Dutch life expectancy

from an international perspective

Leyden Academy
ON VITALITY AND AGEING

Contents

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D. van Bodegom MD [1,3]

L. Bonneux MD PhD [2]

F. M. Engelaer MSc [1]

J. Lindenberg PhD [1]

J. J. Meij PhD [1,3]

R. G. J. Westendorp MD PhD [1,3,4]

[1] Leyden Academy on Vitality and Ageing

[2] Netherlands Interdisciplinary Demographic Institute (NIDI)

[3] Leiden University Medical Center (LUMC)

[4] ILC Zorg voor Later

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the authors

David van Bodegom (1978), MD MA, is a member of the scientific staff of the Leyden Academy on Vitality and Ageing. He is involved in the educational and research activities of the Academy, amongst others its Master programme. He is project leader of the Health & Life research project in Ghana at the Leiden University Medical Center (LUMC).

Luc Bonneux (1954), MD PhD., is senior researcher at the Netherlands Interdisciplinary Demographic Institute (NIDI). Besides this he is a freelance medical writer for diverse journals and consumer organisations, amongst others 'Medisch Contact' (Dutch journal for general medicine) and 'De Tijd' (Financial journal).

Frouke Engelaer (1985), MD, is a PhD. candidate at the Leyden Academy on Vitality and Ageing. Her research will be in the field of Public Health with special interest in the older population.

Jolanda Lindenberg (1982), PhD., is a member of the scientific staff of the Leyden Academy on Vitality and Ageing. She is involved in the educational and research activities of the Academy, amongst others its Master programme. Dr. Lindenberg previously worked at the Max Planck Institute for Social Anthropology.

Hans Meij (1960), PhD. MBA, is member of the board of directors at Amphia Hospital in Breda. Until April 2010 he was the managing director of the Leyden Academy on Vitality and Ageing. Dr. Meij is also associate professor at Leiden University Medical Center (LUMC).

Rudi Westendorp (1959), MD PhD., is executive director of the Leyden Academy on Vitality and Ageing and head of the Geriatrics and Gerontology Department of the Leiden University Medical Center (LUMC). Professor Westendorp has been involved in several major research projects, of which the National Programme Elderly (NPO), funded by ZonMw, is the most recent.

Summary

Between 1934 and 1964, the Dutch repeatedly enjoyed the highest life expectancy in the world. Since then, both men and women experienced a long period of stagnation and by now life expectancy in the Netherlands has been surpassed by many countries. It has dropped from its first place position to the ninth place in the European Union (EU-15). As a longer life expectancy reflects the fact that good health is being maintained for longer, it is of key importance to better understand differences in life expectancy among countries.

In this report, we have compared trends in life expectancy in the Netherlands to the United States that has a similar pattern, and to Sweden and France, the winners in Europe, and to Japan. Japan has had the highest life expectancy at birth for more than two decades now, currently approximating 79 years for men and 86 years for women. The corresponding life expectancy at birth in the Netherlands is respectively 77 and 81 years. In our study we show that the observed differences in life expectancy between these countries are dominated by mortality after age 65, as mortality at young age has almost vanished and death at middle age is minimised. The period of stagnation in life expectancy observed in the Netherlands is mainly caused by the fact that the rate of mortality in old age has remained constant whereas in other countries, most prominently in Japan, has continued to decrease.

Smoking is an important determinant of mortality in old age. We have therefore closely examined the effect of smoking on life expectancy. At age 65 smoking in the Netherlands shortens life expectancy among men by 3.5 years and 1.5 years among women. We also calculated life expectancy at age 65 after correction for different smoking behaviour in the countries under study and found that the shorter life expectancy after age 65 of Dutch men is by and large attributable to smoking. Among Dutch women of 65 years and older, smoking also explains part of the shorter life expectancy, but, after correction for smoking, life expectancy remains more than two years shorter when compared to Japanese women of the same age.
It remains to be elucidated why older women in the Netherlands live several years less than in Japan. As we show in this report, the increased mortality rate cannot be attributed to a specific group of diseases. An emerging hypothesis therefore is that more general, societal determinants could explain for the shorter life expectancy of Dutch women.

Over the past fifty years, Dutch society has seen major shifts in responsibility for care of the elderly. Traditionally, the family and religious institutions took care, but this responsibility has almost completely shifted to formal and institutionalised care. In this report, we have explored whether this shift in

responsibility of care may have contributed to the differences in life expectancy. A widespread idea is that the Netherlands has one of the highest rates of institutionalisation in the world whereas Japan has one of the lowest. We show that this assumption is only correct on first sight. If we take into account the long-term stay in hospitals in Japan, the Netherlands and Japan have a similar rate of institutionalisation above age 65. We therefore believe that institutionalisation cannot be responsible for the differences in life expectancy. Following from this, we concentrated on another striking difference between Japan and the Netherlands, namely the responsibility for informal care. We put forward two observations. First, in Japan older people live far more often with, or in close proximity of their children. Second, we have established that in Japan instrumental support is commonly included in informal care, whereas in the Netherlands emotional support plays a far greater role. It is tempting to speculate that co-residence and the different kind of support, may, in part, be the explanation for the differences in life expectancy.

In conclusion, this international comparison has shown us that life expectancy continues to rise. It is a challenge how to further improve outcomes of older people in the Netherlands and to narrow the gap with countries that have higher life expectancies. Strategies to discourage the habit of smoking in the Netherlands should be intensified and there is no reason to lessen attention for smokers above the age of 65. Next, it is necessary to continue the falsification of hypotheses that can explain the gap between the Netherlands and other countries, and to find positive arguments for causal explanations, further extending the healthy years of life.

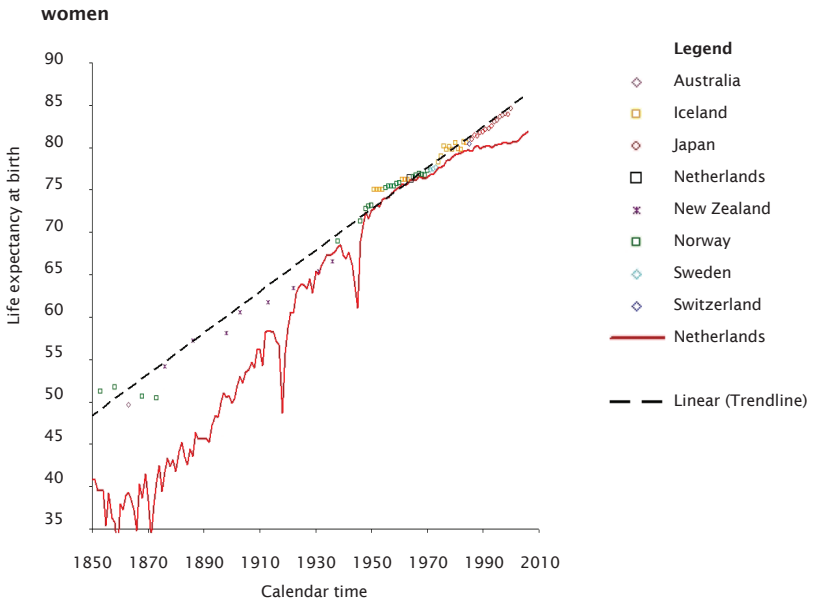
Preface

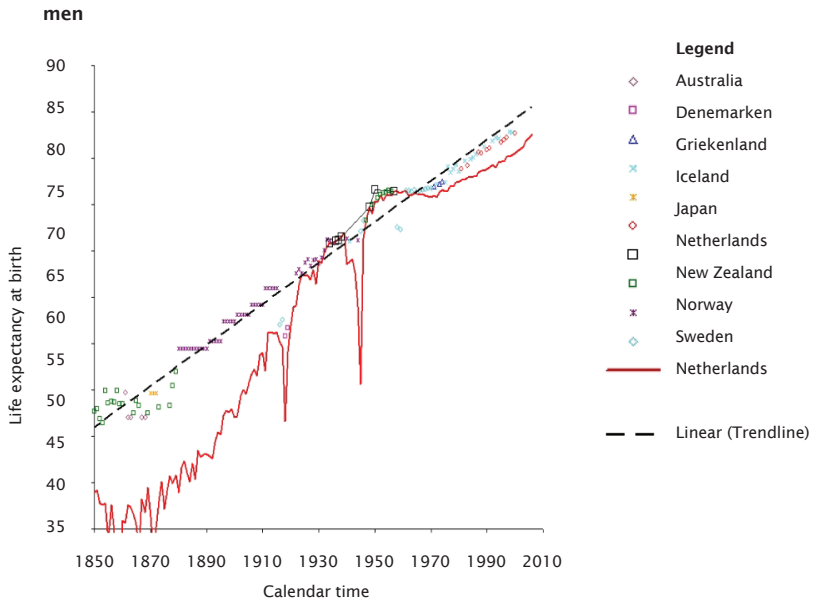
Life expectancy is a key demographic figure as it reflects overall mortality and can be validly compared between countries and periods. Life expectancy is a sign of the net health outcomes of current medical, societal, and political structures of all age groups. With continuing socio-economic development, life expectancy has spectacularly increased in all developed countries over the past 150 years.

Figure 1 shows the 'best-performance life expectancy', i.e. the countries with the highest life expectancy from 1850 to the present day. These data show that life expectancy has increased with a remarkably steady trend by almost 2.5 years per decade and that there is no indication yet that the increase in life expectancy is levelling off.

The Dutch life expectancy trend is plotted in red. A first observation is that in 1850 life expectancy in the Netherlands was far below the linear trend line. From 1850 onwards however, Dutch life expectancy increased at a pace that surpassed the general trend of the countries that were leading at the time. From the 1950s through the 1960s, life expectancy of women in the Netherlands was among the best of the world.
For men, the Netherlands performed at top level from 1920 to 1960, with World War II being the exception. From the 1960s onwards, the Netherlands have not been able to keep up with other countries and many have now surpassed us. In the period 2002 to 2004, life expectancy of the Netherlands dropped below average in the EU-15 (the EU before accession of ten new members in 2004), to the ninth position of fifteen. According to our socioeconomic status, life expectancy in the Netherlands is several years shorter than can be expected.

Figure 1: Life expectancies at birth from 1850 to the present.
Country with the best performance versus the Netherlands





Source: Human Mortality Database

To investigate the period of stagnation of Dutch life expectancy, this report compares Dutch life expectancy to life expectancy in four countries: the United States, Sweden, France, and Japan. We selected these countries because France and Japan have the highest life expectancy in Europe and worldwide, respectively. Sweden is included in the comparison because it has a similar socioeconomic history as the Netherlands. The United States is included because it experienced stagnation of mortality similar to the Netherlands.

1. Trends in life expectancy

In this chapter, we describe the changes in mortality and life expectancy in the Netherlands and compare these trends to those in the United States, Sweden, France, and Japan.

1.1 Epidemiologic transition in the Netherlands

Over the past 150 years, the Netherlands, in line with other developed countries, saw a remarkable change in mortality patterns. First, child mortality greatly reduced. This marks the transition from a period where mortality is determined by epidemics of infectious diseases to a period where mortality is predominantly caused by chronic diseases at higher ages. This so-called 'epidemiologic transition' was followed in the second half of the 20th century by a decrease in mortality at middle age. Mortality at old age, however, has changed only little, a phenomenon that is even more pronounced for men than for women. This stagnation of 'mortality decrease in old age' is peculiar, and the Netherlands clearly stands out in this respect, as in other developed countries mortality at higher ages did significantly decrease. The latter observation strongly argues against the common idea that mortality in old age is fixed and cannot be positively influenced.

Box 1. Cohort and period life expectancy

No demographic measure is so often misquoted and misunderstood as life expectancy. We can define two types of life expectancies: cohort life expectancy and period life expectancy. A cohort life expectancy is the true life expectancy of a cohort born in a certain year, e.g. all the people born in 1900. This cohort life expectancy is only known for sure in very old cohorts, who have all passed away or are close to dying. In 1900, the cohort life expectancy in the Netherlands was 55 years.

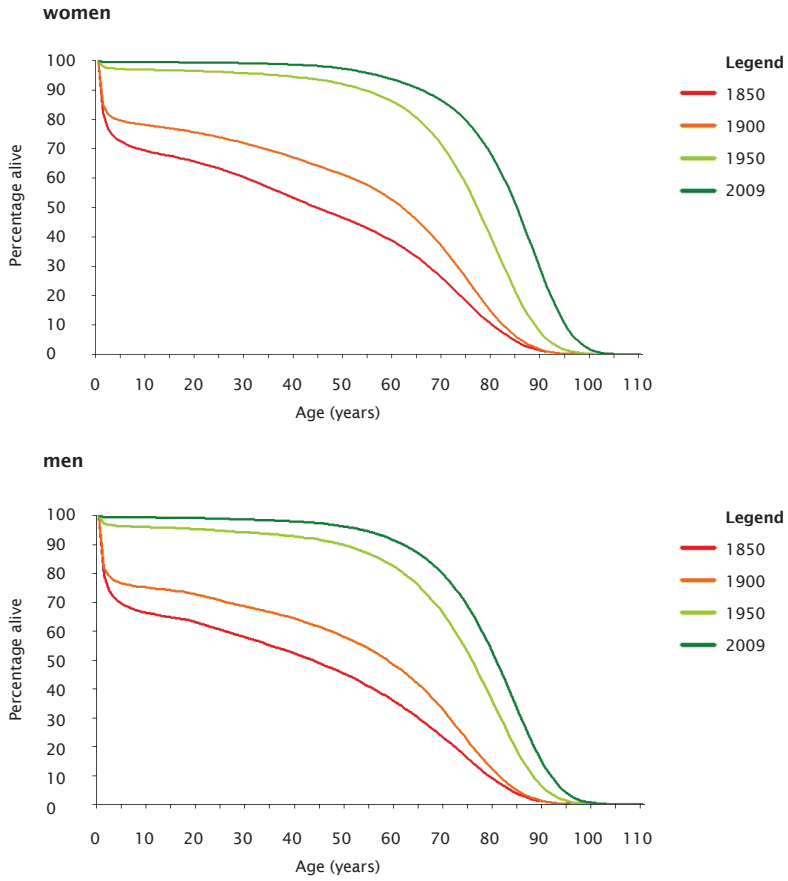
What is commonly used in health policy is period life expectancy. In 1900, the period life expectancy in the Netherlands was 48 years, not less than seven years lower than the cohort life expectancy. The period life expectancy summarises all age specific death rates of a single period (in this case the year 1900). Among the population of 1900, the mortality was much higher than among the birth cohort of 1900, which will be subjected to the mortality of 1900-2010 (if we ignore the few

that reached the age of 110 or above). A period life expectancy is a mean age at death of a distribution with (historically) two modi: one in infancy and one at old age. The low life expectancy of earlier periods, or of low-income countries today, means that many children die. In 1900, the period life expectancy at birth (age 0) was 48 years old, but at age 1 this was already 57 years. In the period life table, the cohort life expectancy at age 1 in 1900 was 65 – close to 70% would reach the age of 65 in 1965. During this period, this would be but slightly more than 50%. That is because the 'synthetic' period life table cohort is subjected to the mortality of 1900.

Figure 2 presents the estimated survival probabilities of women and men born in 1850, 1900, 1950, and 2008, assuming that age-specific mortality would not have changed over their lifetime.

Before 1950, survival probabilities at young ages improved for both boys and girls. This becomes apparent if one compares the curves of 1850 and 1900 at young ages. At that age, mortality has simply vanished. Next, between 1950 and 2008, survival probabilities in middle age have approached 100 percent, an indication that mortality in middle age has decreased considerably. It is generally accepted that this benefit mainly results from a 80% decrease in death from coronary heart disease in this age group. Nowadays survival probabilities up to age 65 amount to approximately 86% for men and 90% for women. Finally, the shift to the right, although moderate, of the survival curve is due to the decreased mortality risk in old age. Mortality now concentrates itself on higher ages and this results in a curve shift to the right in the figure, meaning that mortality not only concentrates itself at old age, but also at continuously higher ages. The lagging behind, as compared to other countries, or phrased otherwise, the inability of the postponement of old age mortality needs to be explained.

Figure 2: Survival probabilities of women and men in the Netherlands in 1850, 1900, 1950, and 2008



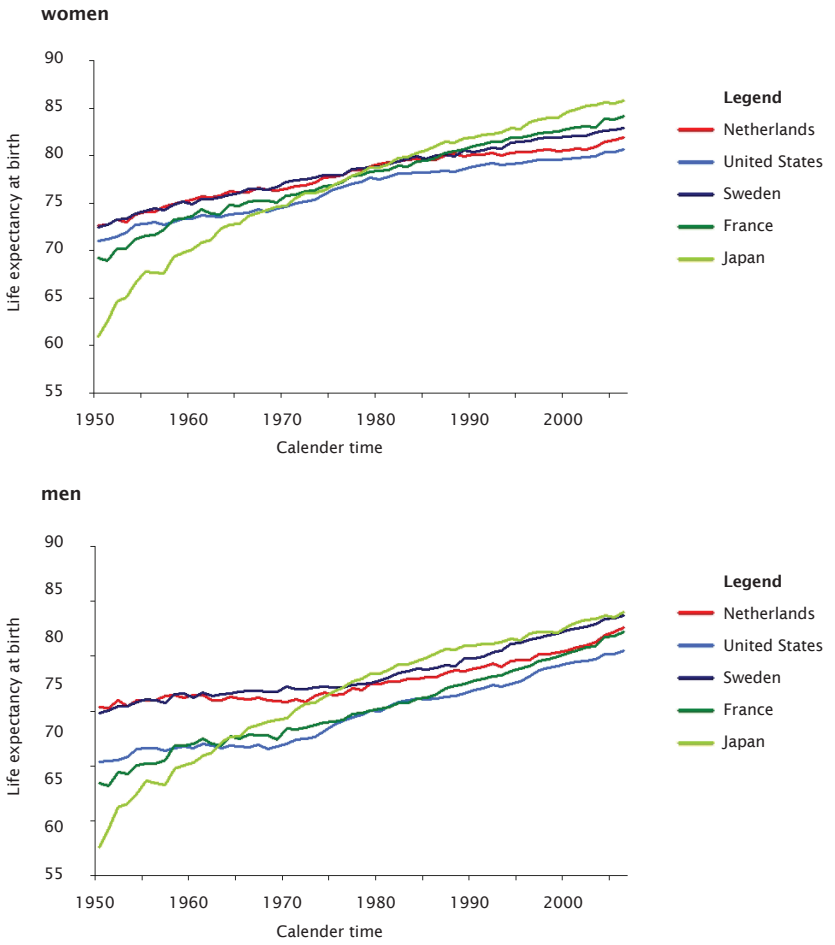
Source: Human Mortality Database

The shape of the survival curve has led to an intensive scientific and socio-political debate. The discussion was initiated in the early 1980s with a seminal paper on the 'compression of mortality'. The central idea was that disease at a young and middle age could be prevented well, whereas mortality in old age was not accessible to intervention and lifespan was therefore limited. This is a highly attractive hypothesis from a socio-medical as well as an economic point of view. Once diseases are successfully dealt with, one would survive in good health until death limits the human lifespan and everyone would die quickly. This hypothesis is false on various grounds. First, insights into the biology of ageing strongly argue against a 'fixed' lifespan. Second, there is a continuous increase in the maximum age at death, the present record being 122 years. Third, observational data on mortality in old age show a significant decrease in various countries. Fourth, survival patterns in developed countries, the Netherlands included (see figure 2), show a shift to the right in mortality. The overall conclusion is that we can delay death to a higher age and therewith successfully increase the length of life.

1.2 An international comparison

Over the last few decades, life expectancy has increased in virtually all developed countries. It decreased only as a consequence of a socio-political system collapsing as witnessed, for example, in Russia in the 1990s. However, life expectancies at birth differ considerably among developed countries and also the pace at which they increase. Figure 3 shows the secular trends of life expectancy for women and men in five developed countries over the past 50 years. In the 1950s, life expectancies at birth were high in the Netherlands and Sweden.

Figure 3: Trends in life expectancies at birth from 1950 onwards



Source: Human Mortality Database

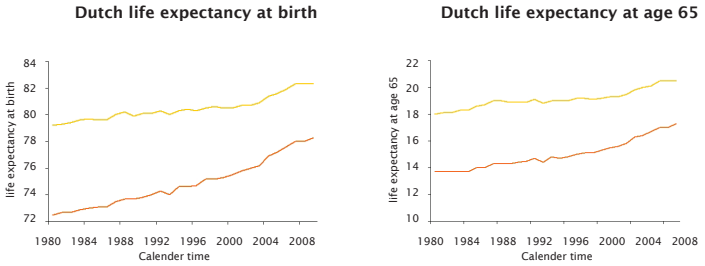
In the last few decades until around 2002, however, due to a period of stagnation, life expectancy in the Netherlands has not improved as much as it has in other countries. Many nations have now surpassed us, leaving the Netherlands, the country with the highest life expectancy in the 1950s, in 2006 at the 14th place among the economic developed countries (OECD).

1.3 The achievements of Japan

The achievements of Japan are extraordinary. In the 1950s, lifespan at birth in Japan was considerably shorter than in other countries. This was not a direct effect of war, as it is not essentially different from the situation in the 1930s, and ensuing from the socioeconomic and political structures at the time. The very rapid increase in life expectancy is the result of a massive decrease in mortality at the time when post-war Japan became an economic power, changing its socio-political structures. The net result is that Japan has enjoyed the highest life expectancy in the world over the last two decades. Apart from the overall increase in financial means, it is yet unknown whether there are specific factors that contribute to the increase in life expectancy. It is intriguing to see that all this happened despite the imprint that an affluent lifestyle left on the causes of death in Japan. Mortality risk at all ages decreased considerably but among those who died, coronary artery disease, lung cancer, and suicide which were virtually unknown causes of death in earlier days, have now become a frequent and fatal disease. If we can understand the factors behind Japan's performance it could give us an understanding of how to improve life expectancy in the Netherlands.

Box 2. Zooming in on the latest figures

Recently, a short report was published about a rapid increase in life expectancy in the Netherlands since 2002. The figures in this box show this specific increase for males and females from 2002 onwards. Both life expectancy at birth and life expectancy at age 65 show a period of increase in life expectancy. The previous period of relative stagnation is clearly present for women. It seems that the males started to improve their life expectancy already earlier; approximately since 1985. This indicates that trends in life expectancy are very susceptible to periodic changes, although the specific factors influencing life expectancy remain unclear.



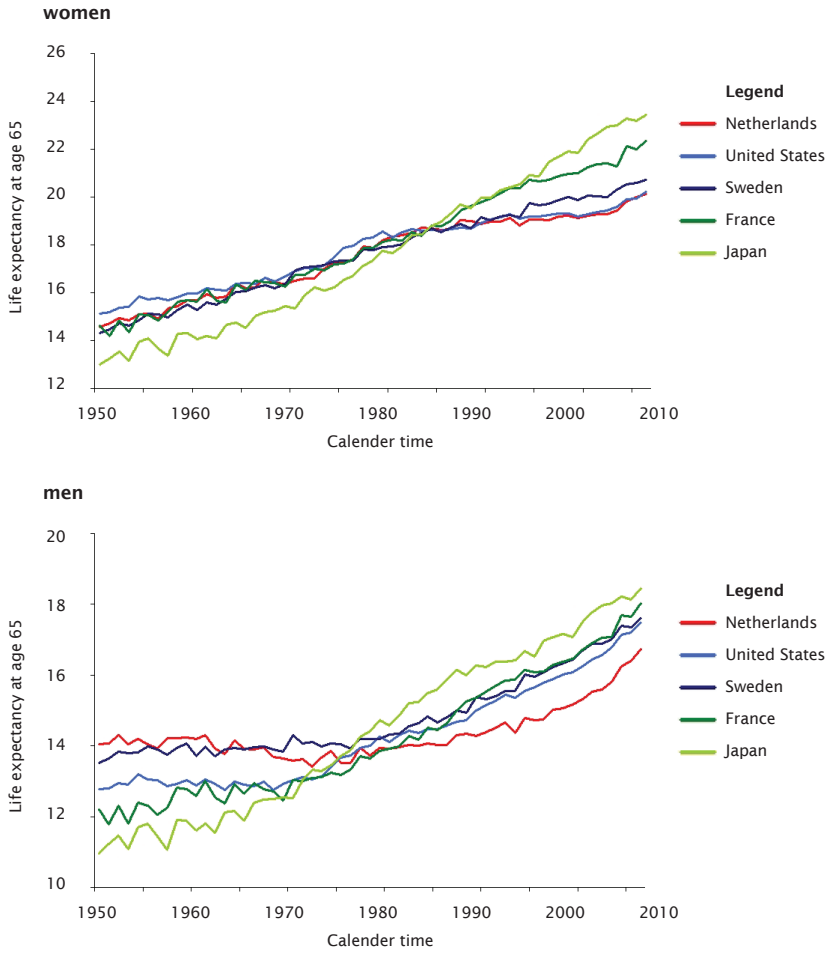
Source: OECD

The figure on the left shows Dutch life expectancy at birth for males and females 1980-2009 in the Netherlands. The right figure shows Dutch life expectancy at age 65 for males and females for the same period.

1.4 Life expectancy at birth reflects differences in mortality at higher ages

As in developed countries mortality at young and middle age has come to a minimum, differences in life expectancy are now mainly caused by mortality differences in old age, close to all mortality is is found among the older people as one can in see figure 2. It is therefore vital to examine life expectancy at age 65, i.e. the number of years people can expect to live when they have reached the age of 65. In Figure 4 it becomes especially clear that there is a different trend in the Netherlands, similar to the United States. Both curves start relatively high but compared to other countries the slope is rather modest and after 1980 an increase is almost absent, especially for women. For the Netherlands, a clear period of relative stagnation can be seen until 2002. This period of stagnation is caused by the fact that the rate of mortality in old age remained constant whereas in other countries, most prominently in Japan, it continued to decrease. As a result, at age 65, life expectancy in the Netherlands is nowadays three years shorter for women and two years for men when compared to Japan. While, if one would compare this to the situation in the 1950s, these results would be exactly the other way around.

Figure 4: Trends in life expectancies at age 65 from 1950 onwards

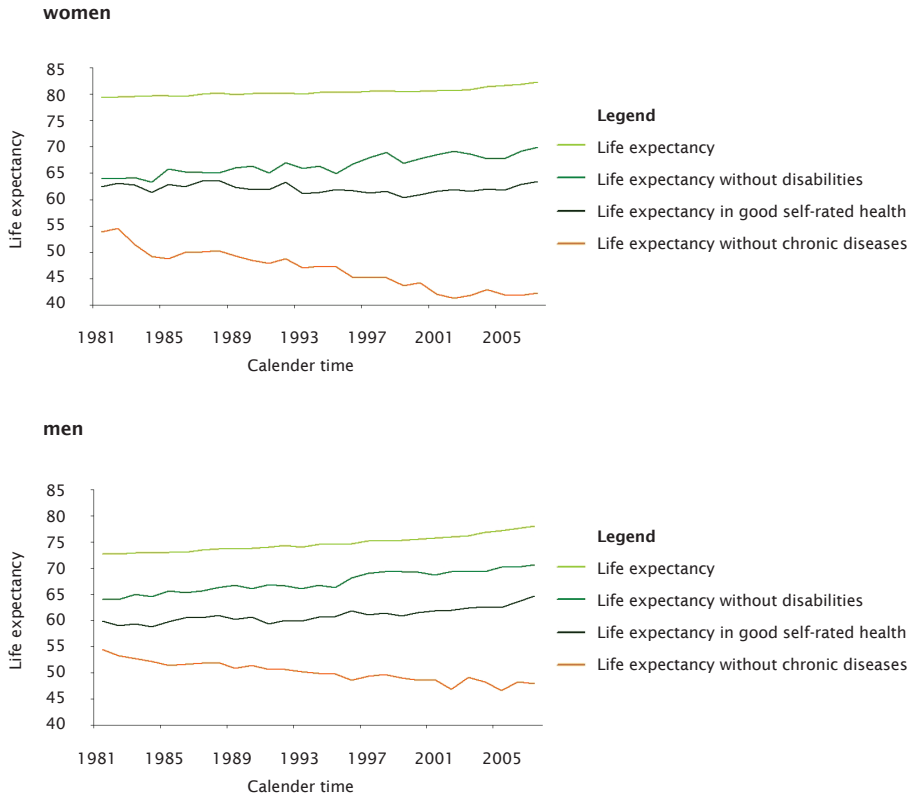


Source: Human Mortality Database

1.5 Life expectancy and healthy life expectancy in the Netherlands

Life expectancy at age 65 in particular reflects outcomes of the socio-medical systems to prevent and cope with chronic, age-associated diseases. This is illustrated in Figure 5, which shows both life expectancy and three different forms of healthy life expectancy in the Netherlands over the past thirty years. The three lines at the top clearly show that the gradually longer life span is associated with longer lives in good self-rated health and longer lives without disabilities. Over the past decennia, the number of years without chronic diseases is decreasing. This is mainly because chronic diseases include high blood pressure, but also because active and passive case detection is moving diagnosis to an earlier age. Added to this is the effect of the lowering of clinical thresholds of disease, often caused by available treatment (e.g. hip replacement). At least part of our longer lives is therefore exactly brought about by increased case detection and increased medical treatment of risk factors. The positive effects of which can be seen in the increase in life expectancy and good self-rated healthy life expectancy, simultaneously these increases come with a decrease in life expectancy without chronic diseases. The positive conclusion is thus that our socio-medical system not only makes people live longer but also extends the number of years in self-rated good health and in active years without disability. The grimmer part of this observation is that we have not yet been able to limit the number of years with disabilities at the end of life.

Figure 5: Life expectancy and healthy life expectancy in the Netherlands



Source: CBS Statline

Given these data, what health messages can be drawn? The extended observations on lifespan and health span outlined above allude to general phenomena that are not exclusive to the Netherlands. It emphasizes that there are various ways to live a longer healthier life. First, it is essential to prevent chronic, age-associated diseases such as atherosclerosis, diabetes and dementia. Here is an important role for public health strategies to prevent smoking, hypertension and obesity, by improving the quality of our diet, and by increasing the level of exercise. Second, it shows the importance of screening and diagnostic strategies for chronic age-associated diseases to minimize persistent complications and disabilities at the earliest time. Although early detection could suggest that more years are spent with disease, early treatment prevents late-life complications, explaining the paradox of increasing life expectancy without disabilities with decreasing life expectancy without disease. Third, optimising cure and care for those with disabilities enables the maintenance of high self-rated health, quality of life and the length of their lifespan.

2. A period of stagnation

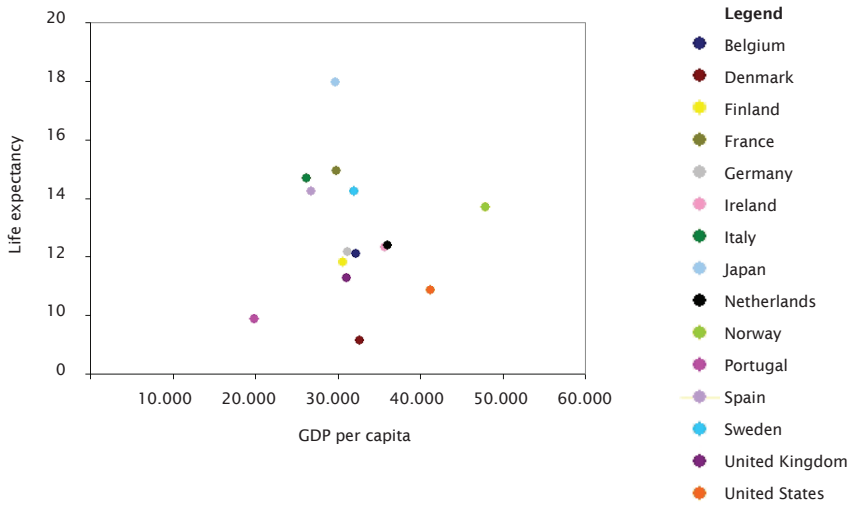
Life expectancy in the Netherlands has not improved as much as in other developed countries. This is mainly driven by mortality differences in old age. What caused this stagnation of mortality decline in old age?

2.1 Common explanations

Earlier studies have put forward various explanations for the relatively long period of stagnation in Dutch life expectancy. The first explanation is that it is a consequence of the high life expectancy that the Dutch enjoyed in the middle of the last century. Mortality at young and middle age was relatively low and people were comparatively well off. The frail, the sick, and those with disabilities had relatively high survival probabilities, up to old age. Due to these, so-called cohort effects or selection, the present day survivors from these earlier periods now experience excess mortality in old age. Sweden has seen similar patterns of low mortality in the last century, in contrast to the Netherlands though life expectancy in Sweden has continued to increase over the past 50 years. A cohort effect or selection is therefore unlikely to be the cause of the Dutch stagnation. An alternative explanation that takes the comparatively welfare in the 1950s in account is the hypothesis that this would have led to acceleration instead of stagnation of life expectancy. The reasoning would then be that those who lived under relatively prosperous conditions have accumulated less damage, have suffered fewer disabilities, and have better survival probabilities, but this is not the case in the Netherlands. The scientific debate on this dispute is as yet unresolved.

A second explanation put forward is the reasoning that economic development, Japan a prime example in this context, drives the increase in life expectancy and that residual differences in economic development are the cause of the dissimilarities in life expectancy. Economic development is an important determinant of socio-medical progress and largely explains the difference in life expectancy between developed and developing countries. Among developed countries, however, international comparisons do not show this strong association of development and life expectancy as shown in figure 6 which compares the Gross Domestic Product (GDP) per capita, taken as indicator of their development and their life expectancy.

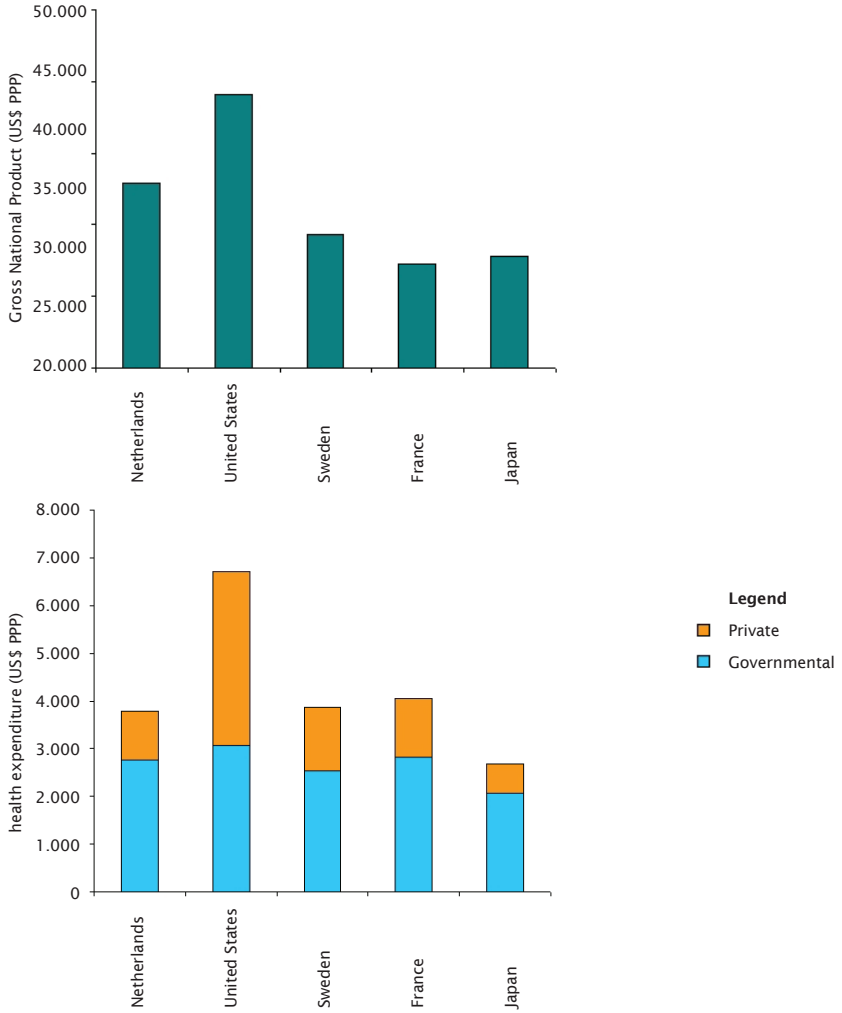
Figure 6: Life expectancy and GDP per capita



Source: Gapminder (various sources)

Also, when focusing on indicators of health expenditures per se, there is no direct relation between investments in health care and life expectancy in developed countries as shown in figure 7. Japan even manages to have the highest life expectancy with relatively low health-related expenses.

Figure 7: Gross national product and health expenditure



Source: WHO Health Statistics

A third explanation that is often put forward argues that the high rate of euthanasia in the Netherlands compared to other countries explains the higher mortality rate in older people. However, the absolute number of people who undergo euthanasia is low, the latest data state 2.636 reports in 2009, 2% of the total number of deaths in the Netherlands. Also, euthanasia is only practiced at the very end of life when the remaining life expectancy of these individuals is very limited. In 2005, for those persons choosing euthanasia – defined as the prescription, providing or administering of a means with the explicit target of quickening the point of death by a physician - their lives were on average shortened by 11 days. Taking into account the low relative impact and limited shortening of life expectancy, the effect of euthanasia on overall life expectancy is negligible and cannot explain why life expectancy from 65 years onwards in the Netherlands is considerably shorter than in other developed countries.

A fourth broadly phrased hypothesis claims that specific dietary habits explain the differences in life expectancy. To date, however, none of these dietary theories has been able to fully explain the observed differences in life expectancy. Recent research has shown that many classic risk factors of mortality and/or morbidity at middle age might be valid for this age group, but these cannot be associated with higher mortality rates in higher age groups. High cholesterol, for example, explains a large burden of disease at middle age, but cannot be associated with increased mortality at higher ages. Also optimal body mass index at older ages is above 25 kg/m², which would be considered obese in adults.

2.2 Smoking

Another explanation is that smoking causes the stagnation of life expectancy in the Netherlands. Smoking is an important risk factor for cardiovascular disease and various forms of cancer. Since smokers have a life expectancy that is a decade shorter than non-smokers, differences in smoking behaviour might well explain the observed differences in life expectancy between countries. Previously, two studies have been published on the effect of smoking on Dutch life expectancy with contradictory results; one study reported that smoking did explain the stagnation of the Dutch life expectancy, while the other study reported that only part of the stagnation was explained by smoking. To come to a more conclusive answer on the effect of smoking in the Netherlands and especially when compared to other countries, we performed an in-depth study of the effect of smoking on mortality in old age.

To study both the immediate and the late effect of smoking on life expectancy, next to current smoking behaviour, historical smoking trends should be taken into account. Smoking increases mortality via a direct effect on the vasculature and clotting mechanism. However, most detrimental effects of which atherosclerosis and cancer are the principle ones, only occur after a prolonged period of time. To estimate historical smoking behaviour in the different countries we adopted a method that makes use of lung cancer mortality.

Box 3. Expected smoking prevalence

The smoking related mortality in a population is dependent on many variables, of which the most important are the number of smokers (prevalence), the amount smoked (often expressed as pack-years), the age of starting smoking and, if applicable, the age of quitting smoking. Smoking prevalence, per se, is but a poor proxy of smoking exposure as the effect of smoking is heavily dose dependent. Peto et al. (1992) developed an elegant method to assess the impact of smoking, using lung cancer mortality as a biological proxy of smoking exposure. In developed countries, lung cancer is a very rare disorder among non-smokers – persons who have never smoked - but very common among smokers. The difference between the lung cancer mortality of non-smokers and the observed lung cancer figures in a population is then an aggregate measure of tobacco exposure, to be treated as a population attributable risk. By assuming the risk ratios of the large American Cancer Society, Cancer Prevention Study II (ACS-CPS II), the model developed by Peto et al. calculates the smoking prevalence expected in that ACS-CPS II study that would cause this population attributable risk of lung cancer mortality. This expected prevalence is then used to calculate the population attributable risks of other smoking related causes of death by applying the risk ratios of the ACS-CPS II study to this population attributable risk and the absolute mortality rates in the studied population. The sum is the mortality attributable to smoking. A more detailed explanation of the methods of this analysis can be found in the chapter 'References and justification' at the end of this report.

The expected smoking prevalence for men is shown in Table 1. Smoking was prevalent among men in all countries. Sweden is an exceptional case, because tobacco was traditionally chewed there, instead of smoked ('*snus*'). Chewing tobacco has fewer negative effects than smoking tobacco. The expected smoking prevalence, based on lung cancer mortality, is therefore lower. The Netherlands stands out as a country with high expected historical smoking prevalence. The life expectancies corrected for smoking are also presented in Table 1. In men, differences in life expectancy between countries are largely caused by differences in smoking behaviour; the initial difference at age 65 of 2.6 years between France and the Netherlands is after correction 0.6 and the difference with Japan decreased from 1.7 to 0.8. Although the pattern –with the highest life expectancy in Japan and the lowest in the Netherlands and Sweden– also corrected for expected smoking behaviour, persists.

Table 1. Expected smoking prevalence and life expectancy of men aged 65 in 2005. Expected smoking prevalence is derived from lung cancer mortality.

	United States	France	Netherlands	Sweden	Japan
Expected smoking prevalence at age 65-74	44%	36%	48%	21%	26%
Expected smoking prevalence at age 75 +	38%	27%	51%	18%	41%
Life expectancy at age 65	17.2	18.0	16.4	17.4	18.1
Life expectancy at age 65, corrected for smoking	20.3	20.4	19.8	18.9	20.6

Data: calculated from data from the WHO and the Human Mortality Database (see for more information the references and justification) using the method described in Peto et al. (1992)

Table 2 shows the expected smoking prevalence for women. In women, smoking was rare in France and Japan. Smoking was most prevalent in women in the United States. In the Netherlands and Sweden during these periods, women also smoked, but not as much as women in the United States.

Table 2. Expected smoking prevalence and life expectancy of women aged 65 in 2005. Expected smoking prevalence is derived from lung cancer mortality.

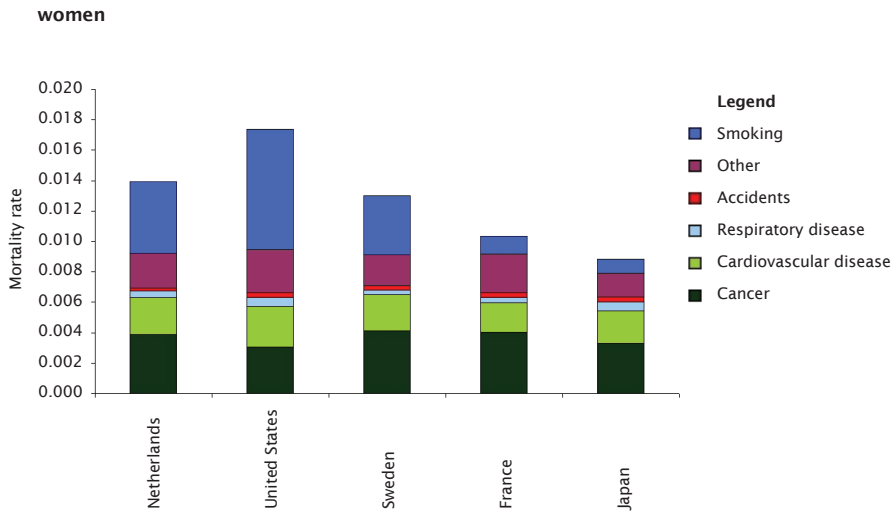
	United States	France	Netherlands	Sweden	Japan
Expected smoking prevalence at age 65-74	53%	8%	33%	27%	8%
Expected smoking prevalence at age 75 +	38%	5%	16%	14%	17%
Life expectancy at age 65	19.9	22.0	20.0	20.6	23.2
Life expectancy at age 65, corrected for smoking	22.4	22.3	21.3	21.6	23.9

Data: calculated from data from the WHO and the Human Mortality Database (see for more information the references and justification) using the method described in Peto et al. (1992)

It is clear that the low life expectancy of women in the United States is largely attributable to smoking behaviour. The differences in life expectancy between countries, however, cannot be fully explained by smoking alone. Also, when corrected for expected smoking behaviour, life expectancies for women in all four countries remain lower than in Japan and this residual difference is more pronounced in the Netherlands and Sweden. This residual deficit is present among women over age 65, the differences with Japan after correcting for smoking is 2.6 years indicating that other factors play a role here. We conclude that for men expected smoking prevalence probably largely explains the differences in life expectancy, but for women these differences are not explained by expected smoking prevalence alone. Below we start exploring possible additional explanations for differences between countries in life expectancy for women.

Figure 8 zooms in on the different causes of death of women in the five countries under study. From this figure it becomes clear again that the differences in smoking behaviour indeed explain a large part of the differences between countries in life expectancy of women of this age group. Women in the United States experience a great deal of mortality from smoking, while in France and Japan, almost no mortality is attributable to smoking. In the Netherlands, a considerable part of the mortality is caused by smoking in women in this age category.

Figure 8: Mortality rates for different causes of death of women aged 65-74 in 2005



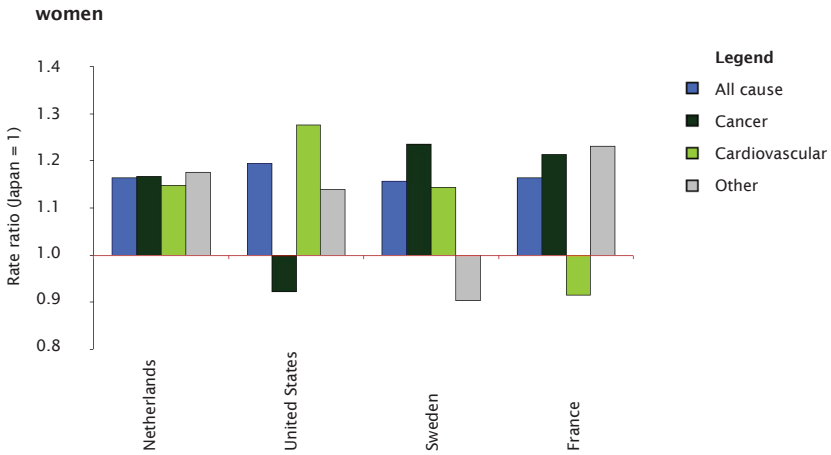
Source: WHO Health Statistics

The mortality from all other categories than smoking is similar in the Netherlands, United States, Sweden and France, all four being higher when compared to Japan. Women in Japan still have the highest life expectancy, also when corrected for smoking.

When mortality related to smoking behaviour is estimated as was done above, it is possible to study the relative differences in the causes of death among the countries, corrected for mortality caused by smoking behaviour. Figure 9 shows these relative mortality differences in women aged 65-74 compared to Japan for different

causes of death. When we compare the Netherlands to Japan after correcting for smoking, there is not one group of diseases that explains why Japanese women have lower death rates. Instead, in all groups of causes of death Japanese women have lower mortality and there is not a single group of diseases that explains the residual difference in life expectancy. An additional observation is the slightly lower cancer mortality rate in the United States, of which the cause is unknown. In France, women experience lower mortality from cardio-vascular disease. This is known as the Mediterranean paradox: countries in southern Europe, even though their diet is rich in fatty foods, have low mortality from cardiovascular disease.

Figure 9: Mortality rate ratios for different causes of death, of woman aged 65-74 in 2005 corrected for smoking.



Source: WHO Health Statistics, * Cancer excluding lung cancer

3. Learning from the best

In the previous chapter, we have seen that smoking behaviour is an important determinant of life expectancy and explains a large part of the differences among developed countries. In the case of the Netherlands, however, smoking behaviour of women explains only part of the stagnation in life expectancy. What other determinants are causing the stagnation in life expectancy in old age in the Netherlands?

A first observation is that after correcting for smoking, residual differences in life expectancy are larger in women than in men. A second observation is that no single disease or group of diseases explains the differences in life expectancy among developed countries. In Dutch women mortality from all groups of diseases is higher than in Japan. From this observation it can be deduced that any quest to explain the differences with specific medical explanations is unlikely to bring the right answer. It is not expected that, for instance, the occurrence or differences in the treatment of cancer or cardiovascular diseases will fully explain the observed differences.

In this chapter, we will first describe the historical changes in the Netherlands since the 1950s. Did the Netherlands follow a different trajectory compared to other developed countries? After describing the historical background, we hypothesise that some of these broader societal changes could have led to the current stagnation in Dutch life expectancy of women at more advanced ages.

3.1 Dutch historical background

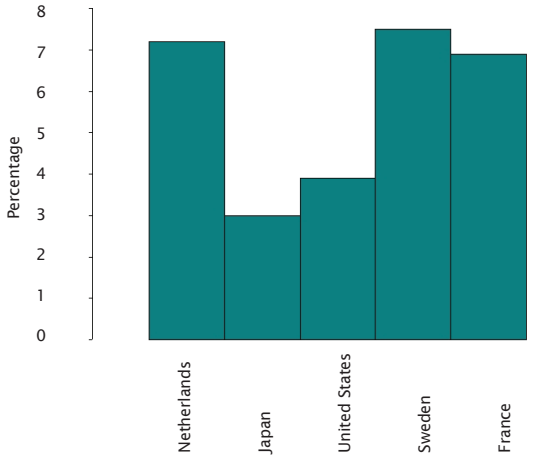
In the 1950s, the Dutch society was strongly divided into different segments known as pillars ('verzuiling'), according to different religions or ideologies. The three largest pillars were the Roman Catholic, Protestant, and social-democratic pillars. These pillars functioned as completely independent sub-groups and all had their own social institutions: schools, political parties, universities, unions, sport clubs, and newspapers. These pillars were also responsible for many societal tasks that are nowadays considered to be formal responsibilities of the government. Each pillar took care of people in almost every aspect of life. Regarding health a pillar had a full structure of care, from midwives and community nurses to entire hospitals. Also, the strong feeling of commitment within each pillar created a large network of informal caregivers in the immediate

environment of sick and older people. The intellectual revolution of the sixties resulted in strong secularisation and, as a consequence, a loss of the integrated sub-system in all pillars of the Dutch society. Within an exceptional short period, the Netherlands transformed itself from a society where care of sick and older people was the primary responsibility of the family and religious or socio-political institutions into a society where the prime responsibility for care of older people has been transferred to governmental or public institutions. Traditionally, older people lived either together or close to their families and formed networks. Increased individualisation and migration have, to a large extent, broken down these informal care networks.

The shift from an informal care network due to increased migration, secularisation and individualisation, is not something unique to the Netherlands. Many other countries experienced similar societal changes but sometimes at a different pace and to a lesser extent. It is therefore interesting to study the effects of these changes on older persons wellbeing and informal care.
Is it perhaps possible that the shift in accountability for the care of older people has contributed to the stagnation in life expectancy? Nowadays the strong commitment of family-associated informal care networks have been replaced by a system in which responsibility has been transferred to institutionalised care, either in the form of professional in-home health workers or in the form of large scale institutionalised care in residential homes or nursing homes. Note here that to fully replace a family member who lives together with an older person, there is a need for more than four full-time employed professional health workers. It needs to be explored whether the formal and institutionalised responsibility for dependent and frail elders is less beneficial than a familial commitment in a less institutionalised society. If so, there is a clear challenge to improve the outcomes of current care.

Figure 10 shows figures of the OECD on the proportion of people above the age of 65 who live in long-term care facilities. The proportions differ widely between the countries. In this comparison, the Netherlands has one of the highest rates of people living in institutions together with France and Sweden. Other western countries have lower levels of institutionalisation and Japan in particular, has very few older people in nursing homes or residential homes. Even when compared to other countries of the OECD, the Netherlands stands out as a country with a very high level of institu-tionalised care for its older inhabitants.

Figure 10: Long Term Care Recipients % of total aged 65 years and older, 2004



Source: OECD Health Data, * Data for France are from 2003, ** Data for United States are an estimate

Women more often live in institutionalised care facilities than men because women are more often widowed. This is not only because they have a longer life expectancy, but also because they traditionally marry men who are several years older.

It remains to be studied in more detail whether the shift in responsibility for care of older people together with the emergence of institutionalised care is a key to understanding the differences in life expectancy. We therefore continue this study with a more in-depth overview of the Japanese healthcare system and then compare these indicators to the Dutch outcomes.

3.2 Institutionalised care in Japan

Healthcare in Japan is mainly paid by a fee per service system. There are both private and public hospitals in Japan that are open for everyone. There are many hospitals in Japan and on average each hospital owns around 20 beds (see table 3). All hospitals should be non-profit and owned by either a medical doctor or by a corporation of physicians. A similar system is in place for pharmacies of which many are (indirectly) owned by physicians. Physicians' incomes then are mainly derived from these two sources.

The payment system combined with physician owned hospitals have given incentives to physicians to first of all aim for quantity instead of quality (more patients means more income), and second, they, for similar reasons, prescribe more medications per visit on average. More specifically, the number of doctor consultations in Japan is three times as high as the OECD average (see table 3). Also the average number of medications is well above OECD average (5 compared to 2 prescriptions on average per physician visit) whereas the average length of a patient visit is short (75.8% of patients spent less than 9 minutes per average visit with a physician in 2005).

Estimates are that the average visit takes about 8 minutes, some even claim 3 minutes, and the Japanese health ministry has now installed a policy in which visits that take less than 5 minutes can no longer be charged. More importantly, the average length of stay in hospitals is more than three times as long as the OECD-average reflecting the so-called 'social hospitalisation' that is actually in place:

Table 3. Health Indicators Comparison Japan, OECD Average and The Netherlands 2008

	Japan	OECD Average	The Netherlands
Number of hospital beds per 1000 population	13.8	5.6	4.3
Average length of hospital stay (days)	33.8	10.3	12.5*
Number of long-term care beds per 1000 population	2.8	1.0	0**
Number of hospitals per 1 million persons	68.9	30.8	11.1
Total pharmaceutical sales/capita US$ PPP	445	373	360
Doctors consultations per capita	13.6***	6.8***	5.7***

Data: OECD Health Data 2009, * 2001 most recent year available, ** non-existent category in the Netherlands, *** 2007 most recent year available

Using the term social hospitalisation seems counterintuitive for the case of Japan. It is after all a common assumption that due to the 'collective' spirit of Japanese society and the importance of filial piety (*oyakoko*), the institutionalisation rate of Japan is low. This common myth mainly stems from two facts: first of all, rates are usually based on the prevalence of long term care institutes in Japan and elderly living in nursing homes, and secondly, the myth finds support in the high rate of elderly living with family.

The OECD rates for institutionalisation, already presented in the previous paragraph, show that in 2008 2.9% of older people lived in long-term care facilities in Japan, compared to a rate of 6.7% in the

Netherlands (65 years and older). This rate, though, we argue is deceiving as it does not take into account another distinctive characteristic of the Japanese healthcare system: the long average length of stay in hospital. The institutionalisation rate looks rather different if we take this into account.

In Japan, in 2005 the number of in-patients per day amounted to 1.391.600 per day and 71.200 in medical clinics, 64% of those patients were above 65 and 43.6% of those patients were above 75 years old. This means that from the total population of 65 years and older in Japan at any day 3.8% of them were in a hospital or a medical clinic. That these patients indeed stay relatively long is indicated by the average length of stay for the age-group 65 and older in 2005 which was 50.8 days and only rising for higher age-groups as is shown in table 4.

Table 4. Average length of stay in days in hospital in Japan (2002 and 2005)

Age-group	Average length of stay (days) in hospital
65-69 (2002)	44.2
70-74 (2002)	43.9
75-79 (2002)	46.4
80-84 (2002)	53.5
85-90 (2002)	67.8
90 and above (2002)	106.4
Regrouped 65 and older (2005)	50.8
Regrouped 70 and older (2005)	52.5
Regrouped 75 and older (2005)	56.9

Data: Ministry of Health and Welfare Japan

Not only is the average stay in Japanese hospitals exceptionally long, but Japanese hospitals also cater more for long-term stay than Dutch hospitals. About 20% of the beds in hospitals are meant for long-term care, in contrast to Dutch hospitals where such beds are non-existent (see table 3). In the Netherlands, older patients are transferred to institutions such as residential homes or nursing homes after a short stay in a hospital.

Other scholars have also remarked this difference. Tatara & Okamoto summarise the matter comprehensively: "Japan has been reliant more on hospitals and less on social services for long-term care. This imbalance may be explained by the difference in financing system, in which hospitals are financed by health insurance while social services are financed by taxation. Being financed by taxation, social services have consistently been restrained by budget and occasionally subject to means testing. From the viewpoints of family caregivers, putting the disabled elderly into hospitals involved less social stigma than putting them into welfare homes for older people, such as nursing homes. Consequently, Japan's geriatric hospitals came to serve as quasi-nursing homes, and the number of geriatric hospitals increased to cater for the growing demand generated by population ageing". Hospitals, in short, function to a high degree as long-term care facilities for elderly in Japan. The incentive for this practice is not solely financial, but there is also a shortage of places in nursing homes and consequently long waiting lists for these places.

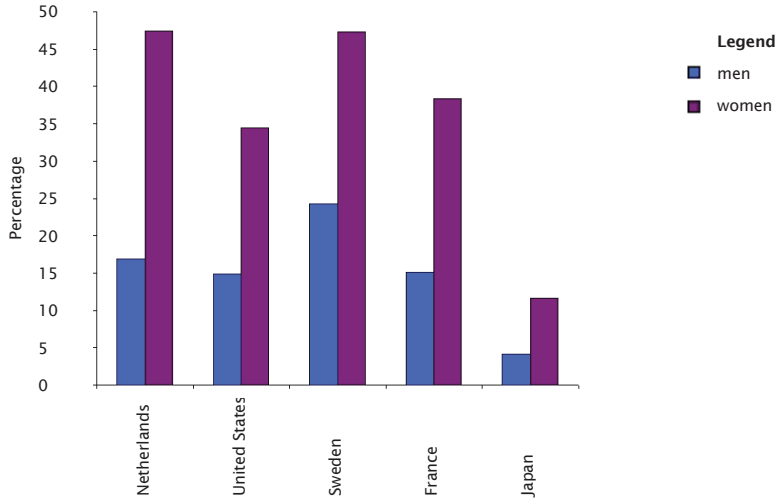
Adding up the 3.0% of older people that live in a nursing home (2005) and the rough estimate of 3.78% of older people that have a prolonged stay in a hospital, one arrives at 6.78% just 0.22% below the Dutch percentage of older people that live in institutions in 2005. Although we assume that not in all cases social hospitalisation is taking place, still we can rather safely assume that the rate of institutionalisation is not extraordinary below the rate of the Netherlands, if one takes into account all kinds of institutions (see also the ILC report "profile of

older Japanese 2010"). In conclusion, Japan seems to be just a fraction below the average institutionalisation rates of OECD-countries such as the USA, Sweden and the Netherlands. The above considered, we do not see differences in institutionalisation as the key to understand the differences in life expectancy, and this, as such, as the source of Japan's outstanding record.

3.3 Responsibility for Care

Yet another demographic difference is the living arrangements of older women (and men) in the countries under study. The living arrangements might influence the care network of older women. Figure 11 shows the number of men and women who live alone in the different countries. Japan stands out because people over 65 do not live alone as often as in western countries. This may reflect the traditional role that children and other family members have in Japan where older people enjoy high social status and care is a familial responsibility.

Figure 11: Percentage of people above age 65 living alone



Source: OECD, living alone means a one-person household

Clearly, in Japan both women and men live alone less often than in the Netherlands. This is already an indication that familial care might play a larger role in Japan than in the Netherlands. However, to investigate our second hypothesis, namely whether the responsibility for care of older people might be accountable for Japan's outstanding record, we need to expand our study of Japan. We must look more in-depth towards the situation of older people in Japan and the Netherlands, for which we therefore present two case-studies below.

Box 4. Being old in Japan and in the Netherlands

Japan, Mrs. W. *is an 86-year old woman living in a residential suburb about 20 kilometres from the centre of Yokohama. She has one son and he and his wife have three children. They live about 200 metres from Mrs. W.'s house. Her house is conveniently located with a supermarket 500 metres from her house, her general practitioner about one kilometre away, a bus stop close-by and the hospital at two kilometres distance. She is reasonably mobile: she uses a cane to walk and uses a bed stick to get out of bed - as a result of a fall last year that was caused by heart failure. With these means she is still independent and lives alone. She feels her health has deteriorated since her heart failure but she is quite healthy for her age with some hypertension, osteoporosis and osteoarthritis and a BMI of 20.6 kg/m². She still walks to her son's house and to shops close-by, but takes a taxi for longer distances or uses home delivery. She enjoys visiting her grandchildren. Her three grandchildren also visit her quite regularly (almost daily for short visits) and help her with some things such as clipping her toe nails, putting out the garbage and airing the bed clothes. Her son and his wife help her out with heavier tasks such as closing the typhoon shields. Other help comes from a home helper (once a week for cleaning) and a gardener (3 times a year).*

The Netherlands, Mrs. F. *is an 85-year old woman living in a village about three kilometres of the city of Leiden. She has five siblings, of whom four are still alive. Her two daughters live a few kilometres from her place. Her house is comfortably located on top of a medium sized shopping complex with an array of shops and services, close to the bus stop, park and within about two kilometres from the hospital. Since her husband died 11 years ago she lives alone. She is unable to walk more than a couple of metres because of osteoporosis and pain. Next to this she has irritable bowel syndrome and hypertension reducing her mobility somewhat further. She has a BMI of around 25 kg/m². She used to be quite active and played tennis until age 75, but now she uses a rollator to walk short distances outside and relies for further distances on her car. Since she has a two-storey apartment she uses a stair-lift to go to her bedroom. Her daughters alternately visit her weekly and she eats at her oldest daughter's place every week. Her grandchildren visit her regularly and she has a neighbour who is also her best friend whom she sees daily. Other friends she sees more sporadically. She is, despite her decreased mobility, largely independent and has a strong will to remain independent and do things herself: she is still capable of doing small housekeeping chores, cooking, shopping and washing and she visits an acupuncturist and a beautician regularly. She is helped in her housekeeping by her daughters (alternately once a week) and she has a formal help for 5 hours every two weeks.*

The case-studies show at first sight many resemblances: two rather healthy older persons receiving both modest amounts of informal and formal care. On closer look the differences become apparent: Mrs. W. from Japan seems to receive more frequent visits from her family and she seems to receive more functional help from especially her grandchildren. The element that stands out in the comparison of these short case-studies is the responsibility for care which seems to rely more on family members and the frequency of social contact in the Japanese case. In the Netherlands, Mrs. F. described that she did not, nor did she expected or wished to, receive functional, especially physical, help from her children. However, this element needs to be looked at in greater context to come to any kind of inference of causes for differences in life expectancy.

Considering the effect of social relations and support it is well known that isolation increases the mortality risk in all causes of death, although there are some differences in survival rates. It is still unclear which kind of relation is especially beneficial for health, but it is clear that all sorts of relations – ranging from neighbours till family members – are advantageous for health outcomes. Important in this is also the role of reciprocity; giving support seems to be at least as beneficial for health as receiving support. It appears even that as Stoller formulates it "the inability to reciprocate rather than the need for assistance undermines the morale of the older person". These findings are consistent with the so-called 'altruism theory'; a theory that claims that giving also brings important benefits. Informal care and frequent social contact then emerge as important for the health of older people both because of the decreased feelings of isolation it provides as well as the opportunity it entails to reciprocate for the older person.

The question still remains on whom the responsibility for care in Japan lies. In Japan, research has shown that the most dependable source for both instrumental and emotional support were family members living together, followed by children living apart, and neighbours and friends. Clearly the responsibility for care in Japan relies first and foremost on the direct family members of older people. This is especially the case for long-term care. In addition family members living together seem a more stable source of support as their support has been found to be independent of functional status, health status or educational background of the older person involved. In the Netherlands, this situation seems different. Rather than a source for instrumental support, family members seem to be more a source for emotional support. As Mrs. F. also indicated, elderly in the Netherlands in general have a strong will to remain independent and not to be 'burdensome' to their family members. This in contrast to Japan where the expectation of filial piety (*oyakoko*) is still important, even if it has been decreasing in importance somewhat in recent years.

3.4 Co-residence

If we compare Japan and the Netherlands in terms of family relationships, it is well known that in Japan it is more common to live with several generations in one house. Geographic proximity is not a direct indicator of emotional and instrumental support, but might increase the likelihood of functional support and social contact by the sheer principle of availability. Moreover, this is an especially important aspect because, as we have noted above, family members that live together are a stable source of support.
In 2007 44% of the Japanese elderly (65 years and older) lived with their children. In addition a large number of elderly live with their children on the same site. In 2001 co-residence for instance – including living on the same site – amounted to 68%. Co-residence is relatively decreasing in recent years though, although a 65-year old in Japan is still far more likely to be living with a child than in other industrial societies. Compared to the Netherlands there is a striking

difference. According to the OECD, in 2002, only 6% of women aged 65 years and older lived with their children, and for men this was slightly higher with about 8%.

Our question then whether the responsibility for care in Japan is beneficial for life expectancy at older ages, cannot be answered directly. The responsibility for instrumental care clearly lies more with family members in Japan than in the Netherlands, but it is not directly evident if this might be a piece of the puzzle why Japan is doing so well in terms of life expectancy. It is apparent, however, that the expectation is that family members take care of elderly. Due to this and the higher rate of adults living with their parents, Japanese elderly simply have social contact more frequently. Adding to this that in Japan instrumental support is more important than emotional support (and vice versa for the Netherlands) it is tempting to speculate whether these two facets potentially benefit the survival rates of older people.

Discussion

Dutch life expectancy has not improved as much as in other countries over the past 50 years. This stagnation is mainly due to stagnation in the decline of the mortality rate of the age-group 65 years and above. For Dutch men of 65 years and older this can be largely explained by the high expected historic prevalence of smoking in the Netherlands. Smoking, however, does not explain the entire period of stagnation of life expectancy in the Netherlands.

Especially for women, even after correction for differences in expected historical smoking prevalence, Dutch women can still expect to live two years less than Japanese women. Since the increased mortality cannot be attributed to a specific group of diseases, an emerging hypothesis is that more general, socio-medical determinants could be behind the shorter life expectancy.

The Netherlands has seen large societal changes over the past 50 years. At first sight, a shift in responsibility for care of older people has taken place from familial and informal care to institutionalised care. As a result one easily comes to the conclusion that the Netherlands is one of the countries with one of the highest rates of institutionalised care in the world. However, this is not the case. In this report we have compared Japanese elderly care with the situation in the Netherlands. Japan, usually praised for its low rates of institutionalised care, in fact has a similar rate of institutionalisation if one takes into account the long-term stay of older people in hospitals.

It is therefore in the last part of this report that we have performed an initial exploration of social relations and informal care in Japan and the Netherlands. Although it is too early to draw any hard conclusions, there are indirect indications that social support is different in Japan and perhaps more beneficial at older age, than in the Netherlands. In the Netherlands giving instrumental support is less expected than giving emotional support. This might have its effects on the degree of informal care as well. It seems that the separation of kinds of support is less prone for family members in Japan and especially giving instrumental help is expected. In Japan therefore, older people might benefit from the idea that giving instrumental help is expected from their adult children as this might lead to higher levels of informal care that includes physical and functional care. In the Netherlands social relations concentrate much more on emotional support. This last kind of support might be less favourable for older people as they feel less inclined to ask or receive

instrumental support of family members. An explanation for this phenomenon might be found in the different descent kinship systems; Japan has a descent kinship system in which as Nauck and Suckow have concluded “instrumental relations determine the character of intergenerative and kinship relations.” In contrast, the Dutch kinship system can be characterised as having a primacy of conjugal relations in which instrumental help is given less whereas expressivity (emotions) in family relations is larger.

Patterns of informal and formal care are also influenced by descent systems in another way, namely by the Japanese patrilineal and patrilocal tradition. Being patrilocal by tradition also results in a higher amount of co-residence, especially with oldest sons, and more often than not adult children live close to their parents. Familial care, as a logical extension of this tradition, is provided by the daughters-in-law or unmarried daughters. This in contrast to affinal kinship, present for instance in Germany and the Netherlands, where the conjugal relationships have higher importance and thus expectations of co-residence and informal care are different. Moreover the high rate of co-residence might influence instrumental care because family members living together have been found to be a stable source of support. These aspects might contribute to health benefits as we have seen in previous research.

Finally, being a caretaker in Japan is still an accepted career-pathway for women, this in contrast to women in many other countries. American female care-givers for example usually perceive care-giving as a break, especially career-wise, whereas in Japan this is much less the case. These factors of support expectations, co-residence and caretaker perspectives might on the one hand together contribute to a larger availability of social contacts in Japan and a more accepted inclination to give instrumental support on the other hand.

In conclusion, in this report we have explored several hypotheses that might explain the stagnation of life expectancy in the Netherlands and the outstanding record of the Japanese. First we explored several, often postulated, hypotheses but these were ruled out. We have found that smoking, especially for women, only explains part of the differences between the countries. We have continued our exploration with the next hypothesis that a high rate of institutionalisation might be contributing to the Dutch stagnation. We ruled this hypothesis out and this led us to argue that several more indirect causes might be the source of Japan’s good standing. Our next hypothesis therefore turned towards informal care and social support. Here we found some differences: in Japan instrumental support of family members is more accepted and expected, and co-residence is more present than in the Netherlands. More research is needed to fully establish the impact of this difference. It is also possible that if we research this in-depth that this is not the whole answer to our dilemma of life expectancy.

It is necessary to continue the falsification of hypotheses and to expand this research towards other factors. Often proposed alternative explanations include nutrition, but direct evidence of the relation between nutrition and life expectancy is still lacking. Especially when it comes to what kind of nutrition is favourable for life expectancy evidence is inconclusive. Also there are some major differences in the organisation and financing of health care in Japan and the Netherlands. The Japanese system might be more equipped for older people and this might have its effects on life expectancy at age 65 and above. Physical activity is another key that is worthwhile to explore in the case of Japan. There is a large body of evidence that physical activity increases the number of years living in good health and free of cardiovascular disease. Moreover it contributes to a slower decline in mobility performance. There is already some evidence that current physical activity – and not only past activity – seems to be more important for mortality risk. This might be an

important hypothesis to explain the differences in life expectancy as data indicates that in Japan the elderly actually physically exercise more after age 65 than at middle ages in Japan, whereas in the Netherlands the trend seems to be that older people do less physical exercise after age 65 compared to the middle age-group.

Japan shows us that Dutch life expectancy can still be improved. This indicates that there is plasticity in life expectancy and this is in fact a hopeful message. It is the future challenge to find out how exactly to improve Dutch life expectancy and especially life expectancy after age 65. Improvements that benefit older people will one day benefit us all.

Acknowledgements

Leyden Academy on Vitality and Ageing, in collaboration with The Netherlands Interdisciplinary Demographic Institute (NIDI) organised an international expert meeting on 10 and 11 November 2009 under the title: 'Dutch life expectancy in international perspective'. This meeting was also attended by demographers and representatives of the International Longevity Centers of four countries under study; the Netherlands, the United States, France and Japan.

On the 10th of November 2009 we discussed the differences in life expectancy between the developed countries. During the meeting, all four countries were successively discussed. From each country both a demographer and a clinician were asked to reflect on the development of life expectancy of their countries over the past 50 years and to reflect on the stagnation of the Dutch life expectancy.

On 11 November we discussed an earlier version of this report. We came to the following conclusions that all participants could agree upon:

- In general, longer life spans go with longer lives with good quality.
- Abstention from smoking is an obvious target to get more out of our lives.
- The ability to better manage chronic diseases is a first step of progress.
- Life expectancy, disability and quality of life are distinct concepts and may have different determinants.
- Differences in smoking behaviour is part of the explanation why life expectancy in most countries is lagging behind the average life expectancy of Japan.
- Too little is known of mortality in the oldest old to fully understand the differences between life expectancy between countries.
- Factors that determine changes in life expectancy over time may differ from determinants that rank countries on their life expectancy.

List of participants of the expert meeting

J. de Beer MSc	Netherlands Interdisciplinary Demographic Institute
L. Bonneux MD PhD	Netherlands Interdisciplinary Demographic Institute
Prof. R. N. Butler MD PhD [1]	International Longevity Center USA
Prof. E. Crimmins PhD [2]	Center on Biodemography and Population Health, University of California
Prof. P. Dykstra PhD	Netherlands Interdisciplinary Demographic Institute
Prof. F. Forette MD PhD	International Longevity Center France
J. Garssen MsC	CBS Statistics Netherlands
Prof. S. J. Olshansky PhD	School of Public Health, University of Illinois at Chicago
M. Osako PhD	ILC Global Alliance Secretariat New York
Prof. J.M. Robine PhD	National Institute of Health and Medical Research, University of Montpellier
Prof. Y. Saito PhD	Nihon University Japan
Prof. H. Shibata MD PhD	International Longevity Center Japan
Prof. F. Willekens PhD	Netherlands Interdisciplinary Demographic Institute
D. van Bodegom MD	Leyden Academy, Leiden University Medical Centre
F. Engelaer MSc	Leyden Academy
J.J. Meij PhD	Leyden Academy, International Longevity Center Netherlands
Prof. R.G.J. Westendorp MD PhD	Leyden Academy, Leiden University Medical Centre

[1] Prof Butler passed away on July 4 2010, before this report was published. We deeply appreciate his support and engagement and highly value his contribution to and expertise in the field of ageing.

[2] Prof Crimmins, co-chair of the U.S. National Academy of Sciences committee 'Understanding Divergent Trends in Longevity in High-Income Countries', gave a presentation on 'Diverging trends in adult mortality. Putting the U.S. and the Netherlands in international context.'

References and justification

Databases

Central Bureau of Statistics (CBS), The Netherlands, http://statline.cbs.nl/statweb

Human Mortality Database, University of California, Berkeley, USA, and Max Planck Institute for Demographic Research, Germany, www.mortality.org

Gapminder database, www.gapminder.org

World Health Organization Statistics, http://www.who.int/healthinfo

Japanese Ministry of Health, Labour and Welfare, Japan, http://www.mhlw.go.jp

Organisation for Economic Co-operation and Development Data, www.sourceoecd.org

International Longevity Center Japan, http://www.ilcjapan.org

Preface

1. Trends in life expectancy

1.1 Epidemiologic transition in the Netherlands

Figure 1 is based on Dutch life expectancy from the human mortality database. Best-performance life expectancy is based on supplementary data from a Science publication by Oeppen and Vaupel: Oeppen, J,Vaupel, JW, Demography: Broken Limits to Life Expectancy.

Science 296(5570): 1029-1031 (2002). Supplementary online data. DOI: 10.1126/science.1069675

Figure 2 represents cumulative survival probabilities. Age-specific mortality rates for a specific year are applied to an imaginary cohort. From a computational point of view, these artificial lives are lived in a split second. Data for historical years are from the Human Mortality Database. Data for 2008 are from the Central Bureau of Statistics (CBS), The Netherlands

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1.2 An international comparison

Data for Figure 3 are from the Human Mortality Database.

Data for box 2 come from the OECD Database. The short report was published as Rapid increase life expectancy, Garssen, J & van der Togt, K CBS Web Magazine, (2008). Retrieved from: http://www.cbs.nl/en-GB/menu/themas/bevolking/publicaties/artikelen/archief/2008/2008-2528-wm.htm.

1.4 Life expectancy at birth reflects differences in mortality at higher ages

Data for figure 4 are from the Human Mortality Database.

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Janssen F, Nusselder WJ, Looman CW, Mackenbach JP, Kunst AE, Stagnation in mortality decline among elders in the Netherlands. Gerontologist 43(5):722-734 (2003).

1.5 Life expectancy and healthy life expectancy

Data for figure 5 are from the CBS-Statline.

2. Dutch stagnation in life expectancy

2.1 Common explanations

Data about euthanasia are from the annual report of the regionale toetsingscommissie euthanasie over 2009. The report can be downloaded from their website: www.euthanasiecommissie.nl, the report from http://www.euthanasiecommissie.nl/doc/pdf/Jaarverlsag%20RTE%202009_def_23204.pdf.

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Data for figure 6 are from the gapminder-database, www.gapminder.org. For life expectancy and GDP per capita we used the latest data available for the countries under study, which was 2009.

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2.2 Smoking

We compared the mortality of five countries: Japan, the Netherlands, Sweden, France, and the United States. Numbers and causes of death were abstracted from the WHO database. 2005 was the latest available year with mortality figures for all countries. Since causes of death are becoming increasingly unreliable with more advanced age, we have focussed here on women ages 65 to 74, for whom we have the best available data. Mortality rates by single years of age were taken from the Human Mortality Database.

Population mortality in developed countries is heavily confounded by smoking behaviour. In developed countries, lung cancer is a rare disorder among non-smokers but a very common one among smokers, as Peto et al. (1992) also concluded "virtually all excess risk of lung cancer is associated with smoking". Therefore, comparisons of observed lung cancer mortality over expected mortality when no one smoked can be used as an indicator for historical smoking behaviour, called therefore in this report expected smoking prevalence. This method was developed by Peto et al.:

Peto R, Lopez AD, Boreham J, Thun M, Heath C, Jr., Mortality from tobacco in developed countries: indirect estimation from national vital statistics. Lancet 339(8804): 1268-1278 (1992).

For ages 65-74, we used published figures on the major groups of causes of death (cardiovascular disease, cancer, respiratory diseases, accidents, and other medical conditions), corrected for expected smoking prevalence, and added smoking-related mortality. For ages 75 and older, we only used lung cancer mortality to correct total mortality.

Among men, smoking-related mortality is far more important. The effect of correction is far larger, and differences caused by correction may be confounded by classification differences between cardiovascular diseases (with higher smoking-attributable risks) and ill-defined causes of death. In Sweden, smoking is historically lower than in the rest of the developed world (a consequence of the use of smokeless tobacco), and the levels of ill-defined causes of death are low due to high autopsy rates. In men 65-74, no pattern emerges and the differences in smoking-adjusted mortality with Japan are small.

Differences after correction for expected smoking prevalence are smaller among men. However, the inter-country pattern is similar: lowest mortality in Japan, intermediate mortality differences in the United States and France, and highest differences in Sweden and the Netherlands.

3. Learning from the best

Data for Figure 10 are from the OECD health database. LTC includes long-term care facilities but excludes hospitals.

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Leyden Academy

on vitality and ageing

The Leyden Academy on Vitality and Ageing is a knowledge centre with an education and research programme in the field of ageing, vitality and geriatric medicine. It was established in November 2008. The Academy offers vocational courses to master students and professionals, given by leading international academics. With these educational programmes it hopes to contribute to its main goal: to advance the quality of life of older people.

Part of the Leyden Academy's research programme is an international comparison project on life expectancy and ageing between the Netherlands, France, the United States and Japan. This programme is carried out in cooperation with various international universities and longevity centers. It focuses specifically on questions that have arisen in conjunction with the period of stagnation in the decline of mortality in the Netherlands.

With its research programme the Leyden Academy hopes to understand the factors that have led to this stagnation of life expectancy. In this exploration it aims to come to insights that might improve the situation in the Netherlands. It hopes to achieve part of this improvement by placing both research and attention for ageing, vitality and life expectancy at the heart of the political and scientific agenda in the Netherlands. Besides this, the institute will identify possible causes of this stagnation that needs to be further researched and examined. This is grounded in high academic standards and with an international orientation.

The main goals are to achieve an analysis of international differences in life expectancy and healthcare and to identify new topics for research to improve both the health and care for the elderly.

Furthermore, Leyden Academy offers the following programmes:
- Medical Master on Vitality and Ageing
- Executive course for managers in healthcare
- PhD programme
- Young Excellence Class

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ON VITALITY AND AGEING