

Life Expectancy without Chronic Morbidity: Trends in Gender and Socioeconomic Disparities

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SYNOPSIS

Objective. Life expectancy without chronic morbidity, or morbidity-free life expectancy (MFLE), was calculated to measure changes in population health status between 1989 and 2000 on the basis of gender and socioeconomic status.

Methods. Sullivan's method was used to calculate morbidity-free life expectancy. Prevalence rates for chronic morbidity were derived from the Netherlands Continuous Health Interview Survey. Four socioeconomic groups were distinguished on the basis of educational level.

Results. Between 1989 and 2000, total life expectancy increased for males and females and for all socioeconomic groups. Morbidity-free life expectancy decreased significantly for males (from 54.7 years to 53.9 years) and females (from 55.3 years to 51.0 years). The gap between males and females in MFLE has reversed, from 0.6 years in favor of females in 1989 to 2.9 years in favor of males in 2000. The gap between the upper and lower classes seems to have narrowed (for males from 11 years to 8.5 years and for females from 4.7 years to 4.0 years).

Conclusions. The results indicate that morbidity-free life expectancy is falling for males and females and in all socioeconomic groups. Part of this decrease could be attributed to earlier diagnosis of chronic diseases. A widening gap in MFLE was observed between males and females in favor of males. The gap between the upper and lower socioeconomic groups seems to be narrowing.

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The aging of the Western population inevitably results in an increase in age-related chronic diseases. This increase is not solely due to demographic changes. A shift in risk factors (lifestyle) to younger ages, as well as earlier diagnosis of chronic diseases, leads to an increase in the registered incidence of diseases. Improved health care interventions, resulting in improvements in survival rates, lead to increasing prevalence rates.¹ For instance, an increase in the incidence and prevalence of diabetes mellitus has been reported as a result of better diagnostics and of improved survival.² An increase in the prevalence of asthma in children has also been reported.³ The rise in non-fatal chronic diseases means that total life expectancy is not sensitive enough as an indicator for measuring changes in population health. Since they combine information about mortality and health status, health expectancies are more appropriate indicators. Health expectancies have been calculated for more than 50 countries.⁴ However, in most calculations, the main focus has been on the consequences of morbidity, due to the inclusion of information about disabilities or perceived health, rather than about the basic concept of morbidity or chronic morbidity.⁵ Data on morbidity-free life expectancy will yield vital information on morbidity, the first step in the chain of events leading to disabilities.

Until now, life expectancy without chronic morbidity, or morbidity-free life expectancy (MFLE), has been calculated for only eight countries, with three countries (France, Norway, and Japan) also including information about changes over time. In Japan, a decrease has been observed in MFLE. In France, MFLE seems to be constant. In Norway, no significant change in years without chronic diseases has been observed for males; however, for females, a decline of almost two years has been reported.⁵

Since health expectancies are based on a life-table approach, they are independent of the age structure of the population and therefore suitable for comparing subgroups in the population. In order to improve our understanding of the dynamics of public health, we need to determine health expectancies for different subgroups with different risk profiles. In most Western countries, females have a higher total life expectancy and a lower health expectancy than males. Higher total life expectancy is not always accompanied by lower health expectancy. International studies show that higher life expectancy in the upper social class is accompanied by higher health expectancy. By contrast, lower social classes have both the lowest total life expectancy and the lowest health expectancy.⁶⁻⁸

Socioeconomic differences in MFLE have been studied in Norway/Finland and in Great Britain. In both studies, differences in MFLE exceed the differences in total life expectancy.

Using a partial life-table approach, Van den Bos et al. reported on morbidity-free life expectancy for the 55–79 age group, finding clear differences between higher and lower socioeconomic groups in terms of the proportion of life expectancy with morbidity. For males, the difference at age 55 is 7% in favor of the higher class; for females, the difference is 5%.^{9,10}

Changes over time in socioeconomic disparities in health expectancies have not been studied for chronic morbidity, but only for disabilities or a combination of health indica-

tors. In France, the gap in disability-free life expectancy between the lowest and the highest socioeconomic groups contracted marginally between 1980 and 1991.¹¹ In the United States, the gap in disability-free life expectancy seemed to double between 1970 and 1990.¹² In Sweden, a tendency toward a widening gap in life expectancy in full health—a combination of perceived health, chronic illness, and disability—has been observed between blue-collar and white-collar workers.¹³

The aim of this article is to present and discuss MFLE in the Netherlands by analyzing changes over time using a chronological series of data from 1989–2000 for males and females and for different socioeconomic groups.

DATA AND METHODS

Morbidity-free life expectancy was calculated using Sullivan's method.^{14,15} Using age-specific mortality figures for a particular year, total life expectancy was calculated for a synthetic, period life-table cohort. The number of person years that the synthetic cohort will live in that interval was calculated for each age interval. This number of person years was then divided into years with and without chronic morbidity, on the basis of the prevalence of chronic diseases in that particular year and age group. Use of the standard life-table approach means that the results are independent of the composition of the population and can therefore be compared to other populations or over time (assuming that the same type of health data are used, as is the case in this study).^{16,17}

Calculation of morbidity-free life expectancy requires data relating to the prevalence of chronic disease by gender and age group. These data were derived from the Periodic Survey of Living Conditions and its predecessor, the Continuous Health Interview Survey, conducted by Statistics Netherlands between 1989 and 2000 (data files obtained from the Netherlands Organisation for Scientific Research/WSA). In 1989 and 2000, the health interview survey included approximately 10,000 non-institutionalized persons, and the response rates were 59% and 55% respectively. In the intervening years, the number of respondents fluctuated between 7,000 (1990) and 11,000 (1997) and the response rate fluctuated between 55% (in 1993 and 2000) and 60% (in 1997). To be representative of the Dutch non-institutionalized living population, the data have been weighted by taking into account socio-demographic characteristics of the Dutch population.¹⁸ The Health Interview Survey and the Periodic Survey on Living Conditions do not include the institutionalized population (the population in residences for the elderly and nursing homes). Data sources including chronic diseases for the institutionalized population were not available to the extent necessary for our study. For our calculations, we considered the entire population in nursing homes to be chronically ill. We assumed, for the population in residences for the elderly, the age- and gender-specific prevalence of chronic diseases for the population living independently.

Sensitivity analysis in another study of trends in life expectancy in well-being have shown that the direction and significance of the trends are not influenced by these assumptions, although the absolute number of healthy years may be under- or overestimated by one year at most.¹⁹

Prevalence rates were assessed using self-reports of the following chronic conditions: heart disease; asthma/COPD; cancer; stroke; diabetes; musculo-skeletal diseases; chronic intestinal diseases (intestines, liver, stomach); severe kidney disease; epilepsy; or migraine. If respondents stated that they had suffered during the last 12 months from at least one of these diseases, they were classified as having a chronic disease.^{20,21} During the period under study, the questions about these diseases remained the same in wording and response categories. Between 1989 and 1993, the questions were included in a face-to-face questionnaire; from 1994 until 2000, they were included in an additional self-administered section.

To analyze the trends for males and females, the gender- and age-specific prevalence rates for each year from 1989 to 2000 were used to calculate annual morbidity-free life expectancy. Trends were assessed using linear regression, with each year being weighted by the inverse of its variance. Significance in the trends is based on $p < 0.01$.²²

Due to the small numbers per year, data were pooled for the socioeconomic analyses into three periods: 1989–92, 1993–96, and 1997–2000. Four socioeconomic groups were defined on the basis of education level: lower (no education or primary education only), lower middle (extended primary school, lower levels of secondary education), upper middle (high school and higher levels of secondary education), and upper (university education).

Since social class or education are not included in standard mortality records in the Netherlands, relative risks were calculated for each class on the basis of the mortality data from four longitudinal studies: GLOBE (Health and Life Situation Survey in the Population of Eindhoven and Sur-

roundings, conducted by Erasmus University Rotterdam), PPHV (Continuous Survey of Heart Diseases, conducted by the National Institute of Public Health and the Environment), LASA (Longitudinal Aging Study Amsterdam, conducted by the Free University Amsterdam), and ERGO (Rotterdam Aging Study, conducted by the Erasmus University Rotterdam).^{23–29} Based on mortality data derived from these studies, relative mortality risks were estimated for each socioeconomic group according to the mortality risk for the total population.³⁰ As data for trends in relative risks are lacking, we assumed that the relative risks had remained the same for the three periods under study.

Changes in the gap between the upper and lower socioeconomic group over time were assessed using a Student's *t*-test.

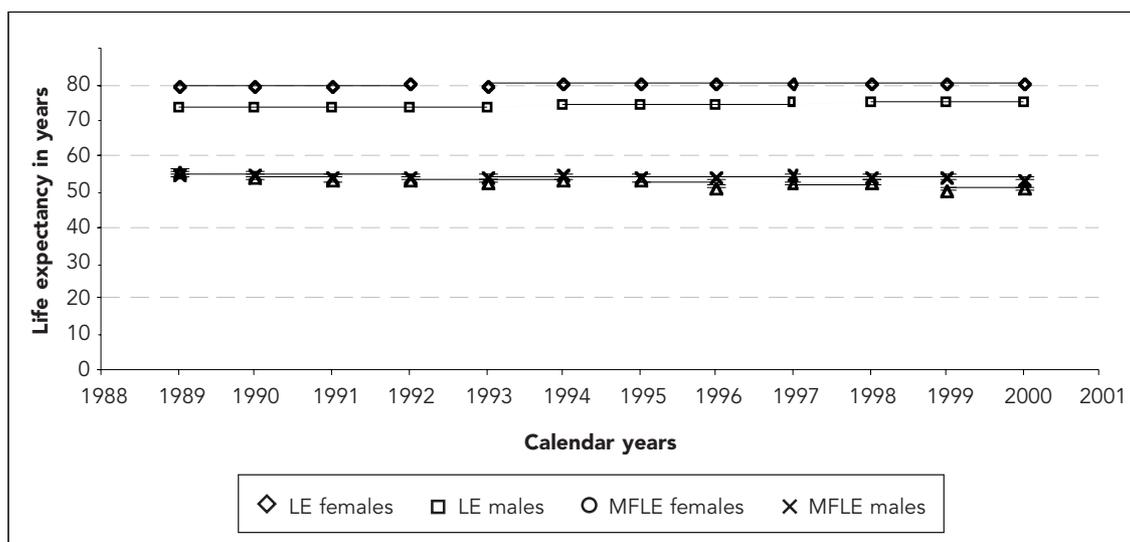
RESULTS

Trends for males and females separately

Between 1989 and 2000, total life expectancy in males increased by almost two years, from 73.7 years to 75.6 years (Figure 1, Table 1). MFLE decreased significantly, by almost one year, from 54.7 to 53.9 years. Life expectancy with chronic diseases increased significantly, by about 2.5 years. In relative terms, MFLE decreased significantly, from 74.2% of the total life expectancy in 1989 to 71.4% of the total life expectancy in 2000 (Figure 2).

During the same period, total life expectancy in females increased by about 0.5 years, from 80.0 to 80.6 years (Figure 1, Table 1). MFLE decreased significantly, from 55.3 to 51.0 years, while life expectancy with chronic diseases also increased significantly, by more than five years, from 24.6 to

Figure 1. Total life expectancy and morbidity-free life expectancy for males and females at birth, 1989–2000



MFLE = morbidity-free life expectancy

LE = life expectancy

Table 1. Total life expectancy, morbidity-free life expectancy, life expectancy with morbidity, standard error, and healthy life percentage for males and females at birth, 1989–2000

Calendar year	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Males												
Total life expectancy	73.7	73.9	74.1	74.3	74.0	74.6	74.6	74.6	75.2	75.2	75.4	75.6
Morbidity-free life expectancy	54.7	55.1	54.4	54.4	54.0	54.5	54.3	53.9	54.4	54.2	54.3	53.9
Life expectancy with morbidity	19.0	18.8	19.7	20.0	20.0	20.1	20.4	20.8	20.8	21.0	21.1	21.6
Standard error	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6
Healthy life percentage	74.2	74.6	73.4	73.1	72.9	73.1	72.7	72.2	72.3	72.1	72.0	71.4
Females												
Total life expectancy	80.0	80.1	80.2	80.3	80.0	80.3	80.4	80.4	80.6	80.7	80.5	80.6
Morbidity-free life expectancy	55.3	53.8	53.4	53.5	52.8	53.5	53.2	51.5	52.2	52.3	50.9	51.0
Life expectancy with morbidity	24.6	26.4	26.8	26.8	27.2	26.8	27.2	28.9	28.3	28.4	29.6	29.6
Standard error	0.5	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.6	0.6	0.6	0.6
Healthy life percentage (%)	69.2	67.1	66.6	66.6	66.0	66.6	66.2	64.1	64.8	64.8	63.3	63.3

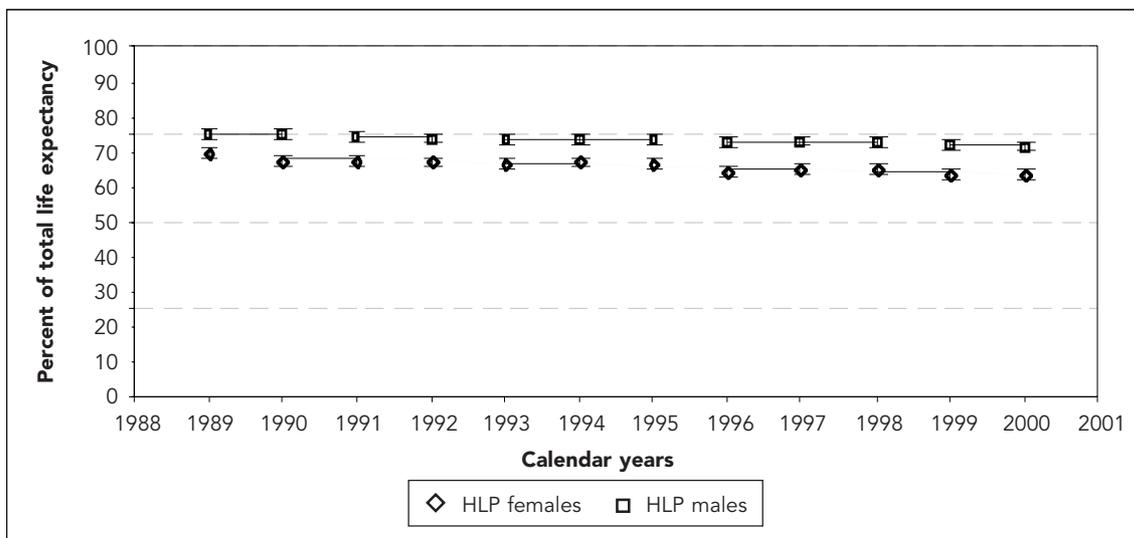
29.6 years. The healthy life percentage decreased significantly, from 69.2% of the total life expectancy in 1989 to 63.3% in 2000 (Figure 2).

Trends in the gap between males and females

Between 1989 and 2000, the gap in total life expectancy for males and females fell from 6.3 years in favor of females to 5.0 years in favor of females (Table 1). The gap in MFLE was

0.6 years in favor of females in 1989 (z score=1.04). However, in 2000, the gap had increased significantly in the opposite direction, to 2.9 years in favor of males (z score=3.30).

Combining these trends, we observed a widening gap between males and females for healthy life percentage, from 5% in 1989 to 8% in 2000 in favor of males.

Figure 2. Morbidity-free life expectancy as a proportion of total life expectancy for males and females at birth, 1989–2000

HLP = healthy life percentage

Trends in differences among socioeconomic groups

Between the periods 1989–92 and 1997–2000, MFLE decreased for males in all socioeconomic groups (Figure 3 and Table 2). In the period 1989–92, a significant gap of almost 11 years (60.7 years vs. 49.8 years, z score=12.1) in MFLE was observed between the lower socioeconomic group and the upper socioeconomic group. During the period 1997–2000, this gap fell significantly by 2.5 years to 8.5 years (57.3 years for the upper socioeconomic group compared to 48.8 years for the lower group in the year 2000; z score=8.0).

For females in all socioeconomic groups, MFLE decreased over the years. Between 1989–92 and 1993–96, the gap in morbidity-free years between the lower and upper socioeconomic groups increased from 4.7 years to 7.0 years (in the first period, 51.8 years and 56.5 years respectively [z score=4.3], compared to 49.8 and 56.8 years respectively in the second period [z score=6.7]). Between the second and third periods, the gap decreased to 4.0 years (48.6 years for the lower group compared to 52.6 years for the upper group; z score=3.2) (Figure 3 and Table 2). Over the total period under study, a significant decrease of 0.7 years was observed in the gap between the upper and lower socioeconomic groups.

DISCUSSION

This article presents trends in the gap in MFLE between males and females and among different socioeconomic groups in the Netherlands. Morbidity is based on the presence of major groups of chronic conditions.

For both males and females, trend analyses for the period 1989–2000 showed a decline in MFLE and a rise in years with chronic morbidity. However, both the decrease in MFLE and the increase in life expectancy with morbidity were smaller for males compared to the changes observed for females. So while females have a higher total life expectancy than males, their morbidity rates are higher. Not only is their MFLE lower, it is also decreasing faster.

One explanation for the decrease in MFLE could be earlier diagnosis of chronic morbidity, leading to a rise in the registered incidence of chronic conditions. At the same time, improvements in therapeutic interventions will result in longer survival with diseases, pushing up prevalence and therefore years with morbidity. For females, the increase in years with morbidity might also be caused by a worsening lifestyle, with more smoking and more stress.³¹

The calculation of MFLE was based on the prevalence of 14 somatic chronic conditions. These conditions were selected based on their prevalence rates and their disabling impact. Some groups of somatic conditions could not be studied because of the lack of data (e.g., multiple sclerosis or thyroid gland disorder). Our study did not include psychiatric disorders. Inclusion of these conditions might result in an even lower MFLE.

In the Netherlands, the trend in MFLE does not run parallel with the trends in disability-free life expectancy or life expectancy in well-being. Life expectancy in well-being, for instance, increased over the same period.¹⁹ And while disability-free life expectancy in the Netherlands decreased over this period, this decrease was mainly caused by an increase in minor disabilities, while the number of years

with moderate or severe disabilities remained the same or even declined.³² So the decrease in MFLE could well be caused by an increase in less severe stages of diseases.

Trend results in life expectancy without chronic morbidity partly confirm the results of the trend studies in other countries. In Japan, the decline over a period of 11 years (1974–1985) was 0.7 years for males (from 62.7 to 62.0 years) and 1.7 years for females (from 65.8 to 64.1 years). However, in contrast with the Netherlands, females in Japan have the highest total life expectancy, and also have the highest MFLE (both in the absolute number of years and when taken as a proportion of total life expectancy).³³ In Norway, the situation for females is comparable to the Netherlands. A decrease of almost two years in MFLE has been observed. For males, the number of years without chronic morbidity did not change.³⁴

Our observation that, over time, the gap between the socioeconomic groups seems to narrow, contradicts the study by Dalstra et al.³⁵ Based on the analysis of combined prevalence rates for 23 diseases, the Dalstra study concluded that socioeconomic health inequalities in the Netherlands remained more or less constant between 1989 and 1999. This difference might be due to the number of diseases included in the analysis.

One explanation for our results—that requires further study—might be that the upper socioeconomic groups participate more in screening programs, resulting in earlier diagnosis.³⁶ Minor differences in specialist care and surgical interventions have been observed.²

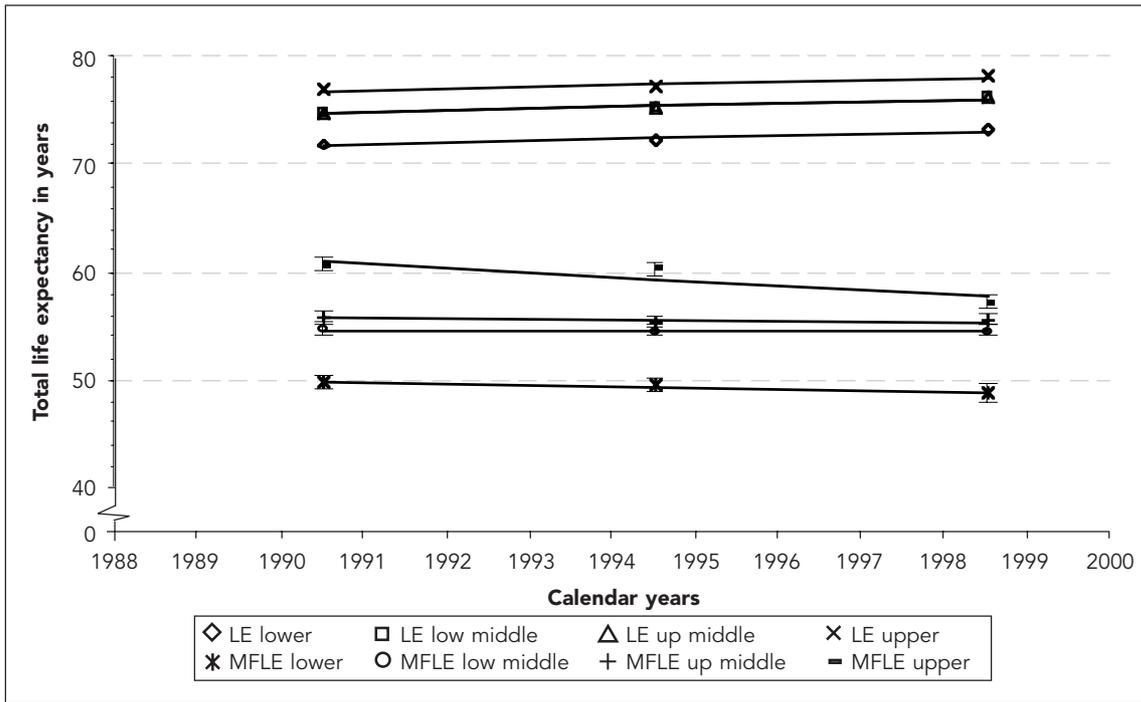
The socioeconomic differences observed in this study confirm those found in Great Britain and in Scandinavian countries.^{37–39}

In our socioeconomic analysis, we did not focus on differences in total life expectancy between the socioeconomic groups. We used relative risks, derived from four longitudinal studies, reflecting mortality in one period. We assumed that relative risks for the socioeconomic groups remained the same over the three periods, so mortality trends in the socioeconomic groups only reflect the overall trend in mortality.

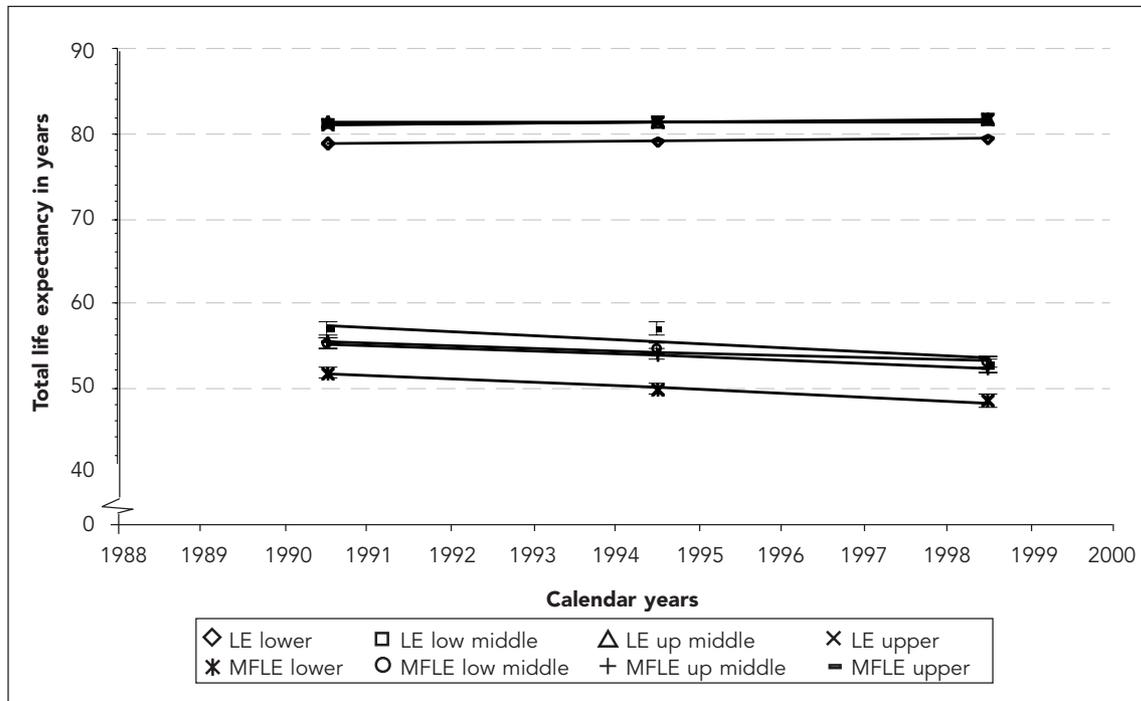
The social gradient in MFLE for females is not as clear as for males. It is possible that the operationalization of socioeconomic classes by education does not fit well for females. In a Belgian study of disability-free life expectancy in 10 socioeconomic classes, the gradient is not as systematic as expected.⁴⁰ Using education as an indicator for socioeconomic status has the advantage that it is stable, but it also suffers from a lack of differentiation at the bottom of the distribution, particularly for older females.⁴¹

Comparing socioeconomic differences with gender differences, we observed a remarkable phenomenon: higher life expectancy in females is accompanied by lower disease-free life expectancy, while higher life expectancy in the upper socioeconomic groups is accompanied by a high disease-free life expectancy. This implies that a higher total life expectancy is not always accompanied by a low MFLE (longer life but in worsening health) or vice-versa. This highlights some areas with potential for gains in health. Improving socioeconomic status may lead to an increase in disease-free life expectancy, while the inconsistency between higher life expectancy and lower disease-free life expectancy in females

Figure 3. Trends in total life expectancy and morbidity-free life expectancy for males (above) and females (below) by socioeconomic group (1989–1992, 1993–1996, and 1997–2000 pooled data)



LE = life expectancy
 MFLE = morbidity-free life expectancy



LE = life expectancy
 MFLE = morbidity-free life expectancy

Table 2. Total life expectancy, morbidity-free life expectancy, life expectancy with morbidity, standard error, and healthy life percentage for males and females by socioeconomic group (1989-1992, 1993-1996, and 1997-2000)

Calendar year	1989-1992					1993-1996					1997-2000				
	Low	L middle	U middle	Upper	Gap	Low	L middle	U middle	Upper	Gap	Low	L middle	U middle	Upper	Gap
Socioeconomic Status															
Males															
Total life expectancy	72.0	75.0	75.0	77.0	5.0	72.5	75.4	75.5	77.4	4.9	73.4	76.3	76.3	78.2	4.8
Morbidity-free life expectancy	49.8	54.7	56.1	60.7	10.9	49.6	54.7	55.4	60.3	10.7	48.8	54.6	55.7	57.3	8.5
Life expectancy with morbidity	22.2	20.3	19.0	16.3	-5.9	22.9	20.8	20.0	17.2	-5.7	24.5	21.7	20.5	20.9	-3.6
Standard error	0.6	0.6	0.5	0.7		0.6	0.6	0.5	0.6		0.8	0.6	0.5	0.7	
Healthy life percentage (%)	69.2	72.9	74.7	78.8	9.6	68.4	72.5	73.5	77.8	9.4	66.6	71.6	73.1	73.3	6.7
Females															
Total life expectancy	79.0	81.4	81.6	81.4	2.4	79.1	81.5	81.7	81.6	2.5	79.5	81.8	82.0	81.8	2.3
Morbidity-free life expectancy	51.8	55.2	55.3	56.5	4.7	49.8	54.5	53.8	56.8	7.0	48.6	53.0	52.5	52.6	4.0
Life expectancy with morbidity	27.2	26.2	26.3	24.9	-2.3	29.3	27.0	27.9	24.8	-4.5	30.9	28.8	29.5	29.3	-1.6
Standard error	0.6	0.6	0.7	0.9		0.6	0.6	0.7	0.8		0.8	0.6	0.8	1.0	
Healthy life percentage (%)	65.6	67.8	67.8	69.5	3.9	63.0	66.9	65.8	69.7	6.7	61.1	64.8	64.0	64.3	3.2

highlights some areas that should be targeted by health care professionals.

In summary, the trend in MFLE is downward for males and females and in all socioeconomic groups. The gap in MFLE between males and females has widened and reversed in favor of males, due to the faster decrease for females. The gap in MFLE among the upper and lower socioeconomic groups has narrowed, due to the faster decrease for the upper socioeconomic group.

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