaria — appear to be an interesting approach to assessing population health in Bulgaria particularly at the present time of transition to a new market system. The indicator “health expectancy” may help in monitoring the changes in population health that result from the interaction of changing mortality and morbidity patterns, in the consequent formulation of health policies, and in a better planning of facilities for health and social care.

## Conclusion

This article describes the results of the first pilot health interview survey and the subsequent calculation of health expectancies in Bulgaria. The scope of the investigation was limited to one single middle-sized town and to people aged  $\geq 60$  years; it therefore is not representative of the whole country. Nevertheless, the results provide a broad outline and serve as a basis for further research.

The results obtained do not differ substantially from those in other countries. The difference between healthy life expectancy for men and women is important. Women can expect to live longer but to enjoy a smaller proportion of good health than men. As might be expected, the HFLE found was much larger than the DFLE; results for DFLE and HLE were similar.

Using the methodology presented here, a series of health expectancy calculations based on a nationwide health interview survey might be of great assistance in providing a description of public health in Bulgaria and also for formulating adequate public health and social policies. The health expectancy indicator seems a promising approach for a more precise assessment and monitoring of the health of the population during the current socioeconomic transition in Bulgaria.

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## Résumé

### Le calcul de l'espérance de vie: un nouveau mode d'approche de l'étude de la santé de la population en Bulgarie

La mesure de l'espérance de vie en termes de bonne ou de mauvaise santé correspond à un nouveau mode d'approche de l'étude de la santé de la population en Bulgarie. L'étude pilote dont il est question ici — réalisée parmi la population des 60 ans d'une ville bulgare de dimensions moyennes — avait pour but d'obtenir des informations sur les années de limitation des capacités fonctionnelles à envisager chez les personnes âgées. Selon leurs réponses à une série de questions (recommandées par l'OMS), les sujets ont été classés en atteints d'incapacités, handicapés ou à différents états de santé apparents. Les indicateurs “espérance de vie sans incapacité”, “espérance de vie sans handicap” et “espérance de vie en bonne santé” (basés sur l'état de santé subjectivement apprécié) étaient calculés d'après la méthode Sullivan. Les résultats montrent, par exemple, que 8,0 des 16,0 années d'espérance de vie moyenne chez les hommes de 60 ans seront exemptes d'incapacités. Chez les hommes de 80 ans, ces chiffres sont de 1,3 et 5,5 années. Pour les femmes des mêmes âges, les résultats sont de 7,3 et 0,5 années sans incapacités pour une espérance de vie de 19,2 et 7,3 années respectivement. On obtient des résultats similaires pour l'espérance de vie sans handicap et l'espérance de vie en bonne santé. A tous âges, la proportion de sujets sans incapacité, sans handicap, ou en bonne santé apparente est nettement moins élevée chez les femmes que chez les hommes. Les femmes vivent en principe plus longtemps mais souffrent d'un mauvais état de santé pendant une plus grande partie de leur vie. La démarche présentée ici pour mesurer l'état de santé des personnes âgées peut être utile pour mieux planifier les soins médicaux et sociaux ainsi que pour définir des politiques de santé publique.

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