

THE ANALYSIS OF EVOLUTION OF MORTALITY IN THE CZECH POPULATION FROM THE PERSPECTIVE OF LIFE EXPECTANCY, MEDIAN LENGTH OF LIFE AND MODAL AGE AT DEATH

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Abstract

Based on the researches can be concluded that human life has extended. For this evolution can be find many reasons. One is an increasing level of health care. The lengthening of the human life is also caused by higher interest in a healthy lifestyle. On the other hand, the lengthening of human life also means that mortality is going to be better and better. Lately, the mortality has started to improve especially at the advanced ages. And this is why demographers focus on this type of mortality even more than before. And that is why it is good to publish more characteristics by which the evolution can be assessed.

In this article it'll be covered three types of the length of life: life expectancy, modal age at death and median length of life. The aim will be to examine their evolution during the reference period. Attention will be also focused on the statistical character of these characteristics. As the input data will be used the data about mortality of the Czech population from 1950 to 2012. The results will be published separately for males and for females.

Key words: mortality, life expectancy, median length of life and modal age at death

JEL Code: J10, J11, J19

Introduction

Mortality (together with natality) is one of the basic components of demographic reproduction and it has a direct impact on the length of human life. Nowadays, there is a lengthening of human life, and one of the causes is just the reduction of mortality in all ages (Horiuchi and Wilmoth, 1998 or Kannisto et al., 1994). Significant improvement in mortality was mainly at the highest ages. Still, it is true that the capture mortality of these people is quite problematic. Due to the fact that number of people at the highest ages is relatively low, the description of mortality is more difficult, there are number of ways, which are used for smoothing of mortality curves at the highest ages (Arltová and Langhamrová JA., 2010). For the evaluation

of the evolution of mortality is the most commonly used indicator known as life expectancy at birth (Langhamrová JI et al., 2011). The other indicators which are also aggregated characteristics, could be included probable length of life (median length of life) or normal length of life (modal age at death), which currently can be a more appropriate indicators for the assessment of trends in mortality.

1 Methodology

For the description of mortality is most commonly used indicator known as life expectancy (its values are obtained from mortality tables). It indicates how long be alive x - year old person in average, when the mortality has not changed during the whole life and it has stayed the same like it was at the time of calculation of mortality tables (Cipra, 1990). During the calculation of mortality tables we obtain values of life expectancy for all ages, but most often is published value for 0 year age persons. This indicates how long be currently born person alive (in average), if mortality has stayed at the same level of mortality (which was valid at the time of her birth) throughout the whole life (Cséfalvaiová et al., 2013). Life expectancy but also has got some disadvantages. As follows from the above definitions, it has got character of the average, and thus its value can be affected by outliers (e.g. high infant mortality) (Arltová et al., 2013). For this reason, it is good to use other characteristics for the description of mortality. One of them is the probable length of life (Langhamrová JA., 2013). It is an age in which will live just half of x years old persons, it's actually a median age at deaths older then x -years minus x . Calculation of probable length of life is shown for example in (Fiala, 2005):

$$\tilde{y}_x = [\bar{y}_x] + \frac{l_{[\tilde{y}_x]} - \frac{l_x}{2}}{l_{[\tilde{y}_x]} - l_{[\tilde{y}_x]+1}}, \quad (1)$$

where $[\tilde{y}_x]$ is the integer age at which the number of survivors at age x still does not drop below the half of the initial set of x -aged persons, $l_{[\tilde{y}_x]}$ is the number of age $[\tilde{y}_x]$, l_x is the number of survivors at age x and $l_{[\tilde{y}_x]+1}$ represents the number of survivors at age $[\tilde{y}_x]+1$.

The median age at death indicates the age to which the x -year old person will live to see with the probability 0.5.

The value of the probable length of life is obtained as (Fiala, 2005):

$$\tilde{e}_x = \tilde{y}_x - x \quad (2)$$

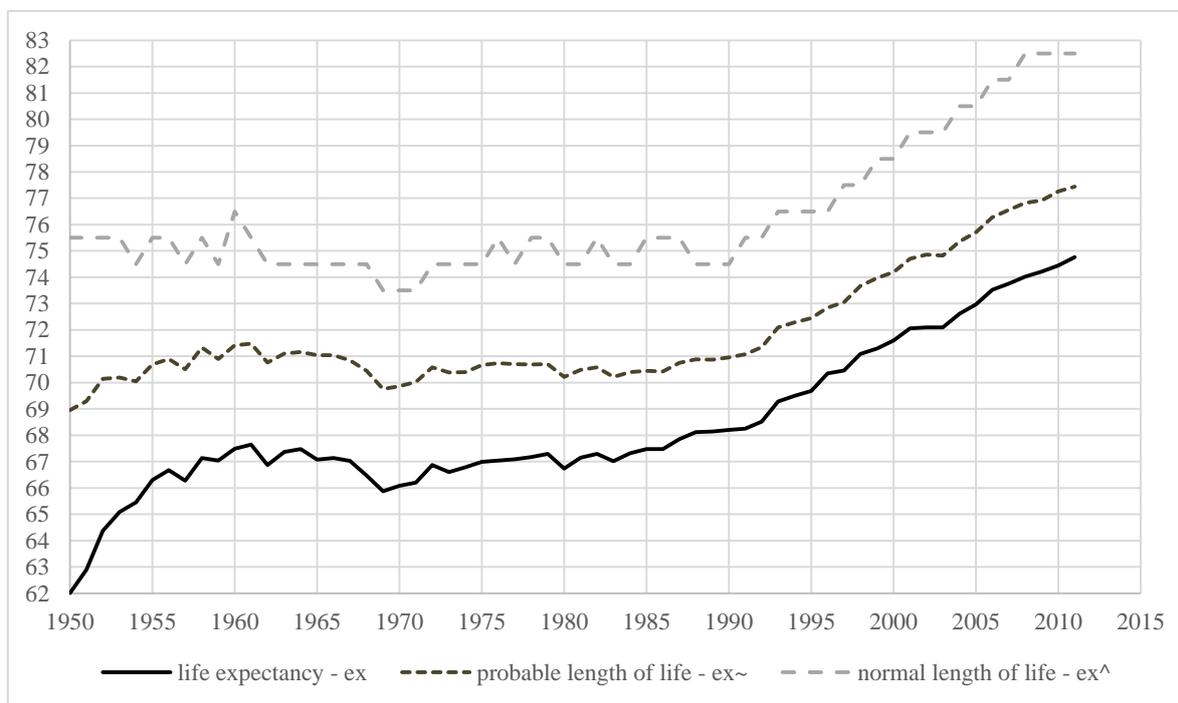
The advantage of the probable length of life is that it has character of median and its value is not therefore affected by outliers.

The last characteristic which will be presented in this paper, which is used for the analyzing of the length of human life, is the normal length of life. Its value indicates the age at which most people die. Its value can be simply estimated by finding the maximum number of deaths from the model population (ie d_x) - excluding 0 year age persons - and this age will be increased by 0.5. The last indicator is modal characteristic, so the outliers have no effect on it (Dotlačilová, 2013).

2 The obtained results

For the analyzing the evolution of lifespans was used the data about deaths, births and living persons in the Czech Republic from 1950 to 2012.

Fig. 1: The evolution of the life expectancy, probable and normal length of life - Czech Republic from 1950 to 2012 – males

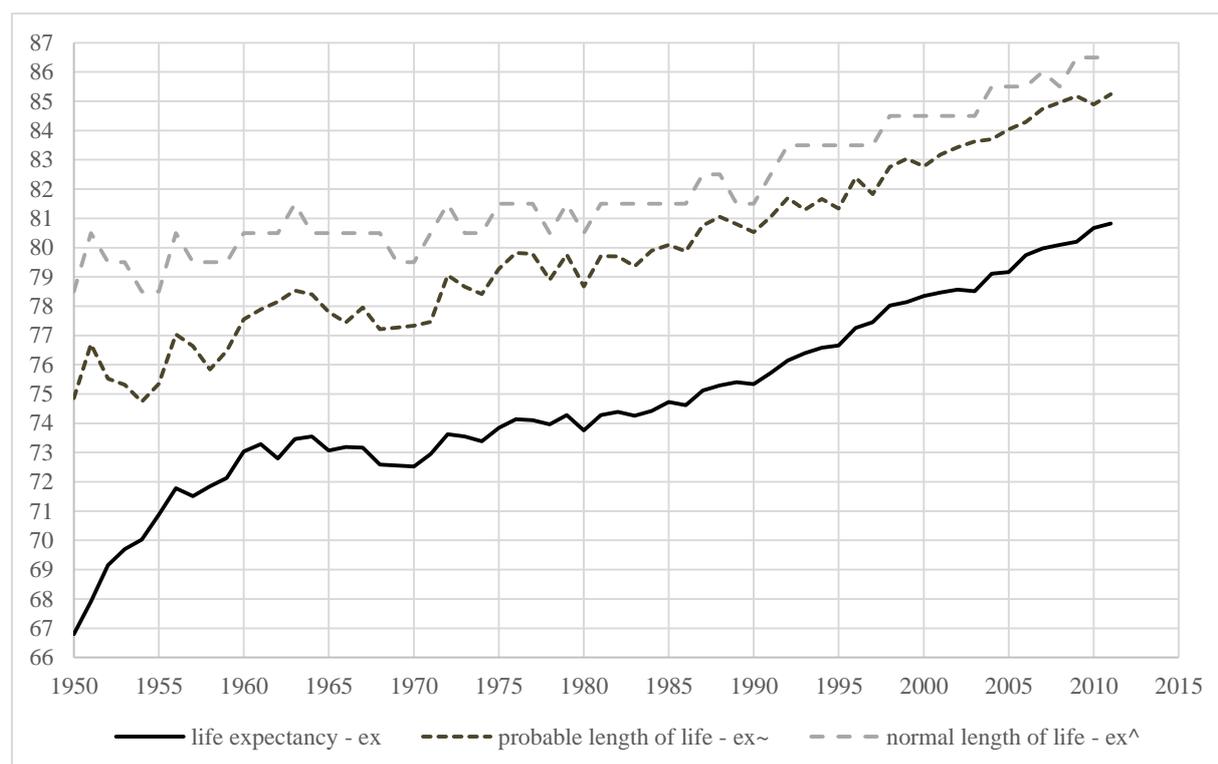


Source: data Czech Statistical Office (CZSO, 2013), author's calculation

The first figure shows the evolution of the life expectancy, probable and normal length of life for males in the Czech Republic from 1950 to 2012. If we compare the development of

the examined characteristics, we can conclude that at the beginning of the period were bigger differences among the life expectancy and other characteristics, which were stabilized later in reference period. The big difference in the early 50s was caused by high infant mortality, which influenced mainly the value of life expectancy of born boys at this time. Later the infant mortality began to decrease, and so the differences among the examined indicators began to equalize. If we focus more on the evolution of a normal and probable length of life in the 50s, we conclude that these indicators are smoother. This is mainly caused by the nature character of these indicators, from which it follows that their values are not affected by high infant mortality. Another important fact is that until the 90s there was a greater variability in the values of the normal length of life. But this is largely due to the rough estimate of this indicator. This rough estimate can cause deviations of 0.5 year.

Fig. 2: The evolution of the life expectancy, probable and normal length of life - Czech Republic from 1950 to 2012 – females



Source: data Czech Statistical Office (CZSO, 2013), author's calculation

The second graph shows the evolution of the life expectancy, probable and normal length of life for females in the Czech Republic from 1950 to 2012. The graphical output shows that even in the normal length of life is greater variability (compared with males). For the life expectancy at age 0 the development was more or less stabilized at around the year 2000. The second graph also shows that (as was the case with males) in the early '50s among

the examined indicators was significant difference. The reason is the same as in the previous case - higher infant mortality.

Since the early sixties of the last century until the end of the 80's (1962-1990) there was a deterioration in mortality of males, for females was reached little improvement until the end of the 80's (after the initial stagnation). Differences in the level of mortality of males and females were deepened. Reduction of infant mortality also had during the 80's influence on the fact that the life expectancy at birth was higher than at the exact age 1, just now disappears so-called paradox of life expectancy. At this time also the life expectancy of males at the exact age 40 years and older decreased below the level of the early fifties. This resulted in the decreasing of life expectancy of males at this time.

If we focus on the character of the examined indicators, we find that it is important to realize that the life expectancy has character the same as average. So therefore it is obvious that it is influenced by outliers. It follows that the major difference among the values of the life expectancy, probable and normal length of life could be explained mainly by higher infant mortality, when higher number of deaths at age 0 caused lower value of life expectancy. Therefore, it is good to have more indicators, which are not affected by outliers and then perform their comparison.

Conclusion

From the obtained results it is clear that during the whole period occurred extending human life. It is also noticeable from the development of all three examined indicators.

During the investigation of the development of the selected lengths of life, we reach the conclusion that, especially at the beginning of the reference period (at the early 50s) the difference among the life expectancy at birth and probable (or normal) length of life was higher than in the other years. This is caused by higher infant mortality, which has gradually begun to decrease. This caused the equalization of the differences among the life expectancy at birth and the other characteristics.

In examining the normal length of life is obvious that the values are somewhat unstable. One reason for this development is the use of a rough estimate to determine its value. This can then cause mentioned deviations.

The general conclusion of the entire contribution is that during the reference period occurred (for males and for females) to increasing of all three types the length of life. This means that the human life has extended. It also confirms the fact that the mortality is going to be better and better. Excess in mortality for males persists.

From the development of life expectancy at birth (compared with the other indicators) can be deduced reduction of infant mortality and in recent decades also improving of mortality in the middle and higher ages.

At the end I would like to mention that due to the statistical character of these lengths of life would be interesting to study their development at all other ages (except for the normal length of life, which value is the same for the whole human life), and then perform their comparison. According to the obtained results could be also predicted the improving of mortality of the Czech population and how fast our population grow older.

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