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# Analysis of Portuguese Life Tables

**Paulo Canas Rodrigues[1] João Tiago Mexia[1] and Dulce Pereira[2]**

[1]Department of Mathematics, Faculty of Science and Technology, Nova University of Lisbon, Quinta da Torre, 2829-516 Caparica, Portugal, e-mail: paulocanas@fct.unl.pt
[2]Department of Mathematics, University of Évora, Rua Romão Ramalho, 59, 7000-671 Évora, Portugal

SUMMARY

In 1995 life tables commissioned by the Portuguese Insurance Institute were obtained. These life tables were then validated and are now updated. The updated tables are used to compare mortality for men and women.

**Key words**: Life tables; Population mortality; Portuguese case.

## 1. Introduction

Portuguese life tables are based on national censuses and have been published every 10 years since the beginning of the 20th century, issued for males and females separately and for the whole population; see Cruz Alves (1997).

In 1995 the Faculty of Science and Technology of Nova University of Lisbon published the first "auto-corrective" mortality tables, by sex, known in Portugal (Mexia and Corte-Real (1995)) at the request of the Portuguese Insurance Institute. At the time, the adjustment of these tables was validated by Bernardino (1995) and Cruz Alves (1997) who showed that the new tables were better adjusted than others currently used in Portugal.

As seen in Chiang (1984), the standard techniques for life table construction rest on the probabilities $q_x$ of a man or woman of age $x$ dying before attaining age $x+1$.

A preliminary study of the evolution of the probabilities $q_x$ presented in Mexia and Corte-Real (1995) showed that they had stabilized or at least smoothly evolved. An update of these probabilities was carried out, using a procedure described later on, in order to update the Portuguese life tables. We present the new tables and discuss some demographic implications.

## 2. Life tables

A life table is a concise way of showing the probabilities of a member of a particular population living to or dying at a particular age. It summarizes the mortality experience of a population as determined by historical data and prior opinion concerning that population.

Life tables play a central role in the Actuarial Sciences. They are primarily used for the calculation of life insurance premiums.

Life tables are usually constructed separately for men and women because of their substantially different mortality rates. Other characteristics can also be used to distinguish different risks, such as smoking-status, occupation and socio-economic class.

### 2.1. The survival function and some sample calculations

Let us consider a newborn child. This newborn's age-at-death, $X$ , is a continuous type random variable. Let $F_X(x)$ denote the distribution function of $X$ ,

$$F_X(x) = P(X \leq x), \quad x \geq 0,$$

and set

$$s(x) = 1 - F_X(x) = P(X > x), \quad x \geq 0.$$

We assume that $F_X(0) = 0$, which implies $s(0) = 1$. The function $s(x)$ is called the survival function. Then for a positive $x$, $s(x)$ is the probability of a newborn attaining age $x$. The distribution of $X$ can be defined by specifying either the function $F_X(x)$ or the survival function $s(x)$, see Bowers *et al.* (1997).

Using these functions we get:

- $P(x < X \leq y) = F_X(y) - F_X(x) = s(x) - s(y)$ this is the probability of a newborn dying between ages $x$ and $y$ ($x < y$).

- $P(x < X \leq y \mid X > x) = \dfrac{F_X(y) - F_X(x)}{1 - F_X(x)} = \dfrac{s(x) - s(y)}{s(x)}$ this is the conditional probability of a newborn dying between ages $x$ and $y$, given that it survived to age $x$.

Before updating the Portuguese life tables we introduce some useful functions. Firstly $T(x) = X - x$ will be the life-span of a person that attained age $x$ and:

- ${}_tq_x = P[T(x) \leq t], \; t \geq 0$ is the probability that a person with age $x$ will die within $t$ years;
- ${}_tp_x = 1 - {}_tq_x = P[T(x) > t], \; t \geq 0$ is the probability that a person with age $x$ will attain age $x + t$;

Namely we will have $T(0) = X$ , ${}_xp_0 = s(x), x \geq 0$ and:

- $q_x = {}_1q_x$ will be the probability of an individual with age $x$ dying before his $(x-1)$th birthday;
- $p_x = {}_1p_x = 1 - q_x$ will be the probability of surviving from age $x$ to age $x+1$;

Beside the probabilities $q_x$, in the life tables we have two more columns, assigned to:

- $l_x$ - the number of people who survive to age $x$ starting usually with $l_0 = 100.000$. Since $l_{x+1} = l_x(1 - q_x) = l_x p_x$ we have ${}_tp_x = \dfrac{l_{x+t}}{l_x}$.
- $e_x = \sum_{t=1}^{\infty} {}_tp_x$ - the life expectancy at age $x$. This value is calculated by adding up the probabilities of surviving to every age, i.e. the expected number of complete years lived (one may think of it as the number of birthdays they will celebrate).

These special functions are taken for both sexes.

## 3. Updating the tables

### 3.1. Method Used

We now describe how the life tables were updated.
Using the data on:

- death of Portuguese men and women from 1917 to 1992;
- birth of Portuguese men and women from 1960 to 1992,

the probabilities $q_x$ for both sexes were obtained for every year from 1940 to 1992.

For instance, for women and ages 11 and 42 we obtained the graphs which are shown in Figure 1.

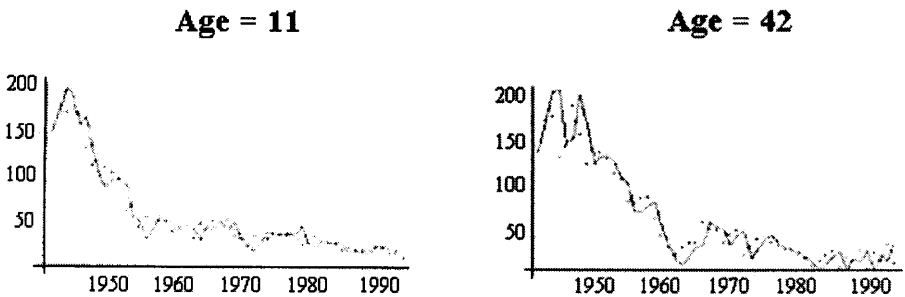


**Figure 1**. Mortality in males being 11 (on the left) and 42 (on the right) years old. Dots represent the chrono-series and the lines the forecast

We see in these two graphs a stabilization of the probabilities $q_x$ from 1970 onwards. This stabilization may be observed for other ages and also for men.

Thus we decided to use the Holt double exponential method to update to the present the values of the probabilities $q_x$. This method minimizes the sum of squares of the errors of forecasting. An extrapolation was then carried out to predict future mortality rates, where:

- the origin of time is placed at the present;
- the weights of the observations decrease geometrically as we go back in time.

Hence this method stresses the importance of recent observations and gives less importance to observations that occurred longer ago.

The problem of forecasting in statistics has been studied deeply, see for example Chatfeld (1989) or Murteira *et al.* (1993).

## 3.2. Results and updated results

In our updating we also used polynomial splines of degrees 4 and 6 to smooth the peaks in the original time series. To reduce the distances between forecasted and adjusted values we opted, after some attempts, to divide the series in two sub-series; one up to 65 years and another from 66 to 105 years old.

In Table 1 we present, for men, the probabilities $q_x$ used by Mexia and Corte-Real (1995) and those obtained through the updating. The corresponding probabilities for women are presented similarly in Table 2.

The evolution of these probabilities for men and women are presented in Figures 2 and 3 respectively.

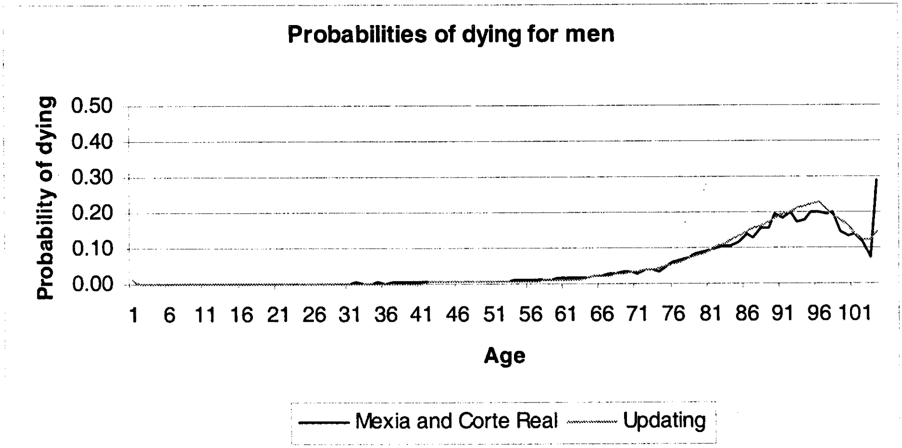


**Figure 2**. Probabilities of dying for men as used by Mexia and Corte Real and those obtained through the updating, based on Table 1

**Table 1**. Probabilities of dying ($\times 10^{-3}$) as used by Mexia and Corte Real (1995) and those obtained through the updating, for men.

| Age | Mexia and Corte Real | Updating | Age | Mexia and Corte Real | Updating | Age | Mexia and Corte Real | Updating |
|---|---|---|---|---|---|---|---|---|
| 0 | 9.058 | 9.058 | 36 | 3.122 | 2.554 | 72 | 38.818 | 41.362 |
| 1 | 0.987 | 0.789 | 37 | 3.172 | 2.597 | 73 | 34.967 | 45.911 |
| 2 | 0.823 | 0.647 | 38 | 3.439 | 2.646 | 74 | 50.687 | 51.049 |
| 3 | 0.493 | 0.542 | 39 | 3.629 | 2.703 | 75 | 62.529 | 56.787 |
| 4 | 0.833 | 0.472 | 40 | 3.522 | 2.770 | 76 | 66.969 | 63.128 |
| 5 | 0.334 | 0.433 | 41 | 3.429 | 2.850 | 77 | 73.117 | 70.062 |
| 6 | 0.342 | 0.421 | 42 | 3.538 | 2.944 | 78 | 81.388 | 77.574 |
| 7 | 0.456 | 0.433 | 43 | 4.216 | 3.057 | 79 | 86.733 | 85.635 |
| 8 | 0.412 | 0.466 | 44 | 3.335 | 3.191 | 80 | 96.770 | 94.209 |
| 9 | 0.125 | 0.517 | 45 | 4.471 | 3.349 | 81 | 99.097 | 103.250 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 10 | 0.331 | 0.583 | 46 | 4.744 | 3.534 | 82 | 104.591 | 112.703 |
| 11 | 0.274 | 0.662 | 47 | 5.205 | 3.750 | 83 | 107.007 | 122.501 |
| 12 | 0.395 | 0.751 | 48 | 5.321 | 4.000 | 84 | 117.971 | 132.570 |
| 13 | 0.576 | 0.848 | 49 | 4.990 | 4.288 | 85 | 138.282 | 142.825 |
| 14 | 0.577 | 0.950 | 50 | 5.838 | 4.619 | 86 | 129.959 | 153.173 |
| 15 | 0.913 | 1.057 | 51 | 6.325 | 4.996 | 87 | 156.199 | 163.508 |
| 16 | 1.380 | 1.165 | 52 | 7.679 | 5.423 | 88 | 156.315 | 173.719 |
| 17 | 1.816 | 1.275 | 53 | 8.479 | 5.905 | 89 | 192.162 | 183.681 |
| 18 | 1.893 | 1.383 | 54 | 9.344 | 6.447 | 90 | 180.571 | 193.262 |
| 19 | 1.876 | 1.489 | 55 | 10.525 | 7.053 | 91 | 197.877 | 202.320 |
| 20 | 1.750 | 1.592 | 56 | 11.133 | 7.728 | 92 | 170.350 | 210.704 |
| 21 | 1.937 | 1.691 | 57 | 11.733 | 8.478 | 93 | 180.434 | 218.251 |
| 22 | 1.742 | 1.784 | 58 | 12.504 | 9.308 | 94 | 197.320 | 224.791 |
| 23 | 1.953 | 1.872 | 59 | 14.079 | 10.222 | 95 | 200.171 | 230.143 |
| 24 | 2.217 | 1.955 | 60 | 16.221 | 11.228 | 96 | 191.908 | 205.473 |
| 25 | 2.441 | 2.031 | 61 | 16.239 | 12.330 | 97 | 197.952 | 190.485 |
| 26 | 2.252 | 2.101 | 62 | 16.894 | 13.535 | 98 | 144.928 | 177.026 |
| 27 | 2.248 | 2.164 | 63 | 18.742 | 14.848 | 99 | 136.054 | 160.556 |
| 28 | 1.991 | 2.222 | 64 | 21.472 | 21.628 | 100 | 137.256 | 141.335 |
| 29 | 2.329 | 2.274 | 65 | 21.616 | 23.029 | 101 | 114.943 | 124.424 |
| 30 | 2.554 | 2.321 | 66 | 27.371 | 24.583 | 102 | 72.993 | 119.684 |
| 31 | 2.884 | 2.364 | 67 | 26.850 | 26.376 | 103 | 289.157 | 141.775 |
| 32 | 2.719 | 2.404 | 68 | 32.079 | 28.489 | 104 | 408.163 | 210.157 |
| 33 | 2.672 | 2.441 | 69 | 32.290 | 30.989 | 105 | 476.190 | 349.090 |
| 34 | 2.985 | 2.478 | 70 | 25.009 | 33.936 | 106 | 1000.000 | 1000.000 |
| 35 | 2.772 | 2.515 | 71 | 38.835 | 37.380 | | | |

**Table 2**. Probabilities of dying ($\times 10^{-3}$) as used by Mexia and Corte Real (1995) and those obtained through the updating, for women

| Age | Mexia and Corte Real | Updating | Age | Mexia and Corte Real | Updating | Age | Mexia and Corte Real | Updating |
|---|---|---|---|---|---|---|---|---|
| 0 | 6.887 | 6.887 | 36 | 0.993 | 0.715 | 72 | 18.273 | 19.181 |
| 1 | 0.458 | 0.713 | 37 | 1.240 | 0.743 | 73 | 19.624 | 20.835 |
| 2 | 0.359 | 0.572 | 38 | 0.707 | 0.776 | 74 | 29.109 | 32.258 |
| 3 | 0.552 | 0.455 | 39 | 1.406 | 0.816 | 75 | 36.733 | 32.539 |
| 4 | 0.353 | 0.359 | 40 | 1.339 | 0.863 | 76 | 40.500 | 38.234 |
| 5 | 0.426 | 0.282 | 41 | 1.613 | 0.920 | 77 | 44.644 | 46.031 |
| 6 | 0.437 | 0.223 | 42 | 1.512 | 0.986 | 78 | 52.702 | 53.898 |
| 7 | 0.166 | 0.180 | 43 | 1.857 | 1.065 | 79 | 56.647 | 60.797 |
| 8 | 0.174 | 0.150 | 44 | 2.326 | 1.158 | 80 | 68.139 | 66.434 |
| 9 | 0.314 | 0.132 | 45 | 2.138 | 1.266 | 81 | 75.724 | 71.029 |
| 10 | 0.288 | 0.125 | 46 | 2.663 | 1.392 | 82 | 80.115 | 75.122 |
| 11 | 0.106 | 0.127 | 47 | 2.058 | 1.537 | 83 | 82.167 | 79.405 |
| 12 | 0.088 | 0.137 | 48 | 2.011 | 1.703 | 84 | 101.625 | 84.581 |
| 13 | 0.225 | 0.152 | 49 | 2.316 | 1.893 | 85 | 29.165 | 91.254 |
| 14 | 0.358 | 0.173 | 50 | 2.849 | 2.109 | 86 | 117.998 | 99.849 |
| 15 | 0.241 | 0.198 | 51 | 3.073 | 2.353 | 87 | 132.804 | 110.558 |
| 16 | 0.238 | 0.226 | 52 | 4.254 | 2.628 | 88 | 147.623 | 123.318 |
| 17 | 0.227 | 0.256 | 53 | 3.882 | 2.936 | 89 | 161.140 | 137.809 |
| 18 | 0.397 | 0.288 | 54 | 3.813 | 3.280 | 90 | 163.228 | 153.498 |
| 19 | 0.460 | 0.319 | 55 | 4.366 | 3.662 | 91 | 166.433 | 169.694 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 20 | 0.461 | 0.351 | 56 | 4.800 | 4.086 | 92 | 178.531 | 185.640 |
| 21 | 0.336 | 0.383 | 57 | 5.157 | 4.554 | 93 | 171.503 | 200.635 |
| 22 | 0.718 | 0.413 | 58 | 5.178 | 5.070 | 94 | 201.782 | 214.183 |
| 23 | 0.509 | 0.442 | 59 | 6.319 | 5.636 | 95 | 207.558 | 226.168 |
| 24 | 0.579 | 0.469 | 60 | 8.539 | 6.255 | 96 | 215.219 | 237.064 |
| 25 | 0.598 | 0.494 | 61 | 6.708 | 6.932 | 97 | 205.770 | 248.166 |
| 26 | 0.605 | 0.518 | 62 | 7.372 | 7.669 | 98 | 210.277 | 261.858 |
| 27 | 0.636 | 0.540 | 63 | 8.446 | 8.470 | 99 | 265.922 | 281.902 |
| 28 | 0.664 | 0.560 | 64 | 9.630 | 9.339 | 100 | 161.832 | 313.763 |
| 29 | 0.629 | 0.579 | 65 | 11.527 | 10.278 | 101 | 152.577 | 364.959 |
| 30 | 0.672 | 0.597 | 66 | 11.934 | 11.293 | 102 | 127.660 | 445.437 |
| 31 | 0.673 | 0.615 | 67 | 11.664 | 12.387 | 103 | 284.501 | 567.985 |
| 32 | 0.705 | 0.632 | 68 | 14.736 | 13.563 | 104 | 403.042 | 748.665 |
| 33 | 0.746 | 0.650 | 69 | 15.686 | 14.827 | 105 | 456.140 | 879.310 |
| 34 | 1.125 | 0.669 | 70 | 18.303 | 16.181 | 106 | 1000.000 | 1000.000 |
| 35 | 0.982 | 0.690 | 71 | 21.403 | 17.631 | | | |

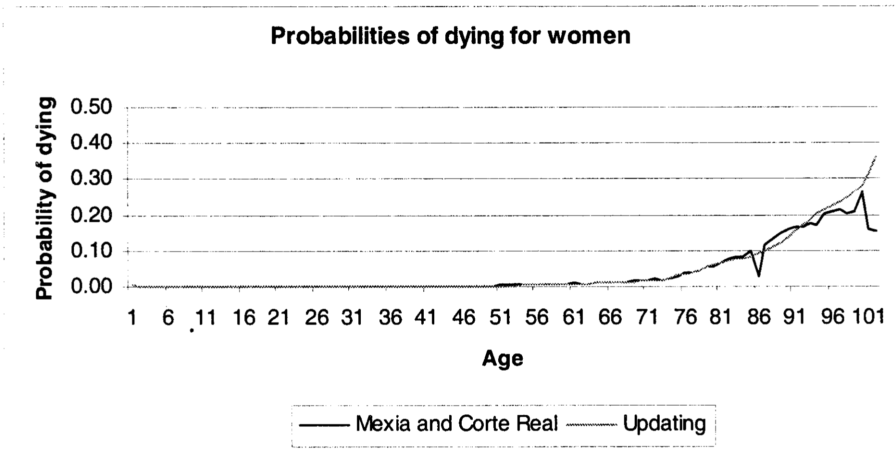


**Figure 3**. Updated probabilities of dying as used by Mexia and Corte Real (1995) and those obtained through the updating, for women, based on Table 2

We observe that our technique led to a smoothing of the evolution of $q_x$ series as is generally recommended; see Chiang (1984).

## 3.3. Life expectancy

Life expectancy for a sex and age is the corresponding expected number of years of life. This expectancy changes with time. The resulting tables for the Portuguese population have been presented. Although perfectly adjusted life tables tend to be outdated in themselves, the idea of constructing auto-correlative life tables has been introduced. The basis for this construction is to use forecast techniques, and also auto-correlatives, for natalities and mortalities for the two sexes and different ages.

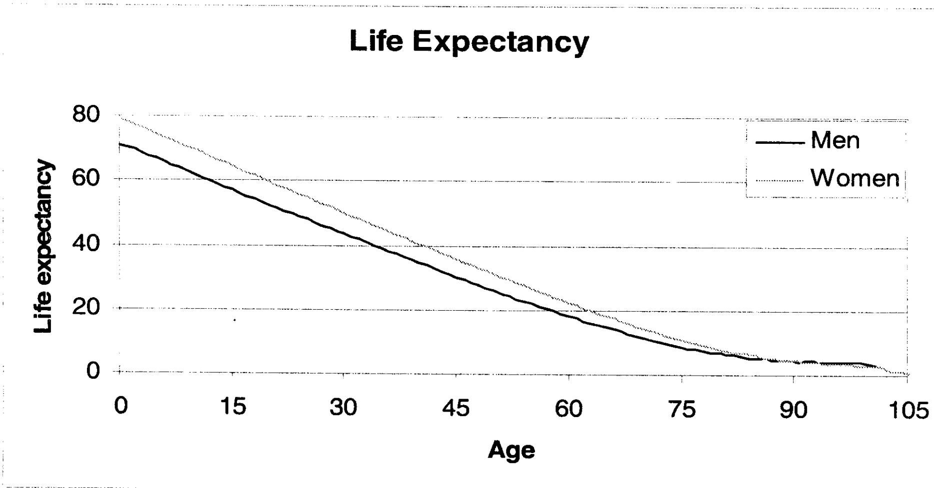


**Figure 4**. Life expectancy by age and sex

Figure 4 shows the life expectancy for men and women. We can see that the life expectancy for women is almost always superior to the life expectancy for men. Only men aged more than 95 years old had a higher life expectancy than the corresponding women.

Although there are few men at this age because they die before 95 more often than women, they are possibly stronger and more resistant. In the appendix we present the life tables with the probability of dying, the proportion of original individuals still alive and the remaining life expectancy by age and sex.

## 3.4. Some comparative analysis

We present now some comparative analysis between males and females to try to find any significant differences.

### Probability of dying between 5 and 50

Figure 5 presents the comparison between probabilities of dying for men and women with ages between 5 and 50 years. The differences between men and women are vast. Between 15 and 20 years the probability of dying for males grows significantly, probably because some risk attitudes are more common in men than in women. Between 40 and 45 years we can see a significant growth in the probabilities of dying, as much in men as in women.

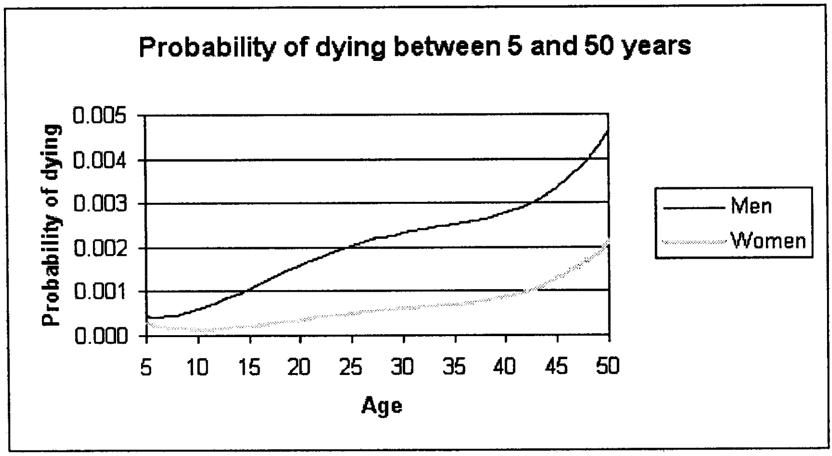


**Figure 5**. Probabilities of dying between 5 and 50 years

## Probability of dying between 65 and 105

In Figure 6 we present the comparison between probabilities of dying for men and women with ages between 65 and 105.

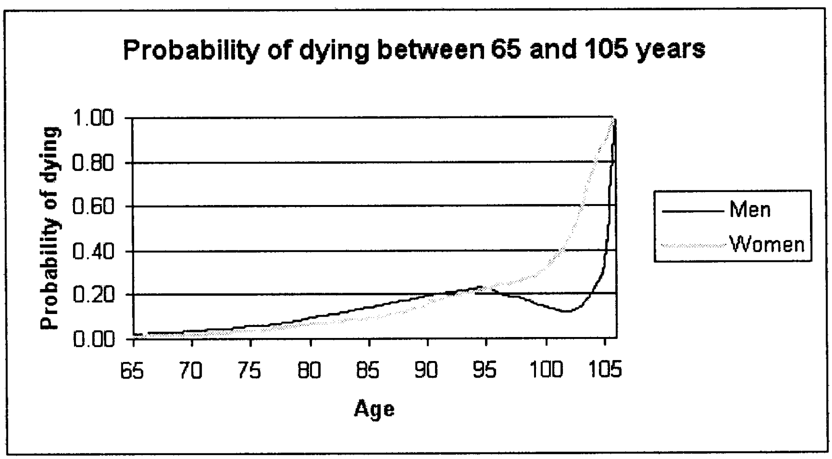


**Figure 6**. Probabilities of dying between 65 and 105 years

We can see that the probability of dying, up to 95 years, is greater for men than for women but after 95 years (as we concluded from the analysis of life expectancy) men were less likely to die (the number of men is smaller than the number of women as we can see in the tables in the appendix).

## 4. Final comments

We conclude by pointing out that:

- The probability of dying is greater for men aged less than 95 years. The opposite is true of life expectancy;
- Between 15 and 25 years, the probability of dying for men is about 4.5 times greater than the probability of dying for women;
- The probability of dying between 41 and 50 years is 1.4 times larger than the probability of dying between 31 and 40 for men and 2.0 times larger for women;
- The life expectancy of women at birth is almost 8 years longer than that for men.

# Appendix

**Tabela 3**. Life table for Portuguese males

| Interval age (in years) from x to x+1 | Probability of dying in the interval (x,x+1) 1000 qx | Number of people alive with age x lx | Life expectancy at age x ex | Interval age (in years) from x to x+1 | Probability of dying in the interval (x,x+1) 1000 qx | Number of people alive with age x lx | Life expectancy at age x ex |
|---|---|---|---|---|---|---|---|
| 0 | 9.058 | 100000 | 70.96 | 54 | 6.447 | 86406 | 22.67 |
| 1 | 0.789 | 99094 | 70.61 | 55 | 7.053 | 85599 | 21.88 |
| 2 | 0.647 | 98996 | 69.68 | 56 | 7.728 | 84698 | 21.12 |
| 3 | 0.542 | 98915 | 68.74 | 57 | 8.478 | 83755 | 20.35 |
| 4 | 0.472 | 98866 | 67.77 | 58 | 9.308 | 82772 | 19.59 |
| 5 | 0.433 | 98784 | 66.83 | 59 | 10.222 | 81737 | 18.84 |
| 6 | 0.421 | 98751 | 65.85 | 60 | 11.228 | 80587 | 18.11 |
| 7 | 0.433 | 98717 | 64.85 | 61 | 12.330 | 79279 | 17.41 |
| 8 | 0.466 | 98672 | 63.88 | 62 | 13.535 | 77992 | 16.70 |
| 9 | 0.517 | 98631 | 62.91 | 63 | 14.848 | 76674 | 15.98 |
| 10 | 0.583 | 98619 | 61.92 | 64 | 21.628 | 75237 | 15.29 |
| 11 | 0.662 | 98586 | 60.94 | 65 | 23.029 | 73622 | 14.63 |
| 12 | 0.751 | 98559 | 59.95 | 66 | 24.583 | 72030 | 13.95 |
| 13 | 0.848 | 98520 | 58.98 | 67 | 26.376 | 70059 | 13.34 |
| 14 | 0.950 | 98464 | 58.01 | 68 | 28.489 | 68178 | 12.71 |
| 15 | 1.057 | 98407 | 57.04 | 69 | 30.989 | 65991 | 12.13 |
| 16 | 1.165 | 98317 | 56.10 | 70 | 33.936 | 63860 | 11.54 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 17 | 1.275 | 98181 | 55.17 | 71 | 37.380 | 62263 | 10.83 |
| 18 | 1.383 | 98003 | 54.27 | 72 | 41.362 | 59845 | 10.27 |
| 19 | 1.489 | 97818 | 53.38 | 73 | 45.911 | 57522 | 9.68 |
| 20 | 1.592 | 97634 | 52.48 | 74 | 51.049 | 55510 | 9.03 |
| 21 | 1.691 | 97463 | 51.57 | 75 | 56.787 | 52697 | 8.52 |
| 22 | 1.784 | 97274 | 50.67 | 76 | 63.128 | 49402 | 8.09 |
| 23 | 1.872 | 97105 | 49.76 | 77 | 70.062 | 46093 | 7.67 |
| 24 | 1.955 | 96915 | 48.86 | 78 | 77.574 | 42723 | 7.27 |
| 25 | 2.031 | 96700 | 47.96 | 79 | 85.635 | 39246 | 6.91 |
| 26 | 2.101 | 96464 | 47.08 | 80 | 94.209 | 35842 | 6.57 |
| 27 | 2.164 | 96247 | 46.19 | 81 | 103.250 | 32374 | 6.28 |
| 28 | 2.222 | 96031 | 45.29 | 82 | 112.703 | 29165 | 5.97 |
| 29 | 2.274 | 95840 | 44.38 | 83 | 122.501 | 26115 | 5.66 |
| 30 | 2.321 | 95616 | 43.49 | 84 | 132.570 | 23321 | 5.34 |
| 31 | 2.364 | 95372 | 42.60 | 85 | 142.825 | 20569 | 5.05 |
| 32 | 2.404 | 95097 | 41.72 | 86 | 153.173 | 17725 | 4.87 |
| 33 | 2.441 | 94839 | 40.83 | 87 | 163.508 | 15421 | 4.59 |
| 34 | 2.478 | 94585 | 39.94 | 88 | 173.719 | 13013 | 4.44 |
| 35 | 2.515 | 94303 | 39.06 | 89 | 183.681 | 10979 | 4.27 |
| 36 | 2.554 | 94041 | 38.17 | 90 | 193.262 | 8869 | 4.28 |
| 37 | 2.597 | 93748 | 37.29 | 91 | 202.320 | 7267 | 4.22 |
| 38 | 2.646 | 93450 | 36.41 | 92 | 210.704 | 5829 | 4.27 |
| 39 | 2.703 | 93129 | 35.54 | 93 | 218.251 | 4836 | 4.14 |
| 40 | 2.770 | 92791 | 34.66 | 94 | 224.791 | 3964 | 4.05 |
| 41 | 2.850 | 92464 | 33.79 | 95 | 230.143 | 3182 | 4.05 |
| 42 | 2.944 | 92147 | 32.90 | 96 | 205.473 | 2545 | 4.06 |
| 43 | 3.057 | 91821 | 32.02 | 97 | 190.485 | 2056 | 4.03 |
| 44 | 3.191 | 91434 | 31.16 | 98 | 177.026 | 1649 | 4.03 |
| 45 | 3.349 | 91129 | 30.26 | 99 | 160.556 | 1410 | 3.71 |
| 46 | 3.534 | 90722 | 29.40 | 100 | 141.335 | 1218 | 3.29 |
| 47 | 3.750 | 90291 | 28.54 | 101 | 124.424 | 1051 | 2.81 |
| 48 | 4.000 | 89821 | 27.69 | 102 | 119.684 | 930 | 2.18 |
| 49 | 4.288 | 89343 | 26.83 | 103 | 141.775 | 862 | 1.35 |
| 50 | 4.619 | 88898 | 25.97 | 104 | 210.157 | 613 | 0.90 |
| 51 | 4.996 | 88379 | 25.12 | 105 | 349.090 | 363 | 0.52 |
| 52 | 5.423 | 87820 | 24.28 | 106 | 1000.000 | 190 | 0.48 |
| 53 | 5.905 | 87145 | 23.47 | | | | |

**Tabela 4**. Life table for Portuguese females

| Interval age (in years) from x to x+1 | Probability of dying in the interval (x,x+1) 1000 qx | Number of people alive with age x lx | Life expectancy at age x ex | Interval age (in years) from x to x+1 | Probability of dying in the interval (x,x+1) 1000 qx | Number of people alive with age x lx | Life expectancy at age x ex |
|---|---|---|---|---|---|---|---|
| 0 | 6.887 | 100000 | 78.73 | 54 | 3.280 | 94016 | 27.56 |
| 1 | 0.713 | 99311 | 78.28 | 55 | 3.662 | 93657 | 26.66 |
| 2 | 0.572 | 99266 | 77.32 | 56 | 4.086 | 93249 | 25.78 |
| 3 | 0.455 | 99230 | 76.34 | 57 | 4.554 | 92801 | 24.90 |
| 4 | 0.359 | 99175 | 75.39 | 58 | 5.070 | 92322 | 24.03 |
| 5 | 0.282 | 99140 | 74.41 | 59 | 5.636 | 91844 | 23.16 |
| 6 | 0.223 | 99098 | 73.44 | 60 | 6.255 | 91264 | 22.30 |
| 7 | 0.180 | 99055 | 72.48 | 61 | 6.932 | 90485 | 21.50 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | 0.150 | 99038 | 71.49 | 62 | 7.669 | 89878 | 20.64 |
| 9 | 0.132 | 99021 | 70.50 | 63 | 8.470 | 89215 | 19.80 |
| 10 | 0.125 | 98990 | 69.52 | 64 | 9.339 | 88462 | 18.96 |
| 11 | 0.127 | 98962 | 68.54 | 65 | 10.278 | 87610 | 18.15 |
| 12 | 0.137 | 98951 | 67.55 | 66 | 11.293 | 86600 | 17.36 |
| 13 | 0.152 | 98942 | 66.56 | 67 | 12.387 | 85566 | 16.57 |
| 14 | 0.173 | 98920 | 65.57 | 68 | 13.563 | 84568 | 15.77 |
| 15 | 0.198 | 98885 | 64.59 | 69 | 14.827 | 83322 | 15.00 |
| 16 | 0.226 | 98861 | 63.61 | 70 | 16.181 | 82015 | 14.24 |
| 17 | 0.256 | 98837 | 62.63 | 71 | 17.631 | 80514 | 13.51 |
| 18 | 0.288 | 98815 | 61.64 | 72 | 19.181 | 78791 | 12.80 |
| 19 | 0.319 | 98776 | 60.66 | 73 | 20.835 | 77351 | 12.04 |
| 20 | 0.351 | 98730 | 59.69 | 74 | 32.258 | 75833 | 11.28 |
| 21 | 0.383 | 98685 | 58.72 | 75 | 32.539 | 73626 | 10.62 |
| 22 | 0.413 | 98652 | 57.74 | 76 | 38.234 | 70921 | 10.02 |
| 23 | 0.442 | 98581 | 56.78 | 77 | 46.031 | 68049 | 9.45 |
| 24 | 0.469 | 98531 | 55.81 | 78 | 53.898 | 65011 | 8.89 |
| 25 | 0.494 | 98474 | 54.84 | 79 | 60.797 | 61585 | 8.38 |
| 26 | 0.518 | 98415 | 53.87 | 80 | 66.434 | 58096 | 7.89 |
| 27 | 0.540 | 98355 | 52.91 | 81 | 71.029 | 54137 | 7.46 |
| 28 | 0.560 | 98293 | 51.94 | 82 | 75.122 | 50038 | 7.07 |
| 29 | 0.579 | 98227 | 50.98 | 83 | 79.405 | 46029 | 6.69 |
| 30 | 0.597 | 98165 | 50.01 | 84 | 84.581 | 42247 | 6.29 |
| 31 | 0.615 | 98100 | 49.04 | 85 | 91.254 | 37954 | 6.00 |
| 32 | 0.632 | 98033 | 48.07 | 86 | 99.849 | 36847 | 5.18 |
| 33 | 0.650 | 97964 | 47.11 | 87 | 110.558 | 32499 | 4.87 |
| 34 | 0.669 | 97891 | 46.14 | 88 | 123.318 | 28183 | 4.62 |
| 35 | 0.690 | 97781 | 45.20 | 89 | 137.809 | 24023 | 4.42 |
| 36 | 0.715 | 97685 | 44.24 | 90 | 153.498 | 20152 | 4.27 |
| 37 | 0.743 | 97588 | 43.28 | 91 | 169.694 | 16862 | 4.10 |
| 38 | 0.776 | 97467 | 42.34 | 92 | 185.640 | 14056 | 3.92 |
| 39 | 0.816 | 97398 | 41.37 | 93 | 200.635 | 11546 | 3.77 |
| 40 | 0.863 | 97261 | 40.43 | 94 | 214.183 | 9566 | 3.55 |
| 41 | 0.920 | 97131 | 39.48 | 95 | 226.168 | 7636 | 3.45 |
| 42 | 0.986 | 96974 | 38.54 | 96 | 237.064 | 6051 | 3.35 |
| 43 | 1.065 | 96828 | 37.60 | 97 | 248.166 | 4749 | 3.27 |
| 44 | 1.158 | 96648 | 36.67 | 98 | 261.858 | 3772 | 3.12 |
| 45 | 1.266 | 96423 | 35.76 | 99 | 281.902 | 2978 | 2.95 |
| 46 | 1.392 | 96217 | 34.83 | 100 | 313.763 | 2186 | 3.02 |
| 47 | 1.537 | 95961 | 33.93 | 101 | 364.959 | 1833 | 2.60 |
| 48 | 1.703 | 95763 | 33.00 | 102 | 445.437 | 1553 | 2.07 |
| 49 | 1.893 | 95571 | 32.06 | 103 | 567.985 | 1355 | 1.37 |
| 50 | 2.109 | 95349 | 31.14 | 104 | 748.665 | 969 | 0.92 |
| 51 | 2.353 | 95078 | 30.23 | 105 | 879.310 | 579 | 0.54 |
| 52 | 2.628 | 94786 | 29.32 | 106 | 1000.000 | 315 | 0.50 |
| 53 | 2.936 | 94382 | 28.45 | | | | |

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