Irish Life Tables No. 16
2010–2012

Life expectancy continues to rise for both men and women

In the period 2010-2012, life expectancy at birth was 78.4 years for males and 82.8 years for females. (See table above and tables 1, 2, 3 and fig. 1).

- In the five years between 2006 and 2011 life expectancy increased by 1.6 years for males and 1.2 years for females.
- The gender gap now stands at 4.4 years, compared with the 4.8 years recorded in 2006.
- In 1926 male life expectancy was 57.4 years while it was slightly higher for females at 57.9 years. This gender gap of 0.5 years continued to increase until 1986 when it stood at 5.7 years and has been decreasing gradually since.

In 2011, the highest life expectancy at birth for males among EU member states was reported in Sweden (79.9 years). For females, France reported the highest life expectancy of 85.7 years. (See table 4).

- In 2011, Irish male life expectancy ranked in joint 10th place with Germany while Irish female life expectancy ranked 17th.

The fifth column of the life table, \( L_x \), is the number of persons surviving to age \( x \) out of the cohort surviving to birth.

The sixth column of the life table, \( T_x \), is the number of deaths in the year of age \( x \) to \( x+1 \) out of \( L_x \).

\[ \frac{T_x}{L_x} = q_x = \frac{l_{x+1} - l_x}{l_x} \]

• The largest difference in male and female life expectancies was in Lithuania at 11.2 years while the smallest was in the Netherlands at 3.7 years.

In 2011 in Ireland a 65 year old male could expect to live another 17.7 years, an increase of 1.1 years since 2006. A 65 year old female could expect to live another 20.6 years, an increase of 0.8 years over the same period. The highest life expectancy at this age for both sexes was reported in France at 19.3 years for males and 23.8 years for females. (See tables 3, 4 and 5).

Significant improvements in life expectancy for both males and females over the past 85 years

Life expectancy at birth has increased significantly for both men and women since the first official life table was compiled in 1926. Over the 85 year period to 2011, male life expectancy increased by 21.0 years (36.6%), while female life expectancy increased by 24.9 years (43.0%).

The improvements have been as a direct result of decreasing mortality rates, particularly infant mortality rates over the period. While there has been a continual increase in life expectancy for both males and females, with increases occurring between each set of life tables, the greatest rate of improvement occurred in the 20 year period between 1946 and 1966 (8.1 years for males and 10.5 years for females). Strong gains have also been seen over the last 20 years with increases of 6.1 years for males and 4.9 years for females. (See table 3).

The Life tables for the period 2010-2012 are based on a revised methodology (Cubic Spline model). A paper, giving the theoretical basis for this methodology, will be published by Kevin McCormack, Senior Statistician. A link to this paper will be made available on the CSO website, www.cso.ie, in due course.

NOTE: This is an amended version of the original release and contains minor revisions to tables 1 and 2. These revisions (effective from 01 September, 2015) are due to errors in the compilation of tables for the release. Tables were further updated on the 19/02/2016 due to changes in the calculation of the life expectancy at ages 99 years and above.

Irish Life Tables No 16 20102012 (full)
The probability of surviving a year, or the ratio of the number completing the year of age $x$ to $x+1$ to the number entering on the year.

$\mathbf{\text{Table 5: Period life expectancy by sex, age, country and year}}$

- **EU15**: European Union (15 countries)
- **HR**: Croatia
- **IE**: Ireland
- **IT**: Italy
- **PT**: Portugal
- **CY**: Cyprus
- **RO**: Romania

**NOTE:** This is an amended version of the original release and contains minor revisions to tables 1 and 2. These revisions (effective from 01 September, 2015) are due to errors in the compilation of 2010 - 2012 life tables and 2011 - 2012 life tables. Revised life tables were published in 2015 (01 September, 2015). Revised life tables are available for download as Excel spreadsheets from the CSO website at [http://www.cso.ie/en/releasesandpublications/er/ilt/lifetablesno162010-2012.html](http://www.cso.ie/en/releasesandpublications/er/ilt/lifetablesno162010-2012.html).

- **Table 3: Period life expectancy at various ages, 1871-2011**
- **Table 4: Period life expectancy at ages 20-50, 1900-02 to 1990-92**

Irish Life Tables No 16 2010-2012 (full)
From equation 3 we see the link between the probability of surviving with that of dying, therefore we can make assumptions on the probability of surviving from the probability of dying.

### Examples

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<th>Probability</th>
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### Glossary of technical terms

- CSO: Central Statistics Office
- EU: European Union
- LV: Latvia
- UK: United Kingdom
- CY: Cyprus
- LU: Luxembourg (Grand-Duché)
- EU15: European Union (15 countries)
- CZ: Czech Republic
- AT: Austria
- ES: Spain
- RO: Romania
- DK: Denmark
- BG: Bulgaria
- PT: Portugal
- IE: Ireland

### Table 4: Period life expectancy in 2011 by sex, age and country

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<th>Age Group</th>
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<th>Gap</th>
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<td>90-95</td>
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<td>8.8</td>
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</table>

**Notes:**

1. The table presents the life expectancy at birth for both males and females.
2. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
3. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
4. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
5. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
6. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
7. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
8. The life expectancy at birth is calculated using the formula:
   \[ e_x = \sum_{t=1}^{n} \frac{d_t}{x} \]
   where \( e_x \) is the life expectancy at age \( x \), \( d_t \) is the number of deaths at age \( x \), and \( n \) is the age at the end of the period.
The document contains a table of Irish Life Tables 2010-2012, showing survival rates and life expectancy for different age groups. The table is accompanied by notes and references to the CSO statistical release, 08 July 2015, 11am. The data is presented in a clear, tabulated format, showing various metrics such as the number of deaths, the number of persons surviving, and life expectancy at different ages. The data is organized by sex and age group, with specific notes on the methodology used to calculate life expectancy. The table also includes historical data from previous periods, showing changes over time.

Irish Life Tables No 16 2010-2012 (full)
<table>
<thead>
<tr>
<th>Age x</th>
<th>Age x+1</th>
<th>Years</th>
<th>Males</th>
<th>Females</th>
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<td>71.3</td>
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</tbody>
</table>

Notes:
- CSO statistical release, 08 July 2015, 11am
- Irish Life Tables No 16, 2010-2012, Central Statistics Office
- Information on Irish Life Table No 16 can be found online: http://www.cso.ie/en/releasesandpublications/er/ilt/irishlifetablesno162010­2012/
- Data not available for all countries.
Background Notes

Life Tables presented here are period life expectancies. Period expectation of life at a given age for 2010-12 is the average number of years a person would live if he or she experienced age-specific mortality rates for that time period throughout his or her life. It is therefore not the number of years someone of that age could actually expect to live because death rates are likely to change in the future.

The basic assumption is that a given cohort of births, (100,000), start in a given year. The mortality rates for each age are used to calculate how many of the cohort will reach each year of age until eventually all members of the cohort have died. This enables the total number of years lived by the cohort to be calculated. When this total is divided by the number of persons in the cohort, (100,000), the result is the average number of years lived in the cohort, or the mean expectation of life at birth. The total number of years lived by the cohort from any given age can also be calculated and, when divided by the number of survivors in the cohort entering upon that year of age, the figure obtained is the expectation of life in years for those persons.

Life Tables were constructed for males and females which are representative of the mortality experience in Ireland in 2011 by using the 2010, 2011 and 2012 estimates and census of population (usually resident) and deaths registered in the three years. The life table should reflect the normal mortality conditions at about the time of the Census.

Glossary of technical terms

- \( x \): the exact age of the person, that is, on his or her birthday.
- \( l_x \): the number of persons surviving to exact age \( x \) out of the original 100,000 aged 0.
- \( d_x \): the number of deaths in the year of age \( x \) to \( x+1 \) out of \( l_x \) persons who enter that year.
- \( p_x \): the probability of surviving a year, or the ratio of the number of persons completing the year of age \( x \) to \( x+1 \) to the number entering on the year.
- \( q_x \): the rate of mortality, the probability of dying in a year, or the ratio of the number of deaths in the year of age \( x \) to \( x+1 \) to the number entering on the year.
- \( l_x^{0} \): the population to be expected according to the Life Table aged between \( x \) and \( x+1 \) years, assuming deaths occur evenly over the year.
- \( T_x \): the expected number of person years to be lived by the survivors at age \( x \).
- \( e_x \): life expectancy at age \( x \) for each person surviving, or the total future life time in years which will on average be passed through by persons aged exactly \( x \).

Examples

Figures from the Male Irish Life Table No. 16 are used in the examples below. Please note that totals may not add up due to rounding.

The first column of the life table, \( l_x \) equals the number of persons surviving in the life table at each exact age \( x \), in other words the January population. \( l_0 \) represents the life table population of new born children or those aged exactly zero. If we let \( l_0 \) equal 100,000 then for example, \( l_5 \) is the number of persons surviving on their fifth birthday, which in this case equals 99,560.

The second column of the life table, \( d_x \) equals the expected number of deaths of persons aged \( x \) in the life table.

**equation 1**

\[ d_x = l_x - l_{x+1} \]

Equation 1 tells us that the number of deaths equals the number of persons surviving at age \( x \) less the number of persons surviving at age \( x+1 \).

E.g. for males aged 5

\[ d_5 = l_5 - l_6 \]

\[ = 99,560 - 99,550 \]

\[ = 10 \]

The third column of the life table, \( p_x \) equals the probability of surviving from exact age \( x \) to \( x+1 \). This is simply the ratio of those completing the year of age \( x \) to \( x+1 \) to the number entering the year. For example, \( p_5 \) is the probability of surviving ones fifth year, which in this case equals 0.99990.

**equation 2**

\[ p_x = \frac{l_{x+1}}{l_x} \]

Rewriting equation 2 where age \( x = 10 \), we see the number of persons surviving to their eleventh birthday equals the number of persons at their tenth birthday multiplied by the probability of their surviving to their eleventh, the remainder having of course died. Migration is ignored in a life table as the population if closed.

\[ L_{11} = L_{10}p_{10} \]

\[ = 99,509 \times 0.999992 \]

\[ = 99,502 \]

The fourth column of the life table, \( q_x \) equals the probability of dying between one birthday and the next. This may also be called the risk of dying in a life table year, in other words the risk of dying at a particular age. The probability of dying and the probability of survival equal unity. In other words one can only be alive or dead.

**equation 3**

\[ q_x = 1 - p_x \]

From equations 1, 2 and 3:

**equation 4**

\[ q_x = \frac{d_x}{l_x} \]

So the probability of dying is the ratio of the number of deaths at exact age \( x \) divided by the number of persons surviving at that exact age. Hence we say the life table is based on ‘current mortality rates only and that no assumptions are made about future changes’. The fifth column of the life table, \( l_x \) equals the number of years survived by the life table cohort between the ages \( x \) and \( x+1 \), in other words the July population. Assuming a uniform distribution of deaths over a year of age and using equation 1 we find:

**equation 5**
\[ L_x = l_x - \frac{(d_x}{2}) \]
\[ l_x = \frac{(l_{x+1} - l_x)}{2} \]
\[ e.g. \text{ for age } 1 \text{ this means} \]
\[ L_1 = l_1 - \frac{(d_1}{2}) = 99,621 - \frac{35}{2} = 99,604 \]

or
\[ L_1 = \frac{1}{x} \frac{l_x}{l_x + 1} / 2 = (99,621 + 99,586)/2 = 99,604 \]

This cannot be used at age 0 as infant deaths are not evenly distributed (i.e. they are non-linear over a year). For example, in 2011 34% of all infant deaths occurred on their first day of life.

The sixth column of the life table, \( T_x \) equals the total number of years which will be survived at age \( x \), \( l_x \). So if \( L_x \) is person years, then \( T_x \) is cumulated person years , i.e.

**equation 6**

\[ T_x = \sum_{x}^{105} l_x \]

\[ e.g. T_{102} = L_{102}*L_{103}*L_{104}*L_{105} \]

The final column of the life table, \( e_0x \), is the life expectancy in years

**equation 7**

\[ e_0x = T_x / l_x \]

\( e_0x \) represents life expectancy at birth and it is broadly used to express the level of mortality. Life expectancy is the average number of additional years a person would live if current mortality trends were to continue. The expectation of life at birth represents the mean length of life of individuals who are subjected since birth to current mortality trends. Life expectancy is usually compiled on the basis of a life table showing the probability of dying at each age for a given population according to the age specific death rates prevailing in a given period.

**Further information**

From equation 3 we see the link between the probability of surviving with that of dying, therefore we can make assumptions on the probability of surviving from the probability of dying. This is what is referred to in population projections as the mortality assumption.

\[ S_x = L_x / L_{x+1} \]

The survivorship ratio at age \( x \), \( S_x \) equals the ratio of those surviving between ages \( x \) and \( x+1 \) and those surviving between the ages of \( x-1 \) and \( x \), e.g. the ratio of those aged 5–9 surviving to age 10–14 is calculated as follows:

\[ S_{10-14} = \frac{L_{10-14}}{L_{10-15}} / \frac{L_{9-14}}{L_{9-15}} \]

Similarly, the probability of a man aged 20 dying before his 50th birthday is calculated as follows:

\[ q_{x} = p_{x} \]

\[ = 1 - (l_{x+1}) / (l_{x}) \]

\[ = (l_{x} - l_{x+1}) / l_{x} \]

therefore

\[ q_{20-50} = \frac{(l_{20-50})}{l_{20}} \]

\[ = (99,237 - 95,409 / 99,237) \]

\[ = 0.039 = 3.9% \]

**FOR MORE INFORMATION ON THIS RELEASE:**
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Caroline.Hennebisy@cso.ie (+353) 21 453 5307

Scan the QR code below to view this release online or go to
<table>
<thead>
<tr>
<th>Age Group</th>
<th>Male Life Expectancy</th>
<th>Female Life Expectancy</th>
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From equation 3 we see the link between the probability of surviving with that of dying, therefore we can make assumptions on the probability of surviving from the probability of dying.

Further information on the demographic data can be found in the CSO statistical release.

The life expectancy presented here is based on the assumptions outlined in equations 3 and 4.