Chapter 8

# Potential Reduction in Mortality Associated with the Shifts of Population Educational Structures in the Czech Republic

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Additional information is available at the end of the chapter

http://dx.doi.org/10.5772/intechopen.69635

**Abstract**

Educational inequalities in mortality are large in Central and Eastern Europe. Mortality levels are particularly high among low educated men as well as women in the Czech Republic. However, differences in male mortality by educational attainment exceed those of females. Two mortality patterns are apparent when dividing the Czech classification of education into four categories—basic, vocational, secondary, and university. Males with basic education experience much higher mortality when compared to their higher educated counterparts. An anomaly in the mortality gradient is observed among women when comparing basic and vocational education. Women with basic education show a rather lower mortality level compared to their vocational counterparts. Three scenarios show how the shifts toward a higher education could contribute to the change in mortality level using temporary life expectancies between ages 30 and 80 for males and females: (a) population structure by sex, age, and education remains the same as from the census 2011; (b) 60% of males having the basic education move into the next higher category (vocational) and 60% of women with basic and vocational education move into the secondary education; and (3) sex age education-specific mortality rates will be shifted upwards by one level.

**Keywords:** mortality, education attainment, sex-differences, Czech Republic population, scenario

## 1. Introduction

Kitagawa and Hauser [1] did the first one of the most complete studies of mortality differentials by socioeconomic status (SES) in the United States. They found that higher SES groups exhibited lower rates of all-cause mortality than did lower SES groups. Later on, the Black Report on Inequalities in Health [2] published by the Department of Health and Social Security in the United Kingdom launched debates about widening socioeconomic inequalities in mortality. Significant differentials in mortality by SES had been identified despite a tremendous increase in life expectancy at birth after the World War II. Since then, many studies have pointed out the differences in mortality by socioeconomic status [1, 3–8]. Moreover, time trends in socioeconomic inequalities in mortality have shown a widening of the gap, in relative terms, in Europe as well as in North America [9–12]. Education, occupational status, and income are the most widely used indicators of socioeconomic status. In reality, socioeconomic stratification reflects benefits or returns of a given educational attainment. Therefore, education has become one of the most commonly used indicators of socioeconomic position. The reasons for its use are that educational level can be determined for all individuals (including older people and women). Educational attainment is normally completed by the early adult years and does not change later in life [13]. The educational level can be considered as a proxy not only for the socioeconomic position/class but also because better-educated people lead a healthy lifestyle and can be more efficient consumers of health care. They are also more likely to take advantage of new technologies especially in treatment and prevention [6, 14, 15]. Therefore, the inverse association between education and mortality risk (the gradient) has been evidenced in many studies as well [6, 16–19]. Educational attainment is also a concrete indicator (compared to occupation) for policymakers when deciding the health or social policies and investments [15].

Educational inequalities in mortality are large in Central and Eastern Europe [20]. Mortality levels are particularly high among low educated men as well as women in the Czech Republic. Therefore, we assume that on average, higher levels of schooling cause people to live longer. The main purpose of our study is to find out to what extent the shifts in population structure toward higher education or mortality reduction based on the shifts of death rates toward one higher educational degree will impact on temporary life expectancy between ages 30 and 80. Changes in education-associated excess mortality aimed at lowering the risks present a challenge for social and health policies. For instance, Woolf et al. [21] showed that more lives would be saved by eliminating education-associated excess mortality than by medical advances only.

The contribution will address the following issues: First, to show long-term trends in life expectancy at birth in the Czech Republic,[1] France, and USA. Second, to illustrate differentials in life expectancy at age 30 by education for selected European countries. Third, to present three scenarios that will show how shifts (in population structure or in mortality rates) toward a higher education contribute to the change in all-cause mortality level between ages 30 and 80 using temporary life expectancy indicator.

[1]All results are related to the territory of the current Czech Republic

http://dx.doi.org/10.5772/intechopen.69635

## 2. Long-term trends in mortality: The Czech Republic, France, and United States

In 2012, US life expectancy at birth reached 81.2 years for women and 76.4 years for men [22]. These figures can also be found in the Czech Republic in 2015 [23] where women's life expectancy at birth was almost the same reaching 81.4 years and slightly shorter for men with 75.8 years (Czech Republic 2012: men 75.0; women 80.9). However, in the United States, the life expectancy at birth for both women and men is not as long as in France [24]. In 2012, French women lived 4 years longer than their American counterparts—84.8 years versus 81.2 years—and for men, the figures were 78.5 and 76.4 years, respectively. Looking back to the history, more particularly before the World War II, the situation was the reverse and US males and females enjoyed better survival [25]. Since the 1980s, life expectancy has increased much more slowly in the United States compared with France and the lag behind France is widening (**Figure 1a** and **b**).

The American slowdown is especially marked among women. Current US lower life expectancy at birth compared to French one is for instance explained by the fact that although the United States are world leaders in technological and medical innovation, not all inhabitants benefit equally. Unlike Europe, a large proportion of the US population have no health

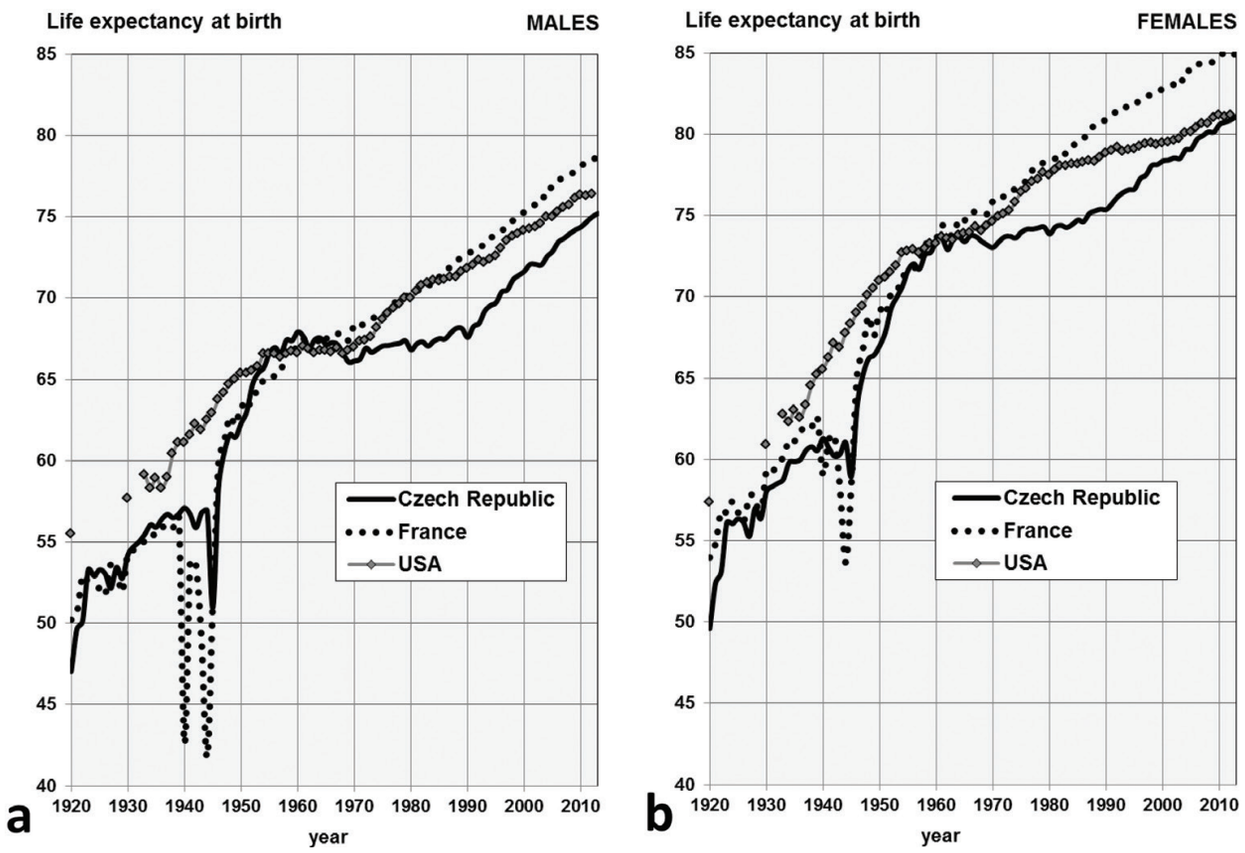


**Figure 1.** a) Trends in life expectancy at birth since 1920, males. b) Trends in life expectancy at birth since 1920, females.

insurance, and their access to health care is limited [25]. Despite the recent slowdown, US healthcare expenditures exceed those of other high-income countries in Europe [26]. The high cost of US healthcare may to some extent explain the higher levels of mortality compared to the high income population of Europe. In July 2014, The Lancet journal published a series of contributions on the health of Americans [27]. According to the authors, a fragmented healthcare delivery system, social environments (differences in health outcomes according to race, education, region), and individual risk factors (health-related behavior: obesity, smoking, physical inactivity, alcohol use, diets low in fruits, and vegetables) play an important role for length of life.

The Czech Republic manifests four dissimilar stages of mortality development (**Figure 1a** and **b**): before World War II; between World War II and mid-1960s; from the mid-1960s to the mid-1980s; and from the mid-1980s until now [28]. During the interwar period up to the mid-1960s, male and female survival in the Czech Republic was close to the levels observed in France [29]. However, age-specific mortality rates at that time were different in both countries. Before WWII, a high infant mortality rate in the Czech population was counterbalanced by a lower mortality at adult ages. Between World War II and the mid-1960s, the situation reversed and the upward trend of life expectancy at birth accelerated mainly because of the decrease in infant mortality rate, while adult and old age mortality had not changed too much. In the Czech Republic from 1950, all health services were nationalized, provided free of charge, and were accessible to anybody according to the new law. Particular attention was paid to child and mother. The comprehensive network of services was established for children and preventive vaccination and medical check-ups became compulsory. The "health-extensive approach"—a large number of medical staff with limited expenditures for equipment, drugs, and maintenance—was successful in reducing and controlling communicable and infectious diseases. Later on, the emergence of new degenerative diseases required a "health intensive approach" involving specialized training, sophisticated equipment, and expensive procedures and drugs. Despite growing awareness among the medical profession, health systems were not able to adjust to the changing health needs of the population. Therefore, the trend of increased mortality started in the mid-1960s and affected most of the population of Central and Eastern Europe including the Czech Republic. The deterioration was particularly marked for the elderly and middle-aged adults and primarily for men. A substantial part of the mortality increase was attributable to an "epidemic" of heart diseases. To a lesser degree, an increase in cerebrovascular diseases, lung cancer, and cirrhosis of the liver was noticed [29]. For instance, by the mid-1980s, the mortality rate from cardiovascular and cerebrovascular diseases was twice as high in the Czech Republic than in France [29]. It appears that the negative mortality development in the Czech Republic since the mid-1960s can be interpreted as an accumulation of previous problems (relatively high mortality of the elderly) and of inapt solutions for new ones (rising intensity of degenerative diseases). From that time, the gap in life expectancy between the Czech Republic and France or USA began to widen rapidly. Since the mid-1980s a new favorable trend in mortality has appeared in the Czech Republic, a new mortality decline has been initiated [28]. From the medical perspective, the use of cardiovascular drugs and the number of operations such as invasive heart surgery increased considerably. In addition, the structure of treatment shifted from traditional medicines to

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the new generations of drugs. The surgical and invasive procedures such as coronary artery bypass grafts, valve replacements, and angioplasties have also significantly increased [30]. The period of transition, beginning after 1989 and accompanied by political, economic, social, and behavioral transformations, has had a different impact on health conditions in former socialist countries. The Czech Republic escaped "Eastern European mortality crisis" [31] and its health situation improved more rapidly. However, the time delay of the Czech Republic in the reduction of mortality rate compared to France is too big, and therefore, the recent improvement in survival rates has not diminished the gap between both countries and life expectancies at birth have followed an almost parallel trend.

## 3. Educational inequality in mortality

Educational attainment plays a central role throughout a life course. In early life, harsh conditions (due to parental socioeconomic status) might impact a later-life mortality risk. However, infant and child mortality fell faster during the twentieth century and also childhood health dramatically improved. Thus, the association between early-life conditions and adult mortality has diminished across cohorts at the aggregate level [12]. Consequently, personal behaviors (diet, smoking, alcoholism, exercise) and the knowledge and the use of health technologies affect adult mortality risk more than early life factors [12].

Everywhere, highly educated adults have lower mortality rates than less educated people. Educational differences in mortality are frequently wider among younger adults compared with their older counterparts. The convergence of differentials by education at later age seems to be more complex, and the explanations vary. The study of Beckett [32] confirms the convergence gradient with age and shows that the protective effect of higher education declines with age because higher educated groups only postpone morbidity toward older age. On the other hand, Masters et al. [12] demonstrate the use of age-period-cohort modeling that educational gap in mortality grows across birth cohorts but not across time periods. Disparities in mortality by education are wider among men than among women. However, recent studies have shown that since the mid-1980s the growing gradient for US all-cause female mortality reflected increasing mortality among low educated women and faster-declining mortality among college-educated women [9].

Increases in all-cause life expectancy at adult ages mask a lot of disparities, including diverging trends, among population groups. Well-educated people live longer and thus represent the potential for reducing future mortality developments. Information on stratification by education of population as well as on mortality differentials can help in promoting and targeting health and social policies.

**Figure 2a** and **b** presents life expectancy at age 30 by gender in European countries where data on education are available. Educational attainment is classified into three categories (ISCED - The International Standard Classification of Education defined by Eurostat): basic = pre-primary, primary, and lower secondary education (ISCED levels 0–2); secondary = upper secondary and post-secondary non-tertiary education (ISCED levels 3 and 4); and tertiary = first and

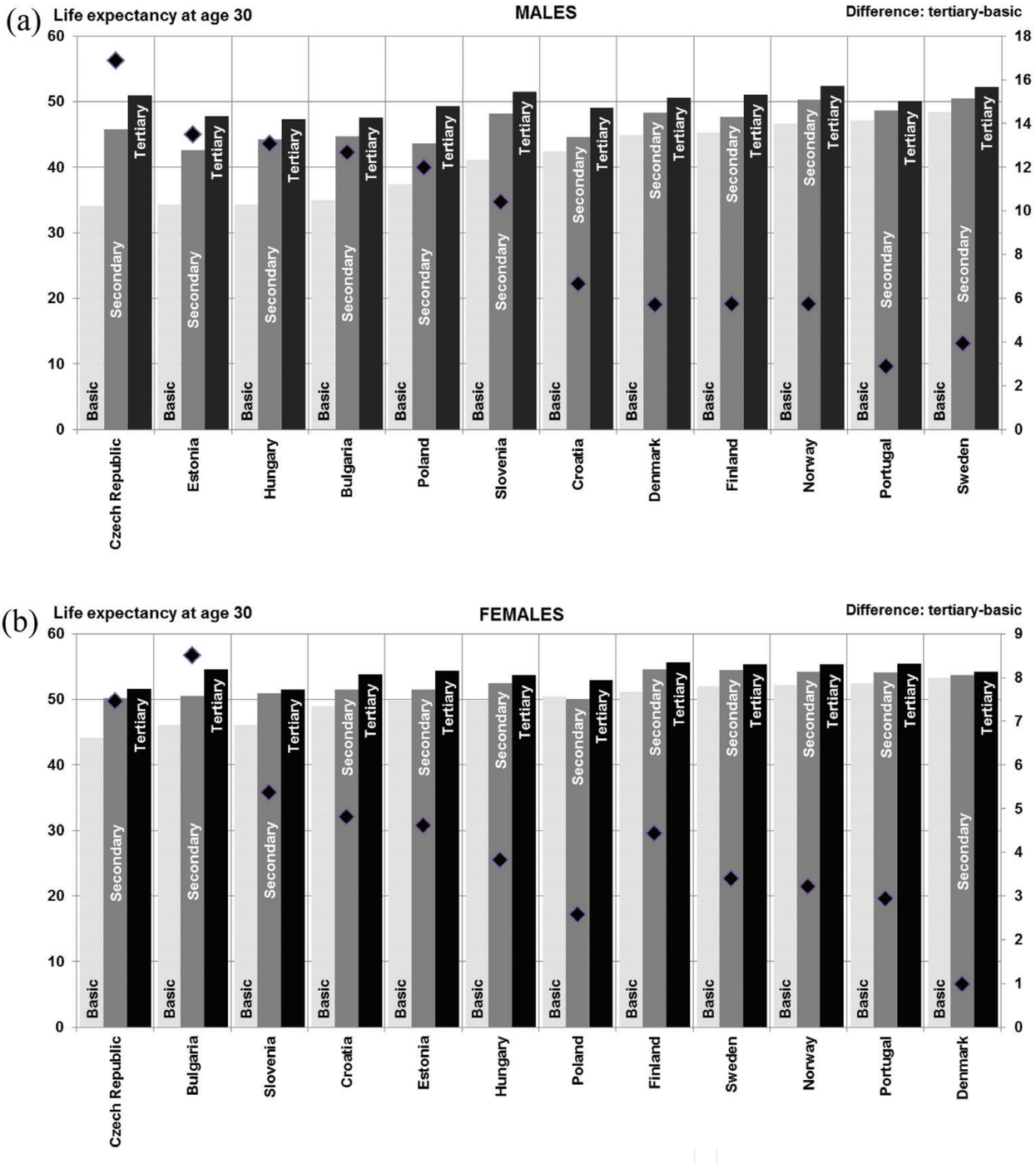


**Figure 2.** a) Life expectancy at age of 30 according to education level in 2010, males. b) Life expectancy at age of 30 according to education level in 2010, females.

second stage of tertiary education (ISCED levels 5 and 6). In all countries, under the study, highly educated adults experience longer survival (the mean number of remaining years of life beyond age 30 or mean survival duration at age 30 under the mortality conditions of the year in question) than less educated people. The results show variation in survival by educational attainment everywhere. However, former socialist countries show not only shorter life expectancies but also a wide variation in survival by educational attainment for both men and

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women. The Czech Republic displays a short life expectancy at age 30 for males and females with the lowest education even when compared with countries of higher mortality (Estonia, Hungary, Bulgaria). The difference between life expectancy at 30 of people with the highest and the lowest educational attainment reaches 16.9 years among Czech men compared to 2.9 years in Portugal or 3.9 in Sweden. The gap in Czech female mortality between the highest and the lowest education level is the second high (7.5), after the Bulgarian one (8.5). This phenomenon happens in spite of low social differentiation and universal access to health services. The explanation can be related to the fact that university graduates experienced better health situation because of better working conditions than people with only basic education working in factories with low-tech equipment and therefore in the more detrimental environment. In addition, the lack of knowledge and awareness of less educated may impair the ability to use available health care services. Also, differences in the lifestyle contributed in widening the gap in health and mortality between educational groups. After the political change (started in 1989) accompanied by transformation toward market economy, better-educated people have been less likely to be unemployed and were better able to face economic hardship. They also have had higher income and more fulfilling and rewarding jobs than less educated individuals. All these facts imply that educational attainment (besides other factors) has played an important role for survival in any society, regardless of living under former socialism, capitalism, or new market economy. Increasing the amount of schooling can lower total level of mortality by two ways: (a) increasing share of highly educated people (with lower mortality) will impact total mortality level as structural effect and (b) faster decrease of death rates among higher educated adults will act as intensity effect. Therefore, in the next part, we model such situations in order to estimate the effects of changing population structure and mortality rates by education toward higher degrees.

## 4. Data and methods

The data on population structures by gender, age, and education come from the Population and Housing Census conducted in March 2011 (midnight from March 25 to 26th 2011) in the Czech Republic. The population counts were adjusted for the date of January 1, 2011 (by subtracting deaths between January 1 and March 25). The modified census counts were used as the denominator (mid-year population of the period 2009–2012) for mortality rates. Data on the number of deceased people according to gender, age, and education were derived from death certificates and served as the numerator for the mortality rates. Both data files (populations and deaths) were not linked because according to the Czech law, personal IDs had to be deleted after cleaning the raw census data.

The study focuses on the age group between 30 and 79 years. As a mortality indicator, it uses the temporary life expectancy between the exact ages 30 and 80. The age interval was chosen because educational attainment does not change almost at all after the age of 30, the death counts beyond the age of 80 are less frequent, and the information on education might be less reliable. In addition, age-specific mortality rates by education at age 80 and older converge.

Temporary life expectancy (life expectancy between two specific ages) measures the average number of years that a group of persons alive at exact age $x$ will live from age $x$ to $x + i$ years [33]

$$ {}_i e_x = \frac{T_x - T_{x+i}}{l_x} \quad (1) $$

${}_i e_x$ is the temporary life expectancy between exact ages $x$ and $x + i$; $T_x$ is the total number of person-years lived between exact ages $x$ and $x + i$; and $l_x$ is number surviving to the beginning of age interval $x$.

The data on population and deaths are classified into four educational attainment categories. This classification has been in use in the Czech Republic since the WWII: (1) less than high school degree is indicated as basic. It takes 9 years usually from the ages of 6 to 15 and consists of a primary and lower secondary stage, where the primary stage encompasses grades 1–5, whereas the lower secondary stage has grades 6–9 (**Table 1**). (2) Upper secondary education termed vocational (apprenticeships or training for skilled occupation) is generally 4 years in length (grades 10–13), and the certificate is not applicable for entering tertiary education. (3) Upper secondary general education (frequently from the age 15 with the usual length of 4 years), called secondary (grammar or high school resulting in a "Maturita" certificate), allows the entrance to the tertiary education. Tertiary or university education includes all studies following the completion of upper secondary education with a successful final examination and obtaining the Maturita certificate.

Three scenarios will be presented. The first one reflects the real situation, and the next two scenarios simulate the shifts toward a higher education: (a) population structure by sex, age and education will remain the same as from the census 2011 as well as mortality rates from 2009 to 2012 will not be changed (reference scenario); (b) change in population structure by education; 60% of males having the basic education will move into the next higher category (vocational) and 60% of women with basic and vocational education will move into the secondary education (it is because the difference in mortality between females with basic and vocational education is negligible); (c) change in death rates; sex age education-specific mortality rates will be shifted upwards by one level (basic = vocational, vocational = secondary, secondary = university, new university = 0.80*university).

| Level of education | Educational attainment (ISCED 97) | Educational attainment (ISCED 2011) |
|---|---|---|
| Basic | ISCED 2 | ISCED 2 and lower |
| Vocational | ISCED 3C | ISCED 35 |
| Secondary | ISCED 3A | ISCED 34 |
| University | ISCED 5A and higher | ISCED 64 and higher |

**Table 1.** Classification of educational attainment in the Czech Republic based on ISCED codes.

## 5. Descriptive results

For the first introduction of the situation in mortality according to education attainment, the age-specific mortality rates were calculated, separately for each education level defined according to the ISCED levels (**Table 1**).

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From the age-specific mortality rates, several the most important basic features are visible (**Figure 3a** and **b**). The first is a higher overall level of mortality for males—it holds for all of the education levels. The second observable feature in **Figure 3a** is the regular gradient of mortality levels according to education for males. In the case of males, the highest level of mortality is tied with the lowest level of education and vice versa.

The third feature observable in **Figure 3b** is the irregular gradient of mortality levels according to the education of females. This anomaly refers to the lowest education levels—basic and vocational. In particular, at higher ages (above 45), the level of mortality of females with basic education is lower in comparison with females with vocational education. There could be long discussions about the reasons for this anomaly; however, in general, it is assumed that this specificity could be tied to worse working conditions of females with vocational education in comparison with their less educated counterparts. Those females (with vocational education) worked more often manually in physically demanding jobs, in factories with substandard working conditions. On the other side, females with basic education worked more often in better conditions—as housewives, cleaners, etc.

Because the main goal of the study is to model possible changes of the education structure and their impact for the mortality changes, it is necessary to describe briefly the initial education structure of the population. The population structure by gender, age, and education attainment from the 2011 population census is shown in **Figure 4**. From the

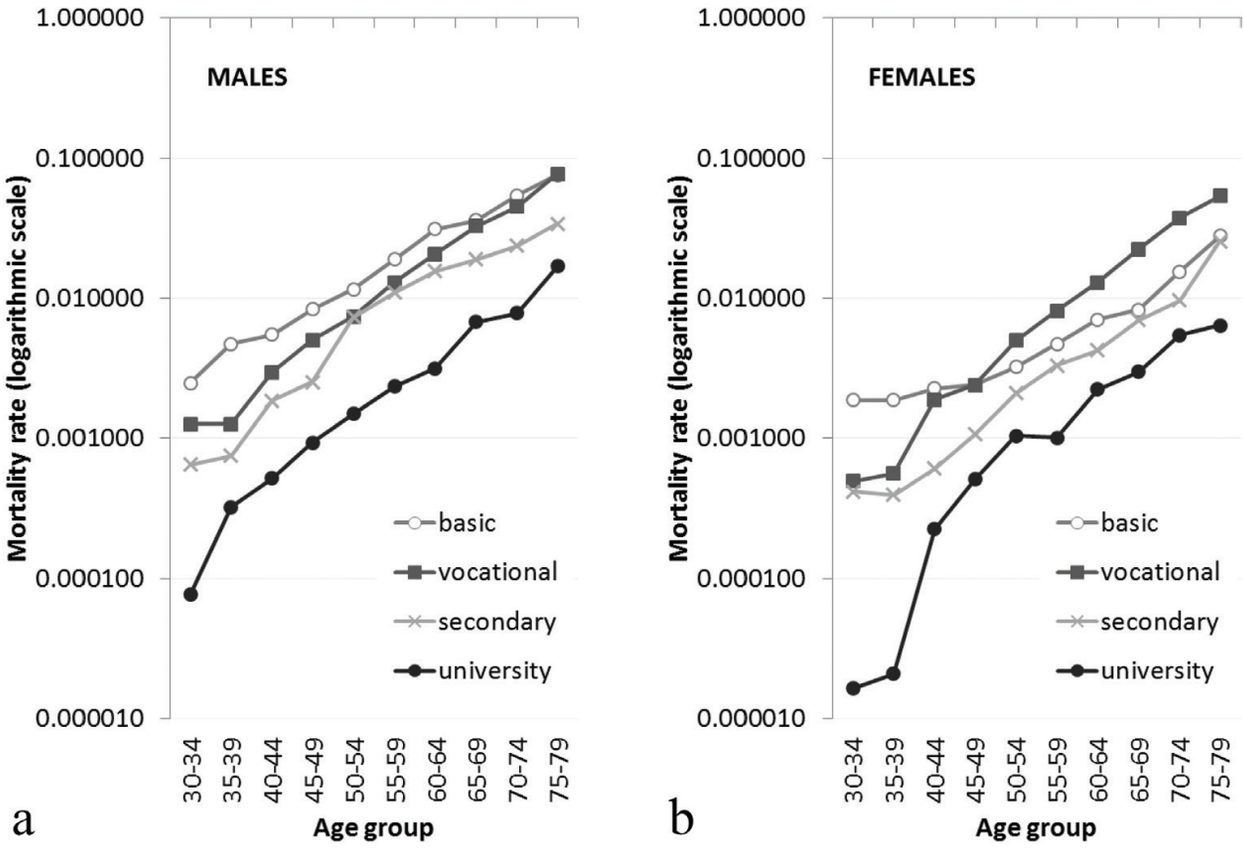


**Figure 3.** a) Czech Republic, age-specific mortality rates, years 2009–2012, males. b) Czech Republic, age-specific mortality rates, years 2009–2012, females.

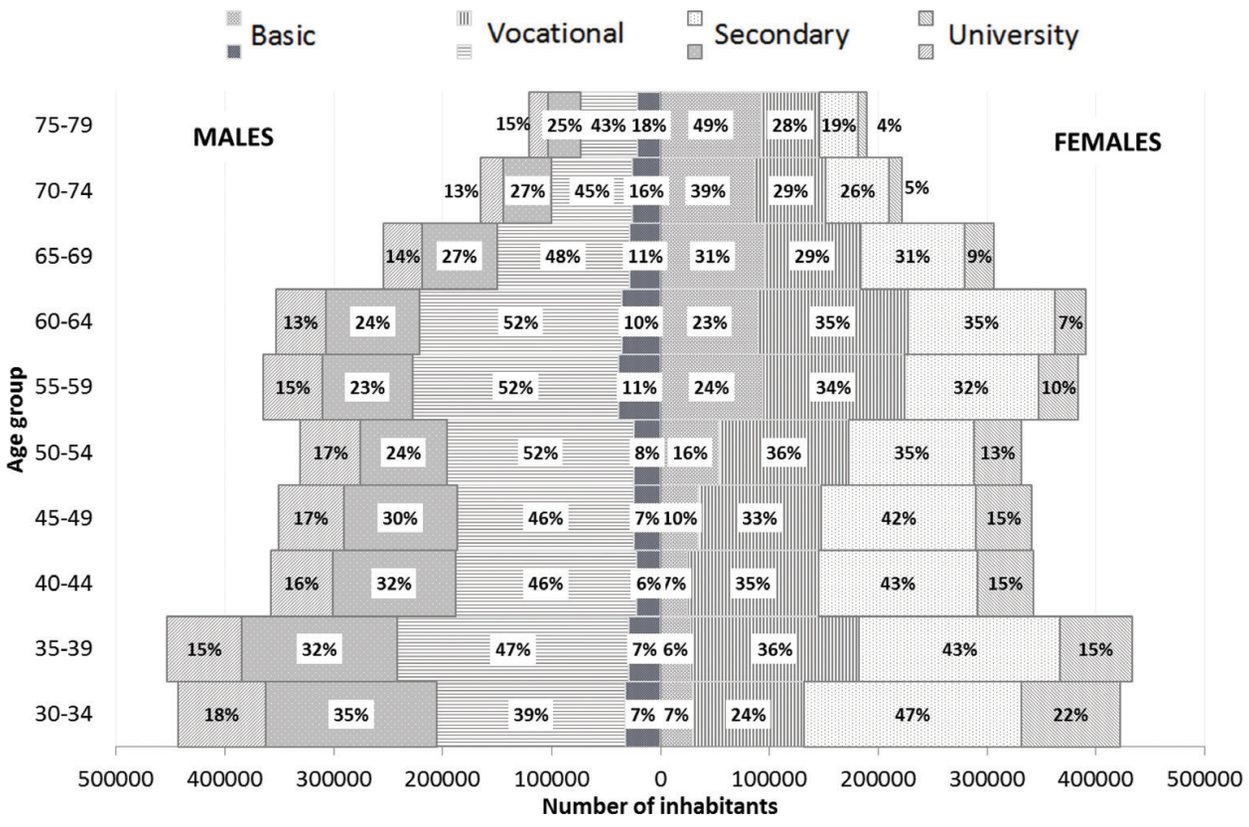


**Figure 4.** Czech Republic, population structure by gender, age, and education from the census 2011, ages 30–79 years.

population pyramid, many important differences could be pointed out. There is a clear increase in the proportion of the population with tertiary education with decreasing age. In the youngest age groups, the proportion of tertiary educated reached 22% for females and 18% for males. On the other side, with increasing age, the proportion of the population with only basic education rises, especially for females. At the highest age group (75–79 years), almost 50% of females had only basic education. In the case of males, the proportion was significantly lower—less than 20% at the oldest age groups and around 10% for the middle ages, and for the youngest age groups, the proportion was even lower. The most common education level for males is the vocational one (almost 50% share).

## 6. Model scenarios: shifting population or death rates by education

As was described in previous parts of the chapter, mortality in the Czech Republic is significantly different according to various levels of education. The aim of the following analysis was to transform the possible future changes of the education population structure or mortality rates into potential changes in temporary life expectancy. There are three different model scenarios defined with the purpose to illustrate the theoretically possible impacts on overall mortality caused by the changes in the education structure.

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### 6.1. Scenario 1

The first model scenario could be indicated as a reference model. In this model, we suppose the education, gender, and age structures to remain unchanged. The population structure by education, gender, and age is that from the census 2011 (adjusted for January 1, 2011) and deaths rates those observed in the period 2009–2012. The population structure is graphically expressed by the population pyramid in **Figure 4** and mortality rates by education in **Figure 3a** and **b**.

The education structure from the 2011 census is characterized by a large proportion of people with only basic education at higher ages, especially for females. For males at the highest age groups, the proportion of basic education was only around 18% (in comparison to the proportion for females at the highest ages, which was almost 50%). At the youngest ages, the proportion of people with basic education decreased to only 7% for both the sexes. The largest proportion of males reached the vocational education (40–50% and this proportion is nearly invariant also at lower ages, except the youngest age group). For females, the vocational education was the second of importance at ages 65 and older. Women aged 30–49 most frequently had the secondary education. Moreover, for females, the proportion of basic education rapidly decreased from the highest age groups to the youngest ones and the proportion of secondary and university graduates increased with decreasing age. For males, almost the same trends can be depicted (see **Figure 4**).

### 6.2. Scenario 2

The second model scenario is characterized by only changes among people with the lowest levels of education. In this scenario, we suppose that 60% of males with only basic education will be moved into the higher category—vocational education. This assumption, in fact, reflects the decrease in the proportion of basic education with decreasing age as well as the high importance of vocational education among males.

For females, we suppose that 60% of females with basic and vocational education will move into the secondary education. Also, in this case, the reason for this assumption could be found in the decrease of the proportion of basic education with decreasing age and moreover the significant increase of the proportion of females with secondary education.

The modeled education structure corresponding with the Scenario 2 is illustrated by the population pyramid in **Figure 5**. According to this model scenario, the proportion of basic education nearly diminishes. On the other side, the proportion of vocational education for males would significantly increase together with the share of secondary education for females would significantly increase. It could be hypothesized that especially for females, this shift in educational structure could have a significant effect on the overall mortality level because the mortality rates of secondary education are visibly lower in comparison to basic and vocational education (see **Figure 3b**). Also in case of males, the effect of modeled changes in education attainment could be expected in order to lower overall mortality, however, not as significant as for females because the modeled change affects only the proportion of basic education which was low already in the real population (see the model Scenario 1).

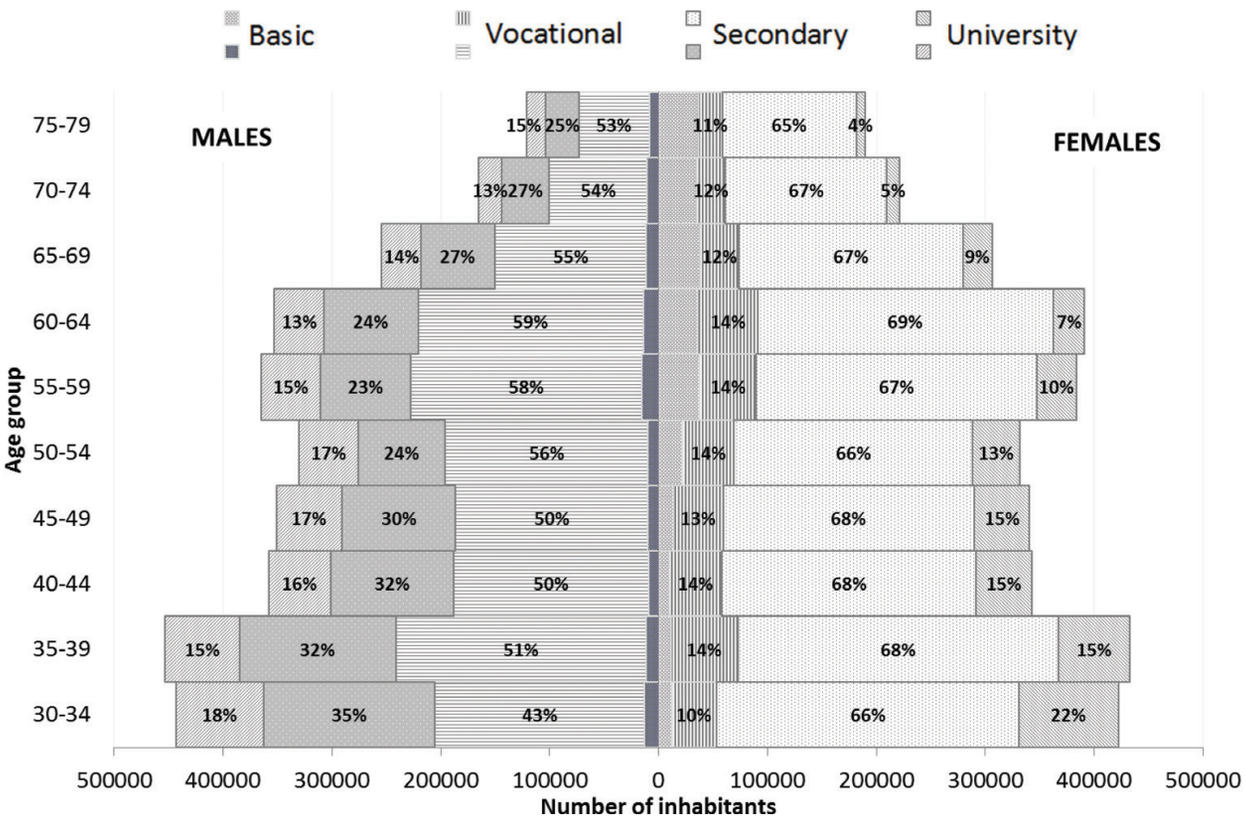


**Figure 5.** Population structure by gender, age, and education in the model Scenario 2, population aged 30–79 years.

### 6.3. Scenario 3

The last model scenario modifies all death rates by education while preserving population structure by education. In this model, we suppose shifts in sex age education-specific mortality rates upwards by one level (basic = vocational, vocational = secondary, secondary = university, new university = 0.80*university). The assumptions of this scenario are consistent with recent rapid changes in the educational structure of the Czech Republic, with a significant shift toward higher education levels. The proposed changes are supposed to impact overall mortality, above all in the case of males. The modeled shift according to this third scenario would lead to significant male mortality improvements due to their clear education gradient. The effect of change could be rather contradictory for females because women with vocational education experience slightly higher mortality compared to those with basic attainment (the above-mentioned anomaly in female mortality gradient by education, see **Figure 3b**). The shift from vocational education to secondary as well as changes connected with shifts toward university education would lower mortality levels for both genders.

## 7. Impact of education shifts on temporary life expectancy

The above-defined model scenarios of education shifts were further applied when calculating temporary life expectancies. Temporary life expectancies between exact ages 30 and 80 according to education attainment and based on Scenario 1 (no shifts) are presented in **Figure 6**.

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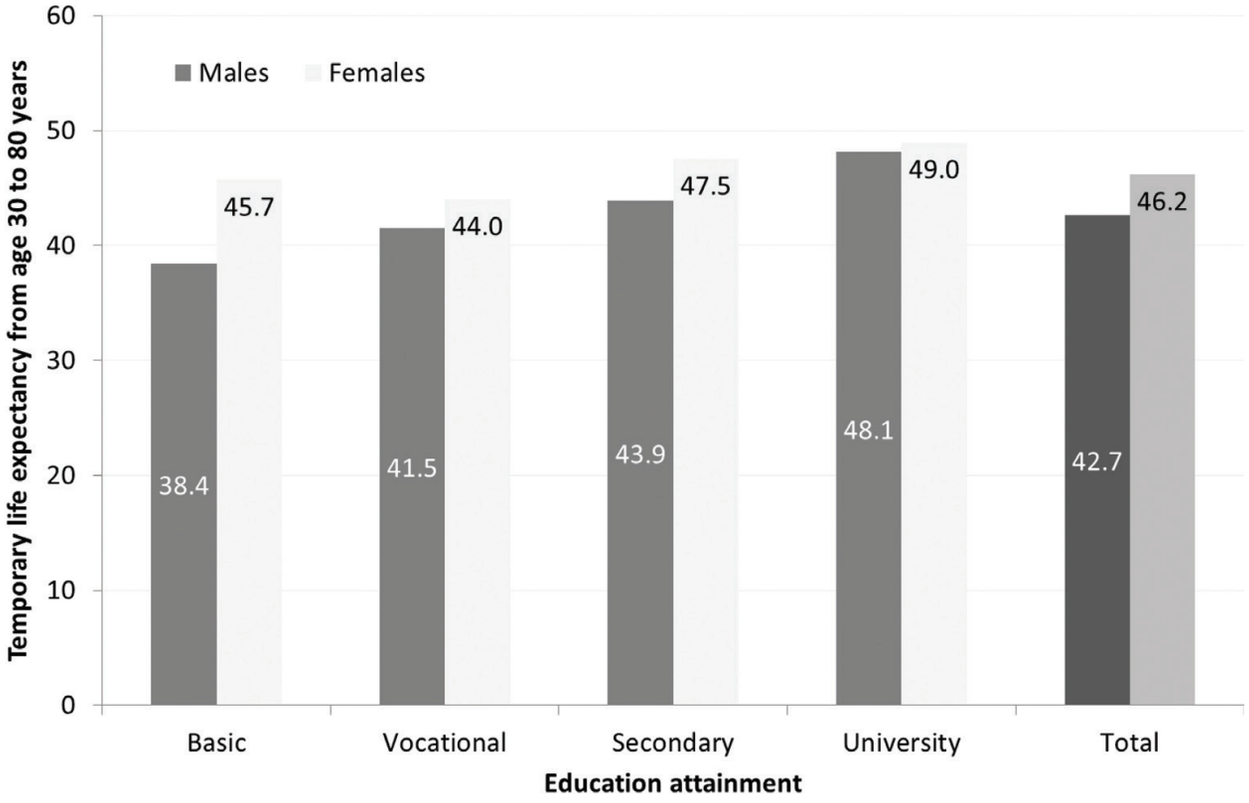


**Figure 6.** Temporary life expectancy for males and females between ages 30 and 80, Scenario 1, Scenario 2, Scenario 2 modified, and Scenario 3.

The most significant differences between males and females are visible for the basic level of education—for males this level of education is clearly the less favorable (**Figure 6**). However, females with basic education show longer temporary life expectancy (45.7 years) compared to those having a vocational degree (44.0 years). The total temporary life expectancy from age 30 to 80 was 42.7 years for males and 46.2 years for females.

According to the Scenario 2, the population of the least educated (basic) males was reduced and the majority of them (60%) moved into the higher educated (vocational) group. About 60% of females with basic and vocational education was moved into the secondary education. The effect of lowering mortality, based on temporary life expectancy, was significant only for females due to a large decrease in the share of women with basic and vocational education moved into the secondary degree. Consequently, the total female temporary life expectancy increased (47.1–46.2 = 0.9) by almost a year (**Figures 6** and **7**). For males, the effect of the shift in educational population structure was negligible—the temporary life expectancy increased by only 0.1 years (42.8–42.7 = 0.1). The reasons were already stated, the proposed change in population educational structure (from basic into vocational) involved only a relatively small group of males. Therefore, a modified Scenario 2 was elaborated for males.

Modification of the Scenario 2 only consists in another shifting of the male population structure by education (females movement is the same as in Scenario 2). According to the modified Scenario 2, 60% of males with vocational education was moved toward secondary education (60% with basic

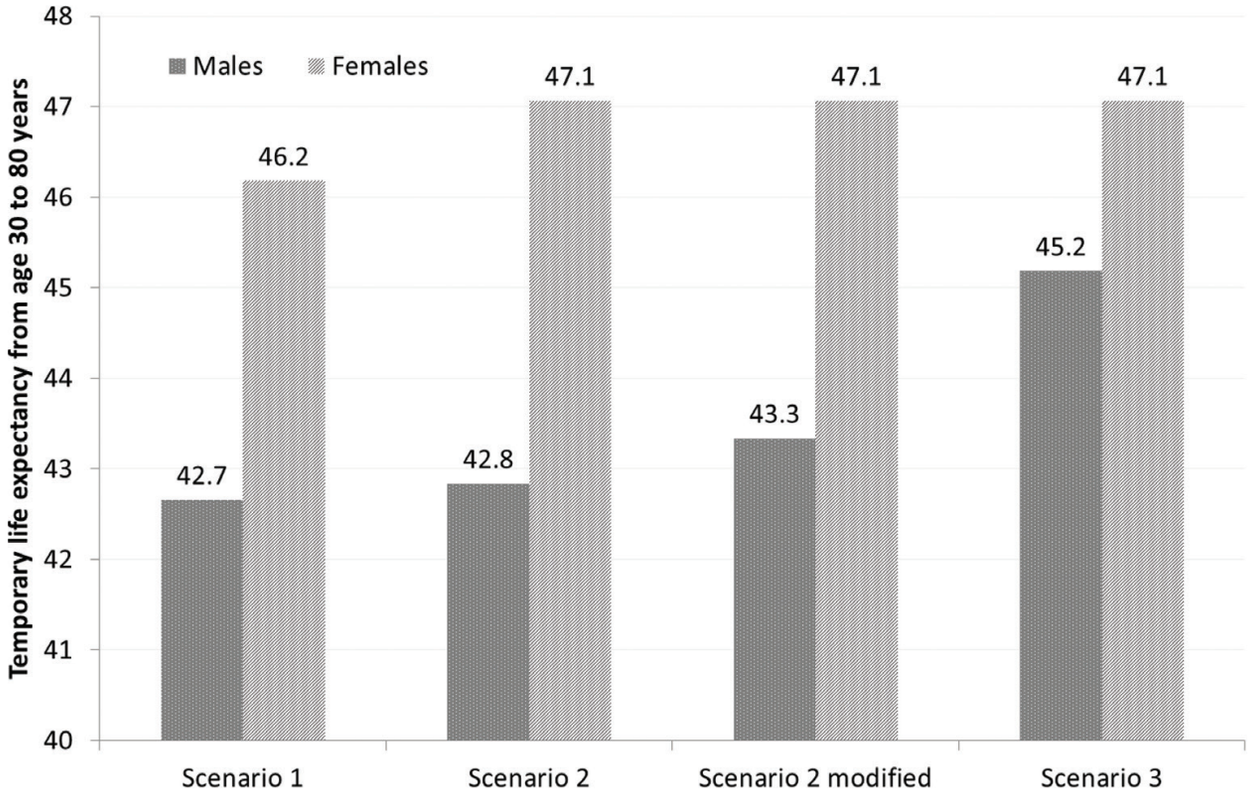


**Figure 7.** Temporary life expectancy between ages 30 and 80 for males and females, Scenarios 1, 2 (without and with modification), and 3.

education moved into vocational). This assumption is in line with the general tendency in the educational structure of the Czech population over time, where secondary education is expanding for males. Because the vocational education group of males is relatively large, we can expect that the resulting effect on temporary life expectancy will be higher than in the Scenario 2 (without modification). Of course, for females, the results will be the same based on Scenario 2 or Scenario 2 modified. The results are shown in **Figure 7**. As it was assumed, the shift of high proportion of the male population with vocational education toward secondary (Scenario 2 modified) had a more significant impact on the rise of the temporary life expectancy between ages 30 and 80—it increased from the initial value of 42.7 to 43.3 years. Based on the Scenario 2 or Scenario 2 modified, it is possible to expect a future growth of the life expectancy caused (among others) by the ongoing changes of population education structure. The improving education structure of the population could lead to an increase in the temporary life expectancy between ages 30 and 80 by nearly a year.

The results based on the Scenario 3 (shifting death rates toward higher education category) were to be the most optimistic ones, especially for males. In the case of females, lower mortality of women with basic education compared to their vocational counterparts can produce a contradictory effect and thus reduce the growth of temporary life expectancy. The general shift in the education structure toward higher levels is likely and is consistent with the ongoing education development in the Czech Republic. From the results (see **Figure 7**), it is seen that initial hypotheses were correct. The estimated outputs (hypothetical temporary life expectancies) are clearly more favorable in case of males (gain of

45.2–42.7 = 2.5 years) in comparison with females (gain of 47.1–46.2 = 0.9 years). The male advantage is closely connected to the shifts of high mortality education categories (basic or vocational) toward much favorable survival experienced by men having a secondary or a university degree. Females show a less pronounced gradient in mortality by education, and therefore, mortality reduction is rather modest. Such a trend is in line with findings in other countries [9, 15].

The complete disappearance of the most unfavorable group of males (with only basic education) or females having a basic or vocational education is unlikely. Therefore, future mortality decline will be primarily driven by lowering sex age education-specific mortality rates. It is the field of health and social policies on one side and personal responsibility for one's own health and for successfully functioning in a society on the other side.

## 8. Conclusion

In recent years, the population of the Czech Republic experienced two important phenomena: increase in the share of higher educated people and a significant decline in mortality at adult ages. The impact of changing education structure (in population as well as in rates) can be especially influential due to large disparities in survival according to educational attainment in the Czech Republic. Because these differences are among the largest in Europe, further studies of related factors are needed. Scientific understanding of determinants of educational differences of adult mortality has increased substantially over the past few decades in developed countries. Some striking phenomena have been identified: (a) educational differences in mortality rates have widened over the past several decades despite a dramatic progression of life expectancy, (b) mortality inequalities by education among women are rising over time ant thus approaching male patterns, and (c) regional differences in mortality by education are more pronounced when comparing with national patterns.

In our contribution, the main goal was to model the potential development in mortality under the various conditions addressing the education shift in the society. Based on the scenarios and their assumptions, the changes in temporary life expectancy between ages 30 and 80 were estimated. The results have shown that a decrease of the proportion of the population with the lowest education would lead to only a small increase in temporary life expectancy. On the other hand, decreasing education specific death rates have a larger impact on aggregate mortality indicators. However, it has to be kept in mind that even a small sub-group of the population matters and is worth considering when looking at the overall mortality level.

## Acknowledgements

The study was supported by the Czech Science Foundation, project No. P404-12-0883.

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