LIFE EXPECTANCY IN THE CZECH REPUBLIC FROM THE VIEWPOINT OF TIME SERIES

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Abstract

This paper focuses on the development of life expectancy and infant mortality in the Czech Republic. This paper compares life expectancy between men and women in long time series by selected ages; it also deals with the paradox of life expectancy and its development. The paradox of life expectancy refers to a condition in which a person will live to old age while it increases life expectancy. All this time series were prepared for whole decades, due to this fact last decades ends in 2010. Next part of this paper is a comparison made for the actual birth rate and the birth rate needed to maintain the simple reproduction since the 18th century to the present. This paper compares development of expectation of life at birth in the Czech Republic and selected European countries. These countries were divided into "eastern" and "western" according to their development and compared with the development of the Czech Republic.

Key words: ageing of population, life expectancy, time series, paradox of life expectancy.

JEL Code: C18, C53, J11

Introduction

At the present time the majority of the advanced countries are struggling with the problem of the ageing of the population. The ageing of the population is caused by the lowering of the mortality rate, the lengthening of the life expectancy and simultaneously by the decline in the birth rate and the dropping of total fertility rate below the maintenance level of simple reproduction. The consequences of these processes can be seen in the changes in the age structure of the population. The number of old people is rising, especially in the older and oldest age groups.

The life expectancy indicators are among the so-called overall characteristics of mortality rates (Koschin, et al., 1998, Pavlík, Rychtaříková, & Šubrtová, 1986). Most

frequently used as an index of length of life is the expectation of life at birth. The life expectancy is influenced by the development of mortality in the given years.

At an earlier time, the expectation of life at birth was low due to high infant, child and maternal mortality. High mortality was also from infectious and parasitic diseases. Because of the huge advances in medicine and many new technologies has greatly increased infant mortality and reduced mortality of older and oldest ages.

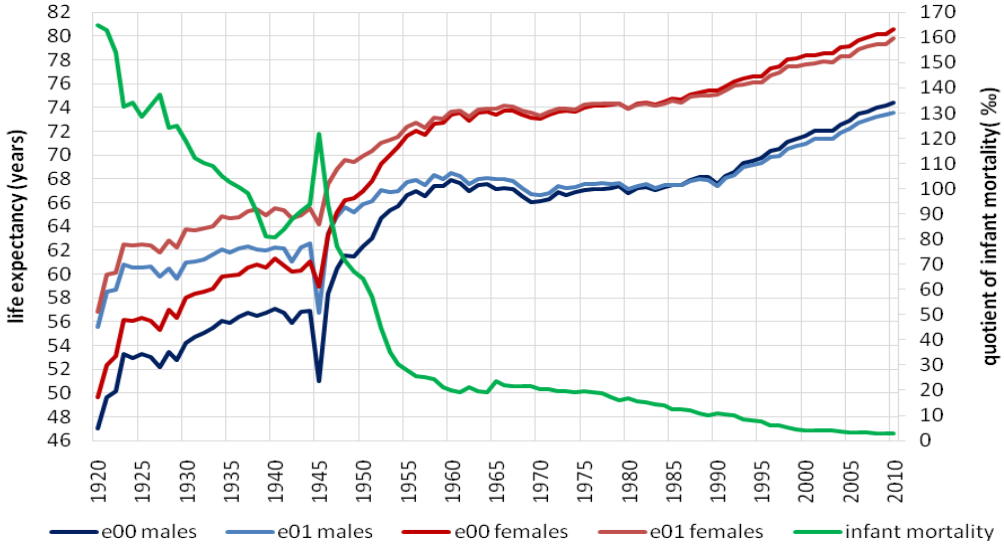
Development of indicators was studied in throughout the decades so the data are finalized for 2010.

1 Development of the life expectancy in the Czech Republic

In the course of last century in the Czech Republic there were several striking increases in the level of mortality. The highest level of mortality was in 1918 as a result of the Spanish Flu pandemic. At the beginning of the 20th century there was also a highly unfavourable level of infant mortality.

It applies in general that the life expectancy extended in time mainly due to a reduction in the quotient of infant mortality. In recent years there has been at a very low level (3-4 per mille). The expectation of life at birth increased for men in the period from 1920 to 2010 by 58%, for women by 62%. Since 2004 there has been a greater increase in the life expectancy of women in the age groups of 68-75 years (by approximately 60-70%). This increase is probably caused by the improving mortality ratios of women in higher age groups.

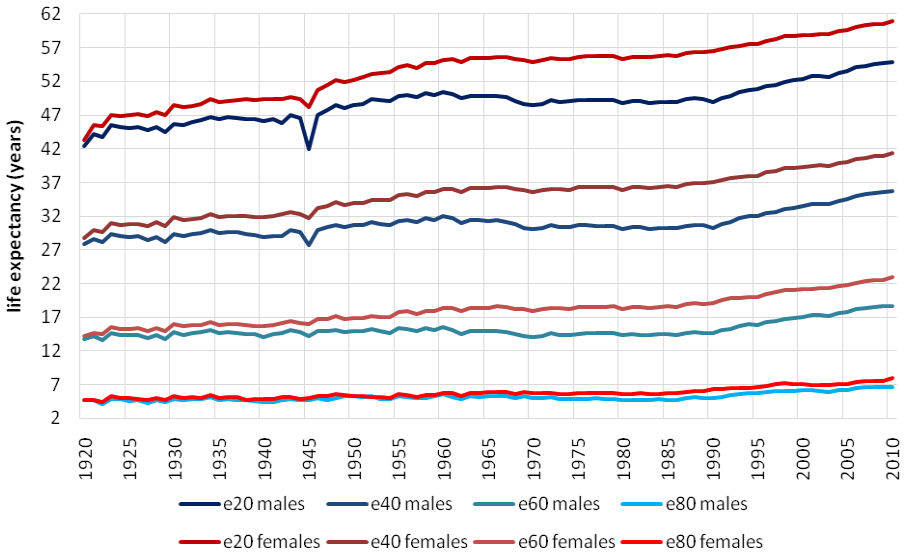
Fig. 1: Comparison of the life expectancy for men and women at the age of 0 (e00) and 1 (e01) year and the infant mortality quotient in the years 1920-2010



Source: data CZSO, own calculations

From the comparison of the development of the life expectancy in selected age groups it emerges that women have a longer life expectancy than men. The lower the age, the greater is the difference in time. It can generally be said, then, that with increasing age there is also a reduction in the difference in life expectancy for men and women. At birth males in the Czech Republic have at present a life expectancy almost 7 years less than females at birth. This phenomenon is caused by the higher intensity of the levels of mortality of men in all age groups. If men do reach an advanced age, however, then they have before them roughly the same life expectancy as women.

Fig. 2: Development of the life expectancy for certain age-groups (20-year old=e20; 40-year old=e40; 60-year old=e60; 80-year old=e80) in the years 1920-2010



Source: data CZSO, own calculations

Tab. 1: Life expectancy for certain age-groups in selected years

	Men					Women				
	0 yrs	20 yrs	40 yrs	60 yrs	80 yrs	0 yrs	20 yrs	40 yrs	60 yrs	80 yrs
1920	47.05	42.47	27.79	13.81	4.72	49.60	43.32	28.72	14.14	4.73
1930	54.22	45.73	29.34	14.78	4.90	58.04	48.49	31.83	15.97	5.34
1940	57.10	46.19	28.86	14.11	4.33	61.29	49.31	31.89	15.69	4.78
1950	62.31	48.51	30.64	14.96	5.29	67.00	52.26	33.88	16.88	5.31
1960	67.92	50.39	31.95	15.56	5.56	73.40	55.22	36.02	18.39	5.74
1970	66.13	48.49	30.11	14.11	5.05	73.02	54.85	35.59	17.96	5.67
1980	66.81	48.75	30.06	14.31	4.64	73.86	55.34	35.91	18.17	5.57
1990	67.58	48.90	30.19	14.58	5.05	75.42	56.45	37.00	19.14	6.25
2000	71.65	52.37	33.43	17.02	6.11	78.35	58.91	39.34	21.21	7.09
2010	74.37	54.86	35.73	18.69	6.62	80.60	60.99	41.35	22.91	7.91

Source: data CZSO, own calculations

The development of the life expectancy is interesting from the viewpoint of the so-called paradox of the life expectancy. Paradox of the life expectancy is generally only used for the comparison of the life expectancy of a person who has just been born and a person who is one year old. In an earlier period it applied, however, that the lifespan of a person aged 13 years was longer than that of a new-born child. From the available data for the expectation of life at birth for men and women it emerges, for instance, that in 1920 the hope of survival for a 13-year-old boy was higher than for a boy just born in the same year. The same applied in 1920 for a girl of 12. This was due to the high rate of infant and child mortality.

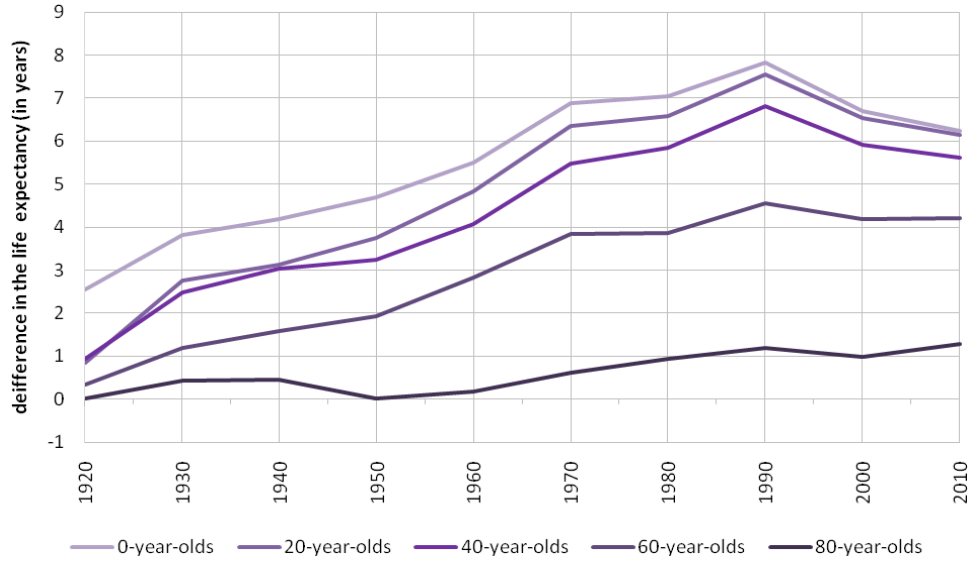
Table 3 shows the difference between a new-born and a child of 1 for selected years in the period 1920-2010. Thanks to the improvement in the level of infant mortality there is a gradual increase in the value of the life expectancy of a new-born baby until the complete disappearance of the paradox of the life expectancy for both genders.

Tab. 2: Difference in the life expectancy between women and men for certain age groups in selected years

	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
0 yrs	2.55	3.82	4.19	4.69	5.49	6.89	7.50	7.83	6.70	6.23
20 yrs	0.84	2.76	3.12	3.75	4.83	6.36	6.59	7.55	6.54	6.14
40 yrs	0.93	2.48	3.30	3.24	4.70	5.47	5.85	6.82	5.91	5.62
60 yrs	0.34	1.19	1.58	1.92	2.83	3.85	3.86	4.56	4.19	4.22
80 yrs	0.01	0.44	0.45	0.02	0.18	0.62	0.93	1.20	0.98	1.29

Source: data CZSO, own calculations

Fig. 3: Difference in the life expectancy of women and men for certain age groups



Source: data CZSO, own calculations

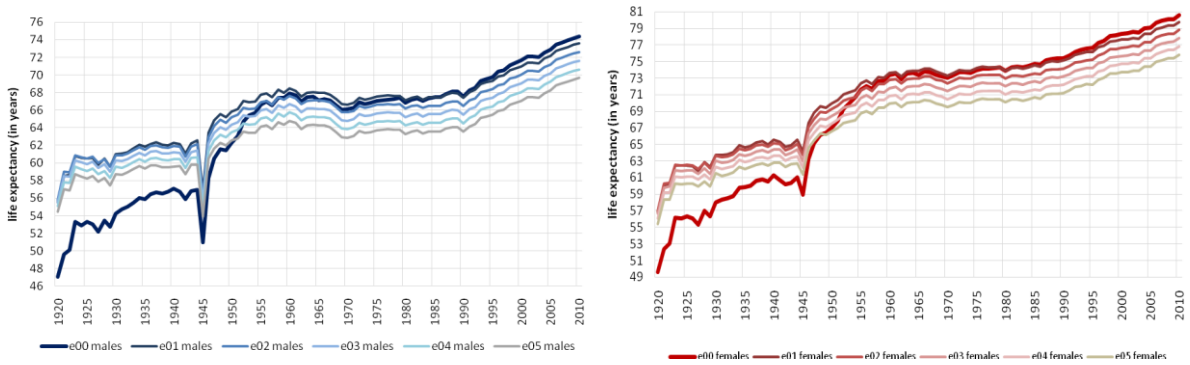
Tab. 3: Difference in the life expectancy of person at 0 and 1 year old in selected years

	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
Men	-8.48	-6.75	-5.15	-3.56	-0.57	-0.53	-0.31	0.16	0.67	0.79
Women	-7.24	-5.70	-4.25	-2.94	-0.25	-0.28	-0.05	0.31	0.72	0.80

Source: data CZSO, own calculations

In 1951 the expectation of life at birth for boy was higher than that of a 5-year-old boy. Only in 1985 was the expectation of life at birth for boy higher than the life expectancy of an 11-year-old boy. For several more years there was no significant difference between the life expectations of a newly born and an 11-year-old boy. But it no longer happened that the expectation of life at birth for boy was shorter than life expectancy for boy aged 1 or more years.

Fig. 4 and Fig. 5: Comparison of the life expectancy for boys and girls from 0-5 years (0-year old=e00; 1-y old=e01; 2-y old=e02; 3-y old=e03; 4-y old=e04; 5-y old=e05)

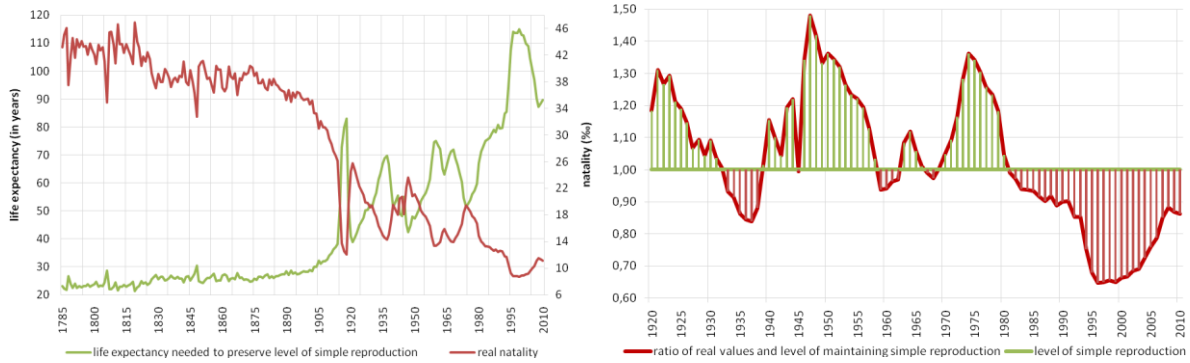


Source: data CZSO, own calculations

In the case of girls the mortality rates develop more favourably and the paradoxes occur in earlier years than is the case for boys. In the case of girls the expectation of life at birth for boy in 1949 was for the first time higher than the life expectancy for 5-year-olds. Only in 1981 was the life expectancy for a girl at birth higher than that for a 1-year-old girl for the first time. For girls it also applies that from this year onwards the life expectancy for a girl at birth was not shorter than the life expectancy for a 1-year-old girl.

Fig. 6: The life expectancy needed for preservation of the simple reproduction of the population at the given level of the birth rate in the years 1785-2010

Fig. 7: Development of the level of reproduction needed to preserve the number of inhabitants in the years 1920-2010



Source: data CZSO, own calculations

The natality limit is the inverted value of the expectation of life at birth multiplied by one thousand and it gives us the value below which the real birth rate should never decline long-term to avoid a decline in the population. If we turn the equation it is possible to calculate what the life expectancy would have to be for the simple reproduction of the population to be preserved with a concrete real birth rate. The time sequence of the true birth rate in the Czech Republic, which is available from the year 1785, was used in the calculation. It was calculated what the expectation of life at birth would have to be for it to ensure the maintenance of population numbers (see Fig. 6). With a high birth rate of around 45 per mille an expectation of life at birth of around 22 years would be sufficient to ensure simple reproduction and with the true birth rate of around 9 per mille, on the other hand, the expectation of life at birth would have to be 114 years in order to maintain simple reproduction. The true birth rate is not sufficiently high to ensure a tenable state of the population (without migration).

Tab. 4: The real life expectancy, the life expectancy needed for preservation of level of the simple reproduction and real natality in 1920-2010

	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010
Life exp. (real)	48.28	56.07	59.14	64.58	70.58	69.47	70.23	71.38	74.90	77.39
Life exp. (calcul.)	40.78	51.38	51,18	47.39	74.95	66,31	67.14	79.37	113.0	89.77
Natality (real)	20.71	17.83	16.91	15.48	14.17	14.39	14.24	14.I	13.35	12.92

Source: data CZSO, own calculations

The extent to which the values of the real birth rate differ from the values needed for the simple reproduction of the population can be seen from Fig. 7. The greatest difference is in 1947, when the true birth rate was almost 48% higher than was necessary for simple reproduction and, on the contrary, in the years 1996 a 1997, when the value was 35% lower than was needed for simple reproduction of the population. From 1981 up to the present day

the level of the birth rate has been below the maintenance level of simple reproduction and there has therefore been a natural decline in the population (Baroňová, D., et al., 2008).

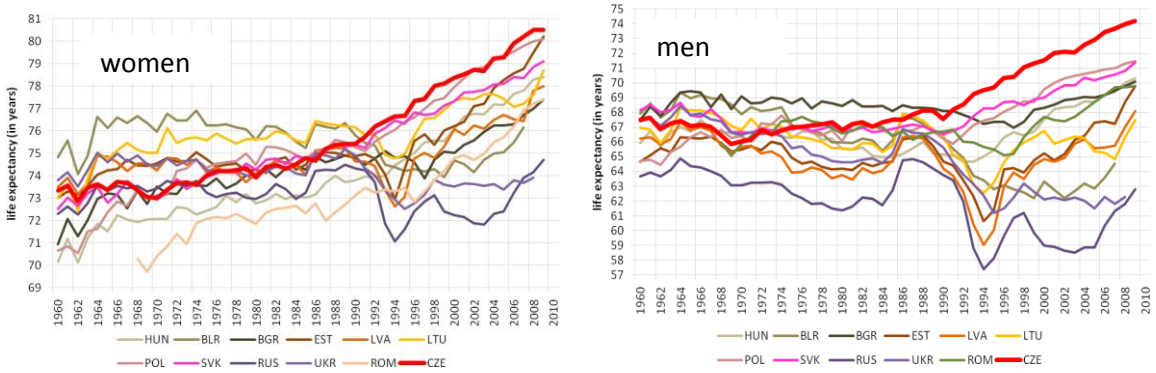
The changes, which have been recorded in the Czech Republic in mortality, correspond to the trends known to exist from other more advanced countries. In a certain way we are catching up on these countries. It is anticipated that the life expectancy will continue to rise and come closer to that in the most advanced countries.

2 Comparison of the expectation of life at birth in the Czech Republic and European countries

The populations of the European countries are ageing. The aim of this part of paper is not to show development of individual countries but affect the trends. The Czech Republic is strongly indicated in the charts (Langhamrová, 2010). The expectation of life at birth for men and women in the Czech Republic is located approximately in the middle of selected European countries.

The expectation of life at birth of men and women has increased in all European countries compared to 1960. More or less linear growth of the expectation of life at birth is evident from seventies up to the present.

Fig. 8 and Fig. 9: Development of the expectation of life at birth for women and men in "eastern" countries in the years 1960-2009



Source: data Eurostat, own calculations

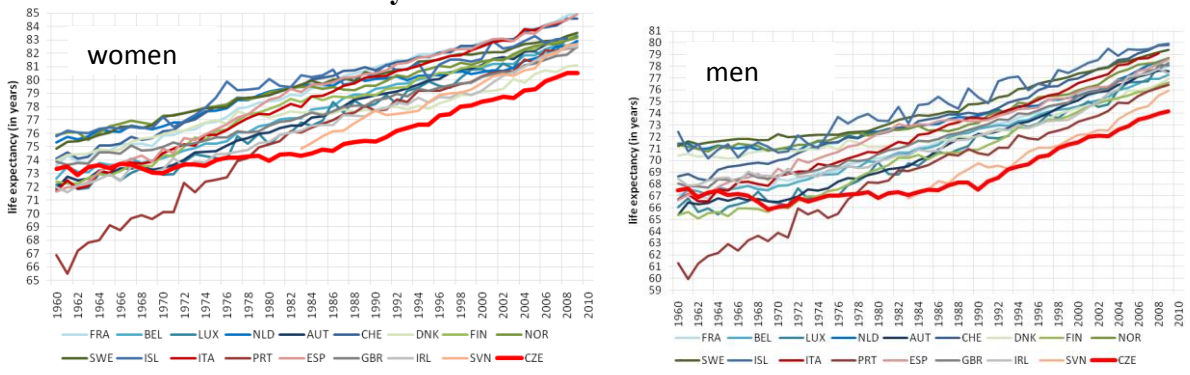
In 1960 was highest expectation of life at birth for men 71.6 years (Norway), for women it was 76.0 (Norway). In 2009 was highest expectation of life at birth for men 79.9 (Switzerland) and for women it was 85.0 (France). Countries were divided by their development into "eastern" and "western" countries. Midway between those countries was placed the Czech Republic. On the Fig. 8 we can see that in 1960 had Belarus highest expectation of life at birth of women (74.82 years) in the eastern countries. In monitored

countries lowest value of the expectation of life at birth of women had Hungary (70.17 years). The Czech Republic moved at this time about the first third of these values of expectation of life at birth of women. After 1990 there was a significant differentiation in the expectation of life at birth.

At the end of the period, the Czech Republic was between these eastern countries first (80.50 years). The second country was Poland (80.10 years). Worst on the expectation of life of women in 2009 was Russia (74.70 years). Highest value of expectation of life at birth for men in 1960 was in Slovakia (68.13 years). Lowest value was recorded in Russia (63.67 years). After 1990 there was also here a significant differentiation in the expectation of life at birth. In 2009 has highest expectation of life at birth for men the Czech Republic (74.2 years) and second was Poland (71.5 years) as by women. Lowest value has Russia (62.8 years). Somewhat a different situation is seen in western countries. During the reporting period there is a convergence of values of expectations of life at birth.

In 1960 was the highest expectation of life at birth for women in Netherlands (75.31 years). Lowest expectation of life at birth for women in western countries was monitored in Portugal (66.91 years). In 2009 highest expectation of life at birth for women had France (85.00 years). Lowest value of expectation of life at birth for women was in Czech Republic (80.50 years). At the beginning of the period highest expectation of life at birth for men was in Netherlands (71.45 years). Lowest value in western countries had Portugal (61.28 years). In 2009 highest expectation of life at birth for men was in Iceland (79.80 years). Lowest value of expectation of life at birth for men was in Czech Republic (74.20 years).

Fig. 10 and Fig. 11: Development of the expectation of life at birth for women and men in "western" countries in the years 1960-2009



Source: data Eurostat, own calculations

The Fig. 8 to Fig. 11 show that the Czech Republic is best country from the view of eastern countries and worst country from the view of western countries. In sixties the Czech

Republic was one of the countries with good level of expectation of life at birth. Followed by stagnation of the indicator and the Czech Republic began to lag behind western countries.

As seen on the Fig. 10 and 11 during the period 1960-2009 in western countries had more or less a constant growth. By contrast, in eastern countries from sixties to nineties there was stagnation in development of expectation of life at birth. And after 1990 there was a significant differentiation in the expectation of life at birth for men and women.

In the Czech Republic has succeeded in reducing quotient of infant mortality (2.7‰ in 2010), which is now at world level. In other words, despite the reduction in infant mortality the expectation of life at birth could not be increased. The Czech Republic lags behind the advanced countries in reducing mortality in middle and older ages. The Czech Republic also has a higher mortality from circulatory diseases and malignant neoplasm. Higher intensity of mortality in the Czech Republic in comparison with western countries and the improvement in nineties could be explained by delays in treatment for Western Europe. In the Czech Republic in fifties began a massive use of relatively inexpensive antibiotics. Also the Czech Republic began to invest in new and expensive technologies and there were not funds purchase expensive equipment that is used in western countries. Medicaments, new methods and technologies, which were used in Western Europe from turn of the sixties and seventies in the Czech Republic, have spread rapidly after 1990.

Conclusion

The development of mortality in various European countries after 1960 had a number of similar, but also specific features. In the middle of 20th century, most of these countries were already at the stage after demographic revolution. There was completed the transition from extensive to intensive forms of reproduction. The post-war geopolitical division of Europe has affected the spatial differentiation of mortality. It was the result of different economic and social living conditions of the population of those countries. Life expectancy at birth, which is result in mortality in those countries, divides Europe into advanced west and lagging east.

The development of mortality in the Czech Republic was in terms of Long-term time series specific. After the World War II until sixties included the Czech Republic to western European countries in term of mortality. Then there was the long-term stagnation and deterioration of the position among eastern European countries. A significant improvement occurred after 1990. The Czech Republic is again closer to western European countries. The closest is the Czech Republic in infant mortality and mortality of children and youth. Very

close to the western countries in the level of mortality in younger and middle age. Conversely the Czech Republic lags in mortality of men and women in higher and post-productive age. The main contributions to the development of mortality gap the Czech Republic in western countries have diseases of the circulatory system. The Czech Republic has the largest reserves in the improvement in mortality of persons over 50 years.

Mortality in the Czech Republic in the long term dynamically decreases. In the future, but has considerable potential for further improvement. It is necessary to reduce risk factors mortality, to improve lifestyle of population, also give more quality of the environment (Cséfalvaiová, Dotlačilová, & Langhamrová, 2013, Smrčka, Arltová, 2012).

So how to extend the life expectancy, it is increasing older and oldest persons in the population (Arltová, Langhamrová & Langhamrová, 2013, Arltová, Smrčka & Čámská, 2013). There is a significant ageing of the population with all its economic and social aspects.

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