DECOMPOSITION OF THE EFFECT OF MORTALITY ACCORDING TO EDUCATION IN CZECHIA

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Abstract

Life expectancy, as a summary indicator of mortality of a given population, can be calculated separately for groups of persons by various demographic characteristics. Education is one of the factors that affects life expectancy. It has been found that people with higher education can expect to live to be older. We calculated life tables according to the level of education (low, medium, high) on the example of Czechia. We found that the gap between the life expectancy of persons with the lowest and highest education widened over time, as several other studies have shown. The decomposition method was used to monitor the effect of mortality on life expectancy. The differences in life expectancy by education were divided into the contributions of changes in group-specific mortality rates (M-effect) and changes in the educational structure of the population (P-effect) to the change in overall life expectancy.

Key words: life expectancy, life tables, education, decomposition analysis

JEL Code: I21, J24, H75

Introduction

Life expectancy at birth is the most common used aggregate characteristic of the mortality of a given population, which represents average life potential of new-borns, assuming constant mortality throughout their lives. It is used not only to examine mortality over time but also for the needs of international comparison, because its amount is not affected by the age structure of the population, respectively its changes. Various socio-economic factors have an impact on the length of human life expressed by life expectancy at birth (Rogers and Wofford, 1989). In addition to the mortality, the indicator is influenced by factors such as the level of health care system, education, and lifestyle, nutritional habits, the environment, and the social and economic or political situation in each country. In less developed countries, as stated in Rogers and Wofford (1989), mortality is affected primarily by urbanization, industrialization, and education and secondarily by access to safe water, physicians, and adequate nutrition.

Based on the results of their study, Luy et al. (2019) showed strong associations between education and overall population health. Also, according to Hummer and Hernandez (2013), the differences in length of life by education may represent critical health and social issues because well-educated individuals have a much longer life expectancy. From this perspective, it is important to examine the differences in mortality by education. Hummer and Hernandez (2013) noticed that despite the potential to reduce educational differences in mortality, it may be overly simplistic to assume that they are easily responsive to increased future investments. Moreover, it is important to note that higher levels of schooling do not necessarily cause people to live longer (Hummer and Hernandez, 2013). Besides that, there are other factors, e.g. parental education and income, that may be related to both levels of schooling and longevity. According to Shkolnikov et al. (2006), "the political and social transition in central and eastern Europe has been generally associated with widening educational differences in life expectancy". Regarding that, it is important to note that the size of educational categories within the population has also changed (Shkolnikov et al., 2006). This phenomenon has also been confirmed in other studies, e.g., Kalediene and Petrauskiene (2000), Mear et al. (2008), and others. Moreover, there is a strong, positive, and well-documented correlation between education and health outcomes (Clark & Royer, 2013).

The decomposition method is used mainly because it is possible to break down the difference in life expectancy at birth into contributions. Decomposition is most often performed by age and sex. The extension is then to use the method in the case of decomposition of the difference in life expectancy according to other demographic characteristics, for example according to causes of death, marital status or education. The method according to Arriaga (1984) is often used for a breakdown by age and sex. However, there are other methods of calculation that lead to similar results, e.g., according to Pressat (1985), Pollard (1982), and others. A comparison of decomposition methods is available, for example see Ponnapali (2005). In this paper, the difference in life expectancy at the age of 30 is distributed according to age and sex, and further according to educational categories (low, middle, high) based on the algorithm according to Andreev et al. (2002).

1. Methodology and data

The aim of the paper is to examine mortality by education. For this reason, life tables were calculated according to the level of education using the example of Czechia. Life tables were calculated to obtain the value of life expectancy, especially for the age of 30 years. The age of 30 was chosen because it is the age at which people generally have already completed their education. Due to the availability of data, the years 2001 and 2011 were selected, in which the Census was held, and it is thus possible to examine the educational structure of the population. The decisive moment in 2001 was 1 March and in 2011 it was 26 March. Population at risk is equal to the number of usually resident people according to the level of highest educational attainment in a given year. In calculating life expectancy by education, in addition to population and risk data, the numbers of deaths in the given years were also used as input data. However, due to the lack of data on deceased persons based on the level of education, we computed the five-year averages for the periods 2001–2005 and 2011–2015. We used standard life-table techniques to calculate the life expectancy by education level in 2001 and 2011 for both sexes. No method of smoothing the life tables was used. We calculated the abridged life tables for both sexes in five age groups from 30–34 years to 80 and more years. Levels of education are divided into three main categories: low, middle and high. Persons with the most ascertained education were counted based on recalculation according to the educational structure of the population in the given year. The share of missing data was approximately 1.5% for men and 1.2% for women in 2001, while in 2011 the share decreased to 0.5% for men and 0.3% for women.

According to Andreev et al. (2002), the general algorithm for decomposition of changes in life expectancy by stepwise replacement can be applied to measure both the contributions of changes in group-specific mortality rates (M-effect) and changes in the educational structure of the population (P-effect) to the change in total life expectancy. This method is known as the replacement decomposition technique (Andreev et al., 2002, Shkolnikov et al., 2003). We performed the decomposition using an available Excel spreadsheet made by authors Andreev et al. (2012). We aimed to decompose the overall life expectancy at the age of 30 between 2001 and 2011 into these two effects as described above. Due to the different way life tables are calculated, life expectancy values may vary slightly. For the calculation of life tables by education, as described above, a different method of calculation was used than that used by the mentioned algorithm according to the authors Andreev et al. (2002).

2. Main results

The aim of this part of the paper was to show the effect of education on life expectancy using the method of life tables. We computed life expectancy by education level for Czechia, separately for men and women. The differences in life expectancy by education level are further decomposed into the contributions of changes in mortality (M-effect) and of changes in the educational structure of the population (P-effect) to the change in life expectancy at the age of 30.

2.1 Life expectancy by education level

Life expectancy at the age of 30 by education level and the gap in life expectancy between the highest and lowest education level in Czechia in 2001 and 2011 are shown for men and women in Table 1. In 2001, we observed a life expectancy gap at the age of 30 equal to 13 years in the case of men, for women it was almost half this amount. Based on the data from 2011, it is possible to see a slight increase in the difference, for men by 0.2 years and for women by 0.9 years. This means that the gap in mortality by education has widened over time. In general, people with the highest education had the longest life expectancy in 2001 and 2011. Life expectancy at the age of 30 was closest to the overall average for people with secondary education.

Tab. 1: Life Expectancy at the Age of 30 by Education Level and the Gap in Life Expectancy between the Highest and Lowest Education Level, Czechia, 2001 and 2011

Education Level	2001		2011		2011/2001	
	Men	Women	Men	Women	Men	Women
Low	37.9	50.3	39.9	52.6	2.0	2.3
Medium	45.8	50.6	47.9	53.0	2.1	2.4
High	50.9	56.1	53.1	59.4	2.2	3.3
All	45.4	51.0	47.4	53.3	2.0	2.3
Gap High/Low	13.0	5.8	13.1	6.8	0.2	0.9

Source: data CZSO, author's calculations.

2.2 Contributions of changes in mortality and education

The contributions of changes in mortality (M-effect) and of changes in the educational structure of the population (P-effect) to the change in life expectancy at the age of 30 in Czechia between the years 2001 and 2011 are seen in Table 2 for men and Table 3 for women.

In the case of men, the overall difference in life expectancy at the age of 30 between 2001 and 2011 was 2.46 years. The increase in life expectancy at the age of 30 contributed most to the improvement in mortality of the population with the lowest education (1.04 years), followed by the population with secondary education (0.81 years) and the contribution of persons with the highest education was negative (–0.09 years). The contribution to the change in life expectancy regarding the change in the educational structure of the population (P-effect) was 0.69 years. When distributing contributions by age groups, contributions to the difference in life expectancy at the age of 30 by education are more significant in older age groups. Namely, the highest contribution was measured in the age group 80+ (0.51 years), followed by 55–59 (0.47 years) and 60–64 (0.40 years). While mortality in lower middle-aged people has improved, mortality has improved significantly in those with the lowest education in older age groups.

Tab. 2: Contributions of Changes in Mortality (M-Effect) and of Changes in the Educational Structure of the Population (P-Effect) to the Change in Life Expectancy at the Age of 30, Czechia, 2001 and 2011, Men

Age group	Total change	M-effect			P-effect
		High education	Middle education	Low education	Educational structure
30–34	0.09	0.00	0.06	0.02	0.01
35–39	0.07	0.00	0.05	0.02	0.01
40–44	0.07	0.01	0.03	0.02	0.02
45–49	0.17	0.00	0.10	0.03	0.05
50–54	0.25	0.00	0.13	0.06	0.06
55–59	0.47	0.00	0.28	0.15	0.03
60–64	0.40	0.00	0.24	0.06	0.10
65–69	0.03	-0.04	-0.06	0.02	0.11
70–74	0.11	-0.03	-0.04	0.12	0.06
75–79	0.28	0.00	0.05	0.17	0.07
80+	0.51	-0.01	-0.03	0.38	0.17
Total	**2.46**	**-0.09**	**0.81**	**1.04**	**0.69**

Source: data CZSO, author's calculations.

Women's life expectancy at the age of 30 increased by almost two years overall between 2001 and 2011 (see Table 3). Compared to men, the contribution structure is similar, with the highest contribution to the difference in life expectancy at age 30 being recorded for women with the lowest education (1.13 years), furthermore for women with a secondary education (0.68 years), and for women with the highest education the contribution was negative (-0.01 years). The contribution to the difference due to the educational structure (P-effect) was significantly lower in women than in men (0.19 years vs. 0.69 years). From the point of view of age groups, the contributions are usually significant for older age groups. The highest contribution was calculated in the age group of women over 80 years (0.83 years), followed by 75–79 years (0.32 years) and 55–59 years (0.22 years).

Tab. 3: Contributions of Changes in Mortality (M-Effect) and of Changes in the Educational Structure of the Population (P-Effect) to the Change in Life Expectancy at the Age of 30, Czechia, 2001 and 2011, Women

Age group	Total change	M-effect			P-effect
		High education	Middle education	Low education	Educational structure
30–34	0.04	0.00	0.01	0.01	0.01
35–39	0.03	0.00	0.02	0.00	0.01
40–44	0.03	0.00	0.03	-0.02	0.02
45–49	0.06	0.00	0.05	-0.01	0.02
50–54	0.09	0.00	0.05	0.02	0.02
55–59	0.22	0.00	0.16	0.06	0.00
60–64	0.21	0.00	0.19	0.02	0.01
65–69	0.02	-0.01	0.02	0.02	-0.01
70–74	0.12	-0.01	0.01	0.13	0.00
75–79	0.32	0.00	0.04	0.28	0.00
80+	0.83	0.02	0.09	0.62	0.11
Total	**1.99**	**-0.01**	**0.68**	**1.13**	**0.19**

Source: data CZSO, author’s calculations.

Conclusion

The length of a human life is influenced by various socio-economic factors as discussed hereinabove. Education, as one of these factors, has been shown to significantly affect life expectancy. People with a higher education live longer. In terms of time, the difference between the life expectancy of people with the lowest and highest education has widened as confirmed in other studies. Nevertheless, at an older age an improvement in mortality was found in people with the lowest education, which was usually more significant compared to people with a secondary or higher education. In contrast, the effect of the change in the educational structure of the population (P-effect) proved to be less significant, especially for women. In the case of the mortality effect (M-effect), there was an improvement in mortality in people with the lowest education and in people with a secondary education. In terms of extending this paper, it would be possible to consider other socio-economic factors influencing life expectancy. However, on the other hand it is also necessary to consider the lower availability of data that is needed for a more detailed analysis.

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