

## Education and survival in the Czech Republic

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### 1. Historical outlook on general mortality trends

From the beginning of the 20<sup>th</sup> century mean length of life increased, however on different speed and unequally across countries. Unlike the present, male and female survival in the Czech Republic was, during the interwar period, close to the levels observed in France (Table 1). Similarly, the Czech lands (Bohemia, Moravia and part of Silesia) belonged at that time among the more economically advanced countries. In 1930, GDP per capita was 720 and productivity in agriculture was 145 when 100 accounted for the European average productivity (France: 890 and 176 respectively; Austria 715 and 134; Hungary 430 and 78; Poland 420 and 49; and Italy 525 and 73) (Bairoch 1981, Kirk 1946).

After the WWII, a new political region – Eastern Europe – emerged. The newly created geo-political socialist territory displayed pronounced inequalities in demographic behaviour, economic indicators, social structures, etc. Through the period of the communist regime, some inequalities were attenuated, however, later on, new ones were formed. Compared with the “West”, mortality indicators, initially fast decreasing, started deteriorating from the mid-1960s. A new reversal in mortality trends in terms of better survival has been observed since the end of the 1980s in some former socialist countries. As regards the Czech Republic **three dissimilar stages in the development of life expectancy at birth** can be distinguished from the WWII up to now: 1) between World War II and the mid-1960s characterized by mortality decrease; 2) from the mid-1960s to the mid-1980s, showing the deterioration of the survival rate; and 3) from the mid-1980s or the beginning of the 1990s to the present with a reappearance of a new decline in mortality.

The Czech favourable development through the 1950s was related to improvements in public health and particularly due to the profound decrease in infant mortality rate. During this short period, men’s mean length of life was longer in the Czech Republic than in France and equal for females (Figure 1, Table 1). This “advantage” persisted until the early 1960s. At that time the pace of improvement in health conditions was substantially faster in Eastern Europe than in most countries of Western or South-Western Europe. The effort for massive schooling of people

and rapid coverage of the entire population with basic health services reduced the biggest contrasts between and within former socialist countries. The “planned economy” based on subsidies for poor sectors or regions moderated those disparities. 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 among the population as a whole. This improvement in health was particularly pronounced for infants and young children.

The decline/stagnation in health conditions from the mid-1960s to the mid-1980s 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 (Figure 1, Table 1). For instance, life expectancy at age 60 was lower for Czech males in 1980 than in 1930! 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 (Rychtaříková 1998, 1997, 1989, UNICEF 2001). By the mid-1980s for instance, the mortality rate from cardiovascular and cerebrovascular diseases was twice as high in the Czech Republic as in France (Rychtaříková et al. 1989). These 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, Eastern European health systems were not able to adjust to the changing health needs of the population. At that time, the gap in life expectancy between the Czech Republic and France began rapidly to widen (Figure 1, Table 1).

Since the mid-1980s a new favourable trend in mortality has appeared in former socialist countries. Also in the Czech Republic, a new mortality decline has been initiated (Figure 1, Table 1). The period of transition, beginning after 1989 and accompanied by political, economic, social and behavioural transformations, has had the different impact on health conditions in respective countries. The Czech Republic has escaped “Eastern European mortality crisis” (UNICEF 1994, 1995, 2001) and its health situation has improved more rapidly than in the other former socialist countries. There are two sets of factors (medical and social/behavioural) to be considered for explaining the recent favourable turnover of mortality. From the medical perspective, the use of cardiovascular drugs and the number of operations of invasive heart-surgery considerably increased. In addition, the structure of treatment shifted from traditional medicines to the new generations of drugs {new beta blockers, long acting Calcium channel blockers, ACE (angiotension converting enzyme) inhibitors, hypolipidemics – statins, etc.}. The surgical and invasive procedures such as coronary artery by-pass grafts, valve replacements and angioplastics have also significantly increased (Rychtaříková 2004). Regarding lifestyle, smoking and alcohol consumption have slightly increased. In spite of the fact that there has been a positive shift from animal to vegetable fats and increased opportunity to buy a wider variety of healthy fruits and vegetables, the recent decline in mortality

Tab. 1 Trends in life expectancy at birth.

year	Czech Republic		France	
	males	females	males	females
1920	47.05	49.60	50.22	53.97
1925	53.30	56.35	52.08	56.73
1930	54.22	58.04	54.35	59.34
1935	55.91	59.86	55.42	61.14
1945	50.96	58.96	51.33	58.60
1950	62.31	67.00	63.45	69.21
1955	66.60	71.63	65.22	71.53
1960	67.92	73.40	67.01	73.59
1965	67.13	73.39	67.47	74.73
1970	66.13	73.02	68.38	75.84
1975	67.05	73.97	69.03	76.88
1980	66.81	73.86	70.19	78.42
1985	67.51	74.72	71.26	79.44
1990	67.58	75.42	72.76	80.96
1995	69.72	76.63	73.94	81.91
2000	71.65	78.35	75.30	82.80
2005	72.88	79.01	76.80	83.80
2006	73.40	79.70	77.20	84.10

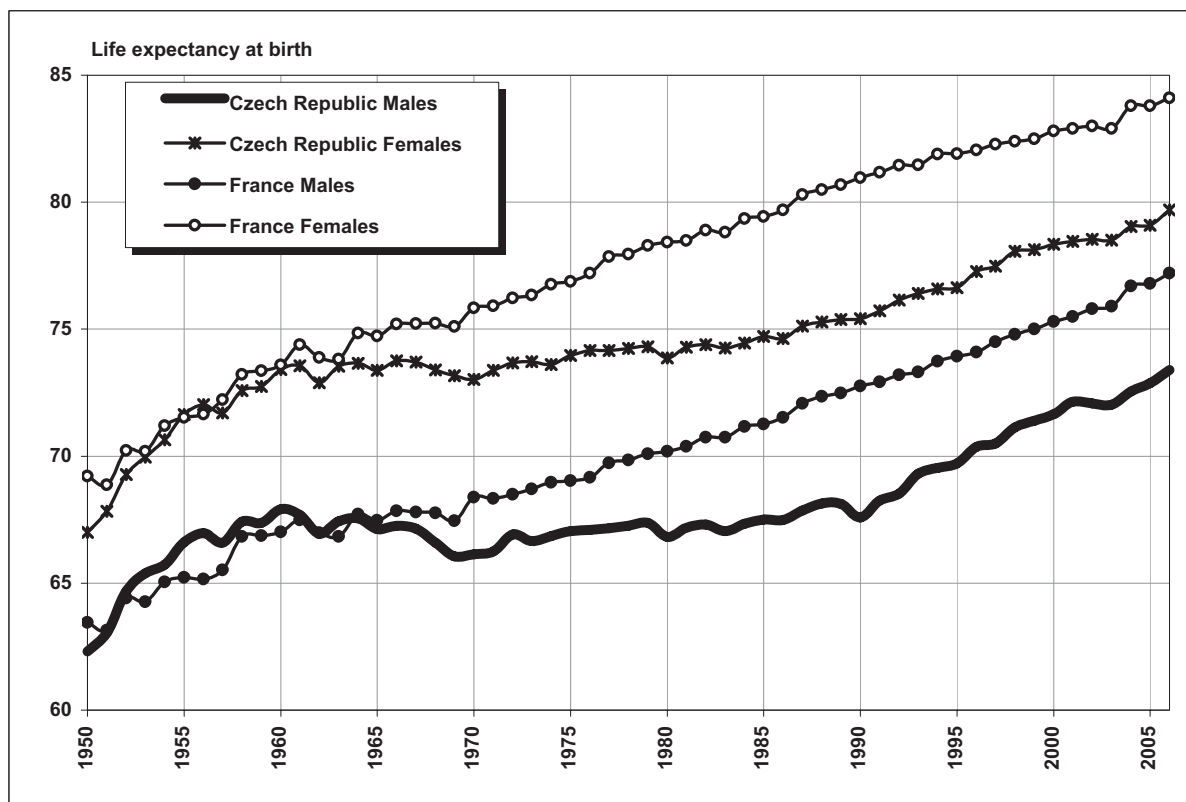


Fig. 1 Trends in male and female life expectancy at birth since 1950

is likely to be attributable to technical progress in medical treatment and less affected by the change in lifestyle. The time delay of the Czech Republic in the reduction of mortality rate compared to France is too big, therefore the recent improvement of survival rates has not diminished the gap between both countries and life expectancies at birth have followed an almost parallel trend (Figure 1). In 2006, life expectancy at birth was in the Czech Republic 73.4 years for men and 79.7 for women (France 77.2 and 84.1) (Table 1). Nevertheless, the recent increase in life expectancy at birth has currently brought the Czech Republic a little closer to the European average.

## 2. Mortality change by age and cause between 1985 and 2005

What has been the origin of such a recent trend? Which ages and which causes of death have contributed to the observed amelioration? For answering these questions the differential in life expectancy between the years 1985 and 2005 was decomposed into age components. The contributions (gains) introduced in table 2 and in figure 2 indicate the part of the specified age group to the overall time differential in life expectancy. The formula employed (suggested by Pressat 1975) is as follows:

$${}_n d_x = (e_x^A - e_x^B) \times (l_x^A + l_x^B) / 2 - (e_{x+n}^A - e_{x+n}^B) \times (l_{x+n}^A + l_{x+n}^B) / 2$$

Where  ${}_n d_x$  is the contribution of the age group  $x, x + n$  to the differential in life expectancy at birth of life tables A and B (here A = year 2005 and B = year 1985);  $e_x^A, e_{x+n}^B$  are life expectancies at age  $x$  and  $x + n$  from life tables A and B resp;  $l_x^A, l_{x+n}^B$  measure survivors to age  $x$  and  $x + n$  in life tables A and B resp, with a radix 1.

Comparing health conditions between the pre-transition (1985) and transition (2005) periods, the age group 45–84, or more precisely 55–74 (Figure 2, Table 2), contributed the most to the improvement of male mortality between the calendar years 1985 and 2005. As a percentage the age ranges represented 63 and 39 percent of total improvement respectively. Similar patterns were observed for females where the gain in life expectancy was due to the survival improvement at ages 55–84 but mostly at 65–74; i.e. 62% and 48%. The continuing decline in the infant mortality rate contributed 18% for males and 17% for females in the life expectancy's prolongation. The better survival in advanced ages has been mainly due to diminishing mortality from cardiovascular and cerebrovascular diseases (Rychtaříková 2004). The “cardiovascular revolution” of the West (Vallin et al., 2001) noticed from the 1970s and characterized by a manifest mortality decrease of circulatory diseases has also been observed since the end of the 1980s in the Czech Republic. The decrease in mortality from ischemic heart disease has been initiated primarily by the considerable use of new technologies and practices (heart surgery, and efficient drugs) and less by change in negative consumption habits such as alcohol and smoking as it has been mentioned in the previous paragraph.

Tab. 2 Gains in life expectancy at birth in the Czech Republic between 1985 and 2005.

age	in years		in percent	
	Males	Females	Males	Females
0	1.075	0.868	17.7	16.6
1-4	0.120	0.093	2.0	1.8
5-14	0.150	0.099	2.5	1.9
15-24	0.186	0.057	3.1	1.1
25-34	0.179	0.093	3.0	1.8
35-44	0.389	0.197	6.4	3.8
45-54	0.699	0.323	11.5	6.2
55-64	1.063	0.767	17.5	14.6
65-74	1.296	1.330	21.4	25.4
75-84	0.782	1.160	12.9	22.1
85+	0.126	0.249	2.1	4.8
Total	6.064	5.236	100.0	100.0

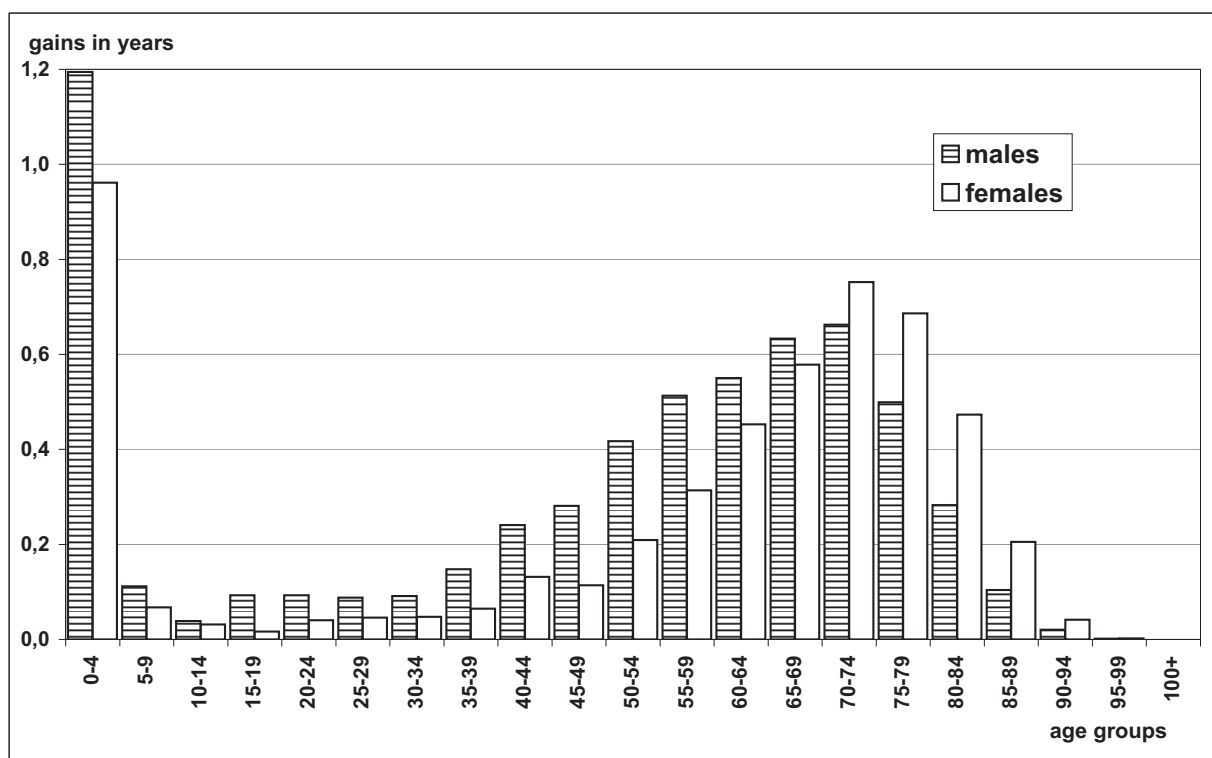


Fig. 2 Czech Republic: Gains in life expectancy at birth between 1985 and 2005

### 3. Educational differentials in mortality and health

Many studies have pointed the differences in mortality by socioeconomic status (Kitagawa, Hauser 1973, Davey Smith et al. 1990). However, socioeconomic stratification also reflects benefits or returns of a given educational attainment. Therefore educational level can be considered as a proxy not only for the socio-economic

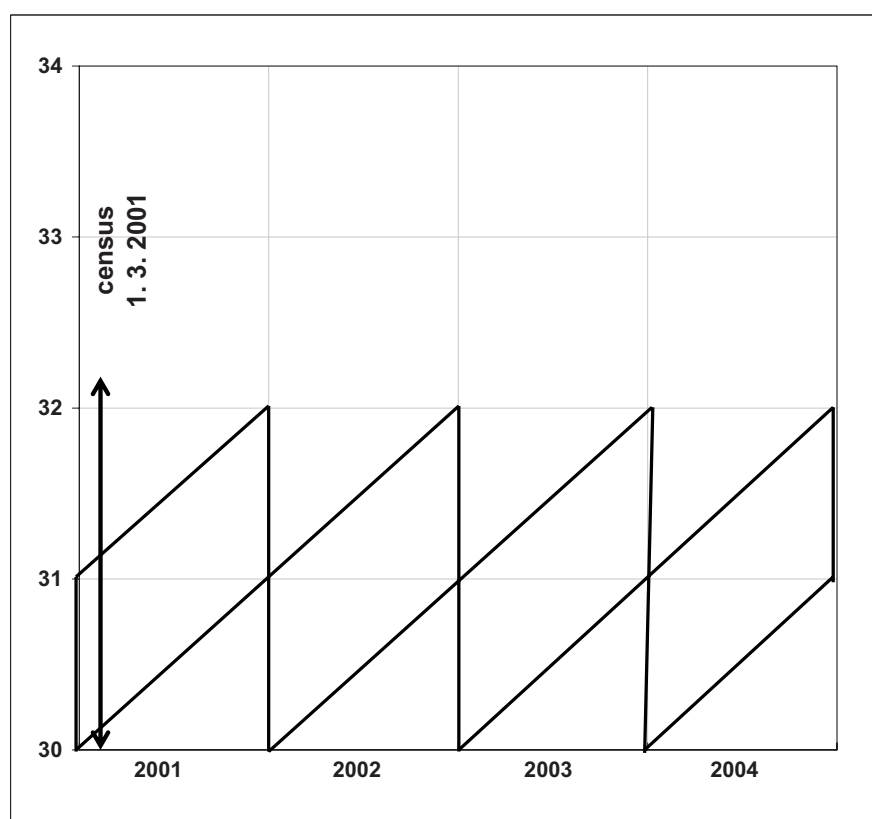


Fig. 3 Lexis diagram for four year life table 2001–2004 (age at last birthday)

position/class and consequently for a life-style but also better educated people could be more efficient consumers of health care because they usually take more rapidly advantage regarding new technologies mainly in treatment and prevention. In addition, the level of acquired education can be dependent on the health situation in terms of positive correlation (better health – higher education).

In spite of low social differentiation in former socialist societies and universal access to free health services, differences in mortality according to education, in terms of negative correlation, were observed (Sobotík, Rychtaříková, 1992). 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 more detrimental environment. Also differences in the life-style contributed in widening the gap in health and mortality between social groups.

In order to conduct a more in depth study of mortality focusing on the role of education, the period of 2001–2004 following the last census (2001) has been chosen for the further investigation (Figure 3). The four categories of educational attainment were considered: Basic (9 years of school), Vocational (12 years of school), Secondary (at least 12 years of schooling resulting in a “Maturita” certificate), and University. The proportions (relative frequencies) were calculated for each generation (birth cohort) and applied to population distribution by age and sex on 1<sup>st</sup> January of 2001; 2002; 2003; and 2004. The probability of dying for each

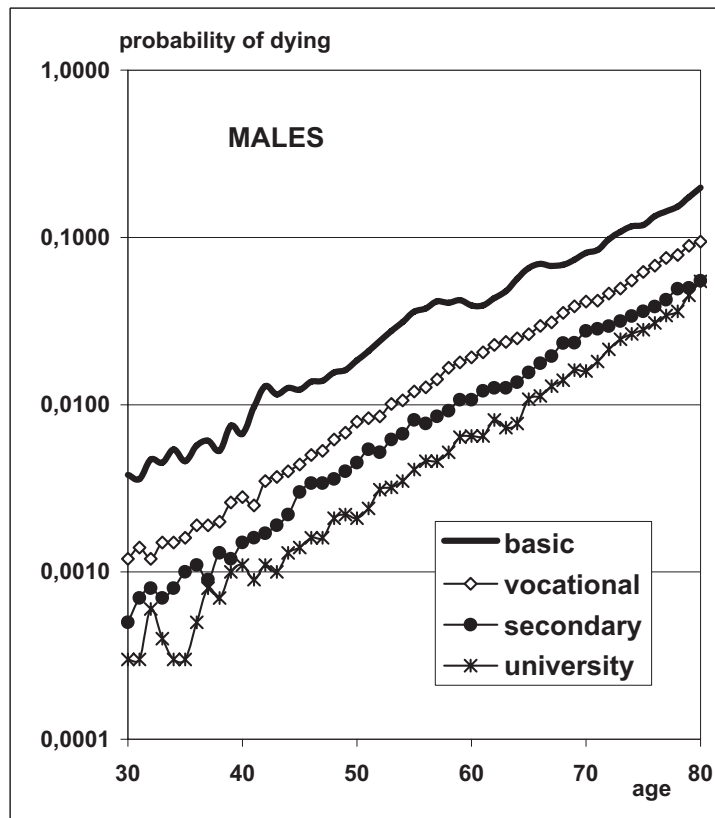


Fig. 4a Czech Republic 2001–2004: Male age specific probabilities of dying

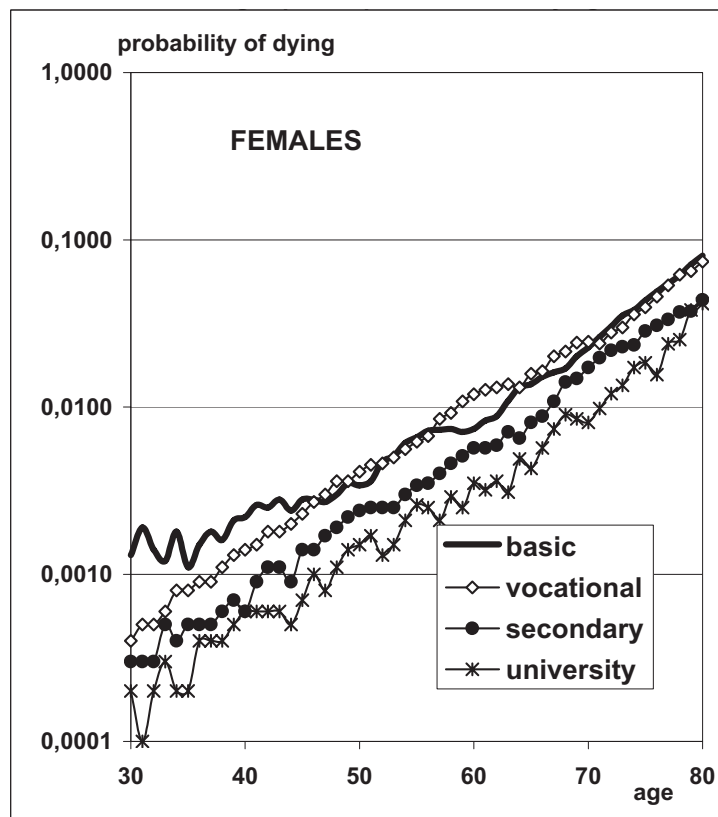


Fig. 4b Czech Republic 2001–2004: Female age specific probabilities of dying

Tab. 3 Czech Republic 2001–2004: Temporary life tables according to educational attainment.

**Males**

*Probability of dying*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	0.050	0.017	0.009	0.005	0.015
40	0.118	0.043	0.026	0.014	0.042
50	0.278	0.113	0.070	0.038	0.111
60	0.445	0.241	0.150	0.097	0.242
70	0.726	0.466	0.312	0.248	0.486
80	0.979	0.714	0.612	0.580	0.827

*Ratio where reference educational category is all*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	3.3	1.1	0.6	0.3	1
40	2.8	1.0	0.6	0.3	1
50	2.5	1.0	0.6	0.3	1
60	1.8	1.0	0.6	0.4	1
70	1.5	1.0	0.6	0.5	1
80	1.2	0.9	0.7	0.7	1

*Ratio where reference educational category is university*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
30	9.8	3.3	1.8	1	
40	8.3	3.0	1.8	1	
50	7.2	2.9	1.8	1	
60	4.6	2.5	1.6	1	
70	2.9	1.9	1.3	1	
80	1.7	1.2	1.1	1	

*Survivors*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	100 000	100 000	100 000	100 000	100 000
40	94 987	98 332	99 088	99 490	98 488
50	83 756	94 078	96 510	98 072	94 369
60	60 486	83 475	89 770	94 297	83 864
70	33 571	63 318	76 298	85 180	63 547
80	9 195	33 808	52 471	64 057	32 644
90	197	9 680	20 344	26 931	5 650

Note: 1 = basic, 2 = vocational, 3 = secondary, 4 = university, 5 = all educational levels



**Females**

*Probability of dying*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	0.016	0.008	0.005	0.003	0.006
40	0.027	0.023	0.013	0.008	0.019
50	0.057	0.063	0.033	0.021	0.048
60	0.123	0.151	0.084	0.052	0.120
70	0.358	0.341	0.241	0.168	0.336
80	0.798	0.679	0.497	0.596	0.746

*Ratio where reference educational category is all*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	2.4	1.2	0.7	0.4	1
40	1.4	1.3	0.7	0.4	1
50	1.2	1.3	0.7	0.4	1
60	1.0	1.3	0.7	0.4	1
70	1.1	1.0	0.7	0.5	1
80	1.1	0.9	0.7	0.8	1

*Ratio where reference educational category is university*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	
30	5.4	2.7	1.6	1	
40	3.4	3.0	1.7	1	
50	2.8	3.1	1.6	1	
60	2.4	2.9	1.6	1	
70	2.1	2.0	1.4	1	
80	1.3	1.1	0.8	1	

*Survivors*

age	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
30	100 000	100 000	100 000	100 000	100 000
40	98 445	99 224	99 541	99 712	99 356
50	95 800	96 895	98 230	98 923	97 493
60	90 329	90 751	94 999	96 873	92 784
70	79 204	77 022	87 002	91 833	81 669
80	50 850	50 733	66 006	76 397	54 196
90	10 291	16 275	33 232	30 874	13 744

Note: 1 = basic, 2 = vocational, 3 = secondary, 4 = university, 5 = all educational levels

age  $x$  (2<sup>nd</sup> parallelogram) and for the time period of four years has been estimated as follows (Figure 3): the numerator consisted of the sum of deaths stemming from the four respective parallelograms and the denominator has been estimated for each age  $x$  as the sum of the four exposed populations (1.1.) within the same time period (2001–2004). The ages from 30 to 80 have been chosen from twofold purpose: after the age of 30 education is already completed and secondly logarithms of risks of dying are almost parallel during this age interval (30–80) and thus convenient for a subsequent logistic modelling.

Inequalities in mortality according to education are visible from Figures 4ab. Excess mortality for males with basic education is particularly striking. As concern women, those with basic education show almost the same risks as their counterparts with vocational certificate, primarily after the age of 50. One can hypothesized that stepped and parallel male mortality risk curves according to educational level, (with the best survival of University graduates), have reflected mainly living conditions (working and life-style) while women showing weaker differentials have been more spared at work and also they have not smoked too much and have not drunk beer in pubs what has been predominantly low educated male affair. The results of such developments are summarized in Table 3 for ten year age groups. The ratios referring to all collapsed educational categories are influenced by different weights (size) of population sub-groups by education, and thus the value (all educational levels) is closer to the most frequent category. Consequently, the risks of dying of males with basic education are almost three times higher and only one and half times higher for females in younger age. However, this ratio decreases when age increases. The selection effect of long-lived people at older age groups (they become more frequent) can be the explanation. Much stronger gradient is observed when comparing respective education categories with university graduates (Table 3). Up to age of 50, the risk of death is eight times higher for males with basic education and from three to five for females with basic or vocational education compared with university graduates. While two thirds of males and three quarters of females with university education celebrate 80<sup>th</sup> birthday (Table 3), it only happens to one tenth of males with basic education and to at about fifty percent of females without maturita certificate (basic and vocational educational attainment).

All inclusive view on mortality change with age and according to education is given when using binary logistic regression (Table 4). The results show the differential in risks (odds ratios) adjusted for remaining variables in the model. Therefore, the gradient of differential mortality according to educational attainment ranges from 8 (basic education) to 1 (university graduates) for men and from almost 3 (basic and vocational) to 1 (university) for women.

Current improving situation in survival of the Czech population can be extended by findings dealing with a differentiation by age and education of self-perceived health. Self-perceived health indicator has been used because it is considered not only as a global measure that includes physical, social, and emotional function, biomedical signs and symptoms of health but also it is a clear indication of unmet

Tab. 4 Czech Republic 2001–2004: Death vs. survival Odds ratios (expb) – relative risks of dying.

Males			Females	
age	Exp(B)	Sig.	Exp(B)	Sig.
30	<b>1</b>	<i>0.000</i>	<b>1</b>	<i>0.000</i>
40	2.6	<i>0.000</i>	2.3	<i>0.000</i>
50	7.4	<i>0.000</i>	5.9	<i>0.000</i>
60	17.3	<i>0.000</i>	15.0	<i>0.000</i>
70	50.1	<i>0.000</i>	51.7	<i>0.000</i>
<b>education</b>				
basic	8.1	<i>0.000</i>	2.8	<i>0.000</i>
vocational	2.8	<i>0.000</i>	2.8	<i>0.000</i>
secondary	1.6	<i>0.000</i>	1.6	<i>0.000</i>
university	<b>1</b>	<i>0.000</i>	<b>1</b>	<i>0.000</i>

Note: Binary logistic regression, main effect model. Two models, apart by gender.

needs, services and health care at a global level. The data come from just completed Generations and Gender Survey 2005. The Czech Generations and Gender Survey (GGS) was conducted in 2005. The survey sample was made up of 10 006 cases, in face to face interviews. As expected, the proportion of people reporting bad or very bad health has been increasing with increasing age and is particularly high for males with basic education (Figure 5a). However, in terms of the age distribution shape, some anomalies arose. The peculiarity appears as regards the answers provided by those in the pre-retirement age (reporting worse subjective health), compared with those just retired (declaring better subjective health). It might be assumed that people in pre-retirement age are more concerned with unemployment and the difficulties associated with economic transition. In contrast, those who are already retired are in a better (more secure) situation and do not report excessively poor health. This anomaly emerges primarily for lower educated people. When males and females are compared, unlike of general gender pattern (women reporting more frequently bad health than men), women in the Czech Republic do not report significantly poorer health than men (Figures 5ab).

Outputs from multinomial logistic regression (main effect model for each gender apart) have revealed the role of age and educational attainment on the level of self-perceived health. Multinomial logistic regression has been used in order to specify the role of “risk factors” on our perceived health. The independent variables were age, and the level of educational attainment. A perception of very good or good health has been decreasing when males and females have become older (Table 5). In case of bad or very bad self-perceived health, the age does not play any important role. In terms of education, the rate of perception of good health is positively correlated with educational attainment. That is, people are more at risk of feeling in good health when they have higher educational levels. The results are similar for males and females. Also in the Czech Republic, the least educated

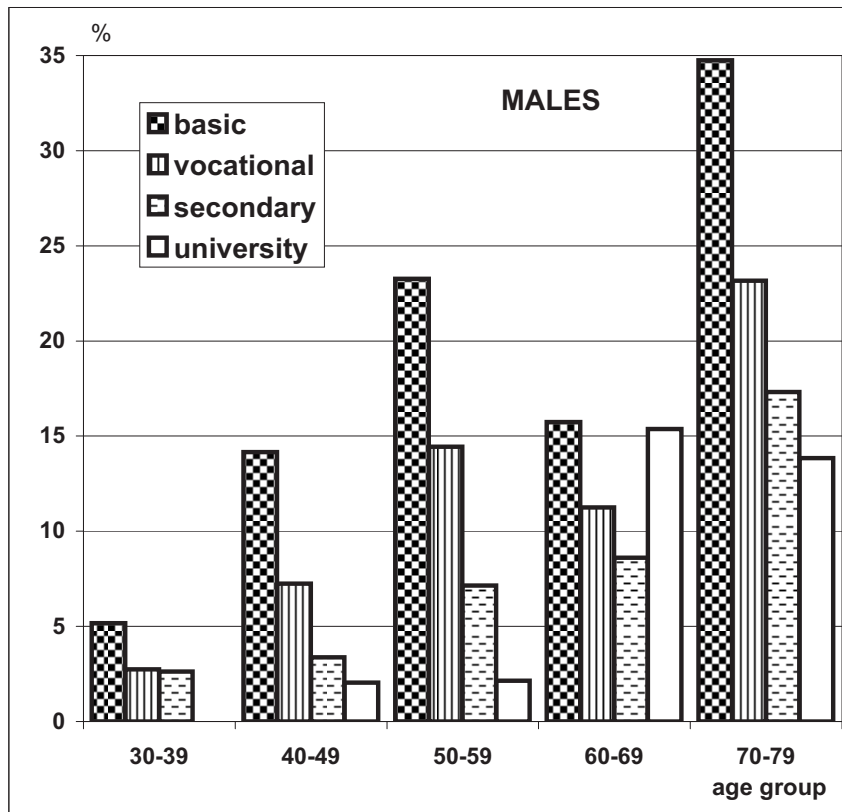


Fig. 5a Share of males with bad and very bad perceived health

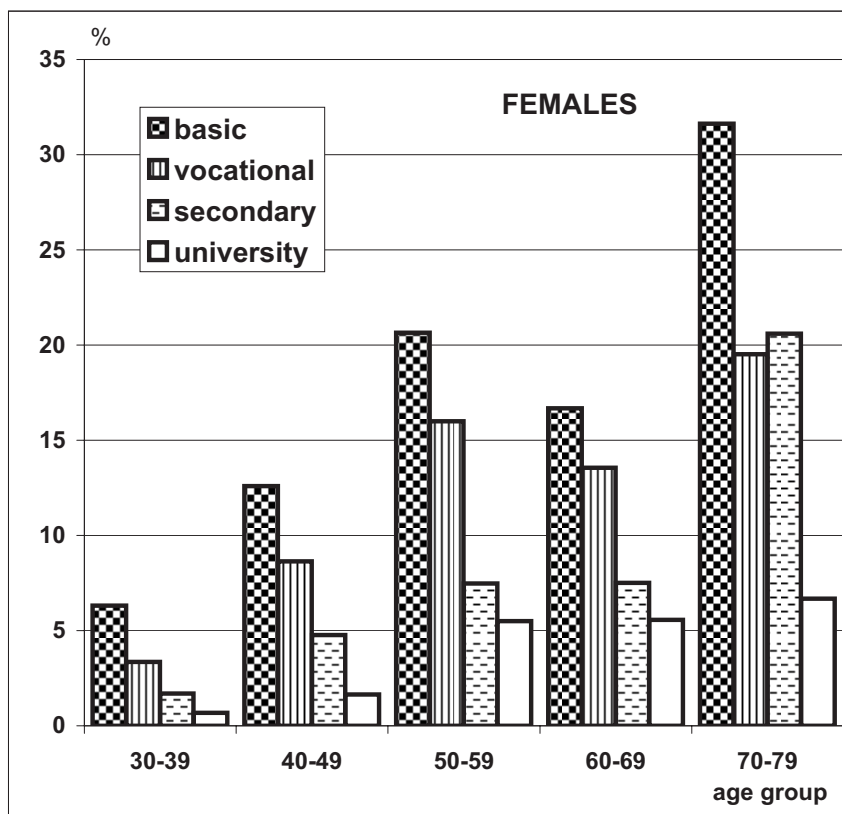


Fig. 5b Share of females with bad and very bad perceived health

Tab. 5 Czech Republic 2001–2004. Odds ratios (expb) – relative risks of self-perceived health.

**SELF- PERCEIVED HEALTH** (dependent variable)

	Males				Females			
	very good and good		bad and very bad		very good and good		bad and very bad	
	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.
age		0.000				0.000		
30	23.23	0.000	0.60	0.061	17.85	0.000	0.54	0.013
40	8.30	0.000	0.67	0.048	6.55	0.000	0.66	0.019
50	3.37	0.000	0.76	0.096	3.48	0.000	0.86	0.335
60	1.65	0.001	0.54	0.001	1.73	0.000	0.54	0.000
70	<b>1</b>		1		1		1	
education		0.000				0.000		
basic	0.42	0.000	2.56	0.000	0.46	0.000	3.54	0.000
vocational	0.49	0.000	1.56	0.046	0.58	0.000	2.56	0.002
secondary	0.73	0.019	1.14	0.589	0.76	0.035	1.66	0.108
university	<b>1</b>		1		1		1	

Note: Multinomial logistic regression, main effect model, reference category for self-perceived health = fair. Source of data: GGS 2005.

people experience more often bad health but also live not as long (compare Table 4 and Table 5). However, the gradient in odds ratios, when mortality and self-perceived health are compared, is much more stronger in mortality and particularly for males with basic education, i.e. 8.1 (Table 4) versus 2.6 (Table 5). As concern women, when controlling for age and taking into account all categories of self-perceived health (good, fair, bad) they complain slightly more than men but results are not statistically significant except those with basic and vocational education.

#### 4. Conclusion

In the Czech Republic during the interwar period, mean length of life increased without any fluctuations and was close to the levels observed in France. During the post-war period, in particular from the mid-1960s to the mid-1980s, deterioration of the survival rate was observed. Forty-one years of socialist government control placed former Czechoslovakia (Czech Republic) into the Eastern European block not only from the economic perspective but later on from the demographic as well. However, during the 1990s there has been a reappearance of a new decline in mortality. The recent favourable development has currently brought the Czech Republic a little closer to the European average. It is very likely that having a lower past mortality prior to WWII and related to a specific cultural setting contributed to a more rapid return to a lowered mortality trajectory. From a relative perspective, the more educated people have experienced a better survival while the most detri-

mental conditions have been lived by Czech males with basic education. The patterns in self-perceived health have shown that people just retired felt better compared with those in pre-retirement age. This anomaly appears mainly for lower education. When mortality and self-perceived health are compared, the gradient in odds ratios is much stronger in mortality and particularly for males with basic education who do not often report poor health but die much more frequently. Future research should investigate how and why education is related to specific chronic diseases. Mainly to focus on the question whether an inverse relation imply the reduction or delay in the incidence of a certain disease among the more highly educated, or does it mean only that more educated people survive longer after the onset of a disease.

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## Résumé

### Vzdělání a délka života v České republice

Česká republika zaznamenala ve svém vývoji někdy protichůdné trendy naděje dožití. Zatímco v období mezi dvěma světovými válkami byla úroveň úmrtnosti, s výjimkou kojenecké, srovnatelná s Francií a bezprostředně po válce u mužů dokonce nižší, tak od poloviny šedesátých let horší úmrtnostní poměry v ČR oproti Francii přetrvávají dodnes. Mimo věku a pohlaví je výrazným faktorem diferenciací v délce života vzdělání, které ji ovlivňuje primárně vzhledem k příznivějším pracovním podmínkám i sekundárně, protože vzdělání ovlivňuje životní styl. Přestože komunistický režim zajišťoval bezplatnou a všem dostupnou zdravotní péči a platy byly nivelizovány, tak rozdíly v délce života podle vzdělání jsou zřetelné u všech generací včetně těch, které prožily většinu svého života za komunismu. U mužů je jednoznačná negativní korelace mezi úrovní úmrtnosti a stupněm dosaženého vzdělání, přičemž gradient změn je postupný, u žen pozorujeme spíše polaritu výše úmrtnosti, protože ženy se základním vzděláním a vyučené mají vyšší úmrtnost oproti těm, které mají alespoň maturitu (středoškolačky a vysokoškolačky). Muži se základním vzděláním méně často deklarovali špatné subjektivní zdraví než by odpovídalo jejich reálné mortalitě. Na špatný zdravotní stav si o něco častěji stěžovaly ženy než muži při stejných věkových kategoriích.