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POPULATION DEVELOPMENT IN THE CZECH REPUBLIC IN 2015

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ABSTRACT

The article describes the demographic situation in the Czech Republic in 2015 and sets it in the context of demographic trends in the past decade. The study analyses the development of individual components of population change and the effects they have on population size and the age and marital structure. A basic overview of the recent trends in cause-of-death statistics is also included. The population of the Czech Republic rose as a result of positive international migration in 2015, and total fertility rate and marriage rates increased as well. But life expectancy at birth for men stagnated and even decreased for women. The total intensity of the divorce rate remained at the 2014 level. The analysis of nuptiality was primarily based on the construction of nuptiality tables; the divorce rate was studied primarily by duration of marriage, and cause of death statistics was evaluated by standardised rates.

Keywords: demographic development, population, age structure, nuptiality, divorce, fertility, abortion, mortality, migration, Czech Republic

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Since 2003 the population of the Czech Republic has been increasing (except in 2013). In 2015 it further increased by 15,568 to 10,553,843 (on 31 Dec.). The whole increase last year resulted from a positive balance of international migration (15,977), while the natural change was negative (–409). The decrease caused by natural change was due to a significant increase in the number of deaths (by 5,508), which could be considered the most important feature of population development in 2015. The large number of deaths interrupted the long-standing trend of increasing life expectancy at birth. In 2015 it stagnated for males (at 75.8 years) and decreased for females (by 0.2 to 81.4 years).

The number of live births increased in 2015 for the second year in a row but it remained almost 9,000 lower than in 2008, when the recent 'baby boom' peaked. The share of children born outside marriage has been going up every year since 1988, but in comparison with EU countries, it is still somewhere in the middle (*Eurostat*, 2016), though in some areas (e.g. districts in north-west Bohemia) the share of children born to unmarried women are on a level observed in EU countries with highest rates of extramarital births. The total fertility rate in the Czech Republic remained at a low level for a long period, from 1994 to 2013, and in 2014 and 2015 was above 1.5 children per woman – i.e. 1.53 and 1.57, respectively. In the last decade, fertility rates of women aged 35 and over in particular increased. The mean age of women at childbirth rose by 1.4 years from 2005 to 2015 to 30.0 years, but the increase per year has been diminishing.

Since 2008 there have been fewer abortions year on year thanks to a decrease in the number of induced abortions. Due to this decrease and the rise in the number of spontaneous abortions, the share of the spontaneous out of the total number of abor-

1) Czech Statistical Office.

tions has increased to 40%. The total spontaneous abortion rate increased as a result of the increasing mean age of women at pregnancy.

The number of marriages and the total marriage rates increased in the last two years and the number of weddings in 2013 remained the lowest in history. The drop in nuptiality resulted from the decrease in nuptiality among people of a young age, which was not fully offset by nuptiality among people at an older age. The timing of nuptiality became stable: the highest intensity of first marriage among men is around the age of 30 and among women around the age of 28.

Table 1 Population and vital statistics and the main analytic indicators of demographic development, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Population and vital statistics							
Live births	102,211	117,153	108,673	108,576	106,751	109,860	110,764
Deaths	107,938	106,844	106,848	108,189	109,160	105,665	111,173
under 1 year of age	347	313	298	285	265	263	272
Marriages	51,829	46,746	45,137	45,206	43,499	45,575	48,191
Divorces	31,288	30,783	28,113	26,402	27,895	26,764	26,083
Abortions	40,023	39,273	38,864	37,733	37,687	36,956	35,761
induced abortions	26,453	23,998	24,055	23,032	22,714	21,893	20,403
Immigrants	60,294	30,515	22,590	30,298	29,579	41,625	34,922
Emigrants	24,065	14,867	5,701	20,005	30,876	19,964	18,945
Natural increase	–5,727	10,309	1,825	387	–2,409	4,195	–409
Net migration	36,229	15,648	16,889	10,293	–1,297	21,661	15,977
Total increase	30,502	25,957	18,714	10,680	–3,706	25,856	15,568
Mid-year population (thousands)	10,234.1	10,517.2	10,496.7	10,509.3	10,510.7	10,524.8	10,542.9
Intensity indicators							
Total first marriage rate – males (%)	62.8	54.9	53.5	53.2	51.4	53.1	55.1
– females (%)	69.1	61.6	61.0	60.6	59.0	60.8	62.4
Mean age at first marriage – males	30.8	32.2	32.2	32.3	32.3	32.3	32.4
– females	28.1	29.4	29.6	29.6	29.8	29.8	29.8
Total divorce rate (%)	47.3	50.0	46.2	44.5	47.8	46.7	46.5
Mean duration of marriage at divorce	12.2	12.7	12.9	12.8	13.0	13.1	13.0
Total fertility rate	1.28	1.49	1.43	1.45	1.46	1.53	1.57
Mean age of mothers at childbirth	28.6	29.6	29.7	29.8	29.9	29.9	30.0
Mean age of mothers at 1st birth	26.6	27.6	27.8	27.9	28.1	28.1	28.2
Percentage of live births outside marriage	31.7	40.3	41.8	43.4	45.0	46.7	47.8
Net reproduction rate	0.62	0.72	0.69	0.70	0.71	0.74	0.76
Total abortion rate	0.53	0.51	0.52	0.51	0.52	0.51	0.51
Total induced abortion rate	0.35	0.32	0.32	0.31	0.32	0.31	0.29
Life expectancy at birth – males	72.9	74.4	74.7	75.0	75.2	75.8	75.8
– females	79.1	80.6	80.7	80.9	81.1	81.7	81.4
Infant mortality rate (‰)	3.4	2.7	2.7	2.6	2.5	2.4	2.5

Note: First marriage indicators are based on the nuptiality life tables for singles.
Source: Czech Statistical Office; authors' calculations.

The divorce rate also stabilised at the level of almost a half of marriages ending in divorce.

The population of the Czech Republic is ageing. Population ageing started back in the 1980s. This process is reflected in the increasing average age of the population, the median age, and the index of ageing. Since 2006 there have been more inhabitants aged 65 and over than those aged 0–14.

POPULATION BY AGE AND MARITAL STATUS

At the end of 2015 there were 6,997,715 people in the population of the Czech Republic aged 15–64, 1,623,716 children aged 0–14, and 1,932,412 people aged 65 and over. Since 2009 only the categories of children and seniors have grown (Table 2). A decline has occurred in the population aged between 15 and 64. At the end of 2015 people of productive age (15–64) accounted for 66.3% of the population, whereas in 2005 it was 71.1% (this population group was largest in 2006 at 71.2%).

The extremely numerous generations born during or after World War II have been shifting into the age group over 65, and as a result the size of this main age group has experienced the most marked changes. In 2015 the number of seniors increased by 52,006 (by 3%) and for the first time they accounted for more than18% of the population (18.3% on 31 Dec. 2015). The biggest population increase occurred in the 65–69 age group (based on absolute figures) and the 75–79 age group (based on relative figures).

The number of children aged 0–14 years has continued to rise (since 2008) and gained another 22,671 people in 2015. The share of children in the population had increased to 15.4% by the end of 2015, a figure 0.8 percentage points higher than ten years ago.

Table 2 Age distribution of population, 2005–2015 (31 Dec.)

Age group/Indicator	2005	2010	2011	2012	2013	2014	2015
Population (thousands)							
Total	10,251.1	10,532.8	10,505.4	10,516.1	10,512.4	10,538.3	10,553.8
0–14	1,501.3	1,518.1	1,541.2	1,560.3	1,577.5	1,601.0	1,623.7
15–64	7,293.4	7,378.8	7,262.8	7,188.2	7,109.4	7,056.8	6,997.7
65+	1,456.4	1,635.8	1,701.4	1,767.6	1,825.5	1,880.4	1,932.4
in: 65–69	431.4	552.1	595.1	635.9	657.3	671.1	693.0
70–74	380.3	383.8	402.7	423.6	452.8	482.0	495.2
75–79	323.2	313.4	307.2	302.0	303.5	308.6	323.7
80–84	219.8	232.0	234.8	238.0	237.2	236.6	232.0
85+	101.7	154.5	161.6	168.1	174.9	182.1	188.5
Percentage of the total population							
0–14	14.6	14.4	14.7	14.8	15.0	15.2	15.4
15–64	71.1	70.1	69.1	68.4	67.6	67.0	66.3
65+	14.2	15.5	16.2	16.8	17.4	17.8	18.3
Characteristics of age distribution							
Average age	40.0	40.8	41.1	41.3	41.5	41.7	41.9
Median age	38.9	39.6	40.1	40.4	40.8	41.1	41.5
Index of ageing[1)]	97.0	107.8	110.4	113.3	115.7	117.4	119.0
Total age dependency ratio[2)]	54.4	55.0	56.3	57.5	58.6	59.8	61.4

Note: 1) The number of people aged 65 and over per 100 children aged 0–14.
2) The number of children aged 0–19 and people aged 65 and over per 100 people aged 20–64.
Source: Czech Statistical Office; authors' calculations.

All analytic indicators of the age structure show evidence of the ongoing population ageing (Table 2). The average age of the population of the Czech Republic increased by 0.2 to 41.9 years (in total) in 2015. The median age, which divides the population into equally numerous halves, shifted by 0.4 to 41.5 years. The index of ageing (the number of people aged 65+ per 100 children aged 0–14) grew from 117.4 to 119.0 between 2014 and 2015. The total age dependency ratio (defined here as the number of people aged 0–19 and 65+ per 100 people aged 20–64) rose above the level of 60 again (for the first time after 1998).

In 2015 there was also a change in the population structure by marital status, which has already been changing for several decades with the increasing share of single and divorced people and the decreasing share of married and widowed people. At the end of 2015, 47.4% of the population aged 15 and over were married, 31.0% were single, 13.2% were divorced, and 8.4% were widowed (Table 3). During the last decade the biggest change occurred in the share of married persons, which dropped by almost 6 percentage points for men and by almost 5 percentage points for women. The population distribution by marital status is in its basic structure similar for both men and women (the majority of them are married), but there are differences in the shares of various marital statuses by sex. While the shares of married or divorced people do not differ significantly, the share of single men is 10 percentage points higher (36.3% in 2015) than the share of single women (25.9%), and the reverse is true for widowed people (13.5% of women compared to 2.9% of men).

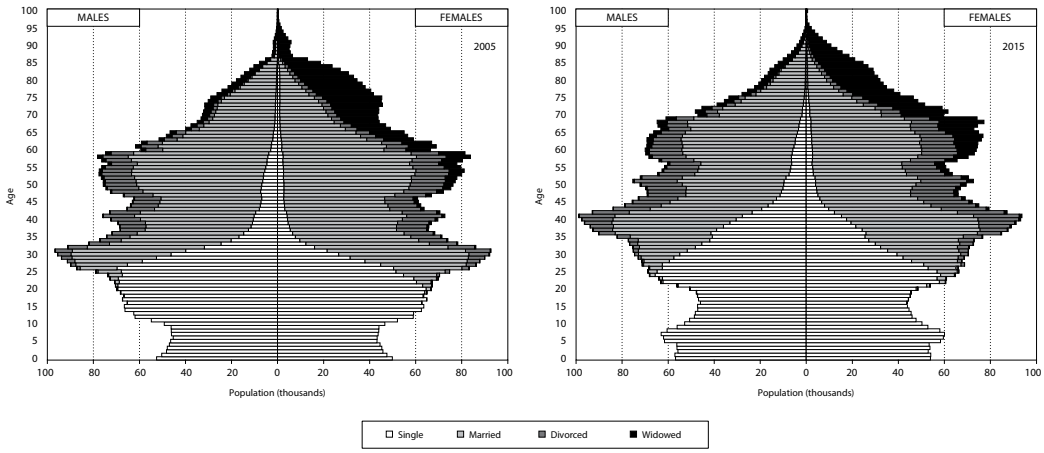
The population structure by marital status significantly differs by age and it gradually changes from year to year in every age group (Figure 1). Between 2005 and 2015 the most pronounced change was among people in their thirties. There are progressively more de iure single people and between 2005 and 2015 the age at which married people outnumber single persons shifted from 29 to 34 years. Breaking the population down into five-year age groups, there were more single than married men in the 30–34 age group in 2015 (unlike 2005). In the female population, the share of single and married women aged 30–34 was similar in 2015, while ten years ago the married population was three times larger than the population of single women. In older age groups the majority of the population was married but, due to lower nuptiality (and the high divorce rate), the highest proportion of married people is at present lower than in the past, and the age group in which the largest

Table 3 Population 15+ years by marital status and sex, 2005–2015 (31 Dec.)

Marital status	2005	2010	2011	2012	2013	2014	2015
				Total population (thousands)			
Single	2,429.1	2,696.4	2,685.0	2,706.5	2,725.3	2,748.5	2,765.9
Married	4,611.7	4,501.9	4,410.0	4,366.2	4,309.1	4,271.8	4,236.1
Divorced	949.5	1,070.2	1,106.6	1,123.8	1,144.8	1,164.6	1,180.6
Widowed	759.5	746.1	762.6	759.3	755.7	752.3	747.5
				Percentage in the male population			
Single	32.8	35.0	35.2	35.5	35.8	36.0	36.3
Married	54.5	51.5	50.7	50.2	49.7	49.2	48.8
Divorced	9.9	10.8	11.2	11.4	11.6	11.8	12.0
Widowed	2.8	2.7	2.9	2.9	2.9	3.0	2.9
				Percentage in the female population			
Single	23.0	25.1	25.0	25.2	25.5	25.7	26.0
Married	51.0	48.5	47.8	47.4	46.9	46.5	46.1
Divorced	11.8	12.9	13.4	13.7	13.9	14.2	14.4
Widowed	14.2	13.5	13.8	13.7	13.7	13.6	13.5

Source: Czech Statistical Office; authors' calculations.

Figure 1 Population by age, sex and marital status, 2005 and 2015 (31 Dec.)



Source: Czech Statistical Office.

share of the population were found to be married is older. In 2005 the largest share of married men (81.5%) was in the 65–69 age group, whereas in 2015 it was in the 70–74 age group at 76.4%. Among females the peak shifted even more: from 72.1% in the 45–49 age group to 64.8% in the 55–59 age group. The amount by which married people outnumber other marital statuses in middle age decreased slightly owing to an increased number of divorced people, and also decreased among the oldest age groups owing to an increased number of widowed people. Although the share of widowed people in the oldest age groups decreased thanks to the mortality decline, the most women were widowed in the 75–79 and 80+ age groups.

NUPTIALITY

The trend of a decreasing number of marriages stopped in 2013, when the historically lowest figure (43,499) was recorded. In the following two years the number of marriages went up – by 2,076 in 2014 and by another 2,616 in 2015 to reach a total of 48,191. This was the highest figure in the last seven-year period.

Table 4 Marriages by order, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Total marriages	51,829	46,746	45,137	45,206	43,499	45,575	48,191
Marriages of two singles	33,446	30,095	29,045	29,684	28,877	30,785	32,689
Remarriages (for both)	8,323	7,693	7,368	6,899	6,604	6,514	6,975
Male order of marriage – first	38,347	34,414	33,371	33,816	32,743	34,691	36,884
– higher	13,482	12,332	11,766	11,390	10,756	10,884	11,307
Female order of marriage – first	38,605	34,734	33,443	34,175	33,029	35,155	37,021
– higher	13,224	12,012	11,694	11,031	10,470	10,420	11,170
Protogamous marriages (%)	64.5	64.4	64.3	65.7	66.4	67.5	67.8
Remarriages (%) – males	26.0	26.4	26.1	25.2	24.7	23.9	23.5
– females	25.5	25.7	25.9	24.4	24.1	22.9	23.2

Source: Czech Statistical Office; authors' calculations.

There were more marriages among people of all marital status in y-o-y comparison in 2015. A total of 32,689 marriages were entered into by both single grooms and brides; the share of protogamous marriages was almost 68%. Roughly three-quarters of brides (37,021) and grooms (36,884) entered into their first marriage in 2015. The share of higher-order marriages was slightly lower in 2015 than in 2005 (23% and 26%, respectively).

The changing number of marriages was not only the result of the changing size of the population at the most common age of marriage, but also reflected the development of nuptiality level (and its age diversification). The changes between 2005 and 2015 were driven mainly by men and women at the age of up to and around the nuptiality peak. During the last ten-year period the largest number of first marriages per 1,000 single men (based on the nuptiality life tables for singles) decreased from 73 to 54 and from 92 to 76 among women. The decline was recorded mainly in the 2005–2010 period. The age at which the highest first-marriage rate occurs did not change significantly: between 2005 and 2015 it shifted only from 29 to 30 years for men and from 27 to 28 for women. A slight increase in nuptiality at older ages was recorded in the last two years.

According to nuptiality life tables for 2015, 55.1% of men and 62.4% of women would enter into their first marriage by their 50th birthday. This is more than each of the years in the 2011–2014 period, but fewer (by almost 8 percentage points) than in 2005 (Table 5). Based on the 2015 first-marriage probabilities, the mean age at first marriage would be 32.4 years for males and 29.8 years for females, provided that the probabilities remained unchanged. These figures didn't change significantly in the last three years, but in comparison with 2005 they were higher by almost 1.5 years.

In 2015 the total remarriage rate of divorcees was 37.2% (males) and 36.3% (females). The development of this indicator was similar to the total first marriage rate: the minimum value was registered in 2013 and despite its rise in 2014–2015 it remained lower than in 2005. On average men would remarry after 8.2 years and women after 8.6 years from a divorce, provided that the remarriages rate remained stable in the future. The average time elapsed from divorce to new marriage has continued to increase slightly. The remarriage rate is the highest just in the first year after divorce and decrease with the time elapsed since the divorce. In short durations since divorce, the remarriage rates are slightly higher for men than for women and from the 10–14 year duration since divorce they don't significantly differ by sex.

DIVORCE

The number of divorces exhibited a decreasing trend in the last ten-year period. In 2015 a total of 26,083 marriages ended in divorce. Roughly one-fifth of divorces were second- or higher-order divorce (Table 6). Divorces with minors accounted for more than one--half of all divorces. The share of divorces with minors gradually decreased from 61.4% to 56.3% be-

Table 5 Nuptiality indicators, 2005–2015

Indicator		2005	2010	2011	2012	2013	2014	2015
Total first marriage rate (%)	– males	62.8	54.9	53.5	53.2	51.4	53.1	55.1
	– females	69.1	61.6	61.0	60.6	59.0	60.8	62.4
Mean age at first marriage	– males	30.8	32.2	32.2	32.3	32.3	32.3	32.4
	– females	28.1	29.4	29.6	29.6	29.8	29.8	29.8
Total remarriage rate of divorcees (%)	– males	41.7	38.4	36.9	36.4	34.7	35.4	37.2
	– females	40.7	37.2	36.6	34.9	33.5	33.6	36.3
Average time elapsed from divorce	– males	7.0	7.5	7.5	7.6	8.0	8.1	8.2
	– females	7.3	7.8	7.8	8.0	8.3	8.5	8.6

Note: First-marriage indicators are based on the nuptiality life tables for singles. The remarriage rates of divorcees are constructed from the distribution of remarriage rates by time elapsed from divorce.
Source: Czech Statistical Office; authors' calculations.

Table 6 Divorce indicators, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Total divorces	31,288	30,783	28,113	26,402	27,895	26,764	26,083
Percentage of repeated divorces – males	19.9	19.5	19.4	19.4	20.0	20.1	19.3
– females	19.1	18.8	19.1	19.1	19.1	19.4	18.8
Divorces without minors	12,078	13,143	12,282	11,213	11,974	11,557	11,090
Divorces with minors	19,210	17,640	15,831	15,189	15,921	15,207	14,993
– percentage of total	61.4	57.3	56.3	57.5	57.1	56.8	57.5
Number of minors in divorced marriages	28,732	26,483	23,716	22,982	24,335	23,119	23,187
– average number of minors per divorce with minors	1.50	1.50	1.50	1.51	1.53	1.52	1.55
Total divorce rate (%)	47.3	50.0	46.2	44.5	47.8	46.7	46.5
Mean duration of marriage at divorce (years)	12.2	12.7	12.9	12.8	13.0	13.1	13.0
Duration of marriage (years):	**Divorce rates (per 100 marriages)**						
0–4	2.1	2.3	2.1	2.0	2.1	2.0	1.9
5–9	2.5	2.4	2.2	2.1	2.3	2.3	2.3
10–14	1.8	1.8	1.6	1.6	1.8	1.6	1.7
15–19	1.3	1.5	1.3	1.3	1.4	1.3	1.3
20–24	0.9	1.0	1.0	0.9	1.0	1.0	1.0
25–29	0.5	0.6	0.6	0.5	0.6	0.6	0.5
30+	0.2	0.2	0.2	0.2	0.2	0.2	0.2

Note: Total divorce rate and mean duration of marriage at divorce resulted from the distribution of reduced divorce rates by time elapsed since entering into marriage.
Source: Czech Statistical Office; authors' calculations.

tween 2005 and 2011, after that it ranged from 57% to 58%. Divorce affected 23,187 minors in 2015, i.e. 1.5 children per divorced marriage. In most cases divorced marriages have only one minor, but the share of divorced marriages with one minor decreased from 56–58% in the 2005–2011 period to 52.2% in 2015. Conversely, the proportion of divorces with two or more minors was higher in 2015 than ten years ago. Since 2002 the total divorce rate has ranged between 45% and 50% (it was slightly below 45% only in 2012) in the Czech Republic. It was 45.5% in 2015. Since the beginning of the 1990s the mean duration of marriage at divorce gradually increased from 10 to 13 years; in the last three years it remained at this level (Table 6). In terms of the duration of a marriage until divorce, the highest divorce rates usually occur after 3–5 years of marriage. In 2015 the peak was 2.62 divorces per 100 marriages of 4-year duration.

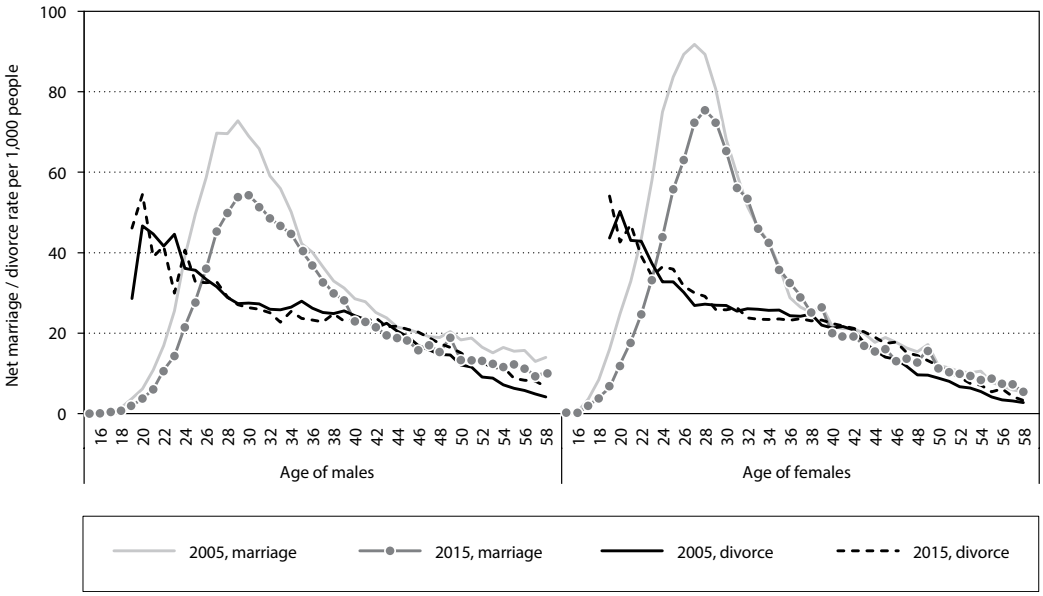
Age-specific net divorce rates did not change as significantly as the age-specific nuptiality rates in the 2005–2015 periods (Figure 2). They are the highest among young ages and are decreasing with age. However, nowadays the divorce rates for men and women aged 40 years and over are higher than in 2005.

FERTILITY

A total of 110,764 live births were recorded in 2015 by the Czech Statistical Office, by 904 more than a year before. The number of newborns rose in the last two years (Table 7). In comparison with 2005 there was an 8.4% increase of live births. The largest number of live births in the last decade was 119,570, reached in 2008. But a substantial decline occurred between 2010 and 2011. Structure of live births by birth order did not change significantly in a ten-year perspective. First-order births accounted for 46–49% of live births, second-order births for 36–39%, and third- and higher-births for 14–15%. The number of first-order births slightly rose by 2% between 2014 and 2015, second-order births stagnated, and third- and higher-order births declined by 2%.

The number of live births to single mothers increased from 44,985 in 2014 to 46,887 in 2015.

Figure 2 Net marriage and divorce rates*) by sex and age, 2005 and 2015



Note: *) Number of marriages/divorces by year of birth per 1,000 people (on 1 January) of a given marital status (single, divorced and widowed for marriages, married for divorces). Age is defined as the age reached during the given year.
Source: Czech Statistical Office; authors' calculations.

The number almost doubled in comparison with 2005. In contrast, the number of children born to mothers with another marital status declined. The share of live births outside marriage (Table 7) increased from 31.7% in 2005 to 47.8% in 2015. The largest share was identified among first-order births (58.0% in 2015);

Table 7 Live births by birth order and marital status of the mother, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Live births	102,211	117,153	108,673	108,576	106,751	109,860	110,764
– first order	49,930	54,331	50,989	51,476	51,092	52,106	53,223
– second order	37,993	45,514	42,156	41,826	40,078	41,196	41,276
– third and higher order	14,288	17,308	15,528	15,274	15,581	16,558	16,265
Marital status of mother							
Single	25,753	39,529	38,666	40,581	41,655	44,985	46,887
Married	69,802	69,989	63,252	61,488	58,751	58,593	57,788
Divorced	6,354	7,389	6,514	6,299	6,134	6,089	5,911
Widowed	302	246	241	208	211	193	178
Percentage of live births outside marriage	31.7	40.3	41.8	43.4	45.0	46.7	47.8
– first order	40.0	51.1	53.1	54.5	55.7	57.3	58.0
– second order	20.8	28.8	29.9	31.6	33.4	35.6	37.5
– third and higher order	31.7	36.5	37.0	38.1	39.3	40.6	40.8

Source: Czech Statistical Office; authors' calculations.

among third- and higher-order births 40.8% were born outside marriage and among second-order births 37.5%. The share of births outside marriage increased from 2005 in all birth orders.

Besides birth order, other important differential characteristics of extramarital births are the age and educational attainment of the mothers. Unmarried motherhood is much more common at a young age: between 15 and 19 years (94.7% in 2015) and between 20 and 24 years (75.3% in 2015). In contrast it is least common among mothers in the 30–39 age group (39.7% in 2015). The share of live births outside marriage was higher in all age groups between 2005 and 2015. Extramarital births are less common among women with higher levels of education. In 2015, 80.5% of births to women with basic education were extramarital. Among tertiary-educated women the figure was only 29.1%. However, in a long-term perspective the share of births outside marriage has increased relatively most among the highest educated group of women. In 2005 only 13.7% of this subpopulation gave birth outside marriage, and the figure then was 67.6% for women with basic education.

The intensity of fertility measured by total fertility rate (TFR) increased from 1.53 children per woman in 2014 to 1.57 one year later. It was the highest level since 1993, and was more than one-fifth higher than in 2005 when it was 1.28 children (Table 8). The last year-on-year increase was mainly the result of the increase in the first-order fertility rate, the increase in the age-specific fertility rates among almost all age groups, except for those aged 15–19, and the higher intensity of both marital and non-marital fertility. The total first-order fertility rate increased by 0.03 children per woman, second-order fertility increased by 0.01, and third- and higher-order intensity stagnated. The net reproduction rate increased from 0.62 in 2005 to 0.76 in 2015, but not only because of the rise in the level of fertility, but also due to the decrease in the mortality intensity of women of reproductive age.

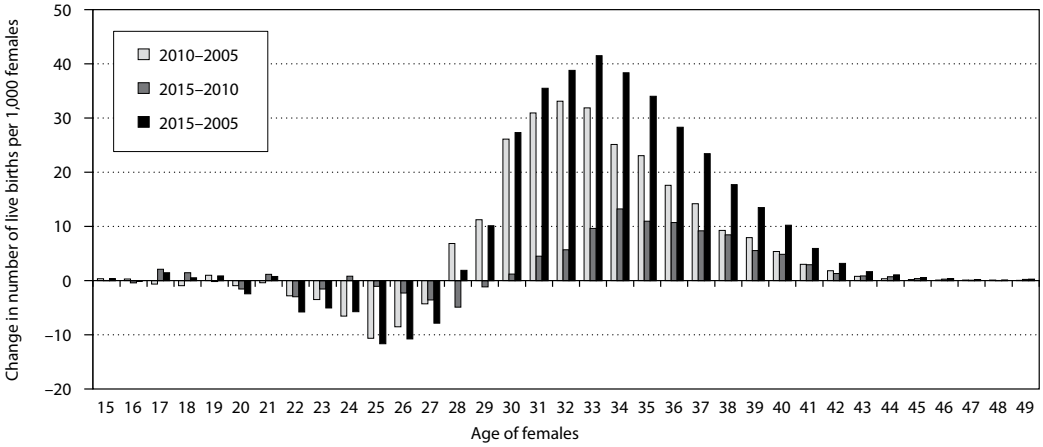
The mean age of mothers at childbirth increased by less than 0.1 year to 30.0 years between 2014 and 2015. The slow-down trend of postponing having children to a later age has already been apparent for the last five years. In comparison with 2010 the rise was 0.4 years, while in comparison with 2005 it was

Table 8 Fertility indicators, 2005–2015

Indicator/Age group		2005	2010	2011	2012	2013	2014	2015
Total fertility rate	– total	1.28	1.49	1.43	1.45	1.46	1.53	1.57
	– first order	0.63	0.72	0.70	0.72	0.73	0.76	0.79
	– second order	0.46	0.56	0.54	0.54	0.53	0.56	0.57
	– third and higher order	0.19	0.21	0.19	0.19	0.20	0.21	0.21
Net reproduction rate		0.62	0.72	0.69	0.70	0.71	0.74	0.76
Mean age of mother at childbirth – total		28.6	29.6	29.7	29.8	29.9	29.9	30.0
	– first order	26.6	27.6	27.8	27.9	28.1	28.1	28.2
	– second order	29.6	30.7	30.9	31.0	31.0	31.1	31.2
	– third and higher order	32.8	33.2	33.3	33.3	33.2	33.3	33.4
Age group:		**Age-specific fertility rates (per 1,000 females)**						
15–19		10.9	11.5	11.3	12.0	11.7	11.9	11.7
20–24		48.7	45.7	42.4	42.5	41.9	43.0	45.5
25–29		100.9	99.7	93.6	93.4	92.4	95.6	97.0
30–34		72.1	99.0	95.7	98.1	98.2	104.4	106.3
35–39		22.8	38.4	37.2	38.4	40.0	43.2	45.3
40–44		3.7	5.9	6.1	6.6	7.1	7.4	8.4
45–49		0.1	0.3	0.3	0.3	0.3	0.4	0.4

Source: Czech Statistical Office; authors' calculations.

Figure 3 Changes in age-specific fertility rates, 2005–2015



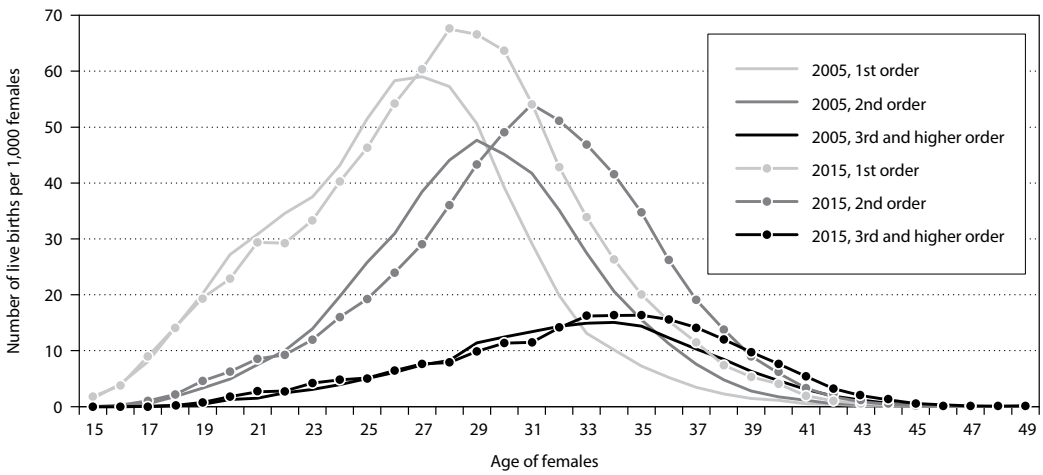
Source: Czech Statistical Office; authors' calculations.

1.4 years. A slight increase in the mean age was identified among all birth orders in the last year on year comparison (Table 8). Between 2005 and 2015 the mean age of mothers at first-order birth increased the most, by 1.6 years, while for second-order births it increased by 1.5 years and for third- and higher-order births by only 0.6 years.

The highest intensity of fertility was in the 30–34 age group of women from 2011 onwards. The average age-specific fertility rate was 106.3 children per 1,000 females at this age in 2015. In a ten-year perspective the highest increases were in the 30–34 and 35–39 age groups, with a slight increase in the 40–44 age group and a slight decrease in the 20–24 and 25–29 age groups (Figure 3).

The top of curves of the fertility rates by age of females have been shifting towards an older

Figure 4 Age-specific fertility rates of women by age and by birth order,*) 2005 and 2015



Note: *) The number of live births of given birth order per 1,000 women of the given age.
In 2005 birth order was surveyed for all births, in 2015 only for live births.
Source: Czech Statistical Office; authors' calculations.

age and also towards a higher intensity of fertility in the last decade, which is especially evident among women aged 28 and older. On the other hand, a decrease was recorded in the 22–27 age group of women. Most of the changes occurred in the first half of the decade.

The highest intensity of fertility moved to an older age in every birth order between 2005 and 2015 (Figure 4). Younger age groups (before the peaks of the curves in 2005) had lower fertility rates in 2015, but not significantly enough to eliminate the higher intensity in the older age groups in the same year, which led to a higher intensity in each birth order.

ABORTION

The number of registered abortions[2] was 35,761 in 2015. This was 1,195 fewer than in the previous year and by 4,262 fewer than in 2005. The number of abortions has declined annually since 2008. The main reason for this development was the decrease in induced abortions[3] (*ČSÚ*, 2015e). There were 20,403 abortions of this type in 2015, which was 1,490 fewer than in 2014 and 6,050 fewer than in 2005 (Table 9). In contrast, the number of spontaneous abortions[4] increased from 12,245 in 2005 to 13,857 in 2014 and to 14,082 in the last year. The share of spontaneous abortions rose from 30.6% to 39.4% in the last decade, while the share of induced abortions decreased from 66.1% to 57.1%. Ectopic pregnancies were counted in about 3% of cases during the last decade.

There were more abortions to single women in 2015 than in 2005. The figure rose from 14,942 to 17,852, however it declined by 147 in the last year. The number of abortions to married women declined markedly from 19,548 in 2005 to 13,368 in 2015; from this the decline was by 846 in 2015. Divorced women also had fewer abortions – there were 4,823 abortions among divorced women ten years ago and 3,505 in the last recorded year.

Although the number of induced abortions went down significantly in the last decade, it didn't decrease among single women (Table 9). The figure was 10,646 in 2005 and 11,067 in 2015; the peak was 11,883 in 2013. A profound drop was recorded among married women (from 11,901 to 6,687) and divorced women (from 3,469 to 2,203). Since 2007 the number of single women who had an induced abortion has been higher than the number of married women. However, these trends resulted mainly from the changing structure of women of reproduction age by marital status, as the share of single women has been growing and the share of married women diminishing. A larger share of women in this subpopulation are staying single.

The share of induced abortions out of all abortions decreased in all categories of women's marital status in the last decade. The lowest figure was among married women (50.0% in 2015), while single (62.0%), divorced (62.9%) and widowed women (71.0%) recorded higher shares. The share of induced abortions decreases as education level rises. The figure ranged from 42.8% among tertiary-educated women to 74.5% among women with basic education. The share of induced abortions has decreased in all categories in the last ten years.

2) Data on abortions are provided by the Institute of Health Information and Statistics of the Czech Republic (IHIS CR).

3) Induced abortions: legally induced abortion by means of vacuum aspiration can be performed in the early stages of gestation (i.e. up to the 7th week in the case of a first pregnancy and to the 8th week in other cases) and by a method other than vacuum aspiration up to the 12th week of gestation, or for health reasons to the 24th week of gestation.

4) Spontaneous abortions up to 31 March 2012 refer to: the spontaneous expulsion of a foetus from the uterus, where:
a) the foetus shows no signs of life and its birth weight is less than 1,000 g, or the weight cannot be measured, and the gestation period was shorter than 28 weeks,
b) the foetus shows one or more signs of life but its birth weight is less than 500 g and it does not survive for more than 24 hours after birth,
c) only the ovum without the foetus or only the decidua was extracted.
Spontaneous abortions since 1 April 2012 refer to: spontaneous expulsion of a foetus from the uterus where the foetus shows no signs of life and its birth weight is lower than 500 g, or, the weight cannot be measured, and the gestation period was shorter than 22 weeks.

Table 9 Abortions, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Abortions	40,023	39,273	38,864	37,733	37,687	36,956	35,761
– induced abortions	26,453	23,998	24,055	23,032	22,714	21,893	20,403
– spontaneous abortions	12,245	13,981	13,637	13,515	13,708	13,857	14,082
– ectopic pregnancies	1,324	1,287	1,172	1,186	1,265	1,206	1,276
Abortions – single females	14,942	16,706	17,269	17,373	18,050	17,999	17,852
– married females	19,548	17,274	16,347	15,393	14,705	14,214	13,368
– divorced females	4,823	4,410	4,264	3,949	3,928	3,766	3,505
Induced abortions – single females	10,646	11,283	11,693	11,566	11,883	11,604	11,067
– married females	11,901	9,296	8,993	8,385	7,774	7,459	6,687
– divorced females	3,469	2,991	2,915	2,622	2,620	2,433	2,203

Source: Czech Statistical Office.

Table 10 Abortion indicators, 2005–2015

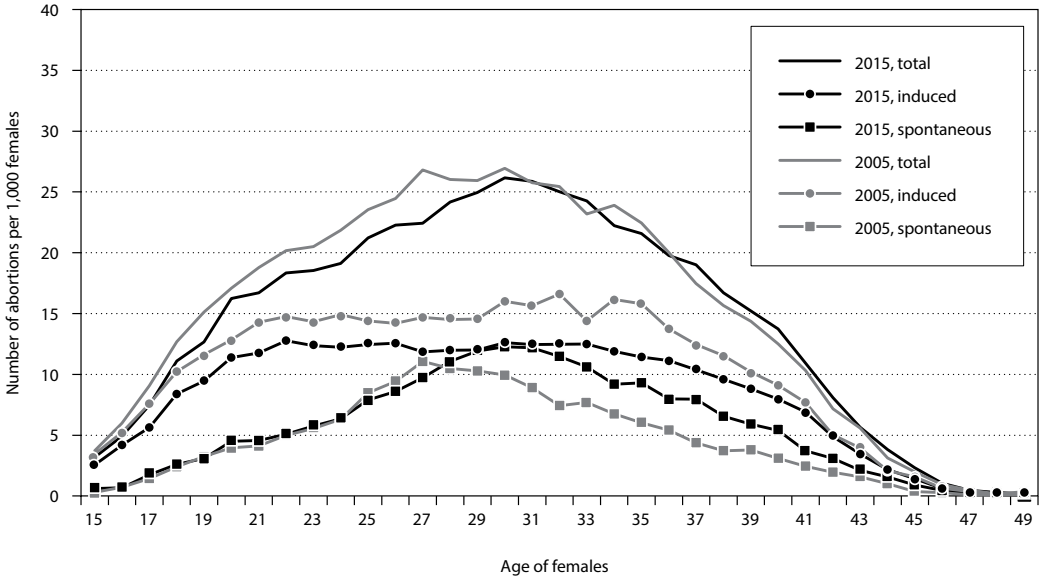
Indicator/Age group	2005	2010	2011	2012	2013	2014	2015
Total abortion rate	0.53	0.51	0.52	0.51	0.52	0.51	0.51
Total induced abortion rate	0.35	0.32	0.32	0.31	0.32	0.31	0.29
Total spontaneous abortion rate	0.16	0.18	0.18	0.18	0.18	0.19	0.20
Mean age at abortion	29.8	30.2	30.1	30.2	30.1	30.3	30.3
Mean age at induced abortion	29.6	29.7	29.7	29.7	29.5	29.7	29.7
Mean age at spontaneous abortion	30.0	31.0	30.9	31.0	31.1	31.2	31.1
Age group:	**Age-specific induced abortion rates (per 1,000 females)**						
15–19	7.7	7.0	7.1	6.8	7.2	6.6	6.1
20–24	14.2	12.7	13.3	12.9	12.9	12.4	12.1
25–29	14.5	13.1	13.5	13.3	13.5	13.0	12.2
30–34	15.8	13.2	13.6	13.3	13.0	13.0	12.4
35–39	12.8	12.0	11.8	11.3	11.3	11.0	10.2
40–49	3.1	2.9	3.0	2.9	2.9	3.2	3.1

Source: Czech Statistical Office; authors' calculations.

The total abortion rate ranged from 0.54 to 0.51 abortions per woman in the last decade (Table 10). The figure stagnated between 2010 and 2015, when the total abortion rate ranged from 0.51 to 0.52. The total induced abortion rate declined from 0.35 to 0.29 in the last ten years (by 0.02 in 2015). In contrast, the total spontaneous abortion rate increased from 0.16 to 0.20 in the same period (by 0.01 in 2015). The mean age at abortion stagnated in 2015 at 30.3 years. In the long term, it increased in relation to the rising age at pregnancy. The trend differed according to the type of abortion: the mean age of women at the time of an induced abortion stagnated over the last ten years between 29.5 years and 29.7 years, while the mean age of women at the time of a spontaneous abortion increased from 30.0 years to 31.1 years.

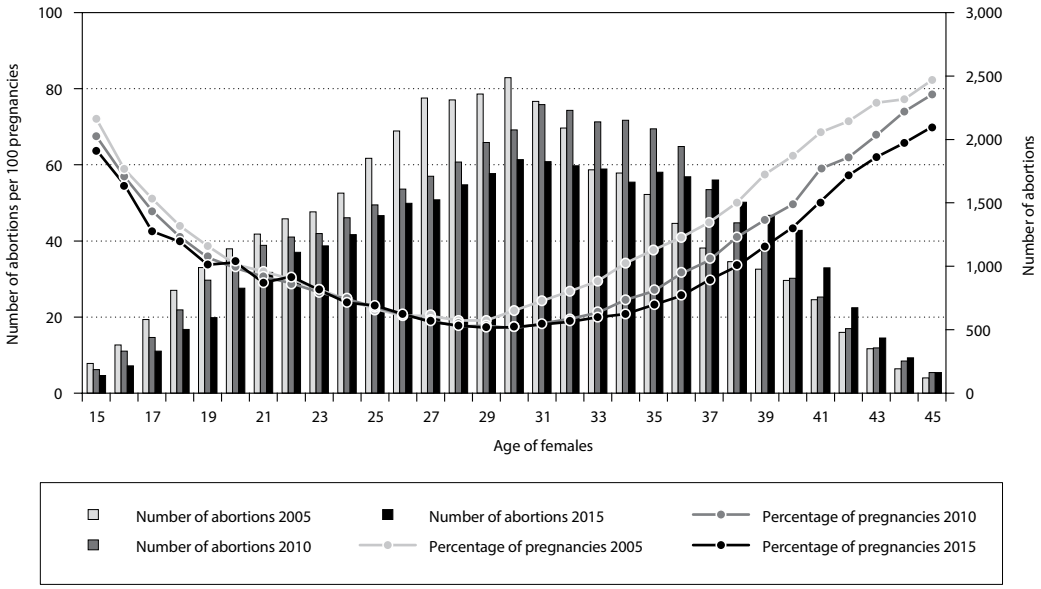
Induced abortion rates declined in the last decade at every age, while the most profound drop was in the 30–34 age group (Figure 5). In contrast, spontaneous abortion rates rose at almost every age (except for age 19 and ages 25–27), and most significantly among women aged 30–39. As a result, total abortion rates stagnated among women aged 30 and over, while the rates decreased among younger women. The spontaneous abortion rates curve was more similar to the age-specific fertility curve. It peaked at age 30 in 2015, three years later than in 2005.

Figure 5 Age-specific abortion rates by type of abortion, 2005 and 2015



Source: Czech Statistical Office; authors' calculations.

Figure 6 Share of pregnancies ended in abortion and number of abortions by age of women, 2005–2015



Source: Czech Statistical Office; authors' calculations.

The share of pregnancies ended in abortion was the highest in the youngest and the oldest age groups (Figure 6). There were 40% or more abortions out of the total number of pregnancies in the 15–17 and 40 and over age groups, but the absolute numbers of abortions at these ages were not high (they accounted for 13.0% of all abortions in 2015). Between 2005 and 2015 the share of pregnancies ended in abortion markedly declined among women aged 30 and over and to a lesser extent also in the 15–19 age group. It didn't change significantly in the 20–29 age group. There were more abortions among women aged 35 and over, but also even more pregnancies in 2015 compared to 2005.

MORTALITY

The number of deaths increased by 5,508 in comparison with 2014 and reached 111,173 in 2015, which was the highest figure since 2004. The number of deceased by sex was almost even in the last recorded year (55,934 males and 55,239 females). The number of deaths under 1 year of age increased only by 9 to 272 in 2015. The infant mortality rate also increased to 2.5 deaths per 1,000 live births, which was a quarter less than in 2005 (Table 11).

The share of deaths at the age 80 and over increased in the long term among both men and women. The figure was 26.1% for men and 50.3% for women in 2005 and it shifted to 33.2% and 58.8%, respectively, in 2015. This development is a result of the changes in age structure and the mortality decrease. The mean age at death for men was 69.4 years in 2005 and 72.2 years a decade later. It was 77.2 and 79.4 years for women in the same calendar years.

The life expectancy at birth for men stagnated at 75.8 years in 2015. It increased in the last ten years from 72.9 years (by 4%). In the case of women the rise was from 79.1 years in 2005 to 81.4 years ten years later (by 3%); however, in the last year there was a decline in life expectancy at birth among women. It went down from 81.7 in 2014. This change was mainly caused by a higher intensity of mortality among women aged 70 and over. A year-on-year decline was last registered in 2003. The overall rise in life expectancy at birth between 2005 and 2015 was caused by the lower mortality of men aged 50–64 and women aged 70 and over. The difference between women and men in life expectancy at birth decreased from 6.22 years in 2005 to 5.62 years in 2015. Trends in mortality by sex in the age groups between 45 and 59 years are what most influenced this decrease.

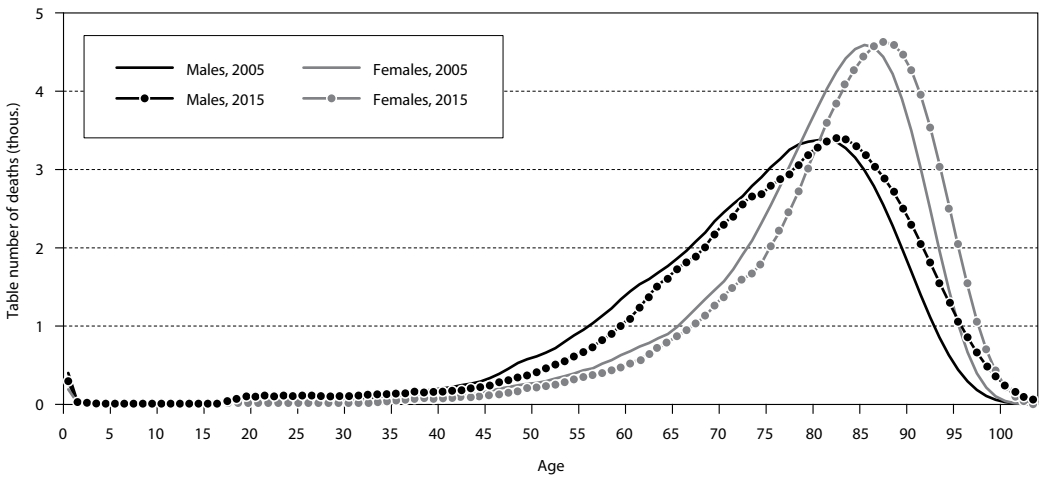
The indicator of the table number of deaths is derived from life tables and is not affected by the changing age structure of the population (Figure 7). The most common age at the time of death for women was 87 years in 2015, two years higher

Table 11 Deaths, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Deaths	107,938	106,844	106,848	108,189	109,160	105,665	111,173
– males	54,072	54,150	54,141	54,550	55,098	53,740	55,934
– females	53,866	52,694	52,707	53,639	54,062	51,925	55,239
Deaths under 1 year of age	347	313	298	285	265	263	272
Infant mortality rate (‰)	3.4	2.7	2.7	2.6	2.5	2.4	2.5
Percentage of deaths at the age 80 and over – males	26.1	30.0	30.5	31.5	32.0	32.5	33.2
– females	50.3	55.5	56.2	57.2	57.6	57.9	58.8
Life expectancy of males at age: 0	72.9	74.4	74.7	75.0	75.2	75.8	75.8
65	14.4	15.3	15.5	15.6	15.7	16.0	16.0
80	6.1	6.6	6.8	7.0	7.2	7.3	7.5
Life expectancy of females at age: 0	79.1	80.6	80.7	80.9	81.1	81.7	81.4
65	17.6	18.7	18.8	18.9	19.1	19.5	19.3
80	7.1	7.9	7.9	8.0	8.2	8.5	8.2

Source: Czech Statistical Office; authors' calculations.

Figure 7 Life-table deaths by sex and age, 2005 and 2015



Source: Czech Statistical Office.

than a decade ago. The most common age at the time of death for men was 81 years in 2005 and 82 years in 2015. Among women deaths were concentrated more around the peak age, while among men deaths occurred within a longer age interval.

Causes of death

There have been important methodological changes that have affected the trend in mortality by cause of death during the period evaluated in this article (2005–2015). Since 2011 IRIS, the automated coding system for selection of the underlying cause of death, has been used in the Czech Republic, which was preceded by the introduction of ACME decision tables into coding practice in 2007; since 2013 a new death certificate with 4 lines in Part I (instead of 3 lines) has been used and the system of data collection was changed. Since 2009 the updates of the ICD-10 are regularly implemented. The last updates valid in the Czech Republic since 1 January 2014 were only minor and did not affect mortality by cause of death, unlike the adoption of the 2nd edition of the ICD-10, including 2009 updates or updates valid from 1 January 2013. Mortality trends by cause of death must be evaluated with caution and an awareness of these changes, because in some cases it is difficult to clearly distinguish between the effects of changes in methodology and the real trend in mortality from a given cause of death. However, in other cases a sudden change in the trend over time has appeared, in which case the 'external influence' is rather clear (see below).

The majority of deaths – though since 2011 already less than half – are from diseases of the circulatory system (45.8% in 2015). In 2015 this figure was less than half not only in the case of men (41.9%) but also, for the first time, in the case of women (49.9%). But the absolute number of deaths from these diseases increased from 48,627 to 50,969 between 2014 and 2015. Deaths from neoplasms in 2015 accounted for 27,407, which is two hundred fewer than in 2014, and these accounted for a quarter of all causes of death in 2015 (24.7%). The share was also a bit lower than a year ago. Unlike diseases of the circulatory system, neoplasms represented a higher share of causes of death among men (27.0% vs 22.3% in 2015) than among women. In 2015, the third most common cause of death for both men and women was a disease of the respiratory system (7.4% and 6.1% of all deaths). This is not usual among men for whom injuries and poisonings are typically the third most frequent cause of death (except in 2013 and 2015, when this was not the third most frequent cause). Deaths from diseases of the respiratory system significantly rose year-on-year both absolutely and relatively, but the rise was bigger due

to the decrease in 2014, when there were exceptionally favourable epidemiological conditions (CZSO, 2015b). External causes of death were the fourth most common cause among men and the sixth among women, in the latter case coming even after endocrine diseases and diseases of the digestive system (Table 12).

In the long-term view, a rare and slight increase (by 2% for men and 3% for women) occurred in the standardised mortality rate from diseases of the circulatory system in 2015. However, the level in 2015 represented 73% (in the case of men) and 71% (women) of the level in 2005. Between 2014 and 2015 mortality rates from a subcategory of this ICD-10 chapter – ischaemic heart diseases (I20–I25) – very slightly increased, but within it the mortality from acute myocardial infarction (I21–I22) decreased by 11%. The mortality rate from another frequent subcategory – cerebrovascular diseases (I60–I69) – decreased only among men, while among women it stagnated. The last year-on-year increase in overall mortality from circulatory diseases was thus caused by other diseases from this ICD-10 chapter. Mortality from ischaemic heart diseases and cerebrovascular diseases was affected most by the methodological changes in 2007 following the introduction of the ACME decision table into coding practice (Figure 8), which corrected some incorrect coding when both causes were present on the death certificate. ACME tables and the implementation of IRIS and updates led to a substantial reduction of mortality from atherosclerosis, a reduction of 85% between 2005 and 2015, which in 2005 was still higher than, for instance, the level of mortality from acute myocardial infarction (in the case of women this was true even until 2010).

The standardised mortality rate from neoplasms decreased between 2014 and 2015 by 2% and the overall average decrease for both sexes between 2005 and 2015 was by almost 20%. This positive trend was for men driven by the decline in mortality from the most frequent neoplasms as causes of death, such as lung cancer (C33–C34), colorectal cancer (C18–C21; but in 2015 no further decrease was registered), and prostate cancer (C61). In the case of women the most significant decrease was recorded for mortality from colorectal neoplasms during the last decade (by 31%), followed by breast cancer (C50; by 28%), and cancer of the genital organs (C51–C58; by 18%). The mortality level from all of these categories is comparable (Figure 8), similarly to the standardised mortality rate from cancer of trachea, bronchus and lung. But for the latter an increasing trend was apparent until 2012, after which it stagnated. Among other more common neoplasms as causes of death, a longer-term decrease in mortality has been observed among both sexes for stomach cancer, while cancer of the pancreas has been characterised by an overall stagnation of the mortality trend with year-on-year oscillation.

The last year-on-year increase in the mortality rate from diseases of the respiratory system was more significant than in the case of diseases of the circulatory system, namely by 12% for men and even 18% for women. Almost 40% of the mortality level from this ICD-10 chapter is made up of mortality from pneumonia (J12–J18), which increased between 2014 and 2015 to a similar extent as mortality from all respiratory diseases. But in the case of pneumonia a more profound decrease since 2005 was recorded. However, the majority of the decrease occurred between 2010 and 2011, in connection with the implementation of an automated coding system. As a consequence of this, male mortality from chronic lower respiratory diseases (J40–J47) has been higher than mortality from pneumonia since 2011, and an overall increasing trend in mortality from this subgroup of diseases has been apparent since that year, and this has also been true for women.

The mortality rate from external causes of death (injuries and poisonings) had a stagnating trend for the last three years in the case of men and for seven years already in the case of women (Figure 8). Before that a decreasing trend was observed for both sexes. The mortality trend from traffic accidents (V01–V99) and suicides (X60–X84) for women has been stable for the last five years, while the male suicide rate has, since the last peak in 2012, been slightly decreasing. Until 2011, an unstable trend was observed in mortality from accidental falls (W00–W19), but in the years since then the implementation of the automated coding system has corrected and harmonised coding practice.

The introduction of IRIS also resulted in a change in the level of mortality from endocrine diseases, and from diabetes mellitus in particular (E10–E14),

Table 12 Deaths by cause of death, selected chapters of ICD-10, 2005–2015

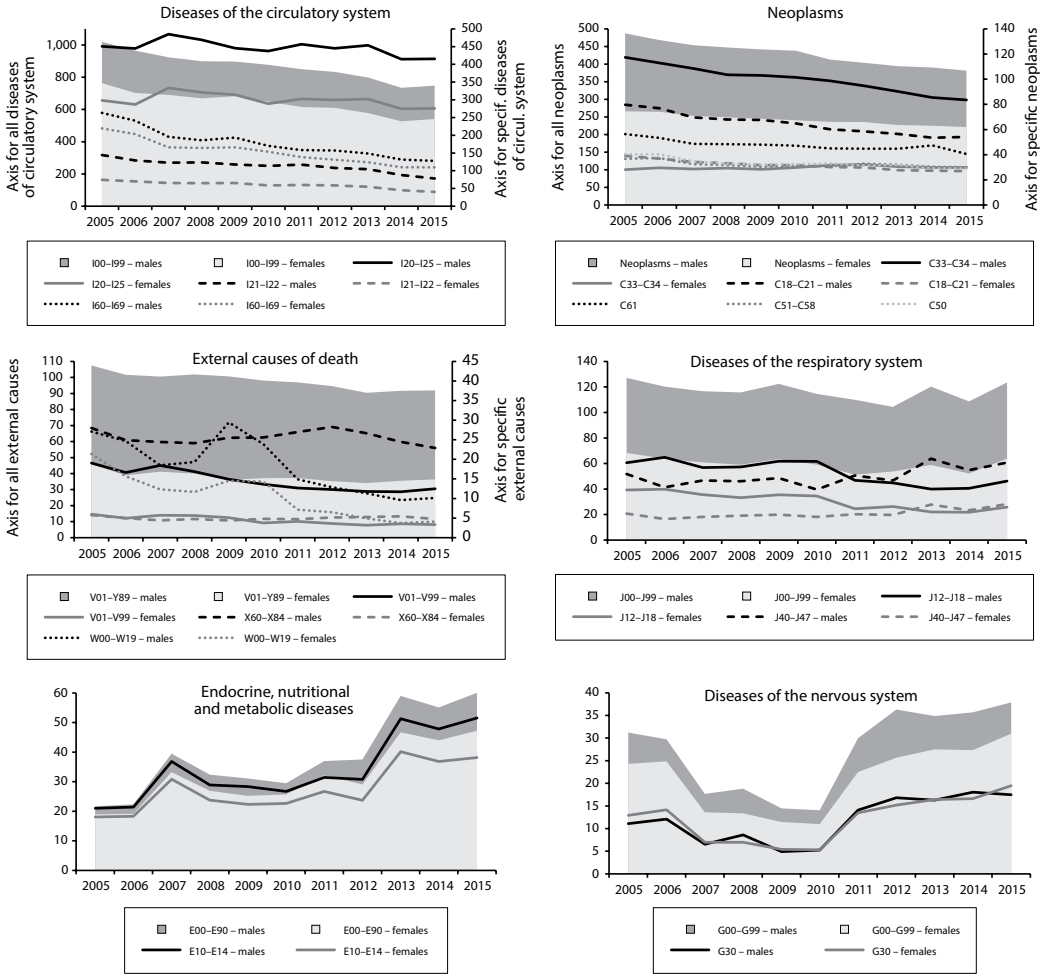
Chapter of ICD-10	2005	2010	2011	2012	2013	2014	2015
	Percentage of the given cause of death out of total deaths						
Neoplasms (C00–D48)	25.9	26.2	25.5	25.6	25.1	26.1	24.7
Endocrine, nutritional and metabolic diseases (E00–E90)	1.4	2.0	2.6	2.5	3.9	3.9	4.0
Mental and behavioural disorders (F00–F99)	0.3	0.2	0.9	0.9	1.1	1.1	1.3
Diseases of the nervous system (G00–G99)	1.9	1.0	2.0	2.3	2.4	2.5	2.7
Diseases of the circulatory system (I00–I99)	51.1	50.2	49.3	49.0	47.4	46.0	45.8
Diseases of the respiratory system (J00–J99)	5.6	5.8	5.3	5.4	6.3	5.9	6.7
Diseases of the digestive system (K00–K99)	4.5	4.4	4.2	4.2	4.2	4.2	4.2
Diseases of the genitourinary system (N00–N99)	1.5	1.4	1.1	1.3	1.1	1.2	1.3
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)	0.9	1.5	1.1	1.1	1.2	1.2	1.3
External causes (V00–Y89)	5.9	5.6	5.6	5.4	5.1	5.4	5.2
	Percentage of the given cause of death out of total male deaths						
Neoplasms (C00–D48)	28.5	28.9	27.6	27.8	27.6	28.4	27.0
Endocrine, nutritional and metabolic diseases (E00–E90)	1.2	1.8	2.2	2.2	3.5	3.4	3.5
Mental and behavioural disorders (F00–F99)	0.4	0.3	0.8	0.8	0.9	1.0	1.1
Diseases of the nervous system (G00–G99)	1.8	0.9	1.8	2.2	2.1	2.3	2.4
Diseases of the circulatory system (I00–I99)	45.4	44.6	44.6	44.3	43.0	41.8	41.9
Diseases of the respiratory system (J00–J99)	6.0	6.2	6.0	5.9	7.0	6.6	7.4
Diseases of the digestive system (K00–K99)	5.1	4.9	4.7	4.6	4.7	4.7	4.7
Diseases of the genitourinary system (N00–N99)	1.3	1.2	1.0	1.2	0.9	1.0	1.1
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)	1.0	1.8	1.3	1.3	1.3	1.3	1.5
External causes (V00–Y89)	8.0	7.7	7.7	7.4	7.0	7.2	7.0
	Percentage of the given cause of death out of total female deaths						
Neoplasms (C00–D48)	23.3	23.5	23.4	23.3	22.6	23.8	22.3
Endocrine, nutritional and metabolic diseases (E00–E90)	1.6	2.3	3.0	2.7	4.4	4.4	4.6
Mental and behavioural disorders (F00–F99)	0.1	0.2	1.0	1.0	1.3	1.3	1.6
Diseases of the nervous system (G00–G99)	2.0	1.1	2.2	2.5	2.7	2.8	3.0
Diseases of the circulatory system (I00–I99)	56.8	55.9	54.3	53.8	51.8	50.3	49.9
Diseases of the respiratory system (J00–J99)	5.2	5.3	4.6	4.9	5.5	5.2	6.1
Diseases of the digestive system (K00–K99)	3.8	3.8	3.7	3.7	3.7	3.7	3.7
Diseases of the genitourinary system (N00–N99)	1.7	1.5	1.3	1.3	1.2	1.3	1.4
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (R00–R99)	0.8	1.3	0.8	0.8	1.1	1.0	1.1
External causes (V00–Y89)	3.8	3.4	3.5	3.3	3.2	3.6	3.5

Source: Czech Statistical Office; authors' calculations.

which has come to be more frequently selected as the underlying cause of death. This began in 2007, when the ACME decision tables were introduced into coding practice. The next change – a rise – was registered in 2013 and was caused by the introduction of a fourth line in Part I of the death certificate and the introduction of the ICD-10 updates (*Štyglerová*, 2014a). The use of IRIS is also connected with the very significant rise in mortality from diseases of the nervous system and mental and behavioural

disorders (*ČSÚ*, 2012d). The latter case is linked mainly to the selection of vascular dementia as the underlying cause of death, which was not applied before. The opposite trend was registered in the case of mortality from ill-defined causes of death (R00–R99); however, since 2013, in connection with the establishment of the modified data collection system, a certain increase has been recorded. A relatively stable mortality level has been observed for the last five years for diseases of the digestive system, including one of the most common diseases of this system – chronic liver diseases, which had stagnated over the long-term among women and, after a short slight decrease in 2008–2010, also among men. The mortality rates from other ICD-10 chapters of causes of death are from the view of overall mortality level marginal, including causes related to infant mortality.[5)]

Figure 8 Standardised mortality rates (per 100,000 inhabitants), selected causes of death, 2005–2015



Note: The new European population standard issued by Eurostat in 2013 was used for standardisation.
Source: Czech Statistical Office; authors' calculations.

5) Also mortality levels from other causes of death were affected by methodological changes and implementation of ICD-10 updates but due to their less important influence on overall mortality they are not discussed here.

INTERNATIONAL MIGRATION

The number of immigrants (34,922) exceeded the number of emigrants (18,945) by 15,977 in 2015.[6] Positive net migration was lower by 5,684 in comparison with 2014. In 2013 the figure was even negative (the only year this was so in the last decade). The volume of migration declined by 7,722 to 53,867 in the last year. Males made up 54.5% of immigrants and 55.4% of emigrants in 2015. Ten years ago the figure was 62.9% for immigrants and 60.4% for emigrants.

Migrants aged 15–34 contributed most to positive net migration in 2015 and also in the long term (Table 13). There were 11,023 more immigrants than emigrants in this age group in 2015 (and they accounted for 69% of net migration). According to the five-year age group the highest net migration was until 2012 among people in the 20–24 age group and in the last two years among those aged 25–29. The net migration of children aged 0–14 was positive in all observed years but nonetheless markedly lower than in the 15–34 age group (3,406 in 2015). Net migration was also lower among people between the ages of 35 and 64 (1,420 in 2015). Older migrants aged 65 and over contributed only minimally, but positively, to net migration (by 128).

Net migration rates by age were higher at the beginning of life (migration with parents), among migrants aged 17–18 (movements related to the end of secondary school), and among migrants aged 23–28 (entering the labour market) than among other ages in 2015.

The positive net migration in 2005–2015 period was mainly made up of citizens from Ukraine, Slovakia, Vietnam, and Russia (Figure 9), which together accounted for 62% of total net migration. In 2015 Slovaks (5,202), Ukrainians (2,246) and Romanians (1,238) made the biggest contributions to net migration, while migrants with Czech and Vietnamese citizenship contributed to net migration negatively (–588 and –229, respectively).

The largest number of immigrants were citizens of Slovakia (6,682), followed by Ukraine (5,454), and the Czech Republic (3,333) in 2015. Emigrants were most commonly Czechs (3,921), Ukrainians (3,208) and Russians (2,061) in the same year. Romania, Bulgaria and Germany accounted for the smallest numbers of emigrants and roughly one thousand immigrants (each), which resulted in high positive net migration rates for these countries.

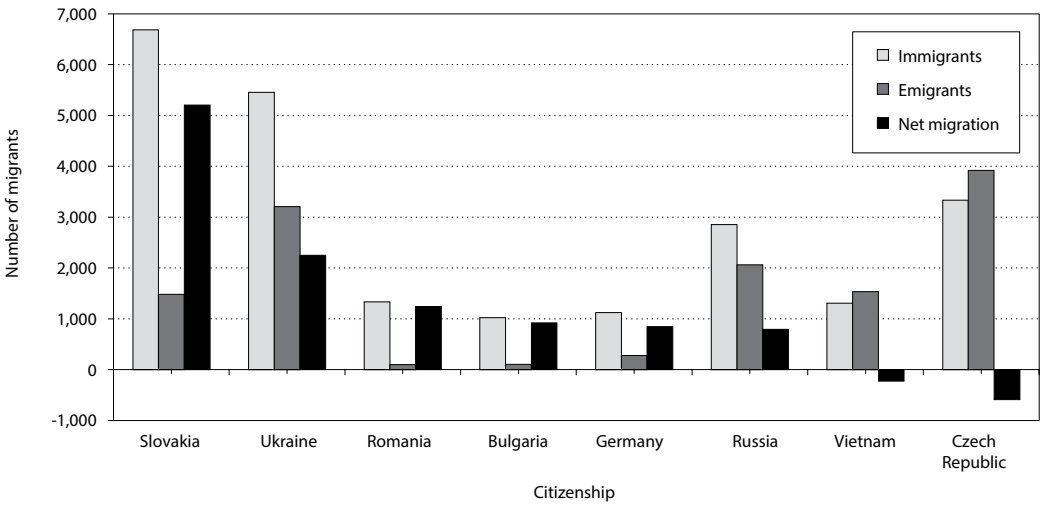
Table 13 International migration, 2005–2015

Indicator	2005	2010	2011	2012	2013	2014	2015
Immigrants	60,294	30,515	22,590	30,298	29,579	41,625	34,922
– males	37,900	16,561	12,440	17,054	16,467	23,115	19,022
Emigrants	24,065	14,867	5,701	20,005	30,876	19,964	18,945
– males	14,546	11,029	3,109	11,901	18,040	11,238	10,502
Volume of migration	84,359	45,382	28,291	50,303	60,455	61,589	53,867
Net migration	36,229	15,648	16,889	10,293	–1,297	21,661	15,977
aged: 0–14	2,808	3,992	2,214	1,754	1,190	3,685	3,406
15–34	21,346	11,889	11,166	7,932	3,036	13,197	11,023
35–64	11,823	–403	3,191	420	–5,528	4,571	1,420
65+	252	170	318	187	5	208	128

Source: Czech Statistical Office.

6) Data was provided from the Central Population Register Record (ISEO), administered by the Ministry of the Interior of the CR, and the Foreigners' Information System (CIS), administered by the Directorate of the Alien Police Service of the CR.

Figure 9 International migration by selected citizenship,*) 2015



Note: *) Citizenships whose number of immigrants, emigrants or net migration was among the top five in 2015.
Source: Czech Statistical Office.

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MOBILE PHONE LOCATION DATA: NEW CHALLENGES FOR GEODEMOGRAPHIC RESEARCH

Lucie Pospíšilová[1] – Jakub Novák[1] [2]

ABSTRACT

Significant changes in spatiotemporal relationships have transformed the organisation of society in recent decades. Therefore, new approaches are required to understand the spatiotemporal aspects of human behaviour and the dynamics of society in the modern world. This paper introduces the possibilities and limitations of mobile phone location data in an attempt to initiate wider discussion among demographers about future research based on data obtained from new technologies.

Keywords: new technologies, mobile phone location data, Prague, mobility, population distribution, spatiotemporal behaviour

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INTRODUCTION

Significant changes in spatiotemporal relationships have occurred in recent decades. These have transformed both human behaviour and the organisation of society and space. Mobility has been increasing and continues to appear in new forms with various meanings, and at the same time there have been changes in the organisation of our space. These developments are reflected in the transformation of human spatiotemporal behaviour (*Vilhelmson*, 1999; *Cresswell*, 2006; *Sheller – Urry*, 2006; *Cresswell – Merriman*, 2011). Our daily lives and patterns of mobility and migration are becoming increasingly varied due to increasing opportunities in all realms of everyday life (*Novák et al.*, 2007; *Macešková – Ouředníček – Temelová*, 2009; *Šimon*, 2011; *Pospíšilová*, 2012a). Thus, the general patterns of human (spatiotemporal) behaviour have been 'disrupted' or at least significantly modified. Therefore, new approaches are required in the field of geodemographic research so that we can better understand the spatiotemporal aspects of human behaviour and the dynamics of society in the modern world (*Ratti et al.*, 2006).

However, to date, most of the studies on population distribution and mobility based on 'big data' employ traditional sources such as the population census or the population register, which are limited in terms of their ability to reflect the spatiotemporal aspects of human behaviour in today's more mobile society. For instance, people often do not always live at their recorded permanent residence; they may change their place of residence weekly or seasonally, and labour flexibility (both temporal and spatial) has also been increasing (*Svoboda – Ouředníček*, 2015). Similarly, there is a greater range of opportunities in terms of where one can spend one's leisure time. Indeed, people may move within a space during the day (and night-time) for many reasons. Consequently, the socio-spatial differentiation of a population is not stable, but rather is constantly changing.

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2) In memoriam.

The most frequently used data source on human spatiotemporal behaviour – the population census – has a number of weaknesses in this respect (*Novák – Novobilský*, 2013). While a census can provide us with data on the resident or commuting population, other types of users of spaces are not considered. Other informal forms of living as well as places where people perform other activities besides working and studying are therefore not discernible in this type of data. A question added to the census regarding a person's place of 'usual residence', in other words, the place where a person stays on a daily basis regardless of their permanent residence (*CZSO*, 2015), led to an improvement in the accuracy of data (*Špačková – Ouředníček – Riška*, 2012; *Šanda*, 2015). Other informal forms of living as well as places of other activities besides working and studying remain unknown. However, due to the high cost of conducting a census and the growing unwillingness among the population at large to provide information about themselves, any other extension to the type of data collected via the census method is highly unlikely in the future. Moreover, the data from a census are often not up to date, even shortly after their release (*Novák – Novobilský*, 2013), and a large percentage of the questions relating to mobility are not answered. Therefore, to address issues of accuracy and the growing complexity of mobility patterns and spatiotemporal relations, traditional statistical data needs to be supplemented with data from new sources reflecting the dynamics of today's society (see also *Palmer et al.*, 2013).

In Czechia, most of the studies based on more detailed data reflecting temporality and changing patterns of behaviour during the day, week, or year, rely on their own surveys (i.e. the diary method) and cover a spatially limited population sample (*Doležalová – Ouředníček*, 2006; *Novák – Sýkora*, 2007; T*emelová et al.*, 2011; *Pospíšilová – Ouředníček*, 2011) or they rely on their own estimations (*Čermák et al.*, 1995; *Burcin et al.*, 2008). Unlike other countries (e.g. Germany, Poland, the USA, Macedonia), in Czechia there is no state-wide collection of data on the spatiotemporal behaviour of the population (what are known as 'time use surveys') except by private companies (e.g. data collected by the research agency MEDIAN). Therefore, identifying new data sources and innovative methods for geodemographic research should be a common interest for many.

New technologies such as GPS or mobile phones not only change human spatiotemporal behaviour, they also represent a great potential avenue through which to study this behaviour (*Ratti et al.*, 2006) because most of the time these devices move with their users (*Steenbrugen et al.*, 2013). In this paper, we focus on mobile phone location data (sometimes called mobile positioning data) that provide us with an exceptional opportunity to extend our research on human spatiotemporal behaviour and the temporal changes of the population in space. These data exist in the databases of mobile network operators, and in Czechia they cover the mobility of most of the population (in 2003, 66% of the population over the age of 16 used a mobile phone [*CZSO*, 2008], and this figure had risen to 97% by 2015 [*CZSO*, 2016]). This type of data is available for any given moment in time and, with some limitations, offers great spatial detail. The comprehensiveness of these data is the main reason for the rapid increase in the amount and scope of research based on mobile phone location data in the social sciences during the last 10 years (*Pae – Ahas – Mark*, 2006; *Ratti et al.*, 2006; *Ahas et al.*, 2008a; *Novák et al.*, 2013; *Silm – Ahas*, 2014a). However, the use of such has been relatively slow to penetrate the Czech academic environment (*Dufková et al.*, 2008; *Novák*, 2010; *Novák – Temelová*, 2012; *Novák – Novobilský*, 2013).

Therefore, in this paper we aim to introduce the possibilities and limitations to using mobile phone location data and to suggest several directions for Czech geodemographic research in this area. First, we introduce the different types of mobile phone location data that exist and their advantages and disadvantages. Then we present an overview and evaluation of existing studies in this area that might be inspiring for Czech geodemographic research. Next we focus on Prague to demonstrate how mobile phone location data can be employed. We then conclude the paper with a discussion of the current situation regarding the availability of mobile phone location data in Czechia and make some suggestions for possible future directions that geodemographic research can take.

MOBILE PHONE LOCATION DATA

Mobile phone communication occurs through a network of towers and antennas (also known as base transceiver stations [BTSs]). The density of BTSs corresponds to that of the population. To communicate with the network, an individual mobile phone chooses a tower with an antennas – usually the closest one[3] – and a call detail record (CDR) is created in the database of the mobile network operator (*Soto – Frías-Martínez*, 2011). The territory of a country or smaller geographical units, such as districts or cities, can be divided into cells with a BTS, which are called location areas (LAs). The size of an LA depends on the population density and the intensity of calling activities. Generally, the size of an LA varies from 100–300 m in cities to several kilometres in rural areas (*Ratti et al.*, 2007). *Ahas et al.* (2008b) show that in Estonia, even data from less-populated areas can be useful because they are more accurate than some other types of data (e.g. tourism statistics). *Novák* (2010) calculated the accuracy of positioning (i.e. the ability to determine where the person using the mobile phone is situated) based on one of the main Czech mobile network operator's data on BTSs and their distribution and found that the average accuracy in Prague is 1,000 m (indeed, it is higher [200 m] in the city centre but decreases towards the outskirts [2,000 m]). The accuracy within Czechia can be described as quite high in regional centres (1,300 m), moderately high (3,500 m) in cities with over 10,000 inhabitants, and low in the countryside (6,000 m) (*Novák*, 2010). In addition to population density, geographical location is also important because the positioning is more accurate in suburban municipalities than in rural municipalities of the same size; methods for making positioning more accurate exist, but they need additional technical adjustments (*Novák*, 2010).

There are two basic types of mobile phone location or mobile positioning data (*Ahas et al.*, 2007a; *Novák*, 2010; *Lokanathan – Gunaratne*, 2015), namely 'passive' and 'active' mobile positioning data. Passive mobile positioning data are automatically saved in the databases of mobile network operators whenever phone users actively use their devices. This includes information on calls, SMSs (made/sent or received), and internet use. These data serve primarily as billing data (billing memory). Even though handovers are tied only to specific situations, it has been revealed that these data are able to describe population mobility with relatively sufficient accuracy (*Ahas et al.*, 2010b). Further, data originating from 'location updates' also fall under the passive data mobile positioning category. Information about the area of a mobile phone's location and each cross-border movement is regularly registered by the mobile network (*Novák*, 2010). It should be noted that an individual user of a mobile phone cannot be identified from these data (*Calabrese – Ratti*, 2006; *Soto – Frías-Martínez*, 2011). These data do not provide complete information about mobile phone users' daily movements; only some of the isolated localities of daily use are identifiable from passive mobile positioning data (*Novák*, 2010). However, it is possible to estimate a user's places of residence and work (*Ahas et al.*, 2008a; *Ahas et al.*, 2010b). In contrast, active mobile positioning data enable selected mobile phones (and thus the daily paths of the owners) to be traced using specialist software. These data are considered personal and in Czechia, like in many other countries, such data must be processed in accordance with the Personal Data Protection Act. Apart from exceptional situations (e.g. a court order), the written consent of the mobile phone user is required (*Novák*, 2010, *Novák – Temelová*, 2012). Currently, the most common studies are those based on passive data.

Use of mobile phone location data in research has both strengths and weaknesses. One of the undeniable advantages is that it is possible to obtain data regarding all (active) users of mobile phones. As the mobile phone is currently an ubiquitous location device in developed countries (*Ratti et al.*, 2006; *Novák*, 2010, *Novák – Temelová*, 2012), mobile phone data cover most of the population and can be considered representative (*Ratti et al.*, 2006). In the European Union, 91% of citizens have individual access to

3) There are also situations when a mobile phone chooses a more distant BTS, which means that the size of the areas covered by a BTS is not always fixed (*Ahas et al.*, 2008b).

Table 1 Usage of mobile phones by individuals in Czechia in 2008, 2012 and 2015

	2008		2012		2015	
	thousands	%	thousands	%	thousands	%
Total 16+	**8,053**	**90.6**	**8,251**	**96.0**	**8,511**	**97.0**
Gender						
Men	4,008	92.6	4,021	96.8	4,164	97.2
Women	4,045	88.7	4,231	95.2	4,347	96.9
Age group						
16–24	1,194	98.0	1,051	99.9	1,004	99.4
25–34	1,691	98.6	1,490	99.5	1,455	99.8
35–44	1,498	98.5	1,597	99.6	1,718	99.6
45–54	1,343	97.0	1,296	98.1	1,340	99.6
55–64	1,335	90.4	1,419	97.4	1,390	97.7
65–74	676	76.6	928	93.1	1,052	94.4
75+	317	46.0	470	70.0	551	78.9
Education (25+)						
Primary	681	67.5	790	83.5	648	87.3
Secondary without GCE	2,739	89.5	3,049	96.3	2,835	96.0
Secondary with GCE	2,424	95.3	2,320	97.7	2,684	98.9
Tertiary	1,013	96.9	1,195	98.8	1,34	99.0

Zdroj: Sčítání lidu, domů a bytů 2001; VŠPS 2002.
Source: *Census 2001; LFS 2002.*

a mobile phone (*Special Eurobarometer 396*, 2013). According to the *Survey on ICT Usage in Households and by Individuals*, 97% of the Czech population aged 16 and over used a mobile phone in 2015 (Table 1) and, on average, there are 0.98 mobile phones per household member aged 6 and over (*CZSO*, 2016). Moreover, these figures are increasing every year and there are no large disparities in the use of mobile phones by gender, age, or education. The highest rate of use of a mobile phone has been recorded among people aged 25–34 years old and among those with a tertiary education, while the lowest usage occurs in the 75+ age group and among people with primary education. Thus, mobile phone location data have strong explanatory power for the population aged 16 and over, and this power is even stronger for the working-age population (16–64).

Given that mobile phone location data already exist in the databases of mobile phone operators, the financial cost of data collection is negligible. However, the data are owned by private companies and their use in research is dependent on close cooperation with them, which very often involves financial expenses for research institutions. Last but not least, use of mobile phone location data enables current research to be enriched with temporality (*Ratti et al.*, 2006), an issue that has long been often overlooked by many authors. The type of information that can be obtained makes it possible for researchers to evaluate the changes in population distribution during the day, week, month, or year, and any differences caused by the weather, season, the transition from day to night, working hours, specific events, etc.

The main weakness of mobile phone location data in terms of their use in geodemographic research is the absence of user details such as gender, age, income, etc. Basic information can be obtained from the contracts of mobile operators' clients; however, not all clients do have a personal contract and operators are often reluctant to provide such information.[4)]

4) See the paper by *Silm – Ahas* (2014a), where these details are used.

Some researchers have tried to solve this problem by trialling what is known as the 'social positioning method' (*Ahas – Mark*, 2005; *Ahas et al.*, 2007a; *Ahas et al.*, 2010a), where location data are collected with the informed consent of mobile phone users who are then asked to fill in a questionnaire aimed at obtaining their socio-demographic or other characteristics. Other researchers have developed their own software and provided it to selected mobile phone users for installation in order to obtain more detailed personal data on users and on their mobility patterns (*Eagle – Pentland*, 2006; *Liccope et al.*, 2008). In this method, the collected data are classified as active positioning data. The method is currently used to a limited extent and mostly in less extensive, selective studies with a relatively small number of respondents.

Other disadvantages relate mainly to the relatively few studies of this kind undertaken to date, and the associated lack of experience of data processing, which has meant only a limited examination of the procedures used for this purpose; there have been problems related to different and often unclear habits of mobile phone users, the incompatibility of BTS areas with administrative and statistical units, or issues of privacy, ethics, and legislation (*Novák*, 2010). However, it may be assumed that these weaknesses will gradually be overcome as these methods are used more widely.

MOBILE PHONE LOCATION DATA IN RESEARCH

The global system for mobile communications (GSM) was created in 1982 (*Steenbruggen et al.*, 2013), so it is a fairly new technology. The first projects and studies that dealt with mobile phone data are also quite recent, dating only to the 1990s (*Steenbruggen et al.*, 2013). These early studies were rather isolated and it was only post-2005 that interest in the application of mobile phone location data in research became more widespread. Over the last 10 years, research using these data has evolved from mainly methodologically and technically oriented pilot studies published by a few researchers (e.g. *Ahas – Mark*, 2005; *Pae – Ahas – Mark*, 2006; *Ahas et. al.*, 2007b; *Calabrese – Ratti*, 2006; *Ratti et al.*, 2006; 2007) to studies addressing a wide spectrum of issues in various scientific fields. As the spatial accuracy of mobile positioning is determined by the density of BTSs and population density, most current research focuses on urban areas. The members of two leading research teams of global significance are among those with the most extensive publishing record in this area (*Novák*, 2010), namely, Rein Ahas and colleagues in the Department of Geography at the University of Tartu in Estonia, who work in cooperation with a private company, Positium, and Carlo Ratti and colleagues based at the Sense*able* City Lab at the Massachusetts Institute of Technology in Cambridge, Massachussetts, USA.[5)]

Analyses based on mobile phone location data are diverse in their scope – from the impact of earthquakes on spatial mobility (*Bengtsson et al.*, 2011), criminology (*Schmitz – Cooper*, 2007), and transport studies (e.g., *Caceres – Wildeberg – Benitez*, 2008) to various aspects of people's everyday lives (e.g., *Ahas et al.*, 2010b). In the paper, we focus on two directions and groups of studies that are relevant to geodemographic research: (1) the temporal aspects of population distribution and (2) new aspects of migration and daily mobility. As *Palmer et al.* (2013) aptly note, research based on mobile phone location data fits well into the development of the mobilities paradigm in the social sciences.

Patterns of population distribution change literally every second, and analyses based on traditional data sources that enable evaluation of a one-year period or even longer intervals are becoming insufficient. Thus, the interpretation of mobile phone location data represent a new challenge in this respect, and many authors have attempted to reveal different aspects of the temporalities of population distribution. *Carlo Ratti et al.* (2006) were among the first to present findings on the spatial differentiation of population changes during the day. Their study focuses on Milan, Italy, and is based on 16 days of data from BTSs (data that mobile operators have always stored) relating

5) For details, on Positium, Tartu, Estonia, see http://www.positium.com/ and for Sense*able* City Laboratory, Massachusetts Institute of Technology School of Architecture + Planning, see http://senseable.mit.edu/.

to users who make calls or send SMSs via each antenna in the city. Setting out with the hypothesis that 'the patterns of cell phone intensity correlate with the intensity of urban activity', they try to reveal important patterns of urban dynamics (*Ratti et al.*, 2006: 744). They concentrate mainly on identifying changes in areas with a concentration of mobile phone activity during the day (e.g. the shift in high-activity areas from the suburbs to the city centre during the morning hours) and daily population changes and related character (functional specialisation, social environment) in particular location areas.[6] Gradually, the same group of researchers developed a widely applicable real-time monitoring method for the urban environment that could be used for urban planning, transportation management, emergency system planning, and epidemic prevention, known as 'the real-time city' (*Calabrese – Ratti*, 2006; *Ratti et al.*, 2007; *Calabrese et al.*, 2011a). Not only mobile phone location data, where the movement of foreigners/tourists is distinguished from those of the local population, but also data provided by transport systems have been processed in this model.

Even though most studies tend to concentrate on the urban environment, the temporal aspects of population distribution can also be monitored on a national scale (*Deville et al.*, 2014). For geodemographic research, the compatibility of data with existing territorial units is important because it enables researchers to evaluate data in relation to the other characteristics of the localities under study, details of which are available from other types of statistical resources. Several studies have attempted to do this for the Prague metropolitan region (*Novák – Novobilský*, 2013; *Nemeškal – Pospíšilová – Ouředníček*, 2016; N*emeškal et al.*, 2016). One important finding from studies of changes in population distribution, especially in relation to predicting distribution, is the existence of a high degree of regularity in spatiotemporal patterns (*Sevtsuk – Ratti*, 2010; *Sun et al.*, 2011). The monitoring of population distribution during the day does not have to be merely descriptive; it can be used for more advanced or deeper analyses – for example, on seasonal or weather-induced spatial differentiation in the presence of tourists (*Ahas et al.*, 2007c; 2008b) or inhabitants (*Silm – Ahas*, 2010), on the automatic identification of types of land use (*Soto – Frías-Martínez*, 2011), and to assess the temporal aspects of segregation (*Silm – Ahas*, 2014a) or the typologies of daily rhythms (*Nemeškal et al.*, 2016).

Mobile phone location data have enriched mobility research in many ways. The main advantage of using this type of data for studying mobility patterns lies in the possibility of being able to monitor all daily movements (and not only those related to work or school) for any period of time regardless of the person's willingness to fill in a questionnaire/diary. Thus, studies based on mobile phone location data are able to reveal hitherto unknown patterns or aspects of human mobility and behaviour – for instance, similarities in the daily activity patterns of people who work in one area with the same characteristics[7] (*Phithakkitnukoon et al.*, 2010), the high degree of regularity in spatiotemporal movements and the probability of people returning to previously visited locations (*González – Hidalgo – Barabási*, 2008), ethnic differences in areas of activities (activity spaces) as a sign of segregation (*Järv et al.*, 2015; *Silm – Ahas*, 2014b), the relationship between changes in the use of mobile phones and travel behaviour (*Nobis – Lenz*, 2009), between people's daily mobility and their social ties, based on the frequency and length of calls made (*Phithakkitnukoon – Smoreda – Olivier*, 2012), or between people's spatial locations and their calls (*Calabrese et al.*, 2011b).

Moreover, studies need not be limited to assessing the mobility of the local population; they can also reveal patterns in the spatiotemporal behaviour of tourists (*Ahas et al.*, 2007c). By using the social positioning method and adding social characteristics to anonymous mobile phone location data, studies can be significantly enriched and can reveal significant social aspects of daily mobility. For instance,

6) Later studies have evaluated population distribution based on regularly collected mobile phone location data that are not dependent on the calling/SMS activity of the user (*Sun et al.*, 2011; *Nemeškal – Pospíšilová – Ouředníček*, 2016).

7) The authors divide the map of the coastal area of the State of Massachusetts into square cells (500 x 500 m) and to each of the cells they add the main activity that can be expected there (shopping, entertainment, eating, etc.).

Silm – Ahas – Nuga (2013) focus on gender differences in the movement in time and space of suburban populations in Estonia, while *Ahas et al.* (2010a) concentrate on differences in the daily rhythms of suburban commuters. A very detailed monitoring of daily mobility and activities can be obtained by combining analyses of mobile phone location data with in-depth interviews of a relatively small sample of respondents (*Licoppe et al.*, 2008; *Novák – Temelová*, 2012). An example of how mobile phone location data and a thorough knowledge of mobility behaviour can improve health studies is presented by *Madan et al.* (2010), who propose a model for predicting the health status of people from their daily movements and communication practices. Indeed, information derived from mobile phone location data can serve many organizations operating especially in developing countries in delivering healthcare (*Anokwa et al.*, 2009).

Even though mobile phone location data are primarily used to examine daily mobility, studies aimed at internal migration have also appeared over the last few years. Mobile phone location data can enrich migration statistics through the identification of unregistered movements, for instance with seasonal migration (*Silm – Ahas*, 2010). Some studies also reveal the effects of migration on people's behaviour. *Phithakkitnukoon – Calabrese* (2011) focus on the question of how migration influences social ties (their strength, distance, and perpetuation), while *Eagle – Montjoye – Bettencourt* (2009) investigate how patterns of communication change after people move from rural to urban areas and interact with their new social environment. Mobile phone location data can be especially beneficial for obtaining information about daily mobility and migration in developing countries where statistics tend to be of poor quality (*Blumenstock*, 2012).

Knowledge about the temporal aspects of population distribution as well as the mobility patterns of individuals can serve as a suitable tool for regionalisation. *Carlo Ratti et al.* (2010) present a regionalisation of Great Britain based on the interactions between people and compare them with the administrative regions. *Jakub Novák et al.* (2013) introduce the potential of mobile phone location data for mapping commuting flows and functional regionalisation in Estonia. They conclude that mobile phone location data can be an alternative source to traditional data sources. The authors of a research report titled *Delimitation of the Functional Area of Prague Metropolitan Region for Integrated Territorial Investments* come to a similar conclusion, which can also be seen in an opposite sense; the data on commuting flows from the census are still sufficient for functional regionalisation despite the high proportion of uncompleted returns, which was the case for the most recent census (*Ouředníček et al.*, 2014).

POPULATION DISTRIBUTION AND DAILY RHYTHMS BASED ON MOBILE PHONE LOCATION DATA: THE EXAMPLE OF PRAGUE

Until recently, studies on the distribution of the population and their daily rhythms in the Prague metropolitan region were based solely on data from censuses, estimations (*Čermák et al.*, 1995; *Burcin et al.*, 2008, *Pospíšilová – Ouředníček – Křivka*, 2012; *Pospíšilová et al.*, 2012), and surveys (participants' diaries and researchers' observations) (*Doležalová – Ouředníček*, 2006; *Novák – Sýkora*, 2007; *Pospíšilová*, 2012b; *Pospíšilová – Ouředníček*, 2011). Access to mobile phone location data has opened up new avenues for Czech research in this field. They combine the main advantages of the sources of data mentioned here; they can reveal the temporal dimension of population distribution (changes in any frequency), all kinds of mobility (related to all activities), and for almost the entire population. In this chapter, we focus on a comparison of socio-spatial differentiation in Prague based on data from the last census and mobile phone location data. We aim to show and discuss the benefits of mobile phone location data compared to the census data (the benefits of which are already known) to highlight the different potential of both to reveal a pattern of population distribution and its changes, and to emphasise the advantage of working with both of them. Then we present short-term changes in socio-spatial differentiation and examples of daily rhythms in selected localities based on mobile phone location data. The aim of this part is to demonstrate the unstable pattern of population distribution in Prague that can be revealed from mobile phone location data.

Jakub Novák can be considered a pioneer in the use of mobile phone location data in the Prague

metropolitan region and Czechia, in both basic (*Novák*, 2010; *Novák – Temelová*, 2012) and applied research (*Ouředníček et al.*, 2014; *Novák – Novobilský*, 2014; *Pospíšilová et al.*, 2012) in the social sciences. The following example of using mobile phone location data builds on his work and also recently published specialist maps on daily rhythms in the Prague metropolitan region (*Nemeškal – Pospíšilová – Ouředníček*, 2016; *Nemeškal et al.*, 2016). Data were provided by the CE-Traffic company and cover one of the main Czech mobile network operators' users on an average weekday and weekend day in spring 2013.[8] Data cover the users who were present in an urbanistic district (basic settlement unit which is called urbanistic district in Prague and other urban areas) during a one-hour interval. If they moved during this time across more than one urbanistic district, they are considered to be present in the urbanistic district in which they spent the most time.

The real population distribution within Prague differs from the distribution of the residential popu-

Figure 1 Difference between the usually resident population and the number of mobile phone users during the night in cadastral territories

Source: CZSO (2011); CE-Traffic (2013).

8) The days were chosen from a bimonthly period as typical days representative of most other days. Data were calculated to be representative of the entire population by CE-Traffic (http://www.ce-traffic.com/cs/).

lation (with permanent or usual residence) and from that of daily users of spaces based only on commuting to work and school. Traditional data sources have limited power to collect all migratory movements (and thus the real spatial pattern of the residential population) and all daily movements (and thus the real pattern of population distribution). In this regard, mobile phone location data can help to obtain better knowledge of the real pattern of population distribution. Figure 1 shows the difference between the spatial pattern of the usually resident population based on the 2011 census and the spatial pattern of mobile phone users between 3 a.m. and 4 a.m.[9] In Prague, the number of inhabitants with their usual residence there is lower than the number of mobile phone users at any given time, which shows that more people spend the night in Prague than live there. The larger number of users might be due to the presence of foreigners, daily users, people who are not registered as residents, or people who have changed their residence since the last census (*Nemeškal – Pospíšilová – Ouředníček*, 2016). There is no clear pattern to these differences in spatial distribution. It can be seen from the figure that the largest differences appear across the entire city: in the city centre and some of the inner city localities, in several parts of the outer city, and in some quarters in the outskirts (mainly in the western part of the city). In these areas, there are 1.5 times more mobile phone users than the usually resident population. There may be several reasons for this, such as the presence of tourists, services, new residential developments, the Prague ring road as an important traffic hub, or warehouses. Mobile phone users also outnumber residents in most of other cadastral territories that are mostly adjacent to the quarters described here; however, the differences are not that great. More or less the same number of both types of population or even a higher number of residents than mobile phone users is evident in residential quarters away from the main and most frequented traffic routes. Despite the limits of this comparison (data refer to different kind of population), it is useful for demonstrating that the spatial distribution of the registered resident population does not correspond to the real situation at any time.

The distribution of the population in Prague changes over the course of the day (24 hours) in accordance with the pattern and temporal aspects of functional use (here functions serve as what are called 'pace makers') (*Parkes – Thrift*, 1975; *Goodchild – Janelle*, 1983; *Mulíček – Osman – Seidenglanz*, 2011). Figure 2 illustrates how the daily pattern of population distribution differs significantly from that at night (based on mobile phone location data). In Prague in the morning (between 10 a.m. and 11 a.m.) several important concentrations of people are apparent. First, in the city centre, which covers not only the historical core, but also adjacent quarters, some of which serve as secondary centres (Smíchov, Karlín, Libeň, Pankrác and Budějovická), and second, in the area that continues south from these quarters almost to the border of Prague, where there is a hospital of importance to the city and beyond, as well as several centres of shopping and services (SAPA, Centrum Chodov and other areas). Third, in the eastern part of the city there are two areas with a higher daytime than night-time population: one of them is in the northeast part of Prague, which has an industrial history and where subway stations (in Vysočany, Hloubětín, Prosek a Letňany) are located in the vicinity of shopping and office areas, and two small airports, a multifunctional exhibition centre, and several production and storage areas are situated (Vysočany, Kbely, Satalice); and the second is not completely separate and is located to the southeast, where there is a large industrial zone and shopping centres. In the western part of Prague, the belt along the edge of the city creates a distinct pattern that is clearly related to the presence of the Prague ring road, which together with other functions, including being the location of several production and storage areas (Třebonice, Řeporyje, Radotín, Modřany), a shopping centre (in Třebonice), and an international airport (Ruzyně), are probably the reason for the predominance of a daytime over a night-time population.

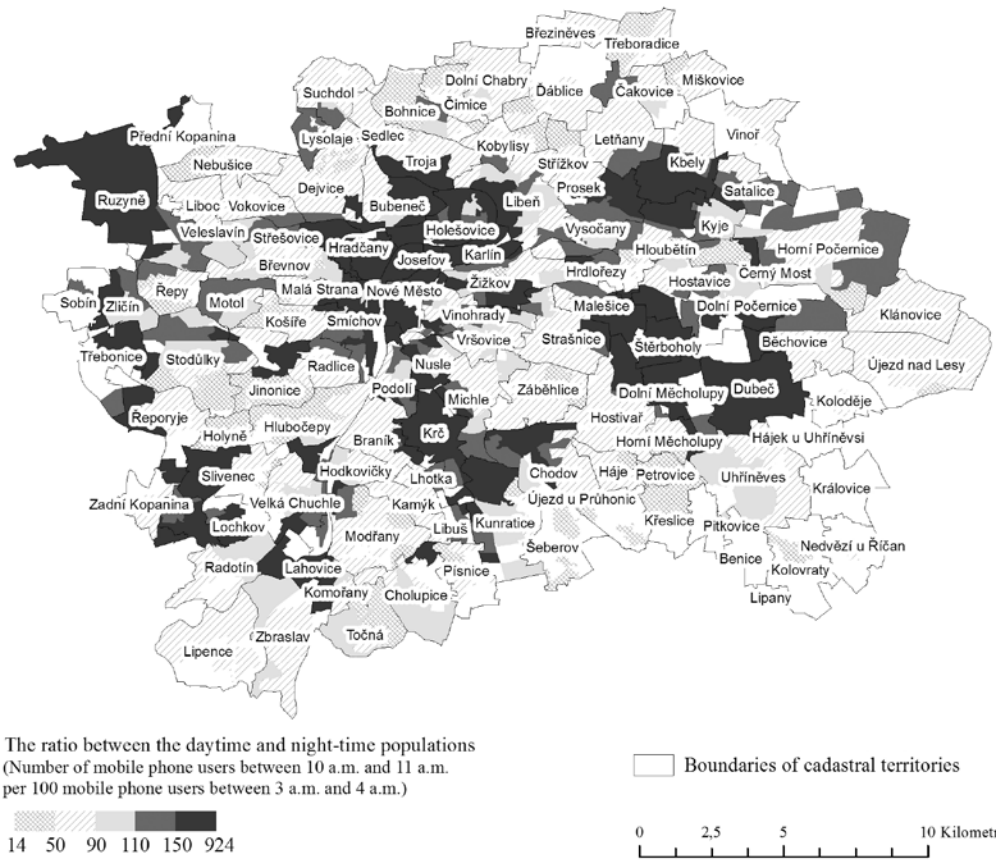
To summarise, in Prague the daytime population is (not surprisingly) over-represented in those

9) This pattern does not refer to the real resident population; it refers to the night-time population, i.e. people present in a given locality during the night.

quarters with a smaller number of inhabitants and a concentration of functions related to production and consumption. Transportation infrastructure, such as subway stations and main roads,[10] is also revealed to be important in this respect. Thanks to the high level of detail on the generated map, many other smaller concentrations of daily population can be identified, such as at shopping centres in the vicinity of housing estates (e.g., Černý Most, Čakovice). The rest of Prague, mainly residential areas situated all over the city, lose their populations during the day, and thus the daytime population is under-represented in these parts.

The pattern of socio-spatial differentiation in Prague remains unchanged almost all day. The concentrations of the daily population are not affected by changes in daily activities; however, they do gradually shrink over time (see Figure 3). Only a few smaller areas such as the city centre and the international airport, where the daytime population significantly outnumbers the night-time population, remain stable until the evening (8–9 p.m.), whereas the population

Figure 2 Areas (urbanistic districts) with a high concentration of daily users, spring 2013

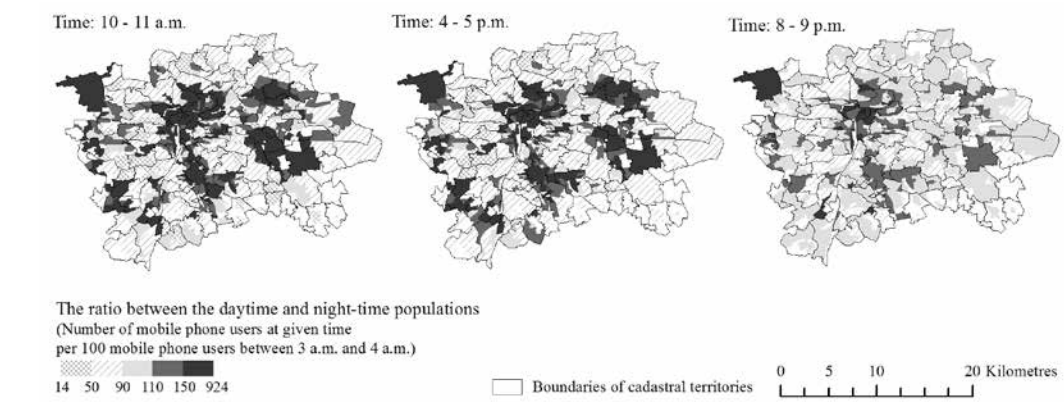


Source: CE-Traffic (2013).
Note: Urbanistic districts with no mobile phone users are shown in white.

10) The effect of the Prague ring road is also apparent in the eastern part of Prague.

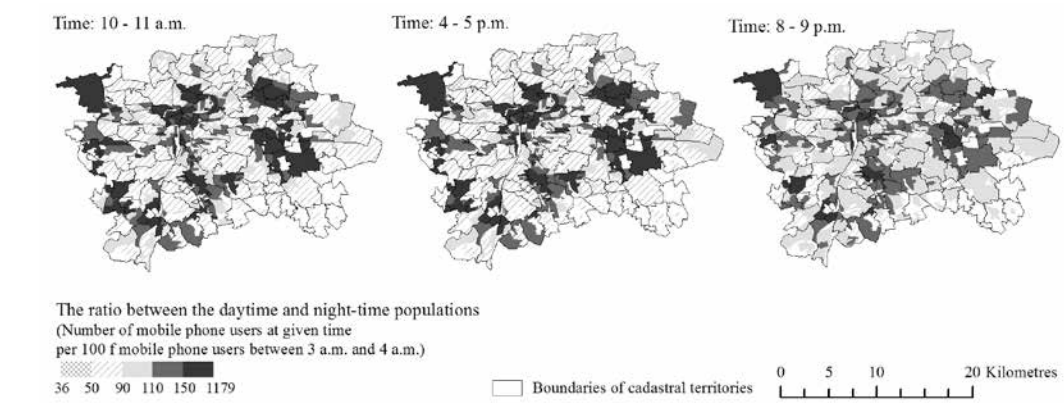
in the other localities decreases more quickly. Even in the evening, however, all the localities with high concentrations of daily population are still visible on the map. A very similar pattern of population distribution can be observed during the weekend (see Figure 4). The areas of concentration of the daytime population in Prague at the weekend are smaller than on weekdays mainly because of the reduced presence of people in industrial and office areas; some of these areas even disappear from the map. However, there are also fewer people present in parts of the city centre that are not attractive to tourists, primarily where residential buildings and government institutions prevail. These areas also shrink over time, yet overall the presence of people is significant in more localities than during weekdays.

Figure 3 Pattern of population distribution based on mobile phone location data during the weekday, spring 2013



Source: CE-Traffic (2013).
Note: Urbanistic districts are depicted in the maps. Urbanistic districts with no mobile phone users are shown in white.

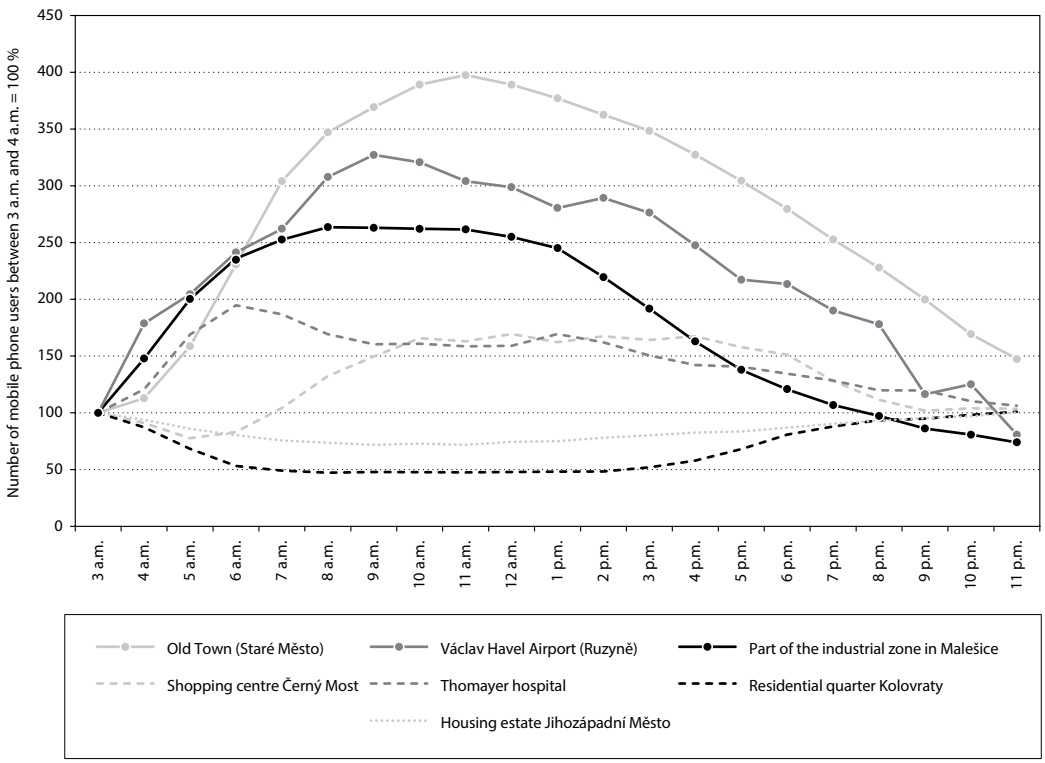
Figure 4 Pattern of population distribution based on mobile phone location data during the weekend, spring 2013



Source: CE-Traffic (2013).
Note: Urbanistic districts are depicted in the maps. Urbanistic districts with no mobile phone users are shown in white.

Variable socio-spatial differentiation is reflected in the distinctive daily rhythms of particular localities.[11] Usually, localities with similar functional patterns share the same daily rhythm (for instance, *Jiří Nemeškal et al.* [2016] identify nine types of daily rhythms in the cadastral territories of the Prague metropolitan region) and the same kind of function can be identified in the daily rhythms of all localities where it is present (*Pospíšilová*, 2012b). Figure 5 provides examples of the daily rhythms in selected localities that have different functions within the city of Prague.[12] As the functional specialisation is the most important factor influencing daily rhythms (*Goodchild – Janelle*, 1983; *Pospíšilová*, 2012b), each curve in the graph has a different shape; both the ratio between the daytime and night-time populations and temporal variations of population differ. Three localities exhibit a large difference between daytime and night-time populations, namely the Old Town in the city centre, the industrial zone, and the airport. The difference is greatest in the Old Town. Compared to the other two localities, the increased influx of people takes place later in the day here. On the other hand, the population starts to decrease much earlier in the industrial

Figure 5 Daily rhythm of selected localities in Prague, spring 2013



Source: CE-Traffic (2013).

11) The daily rhythm of a locality is a temporal pattern of daily use that arises from a combination of functional specialisation, the other characteristics of the locality, and the everyday lives of a diverse range of people (*Goodchild – Janelle*, 1983; *Pospíšilová*, 2012a).

12) The localities (one or more urbanistic districts) were selected to represent typical urban functions and their temporal patterns.

zone than in these other two localities. This is because these localities are frequented by different types of daily users. The daily rhythms in the other two non-residential localities are much more balanced. In the hospital area, the effect of the early morning rush hour is apparent and this is followed by a relatively constant number of people being present during the morning time and a gradual decrease in the afternoon. In the shopping centre, the population increase is determined by shop opening hours (only during daylight hours) and is therefore not apparent until 7 a.m. The two residential quarters have inverse daily rhythms; they lose population during the day. The decrease is larger in Kolovraty, a residential quarter on the outskirts, because there are no other important functions there. In contrast, the housing estates in Prague are well equipped with service facilities, so the presence of other functions (mainly shopping and services) results in a lower population decrease during the day.

THE USE OF MOBILE PHONE LOCATION DATA: A DISCUSSION OF THE CURRENT SITUATION AND FUTURE DIRECTIONS OF GEODEMOGRAPHIC RESEARCH IN CZECHIA

The use of mobile phone location data represents a big challenge for geodemographic research. There is no doubt that this new technology has changed both mobility behaviour and the functioning of society as a whole (*Ratti et al.*, 2006). However, it can also help us to study it by exploring our constantly changing reality in order to help us to gain a deeper understanding of the spatial aspects of human behaviour. Because demographic behaviour is influenced by local as well as national or even global socio-spatial contexts, acquiring knowledge of the temporal characteristics of spaces on different scales is of great importance for demographers (*Entwisle*, 2007). Although the use of mobile phone location data in various research fields has evolved rapidly in recent years, there are still relatively few demographers[13] who are taking advantage of the detail that these data can provide. Therefore, there is great potential for demographers to formulate new questions on, and seek answers to existing questions in, both (geo)demographic and mobile phone data research topics (see also *Palmer et al.*, 2013). As in many other European countries, research based on mobile phone location data is still at a nascent stage in Czechia (c.f. Estonia). Only a few teams in the country are developing this kind of research (e.g. Research and Development Centre for Mobile Communication, Czech Technical University in Prague; the Urban and Regional Laboratory, Faculty of Science, Charles University in Prague; and the Faculty of Informatics and Statistics, University of Economics, Prague),[14] although the Prague Institute of Planning and Development has also recently started to use mobile phone data for its analyses.

The main obstacle to the wider use of these data in (geodemographic) research is, in our opinion, their availability. Developing a cooperative relationship with mobile operator(s) is a relatively problematic process because they tend to regard their data as classified and are concerned about losing the trust of their customers (*Novák*, 2010). However, these concerns are gradually being overcome and we have witnessed a spread in the use of mobile phone location data in both the private and public sectors, as well as in basic and applied research in Czechia. Strictly speaking, cooperation between mobile operators and researches is not necessary, as several private companies offer mobile phone location data for purchase, but these have a high financial cost. The character of the data that can be obtained for (geodemographic) research is also dependent on a relationship with a mobile operator or company to provide the data. If we omit cases where the written consent of the mobile phone user is necessary, we can say that it is possible to get data about the area of a mobile phone's location and cross-border movement based on the active use of mobile phones by their users or regular location updates. These data require subsequent processing before they can be used in social research. From our experience, data on the number of mobile phone users (sorted based

13) Mobile phone data research is being developed in geography more than in demography.

14) More people in Czechia probably use mobile phone location data for their research; however, the outcomes are not easy to trace.

on the location of mobile phone [residents, commuters to work, other users] or origin of SIM card [Czechs, foreigners]) in basic settlement units for each hour are of relatively sufficient accuracy. In addition data on traffic flows have been already tested in Czechia. Indeed there are other kinds of data that could be obtained from databases of mobile operators; however, the possibility to use them is always based on the willingness of the mobile operator to provide them and also on data accuracy, which needs to be tested. Establishing cooperation between mobile operators and national statistical offices (*Novák*, 2010) would offer the greatest benefit to researchers. However, such cooperation is at present unlikely in Czechia.

Overcoming other disadvantages goes hand in hand with using these data in the research. For demographers, the lack of information on the social characteristics of mobile phone users and the ambiguities and inaccuracies in the data are the two main deterrents to using these data in their research. However, both these problems can be addressed within the framework of interdisciplinary cooperation with, for instance, social scientists. The first problem has already been solved to some extent by supplementing mobile phone location data with data derived from questionnaires (*Ahas et al.*, 2007a; *Liccope et al.*, 2008; *Ahas et al.* 2010a). Developing other methods for linking anonymous data with users' identification details by, for instance, obtaining data from the contracts of mobile operators' clients or by connecting mobile phone data with other available data sources could be the next step in overcoming this drawback. However, the adoption of such methods raises the issue of privacy, which is another problem that needs further discussion (*Ratti et al.*, 2006; *Novák – Temelová*, 2012). It is, of course, essential to establish rules for using data that are not completely anonymous as well as for preventing data from being misused. As *Jakub Novák* (2010) points out, we could find inspiration from how census data are managed in this regard. However, it is necessary to add that not all identification details jeopardise the anonymity of mobile phone users. For instance, in Estonia, researchers obtain information about the ethnicity of mobile phone users from the language used for communication with the operator (*Silm – Ahas*, 2014a). The second disadvantage mentioned above, that of ambiguity and inaccuracy, lies in the lack of knowledge about the practices of mobile phone users (such as their use of two or more mobile phones or SIM cards, the times and reasons for switching the phone on and off, discrepancies in the movements of the mobile phone and its user, etc.), incompatibility of spatial and administrative units with network cells, and related decision-making procedures about the final location of mobile phones.[15] Other issues with respect to accuracy include, for instance, the rapid movement of a mobile phone (e.g. on the road) or the connecting of a mobile phone to a BTS other than the one nearest to it. All these issues need further research, which should ideally be coordinated to avoid the simultaneous and repeated search for solutions to the same problem. Czech research teams could also obtain inspiration from Estonia in this regard. However, it is possible to say that all of these discrepancies do not significantly reduce the data quality if triangulation of data sources is applied. This technique is very often employed by mobile phone data providers before the data reach the end users. To conclude, we are convinced that, despite some shortcomings, the use of mobile phone location data offers great potential for Czech geodemographic research and we think that it would be a missed opportunity if these data were not used. The aim of this paper has been not to prescribe how this should be done, but to initiate a wider discussion among demographers and those working in the field in Czechia in particular, and thereby to open the door to new ways of using mobile phone data and to new insights into (geo)demographic processes.

15) In the example of Prague presented in this paper, some inaccuracies can also be seen: in some urbanistic districts a large number of mobile phones were recorded even though there is no apparent reason for their presence. They were probably located in adjacent districts.

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THOMAS ROBERT MALTHUS (1766–1834)

Zdeněk Pavlík[1)]

ABSTRACT

Thomas Robert Malthus was born into a wealthy intellectual family in 1766. Malthus tried to discover the reasons for great changes in economic, social and demographic development and he saw them in the overly rapid pace of population growth in relation to the availability of sources of subsistence. He was the first person to formulate a simple mathematical expression for this problem. He published an essay on the problem anonymously in 1798 as a reaction to the optimistic views of his father's friends and he was surprised by the large response it got from the public. His essay had its admirers but also some harsh critics. He was aware of the shortcomings of the text; it was more a pamphlet than a scientific work. He devoted the next five years after the essay's publication to studying this subject, visited several countries, and published his findings in another essay in 1803 that was three times longer and was released under his name. This second essay presented many new ideas and he put much more emphasis on the moral restraints of population growth.

Keywords: Thomas Robert Malthus, population growth, overpopulation, checks of population growth, Malthusianism

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LIFE AND FAMILY

Robert Malthus (he did not use his first name) was born on 13 February 1766, just 250 years ago, as the seventh child and the second son of Henrietta Catherine and Daniel Malthus. He grew up in Westcott, near Doping in Surrey. His father Daniel was a free-thinker from a well-off family and a friend of David Hume and Jean Jacques Rousseau. Malthus's discussions with him father very much influenced his intellectual development, although the two men often differed in their views. He received his earliest education at home, when the family was living in Bramcote, Nottinghamshire, and he then went on to study at Warrington Academy, which was a school run by dissenters from the Church of England and at that time the school was approaching the end of its existence. It closed in 1783, when Robert was 17 years old, and a year later he entered Jesus College in Cambridge. He received a scholarship to study English declamation, Latin, and Greek, ultimately graduating with honours. He also successfully studied mathematics. He received an MA degree in 1791 and was elected a Fellow of Jesus College two years later (*Wikipedia*).

He resigned the fellowship after eleven years in order to marry. The Church of England allowed clergymen to marry, but Cambridge was not as liberal towards its fellows. He married his cousin Harriet in 1804 (he was 38 years old by that time), the daughter of John Eckersall of Claverton House, St Catherine's, near Bath, Somerset. The couple first had a son (he was born 8 months after the marriage) and then two daughters. In 1805 he was appointed to the first chair of political economy in England, at the East India College (which later became Hailey bury), where he remained until his death. He passed away sudden-

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ly of heart disease on 29 December 1834 (although a different date, 23 December, is given, for example, can be found e.g. in the Encyclopaedia Britannica, 1911) aged 68 in Bath, Somerset. He was buried in Bath Abbey. His contemporaries describe him as tall and good-looking, but with a cleft lip and palate, which affected his speech. He inherited this defect from his ancestors (*Wikipedia*; *Himmelfarb*, 1960; *Šubrtová*, 1989; *Loužek*, 2010). He refused has his portrait pained up until the last year his life, so there is only one portrait of Malthus that exists.

THE IMPORTANCE OF DEMOGRAPHIC REPRODUCTION

Demographic reproduction is basically a biological process that is identical to processes in any population of mammals. Human beings are born in the same way as individual members in the species of apes, wolfs, and elephants. They acquire the social part of their existence as soon as they are born. It is not just the first light in their life, but caresses and the maternal voice that are equally or even more important, as they involve emotions and are the start of the individual's further education. Herein lies the emotional significance of the maternal language. Every child born has to be accepted into society. His exposure, even if saved by other than human population, prevents him to become a human being. The vocal cords are not completely formed at the moment of birth; they gradually develop as the child repeats the words he or she hears. Both basic demographic processes occur within a biological frame. Natality is limited by the duration of a woman's fecundity and mortality is limited by maximum age. All human beings are mortal, like every other living creature. Demography, by studying the renewal of the human population, is therefore a bio-social discipline.

The renewal of any population is essential for its natural continuation. Were it to cease, that would be the end of human existence. Sufficient food or sources of food generally is another precondition for life and the reproduction of any population. Leaving aside changes in climate, which have effects over very long periods of thousands or millions of years, the amount of food does not affect the existence of the population as a whole, but has a decisive effect on its size. Data are not available for the prehistoric period, so we can only speculate. The numerical growth of the human population was very slow on average in that period because the differences between the levels of natality and mortality were very small or the levels were equal or the mortality was even higher in certain periods. The numerical size of individual populations was very limited during the hunting and gathering period before permanent settlement. Migration was important at that time for social development for two main reasons. The first reason was that it safeguarded the biological unity of the human subspecies Homo sapiens sapiens by mixing genes from various populations.

Human populations became societies in the process of development, as advances occurred in the division of labour, social groups (structures) emerged, and more sophisticated forms of social organisation took shape. This came with the Neolithic revolution based on agriculture, which required stable settlement and allowed the emergence of large populations by increasing food sources to previously unthinkable level. We call these societies civilisations, and they developed specific cultures with the strong rules, traditions, and ideology. Stability is very important for this kind of culture, but there is a danger that further improvement will stop if stability exists for too long. Migration can have a stimulating effect on an immobile culture, and this is its second important reason for the importance of migration for human development. However, a harmonious balance must be maintained between the cultural stability and new impulses, otherwise chaos could emerge.

The renewal of human populations in relation to their sources of subsistence was the main concern of mankind in history, and it still is so now and will continue to be in the future. Speculations about prehistorical times could be replaced by following the history of thought about population, in which two lines of thinking can be identified:

1) The optimistic belief in the harmonious development of population, which existed especially during the Enlightenment with its idea of human equality, and the unshakable believe in the omnipotence of human reason and knowledge;
2) The dread of overpopulation, the fear of surpassing certain limits of growth. In its less exagge

rated form this outlook sought to determine an optimum population size or a stable number of people, usually in reference to specific countries. An interest in the planet as a whole began only in the second half of the 20th century, when the demographic revolution entered its second period. It was ending in developed countries and it spread to developing ones.

People have been formulating ideas human renewal and sources of subsistence since even before the existence of literature, doing so for millennia years ago with the aid of various pictures and statutes. The statuettes of Venus and the pictures of hunting beasts in the Palaeolithic period confirm this. Pictograms, followed by cuneiform and hieroglyphic writings in Mesopotamia and Egypt were the next step in the development of literature. Different scripts emerged (e. g. Semitic, Sino-Tibetan, Greek, Latin), which originally expressed a certain notion gradually acquiring the notion of a sound in speech, which evolved into a syllable and finally into words. This process differed in individual language groups.

True literature emerged in the third millennium before Christ and it would be impossible to trace all its further progress here. We can only state that Thomas Robert Malthus had many predecessors in addressing the relationship between population growth and available sources of subsistence, although none of them is as well known. Writings of this nature often had a religious, ethical or judicial context (*Šubrtová*, 1989). It is interesting that first notable writings originated in Mesopotamia, which is situated at a point of contact between three continents – Africa, Asia, and Europe. We can assume that all intercontinental migrations had to cross this location and brought with them new impulses. This territory was also very well suited for the development of agriculture. The Code of Hammurabi is the oldest known work of writing; it was created during the reign of King Hammurabi (1793–1750 BCE). Mention should also be made of the Bible already from the 1st millennium, the Old Testament, the Torah, the Talmud, and the writings of Zarathustra (660?–583 BCE), Confucius (552–479 BCE), Buddha (563–483 BCE) and many others. Religious texts usually take a favourable view of population growth. Confucius' writings are one exception. He sought an optimal relationship how many people were necessary in a population and the available agrarian land. He advised the ruler to ensure the granaries were full for periods of poor harvest. However, were such periods to recur too often, the emperor would have limited ability to deal with the problem, so he suggested also forcing people to migrate to less populated areas and admitted that very high population growth leads to poverty and social problems. Some other Confucian authors assumed that the insufficient supply of foodstuff would cause an increase in mortality levels (*Šubrtová*, 1989: 24).

Many diverse civilisations existed in the word up to now. Same of them vanished completely, others transformed into new ones. The world-renowned historian Arnold Joseph Toynbee (1889–1975) identified first 21 and then 31 civilisations, while Samuel Huntington (*1927), in his famous works on the clash of civilisations, pointed first to 6 and later 8 civilisations that exist today. Our Western civilisation is affiliated with the former Hellenic and Assyrian civilisations that now only exist as subjects of historical study. These problems of historical civilisations have also been extensively discussed in an excellent book by Jaroslav Krejčí (1916–2014). He showed how various civilisations transformed over time and described the complicated evolution of different societies and states and the economic, social, and political consequences of their development. Thereby he touched the general and specific patterns of development (*Krejčí*, 2002).

THE ORIGIN OF WESTERN CIVILISATION

Greece is considered the cradle of Western civilisation. This is not surprising when we look at the map. Its relative geographical proximity to Mesopotamia, Egypt, and the Aegean islands helps to explain this. Greek thinkers had a decisive impact on the development of Western culture. Plato (427–347 BCE) and Aristotle (384–322 BCE) were contemporaries of Confucius. According to Plato, in the perfect state, people would not produce children if they lived in fear of poverty and war. He argued that it was up to the guardians of the state to ensure an optimal population size and keep it stable. Today these ideas smack of social engineering. He also recommended the supervision of marriages. When the population

size decreased below a stable level, the guardians could introduce measures to restore the optimal number of people. He mentions migration as one measure for keeping the population stable. Aristotle followed with similar ideas. He was strongly against leaving numerical population growth up to people and without any restrictions (*Šubrtová*, 1989: 47). These opinions surely served as a good source of inspiration for Thomas Malthus. Aristotle's writings were also important for the development of science: He distinguished the first and second philosophy, the first being mythology and the second the study of objective reality (which comprises all the scientific disciplines known today).

Roman culture was a continuation of Hellenic civilisation and the transfer station to Western civilisation. The organisation of Roman society and its political system were also considerably shaped by Greek intellectual influence. The Roman republic acquired through war large territories in Africa, Asia, and Europe, around the Mediterranean Sea, the southern borders of the Black Sea, and almost all of southern and western Europe. Roman expansion continued even after the republican establishment was finally removed and the Empire was established by Augustus in the year 27 BCE. Long-running wars required soldiers, so the numerical population growth and the growth of families were officially endorsed, for example, by law. Marriages and families were supported in the famous *'lex Papia et Poppaea´* from the beginning of the first century A.D. Roman law was well developed is still taught at many universities around the world to the present day. The New Testament, which was gradually compiled on the basis of the Revelations of the Apostles, also adopted a favourable attitude towards families, children, and population growth. It became the basis of Christian religion, represented first by the Roman Catholic Church, which acquired its name when its main representative and first pontiff Peter moved from Jerusalem to Roma in the year 42 AD. Other Christian churches were later created, Christianity with one Christ – God became a world religion and one of the fundaments of Western civilisation.

Scholasticism was the leading ideology in the Middle Ages; Thomas Aquinas (Doctor Angelicus, 1225–1274) was its main representative. He followed the Bible's commandment: the population should multiply and fill the Earth (crescite et multiplicamini et replete terram). From this point of view he criticised Aristotle's idea about the need to keep the size of the population stable. The scholastic ideology was not favourable for the development of science, with the exception of such formal disciplines as mathematics and logic. Some ancient scientific writings were banned. Western civilisation entered a new period of development in the 15th century. The new continent of America was discovered, the bishop of Siena Francisco Patricio (1412–1494) stated in his book *De institutuione Reipublicae* (published first in 1569) that a too large population in relation to a lack of land and unemployment could create problems. He quoted Aristotle and agreed with his ideas concerning migration (*Šubrtová*, 1989: 149). He is also one of the predecessors of Robert Malthus. Niccoló Machiavelli (1469–1527) is another one, as he equated population size with wealth and power, but stated that if the number of the population surpasses its means of subsistence and even emigration cannot help overpopulation, then famine and disease would follow.

Important steps forward were made in the 16th and 17th centuries. Francis Bacon (1551–1620) had probably the biggest influence on the formation of natural philosophy and the rejection of scholasticism. His life work was the Great Instauration, which remained incomplete. He sought to lay the foundations of the sciences entirely anew, with a new inductive method and logic, and subjects such as Phenomena of the Universe, natural history, and finally the New Philosophy or Active Science (*Hesse*, 1964). He was the first representative of empirical science. Concerning population, he focused more on the quality of population then its number. In the absence of demographic data he expressed the opinion that England had a larger population than it needed. His imminent successor was Thomas Hobbes (1588–1679), who in his youth was Bacon's secretary. He wrote several books, some of them are widely known, such as *Leviathan* and *De Cive*. In the latter he related the number of people to the quantity of food, and argued that if it were not possible to nourish all the population, then some people would have to be sent to the colonies; if the world became too full, the last remedy would be war (*Flew*, 1964).

THE WRITINGS CLOSEST TO THE TOPIC OF THOMAS ROBERT MALTHUS

Many other authors touched on the population problem in the 18th and 19th centuries, when Thomas Robert Malthus published his famous essay. Some of them were a source of inspiration for him in a positive or negative sense, and here they will be mentioned in order of preference for him. François Marie Arouet (known as Voltaire; 1694–1778) was one influence. In his *Philosophical Dictionary* (1764) he ridiculed the opinion that the world was more populated before the deluge and had 5 milliard inhabitants. He mentioned the growth of cities in recent centuries. Never in the past had the world population size been so big and it was steadily rising. Jean Jacques Rousseau (1712–1778) was not only the author of the Social Contract, but also a friend of Robert's father Daniel and Robert's godfather. He devoted considerable attention to population questions. He was aware of the complexity of the various causes of population development, both external (climate, quality of land, geographical position) and internal (social organisation, legislation, religion, good governance). The full acceptance of human rights would guarantee harmonious population development. His ideas served as the basis for the Declaration of Human Rights (1789) and for the Jacobin constitution (1793), even if he was not revolutionary. From his writings it is possible to sense that he was in favour of attaining an optimal population size without actually saying so. He did not however fear overpopulation (*Šubrtová*, 1989: 194).

Three other authors should be mentioned in this context. Robert Wallace (1694–1771) thought that the population increase was slowing compared to previous ages. It is interesting that he noticed lower population growth in cities and then in the countryside. He supported population growth as a believer of physiocratic ideology. Benjamin Franklin 1706–1790) ruminated in his writings on different cases of population growth in Europe and America. He estimated that the population in America doubled every 25 years. However, he was an optimist about the future. He did not expect any shortage of food but he was aware that in every country the situation would be specific. (*Šubrtová*, 1989: 226). The third name mentioned here deserves much more attention than we will give him here. It is the famous philosopher David Hume (1711–1776), who touched on many social problems, among them demographic reproduction. He thought that the parental instinct is so important for every population that only a bad government would try to prevent its fulfilment. Population growth is then a sign of good government (*Flew*, 1964). Without a doubt, Malthus was familiar with all their writings.

Robert Malthus was an economist, but his significance for demography is similar to that of its founder John Graunt (1620–1674). Malthus's essay drew wider attention to population problems. John Graunt was a follower of Bacon's ideas of natural philosophy, as he stated modestly in the introduction to his *Political Observations* (1662). He was also the cofounder of statistics together with William Petty (1623–1687). Robert Malthus was mainly an economist and follower of Adam Smith (1723–1790), who subordinated demographic reproduction to economic reproduction. He stated that the demand for people, like any other form of demand, necessarily also determined the 'supply' of people (*Smith*, 1958: 96; *Pavlík et al.*, 1986: 594). Malthus did not criticise this statement, so we must assume that he agreed with it. This idea is the basis for his population law. I have not discovered whether they were in contact, but Malthus was 34 years old when Adam Smith passed away, so they may have been. After Smith's death he became the main representative of the classical economic school together with David Ricardo (1772–1723), with whom he was in frequent contact. Although they represent the same school, they differ slightly on several questions. Adam Smith could be labelled an optimist about population growth. A larger population is favourable for the economy, because it allows a more advanced division of labour. Robert Malthus, on the other hand, deservedly earned the mark of a pessimist owing to his population law. If his law were right, then mankind would be on the road to ruining itself. This is the law of geometrical progression.

The next two authors are directly responsible for Malthus's work. Both of them were friends of his father David, who agreed with them. Marie Jean Antoine Nicolas de Condorcet (1743–1794) was the older one. He was a representative of the age of the Enlightenment, a philosopher, mathematician, and friend of Voltaire and of Ann Robert Jacques Turgot (1727–1781). Condorcet was an incorrigible optimist but

a rational thinker. He was of the opinion that nature did not place any limits on human ability and that the potential for human improvement is unlimited. The only limitation lies in the Earth's existence, not among the people. He criticised social organisation that leads to the inequality of states and human beings, to nationalism, to international dupery and to the efforts of powerful states to divide the world according to their interests. The hope of a better future for society is tied to three requirements: removing inequality among nations, establishing equality among human beings, irrespective of their origin, and improving human character through education and health care. He did not fear overpopulation. He believed in permanent and continual progress. According to him, it would be necessary to stop population growth in the future, but that time was still far away. The people would find enough food before then or would rationally stop growth. In his writings it is possible to identify the feeling of certain features of the demographic revolution, which had already started in France, unnoticed, by that time. Condorcet died in prison from exhaustion and his main work about the progress of the human spirit was published only after his death (*Šubrtová*, 1989: 257).

William Godwin (1756–1836) was the second author who inspired Malthus. He was considered as utopian with anarchist leanings. His work on political justice (1793) sparked a wide response, as did Malthus's essay later on. His publication was especially welcomed by radical proponents of social reforms and the emancipation of women and by artists and writers. Godwin attacked the throne, religion, and leaders. The content of his writings can be summarised in the following points. Man made significant progress in the past. Evil stemmed from the ill functioning of institutions, which are the means of oppression and domination. All governments should be liquidated. The ideal society consists only of free individuals. No bigger organisation of authority should be accepted than the parish. The unequal distribution of wealth should be removed. Marriage as an institution should disappear. Man is capable of unlimited progress in the future if people control themselves with the use of reason. He went beyond the limits of the Enlightenment with his irrational support for individualism and refusal of the state authorities. He was very optimistic about population size, too. According to him, three-quarters of the Earth was still unused and even populated land could support more people than it was. The size of the population could grow for a billion years and the Earth would provide them with enough food, and he felt that it was likely that overpopulation would not occur even in the distant future (*Godwin*, 1973, II: 893). In spite of the utopian character of Godwin's writings it is interesting to observe that he had certain ideas about future changes in the character of demographic reproduction. He envisioned a situation in which reason would overcome the libido and so the number of children born would be managed accordingly. He had the same ideas as Condorcet. However, the features of the coming demographic revolution were more evident in France than in England. Given the lack of statistics it is difficult to say more. The first population censuses were not held in France or England until 1801.

THE FIRST EDITION OF MALTHUS'S ESSAY

The title of Malthus's book characterises its content well: *An Essay on the Principle of Population as it affects the future improvement of society with remarks on the speculations of Mr. Godwin, M. Condorcet, and other writers.* First, we have to imagine the social situation of the majority of the working population in England during the last decade of the 18th century. The first accumulation of capital was occurring in this period. Industry was already in the stage of rapid development and needed workers. There was a sufficient number in the countryside, where there was not enough employment, so those people were ready to move to the cities. However, cities were not prepared to receive a huge number of immigrants from the countryside. There was a lack of dwellings for families with many children and the city's infrastructure was insufficient. Children had to work instead of going to schools. Working time was long. The level of mortality was high but already slightly decreasing, and health was also poor. Poverty could be felt everywhere.

We cannot be surprised that Malthus, in confrontation with harsh rough reality, after reading the writings of Voltaire, Condorcet and Godwin, and after the discussion with his father, who shared their

opinion, was led to adopt the approach to the population problem that he did. Daniel Malthus belongs among the many English intellectuals who responded sympathetically to the French Revolution and admired the utopian writers. He was a country gentlemen and a great admirer of Rousseau. One of Rousseau's essays, 'Avarice and Profusion', published in the *Enquirer* (1797), propounded the thesis that a state of cultivated equality is the most consonant with the nature of man, and the most conductive to the extensive diffusion of wellbeing. Daniel Malthus defended Rousseau's ideas and this led to a conflict with his son Robert. Against his father and against all utopians Robert argued that there was one fatal obstacle to such a state of equality and felicity: the inevitable tendency of the population to exceed the food supply. His father encouraged him to write down all his arguments. He developed these ideas quickly and had published them anonymously by 1798; the preface is dated 7 June (*Himmelfarb*, 1960: xvi). The essay is generally attributed to him, but it is probable that his father read it before publication.

The essay consists of nineteen chapters and a short preface and a total of 143 pages. The aim of the essay is in the beginning of the preface: 'The following Essay owes its origin to a conversation with a friend, on the subject of Mr. Godwin's Essay, on avarice and profusion, in his Enquierer, [i.e. the volume of his essays, published under the title *The Enquierer*, in 1797; note of ZP]. The discussion started the general question on the future improvement of society; and the Author at first sat down with an intention of merely stating his thoughts to his friend, upon paper, in a clearer manner than he thought he could do in conversation. But as the subject opened upon him, some ideas occurred, which he did not recollect to have met with before; and as he conceived that every last light, on a topic so generally interesting, may be received with candour, he determined to put his thoughts in a form for publication.' He apologised further that he had written the essay quickly and that he was aware that 'a collection of greater number of facts in elucidation of the general argument would be needed'. In the preface he expressed his main thesis that it 'is an obvious truth, which has been taken notice by many writers, that population must always be kept down to the level of the means of subsistence; but no writer that the Author recollects has inquired particularly into the means by which this level is effected: and it is a view of this means whish forms, to his mind, the strongest obstacle in the way to any great future improvement of society.' At the end of the preface he displayed his modesty. He wanted to draw attention to the more able men who are able to conceive what the principal difficulty is on the path to improving society, promising if we as a result 'see this difficulty removed, even on theory, he will gladly retract his present options and rejoice in a conviction of his error' (*Himmelfarb*, 1960: 3).

Robert Malthus was aware of the great progress that had been made in the 18th century in all social processes and in the sciences and technology. Without mentioning Francis Bacon he picked up on his natural philosophy and used inductive methods to study society. Let's give him the opportunity to express himself. At the beginning of the first chapter, he clearly summarised his opinion: 'The great and unlooked for discoveries that have taken place of late years in natural philosophy, the increasing diffusion of general knowledge from the extension of the art of printing, the ardent and unshackled spirit of inquiry that prevails throughout the lettered and even unlettered world, the new and extraordinary light that gave been thrown on political subjects which dazzle and astonish the understanding, and particularly the tremendous phenomenon in the political horizon, the French revolution, which, like a blazing comet, seems destined either to inspire with fresh life and vigour, or to scorch up and destroy the shrinking inhabitants of the earth, have all concurred to lead able men into the opinion that we were touching on a period big with most important changes, changes that would in some measure be decisive of the future fate of mankind.' (ib, p. 5)

Further he expressed two postulates: 'first that food is necessary to the existence of man and secondly that the passion between the sexes is necessary and will remain nearly in the present state. These two laws, ever since we have had any knowledge of mankind appear to have been fixed laws of our nature, and, as we have not hitherto any alteration in them, we have no right to conclude that they will ever cease to be what they now are, without an immediate act in that Being, who first arranged the system if the universe, and for

the advantage of his creatures, still executes, according to fixed laws, all its various operations.' (ib., p. 8) He continued in a similar way: 'Assuming then, my postulata as granted, I say, that the power of population is indefinitely greater than the power in the earth to produce substance for man. Population, when unchecked, increases in a geometrical ratio. Subsistence increases only in arithmetical ratio.' (ib, p. 9)

'This implies a strong and constantly operating check on population from the difficulty of subsistence… Among plants and animals its effects are waste if seeds, sickness and premature deaths among mankind, misery and vice. The former, misery, is an absolutely necessary consequence of it. Vice is a highly probable consequence, and we therefore see it abundantly prevail, bit it ought not, perhaps, to be called the absolutely necessary consequence. The ordeal to virtue is to resist all consequences of evil.' (ib, p. 10) In the next chapter Malthus developed the idea of the geometrical ratio of population growth when no restrictions exist. He was fascinated with this invention and this is probably also one of reason for its popularity. It is a sample mathematical formula, which anyone with an elementary knowledge of mathematics can understand. We would call this growth exponential. In reality, no social process could be expressed in such a simple way. No growth can be permanently exponential. P. F. Verhulst, four decades after Malthus, developed his own logistic curve (1838), based also on the idea of exponential growth, but comprising a fixed limit. It can be called a compound exponential curve and it fits the population growth of some countries – for example, the United States in the period from the beginning of 18th century up to the Second World War (*Pavlík et al.*, 1986: 393). The logistic curve was first accepted with great enthusiasm, which gradually disappeared. Malthus considered 25 years to be the doubling time for a population without any restrictions. This means a yearly growth of 2.8%. Such growth is possible, but it is exceptional and only occurred in the short period of the demographic revolution, when the level of mortality had already decreased and the intensity of natality remained temporarily high. The highest rate of world population growth, 2.1%, was recorded in the late 1960s, when the demographic revolution was starting in developing countries (it was already completed in developed countries).

When we speak of Malthus's essay, we must keep in mind what the situation was like in all social strata/social classes at that time. Mankind has made enormous progress since then. The estimated time of the world's existence then was 6,000 years (*Himmelfarb*, 1960: 77). The essay became a classic and is worth reading. The reader understands that Malthus was a sincere writer, whose goal was to contribute to the improvement of society. An essential part of the book is devoted to a critical debate with Marie Jean Antoine Condorcet and William Godwin. It is not possible to mention all the topics that the essay comprises, but we can mention at least some of them. He stated that 'the farmers and capitalists are growing rich from the real cheapness of labour. Their increased capital enable them a greater number of men. Work therefore may be plentiful, and the price of labour will consequently rise' (ib, p. 16). He discussed the poor laws. 'Fortunately for England, a spirit of independence still remains among the peasantry. The poor-laws are strongly calculated to eradicate this spirit.' (ib, p. 33). 'The labouring poor, to use a vulgar expression, seem always to live from hand to mount.' (ib, p. 34) He expressed opinions on population growth in history, on justice, and on the equalisation of property, and he criticised the bad social situation in the colonies. It is interesting that Malthus did not use the demographic data from John Graunt's publication, but the data from the tables of Johann Süssmilch (1707–1767). They are the sole data on the number of births, deaths and marriages (ib, pp. 43–45). Malthus was not as pessimistic as might be judged from his writings. He state that the numerical growth of people could also have positive consequences. 'As the reason, therefore, for the constancy of the laws of nature seem, even to our understanding, obvious and striking, if we return to the principle of population and consider man as he really is, inert, sluggish, and averse from labour, unless compelled by necessity, … we may pronounce with certainty that the world would not have been peopled, but for the superiority of the power of population to the means of subsistence. … Had population and food in the same ratio, it is probable, that man might never have emerged from the savage state.' (ib, p. 131) This mosaic of topics should present a picture of the essay's content; it is very extensive and also forms a mosaic.

FURTHER EDITIONS OF MALTHUS'S ESSAY

Robert Malthus was surely surprised by the strong response to his publication. He had more modest expectations, as we can see from the title and preface of his essay. The main purpose of the essay was to express in writing his main ideas, which stem from his discussions with his father, with the marquis de Condorcet and with William Godwin. Nothing in his life suggests the pessimistic content of his essay except the ideas of his opponents in the long discussions, confronted with the real situation in society. This probably irritated him. His essay earned admirers, but also some harsh critics, who even used hoaxes against him. They spoke about his eleven daughters, and how he then presumed to preach to others about the virtues of celibacy. This myth has persisted to this day. 'Nor was Malthus the ruthless, mean-spirited, hard-hearted man his enemies made him out. His associates all remarked upon his exceptionally amiability, good-nature and gentleness, in contrast to Godwin who was inconstant on hid affections querulous in personal as in intellectual affairs.' (*Himmelfarb*, 1960: xvii) Malthus himself described his feelings in the preface (he referred to himself as the 'author'): 'The view which he has given of human life has a melancholy hue, but he feels conscious, that he has drawn these dark tints, from a conviction that they are really in the picture, and not from a jaundiced eye or an inherent spleen of disposition.' (ib, p. 4)

He was aware that the essay had been written quickly and that his arguments were not sufficiently substantiated. The unexpected success of the essay led him to spend the next five years studying the subject and he ultimately prepared a second edition of it as a real scientific work without changing the main idea. He spent much time reading, reflecting, and travelling. His first trip took him to Germany, Sweden, Norway, Finland, and Russia. After the war with France, he went to France and Switzerland. He collected information, theories, and data (censuses occurred in some of these countries after 1800). The population of England was more numerous than he expected. This was the first census and so no population growth could be calculated from its results. However, a certain estimate could be made from the data.

The second edition appeared in 1801, five further editions up to 1834 and the seventh edition in 1872. Extensive changes were made to the second edition and only minor changes after that. The length of the second edition was about three times that of the first. The essay was given a new title: *An Essay on in the Principle of Population, or, A View of its Past and Present Effects on Human Happiness; with an Inquiry into our Prospects Respecting the Future Removal of Mitigation of the Evils which it Occasions.* The names of Condorcet and Godwin almost disappeared entirely from it; they are mentioned in the whole text only twice; this is a big difference from the first edition, where the discussion with them took up a considerable part of the text). The title promised a great work, which could not be completely fulfilled given the lack of necessary information and the size of the goal.

The structure of the essay also changed dramatically. Instead of nineteen chapters without headings, the whole text was divided into four books, which were further divided into chapters with headings that facilitate an orientation in the text. These are as follows (a few chapters were omitted in the seventh edition, because they are the same as in the first edition or they were considered unimportant): Book I: Of the checks to population in the less civilized parts of the world and in past times: Statement of the subject – ratios of the increase of population and food (I); Of the general checks to population, and the mode of their operation (II); Of the checks to population in the lowest stage of human society (III); Of the checks to population in the islands of the south sea (V); Of the checks to population among the ancient inhabitants of the north of Europe (VI); Of the checks to population in China and Japan (XII); Of the checks to population among the Greeks (XIII); Of the check to population among the Romans (XIV); Book II: Of the checks to population in the different states of modern Europe: Of the checks to population in Switzerland (V); On the check to population in France (VI); Of the checks to population in France – continued (VII); Of the checks to population in England (VIII); Of the checks to population in England – continued (IX); On the fruitfulness of marriages (XI); General deductions from the preceding view of society (XIII); Book III: Of the different systems or expedients

which have been proposed or have prevailed in society, as they affect the evils arising from the principle of population; Of systems of equality – continued (III); Of emigration (IV); Of poor-laws (V); Of poor-laws – continued (VI); Of poor-laws – continued (VII); Of the agricultural system (VIII); Of the commercial system (IX); Of systems of agriculture and commerce, combined (X); Of corn-laws – bounties on exportation (XI); Of corn-laws – restrictions on importation (XII); Of increasing wealth, as it affects the condition of the poor (XIII); General observations (XIV); Book IV: Of our future prospects respecting the removal or mitigation of the evils arising from the principle of population: Of moral restraint, and our obligation to practise this virtue (I); Of the effects which would result to society from the prevalence of moral restraint (II); Of the only effectual mode of improving the condition of the poor (III); Of the consequences of pursuing the opposite mode (V); Effects of the knowledge of the principal cause of poverty on civil liberty (VI); Continuation of the same subject (VII); Plan of the gradual abolition of the poor laws proposed (VIII); Of the modes of correcting the prevailing opinions on population (IX); Of the direction of our charity (X); Different plans of improving the condition of the poor considered (XI); Continuation of the same subject (XII); Of the necessity of general principles on this subject (XIII); Of our rational expectations respecting the future improvement of society (XIV).

In the preface to the second edition, dated 8 June 1803, Malthus explained the differences from the first edition. Every reader can feel how the second edition differs from the first in several points. While the first one comes across as a pamphlet, the second is based on a wide and intensive study of reality and has a scientific character. It is much more general and large (this is also seen in a comparison of its size). 'It is curious that so drastic a change as that between the two versions of the Essay should have been largely ignored both by Malthus´ contemporaries and by later commentators.' (*Himmelfarb*, 1960: xxxiii) They did not see the importance of the introduction of moral restraint to population growth as another check to population. Malthus approached to the theory of the demographic revolution, the first features of which could already be seen in the more developed countries of Western civilisation in the second half of the 18th century. In the last chapter of the essay he mentioned that in Norway, Switzerland, England, and Scotland it was already possible to find prevalence of preventive checks and at the same time a decreasing level of mortality. He also confessed 'that the evils resulting from the principle of population have rather diminished than increased, even under the disadvantage of an almost total ignorance of the real cause' (ib. p. 592). Malthus ranks among the first few authors to use inductive method recognise the early features of the dramatic changes accompanying the demographic revolution.

CONCLUSION

Thomas Robert Malthus became a symbol of the ideology of Malthusianism, which is based on a negative attitude to population growth, which was especially observed during the period of large growth in the first phases of demographic revolution. This ideology is against using any unnatural means of contraception. This changed with the doctrine of Neo-Malthusianism, which in the first half of the 19th century expressed approval of all contraceptive methods, while maintaining the same attitude towards population growth. A new wave of Neo-Malthusianism emerged in the middle of the 20th century, when the demographic revolution started in developing countries. The biologist Paul Ehrlich expressed a catastrophic opinion that cannot be found in the Malthus's works when he wrote: 'The battle to feed all of humanity is over. In the 1970´s the world will undergo famines – hundreds of millions of people are going to starve to death in spite of any crash programs embarked up to now. … Our position required that we take immediate action at home and promote effective action worldwide. We must have population control at home, hopefully through the system of incentive and penalties, but by compulsion if voluntary methods fail.' (*Ehrlich*, 1968: 7) A similar catastrophic scenario was published as a report for the Club of Rome, using sophisticated models based on a simple extrapolation of past data (*Meadows*, 1972). The results were no different from those of Ehrlich and were labelled Malthusian, or were described as Malthus with a computer (*Loužek*, 2010). A similar discussion had already taken place

at the World Population Conference, which was organised jointly by the United Nations and the International Union of Population Studies in Belgrade in 1965. The numerical growth of the world population was then the highest in the history of mankind, reaching 2.1% annually. This meant a doubling of the population size in 33 years, if the conditions remained constant. Two opposite approaches developed during the conference, where a suggested population clock was presented. The first group of participants asserted the idea of family planning in all developed countries; the second group saw overall economic and social development accompanied by free access to family planning to be more effective. The last World Population Conference, held in Cairo in 1991, was organised already under the title 'Population and Development'. The demographic revolution as a universal process will end on the international level in the second half of this century. New problems will emerge; and one of them is already present: international migration.

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REGISTER-BASED STATISTICS IN THE NETHERLANDS

Anna Podpierová

In August 2016, experts from the Czech Statistical office (CZSO) made a study visit to Statistics Netherlands to attend a course on 'Using Registers and Administrative Data in the Census'. The study visit was organised as part of the grant project 'Improvement of the Use of Administrative Sources' (ESS. VIP ADMIN WP6 Pilot studies and applications).

Using registers and administrative data in the census has a long-standing tradition in Netherlands. The last traditional enumeration in the Netherlands was conducted in 1971. Until then, traditional censuses had been performed since 1829 by the Ministry of Home Affairs and later since 1899 by Statistics Netherlands. Due to the unwillingness of respondents to take part in censuses (non-response) and due to the need to reduce the costs traditional censuses were stopped after the 1971 census. Statistics Netherlands now conducts a register-based census and uses data already available to Statistics Netherlands, thus placing no burden on individuals. For the 2011 Census, Statistics Netherlands compiled required census tables by combining existing register data with sample survey data.

There are thirteen basic registers in the Netherlands, eleven of them are functioning and filled with data. The Minister of the Interior is responsible for the system of basic registration and cabinet ministers are responsible for each basic registers. For instance, the Minister of the Interior is responsible for the Population Register, the Minister of Infrastructure and the Environment is responsible for Addresses and Buildings, Real Estate, topography, Motor Cars, and Subsoil, and the Minister of Social Affairs for Labour. The registers are managed by municipalities (e.g. the Population Register), the central government organisations, and the Chamber of Commerce. Data are always kept in only one register – for example, an address is recorded in the Basic Register of Addresses and other registers refer to it. Use of basic register data is compulsory for all governmental organisations. Organisations are not allowed to ask inhabitants about the data included in the basic registers, such as their birth date or address. Users are obliged to notify the basic registers with alternative data that are considered to be better. Therefore, all users of the system contribute to the quality of the data.

All objects in the basic registers (persons, enterprises, addresses etc.) have a unique pin (key). The basic registers are linked to one other through pins. This means that the statistical data are coherent.

Each basic register has its own project board which operates within the legal framework and sees to it that the register data meet legal requirements and that the data are correctly applied. The project board meets 4–6 times a year.

Statistics based on the basic registers, including the population and housing census, need a limited amount of data editing. The register-based census has a much lower, almost zero level non-response rate, unlike traditional enumeration. Users can rely on the validity of these statistics. Statistics production based on register data is usually faster and cheaper. On the other hand, the costs to set up separate registers are high. Compared to traditional census data, the data in basic registers do not always apply to the same point in time. Some data are also delayed, such as income of self-employed persons.

In the Netherlands, unlike the Czech Republic, all essential data are included in the registers. The biggest problem in the Czech Republic is the absence of a register of dwellings, which makes a census without field enumeration impossible. Statistics Netherlands is entitled to use all register data for official statistics, register holders do not question their needs to use the data. The data in the Dutch basic registers, especially the population register, are regularly/easily updated. On top of that, the public and the authorities have more respect for their own legal responsibilities. That is why the quality of Dutch registers is generally very high.

LOW FERTILITY, INSTITUTIONS, AND THEIR POLICIES: VARIATIONS ACROSS INDUSTRIALIZED COUNTRIES[1)]

Kornélia Cséfalvaiová[2)]

The publication *Low Fertility, Institutions, and Their Policies: Variations across Industrialized Countries* compares economically developed countries in Europe and Asia that have experienced different levels of fertility decline. Readers will are provided with an overview across regions of the causes and consequences of low birth rates, fertility trends, and the different government respones to this ongoing trend. Low fertility leads to population ageing and issues of labour force size and the provision of welfare benefits to the elderly.

The publication consists of 11 chapters:

- Diverse Paths to Low and Lower Fertility: An Overview
- Not so Low Fertlity in Norway – A Result of Affluence, Liberal Values, Gender-Equality Ideals, and the Welfare State
- The Influence of Family Policies on Fertility in France: Lessons from the Past and Prospects for the Future
- Fertility and Population Change in the United Kingdom
- Canadian Fertility Trends and Policies: A Story of Regional Variation
- The European Middle Way? Low Fertility, Family Change, and Gradual Policy Adjustments in Austria and the Czech Republic
- Fertility Decline and the Persistence of Low Fertility in a Changing Policy Environment – A Hungarian Case Study
- The Policy Context of Fertility in Spain: Toward a Gender-Egalitarian Model?
- Aging Italy: Low Fertility and Societal Rigidities
- Transition from Anti-natalist to Pro-natalist Policies in Taiwan
- Governmental Support for Families and Obstacles to Fertility in East Asia and Other Industrialized Regions

The countries analysed in the publication differ geographically, culturally, and historically and also have different governments and institutions. Some countries represented in this volume have fertility below the replacement level of 1.5 children per woman (Austria, Czech Republic, Hungary, Italy, Spain and Taiwan) and selected countries (Canada, France, Norway and United Kingdom) have fertility close to the replacement level of 2.1 children per woman. For most of these countries, the connection between marriage and fertility has been weakening. Although fertility has gone down in all these countries over the period under observation, the chapters examine the institutional, policy, and cultural factors that have led some countries to have much lower fertility rates than others. In Norway the total fertility rate is higher than in other rich countries. Norway's developed economic situation and low income insecurity for families and the state can afford to be generous with

1) Ronald R. Rindfuss – Minja Kim Choe. 2016. *Low Fertility, Institutions, and Their Policies: Variations across Industrialized Countries.* Springer International Publishing Switzerland. 303 pp. ISBN: 978-3-319-32995-6.

2) University of Economics, Prague.

parents. As birth rates are decreasing, there is increasing concern about the social welfare systems, including health-care systems and programmes for the elderly. While meeting the needs of an older population clearly presents challenges, there are also some advantages to having an older population. This publication helps to better understand the prime and original causes of demographic problems with its insightful discussion of how a country's institutions, policies, and culture shape fertility trends and levels. The final chapter provides a cross-country comparison of the individual understanding of barriers to fertility, based on survey data and government support for families. This broad overview, together with a general introduction, helps to highlight the specifics of each country.

THE VIENNA YEARBOOK OF POPULATION RESEARCH 2014[1)]

Martina Miskolczi[2)]

The Vienna Yearbook of Population Research published by the Vienna Institute of Demography for the year 2014 focuses on the link between health, life length, education, and retirement. This issue contains a selection of seven papers that were presented at the conference 'Health, Education, and Retirement over the Prolonged Life Cycle', which was organised by the Vienna Institute of Demography of the Austrian Academy of Sciences and held in Vienna in November 2013. The conference was devoted to the socio-economic causes and consequences, at both the individual and the societal level, of the unprecedented increase in life expectancy over the past few decades.

At the micro level, a better understanding is needed of the extent to which the increase in human life expectancy has been shaped by individual health behaviour, rather than by other socio-economic influences, and through which channels this happened. Conversely, it is important to understand better how the prolongation of the life cycle will shape individual behaviour. The conference focused on behaviour relating to health, education, and the supply of labour.

At the macro level, the consequences of the prolongation of the individual life cycle create policy challenges for social security and the cohesion of society They also generate a need to assess the extent to which retirement, health, and educational policies need to be reformed and to determine to what extent different social groups will benefit from rising longevity and ensuing changes.

SECTION HEALTH, HEALTH BEHAVIOUR AND RETIREMENT

This section presents articles related to health and health behaviour and to retirement and describes some of the interesting links between these two fields of study.

Authors *Heather Booth, Pilar Rioseco* and *Heather Crawford* of the chapter **'What can reverse causation tell us about demographic differences in the social network and social support determinants**

1) Lutz, W. – Kuhn, M. – Prskawety, A. – Sunde, U. (ed.). 2015. *Vienna Yearbook of Population Research 2014.* Volume 12. Vienna: Vienna Institute of Demography, Austrian Academy of Science. Avalable at: http://www.oeaw.ac.at/vid/publications/serial-publications/vienna-yearbook-of-population-research/vienna-yearbook-of-population-research-2014-vol-12/. ISBN-13: 978-3-7001-7948-1 ISBN-13 Online: 978-3-7001-7924-5.

2) University of Economics, Prague.

of self rated health in later life?' deal with the role of demographic differences in the association between social networks, social support, and self-rated health among the elderly population. They argue that demography is likely to shape this relationship in at least three dimensions: the family status of an individual delineates his or her social networks of relatives and friends; these networks evolve and change with demographic events (such as marriage, widowhood, etc.) over the life cycle, which implies that the networks of the elderly depend on earlier life course events; the impact of the social networks and the social support structures on self-rated health is prone to vary across (demographic) subgroups of the population.

The second chapter, by *Lucia Coppola* and *Daniele Spizzichino*, entitled **'The effect of retirement on self-reported health: a gender comparison in Italy'** use EU-SILC data on Italy to study the impact of retirement on self-reported health. They focus on the role of gender and argue that due to the persistence of traditional family role models in Italy the effects may differ considerably across male and female retirees – i.e. while retirement may lead to a worsening of self-reported health due to the stress associated with the reorganisation of lifestyles and family roles after retirement, the opposite may be the case for women who were previously struggling to reconcile work and family roles. Their hypothesis was partially confirmed: while retirement has a negative short-term impact on male health, it has no significant effects on female health.

SECTION AGEING, LABOUR SUPPLY AND RETIREMENT

This section highlights the changing roles of leisure, socio-economic status, education, and social networks for labour supply and retirement.

In this section, the third chapter in the yearbook, **'Real wages and labor supply in a quasi life-cycle framework: a macro compression by Swedish National Transfer Accounts (1985–2003)'**, by *Haodong Qui*, presents new estimates on the relationship between labour supply and wage dynamics in Sweden for the time period 1985–2003. As population ageing will require an extension of the labour supply among the working-age population, it is important that we gain a better understanding of how the age--specific labour supply reacts to changes in the wage structure. According to the 'inter-temporal substitution' hypothesis, labour supply and wages should be positively correlated over the life cycle; however, empirical estimates at the micro and the macro levels are to date inconclusive. Based on data from the National Transfer Accounts, Qui compares age-specific values of inter-temporal substitution on the macro and micro level. He shows that the variation across ages on the micro level is quite high, which may be caused also by the overlapping generation economies and the various lifecycle-pattern elasticities of the labour supply.

The next chapter, **'Working after age 50 in Spain. Is the trend towards early retirement reversing?'**, by *Madelin Gómez-León* and *Pau Miret-Gamundi*, investigates the role of socio-economic determinants for early retirement in Spain during the 1999–2012 period based on data from the Spanish Labour Force survey. It is important to better understand socio-economic characteristics associated with early labour market exit in Spain, as this country has one of the oldest populations in Europe and one of the lowest labour force participation rates among the elderly. The study focuses on the role of family arrangements in early retirement and indicates that there is a strong gender division in the Spanish labour market, with men being more active than women. In terms of family structure, women are more likely to retire if they live with dependants (e.g. parents), while men are more likely to retire if they have a partner. The trend towards early exit from the labour market appears to be slowing among women but accelerating among men. Since education is positively correlated with working longer, investing in training and qualifications for adults may help to keep them in the work force longer.

Linda Kridhal, in her chapter **'Retirement and leisure: a longitudinal study using Swedish data'**, investigates the role of leisure activities for retirement using Swedish longitudinal data over the 1981–2010 period. Since engaging in leisure activities is associated with having an active and healthy life, postponing retirement may be expected to have detrimental effects on retirees' activity and health levels. At first glance, there is a clear association between engagement

in specific leisure activities (e.g. cultural activities, gardening) and early retirement. However, once a period effect (representing labour market or pension policies) is controlled for, the empirical estimates indicate that those who are more engaged in leisure activities before retirement are not entering retirement significantly earlier.

SECTION LABOUR SUPPLY AND RETIREMENT

The final section deals with the link between the labour supply, retirement, and institutional aspects and highlights the broader implications of a prolonged life cycle for society.

The chapter **'More with less: the almost ideal pension systems (AIPSs)',** by *Gustavo de Santis*, examines the properties of what are known as 'Almost Ideal Pension Systems' (AIPS), which are pay-as-you-go schemes in which the parameters are mostly set in relative rather than absolute terms (e.g. they include the relative share of the life course spent working and in retirement, the standard of living afforded to children and pensioners relative to that of the working-age population, and the weight attached to actuarial fairness as opposed to intra-generational redistribution). He shows how the design of these schemes appears to be resilient to demographic and economic changes and compares these schemes with more conventional pension schemes (defined contribution, defined benefit, and risk-sharing) to show the AIPs' outperformance.

Josh Goldstein and *Ronald Lee* relate the on-going process of population ageing to the inequality of wealth in society in their chapter **'How large are the effects of population aging on economic inequality?'** The authors study three channels through which population ageing may affect inequality of income and of net worth: the increase in capital intensity under a slowdown of population growth; the shift in the age structure towards older and typically more unequal cohorts; and the impact of a longer life cycle on earnings and on the accumulation of capital. Employing US data, they find that a slowdown in population growth by one percentage point is expected to raise the income share of the top decile from 50% to about 55%, which represents a considerable increase in income inequality, merely through the increase in capital intensity. While the other two channels give rise to weaker effects, they conclude that the process of population ageing is likely to be accompanied by a sizeable increase in economic inequality.

The contributions presented in this volume highlight the roles of health behaviours, education, and social context in shaping health and longevity. This has clear consequences for labour markets (in particular labour supply), social care, retirement and relevant policies. Both the macro and micro levels are investigated and both directions of impact are discussed in the yearbook – i.e. how society and institutional decisions influence the individual life course and, conversely, how changes at the personal level impact mass societal changes.

European Population Conference

The European Population Conference (EPC) is one of the most important events of the European Association for Population Studies (EAPS). The 13th EPC was held in Mainz at Johannes Gutenberg University Mainz (JGU) from 31 August to 3 September 2016. Approximately 900 participants attended the conference over the course of four days. During the conference, titled 'Demographic Change and Policy Implications', 529 papers and 236 posters were presented. The Federal Institute for Population Research, Germany, and the JGU were the co-organisers of the conference. The conference was supported by the European Union Agency for Fundamental Rights, Springer Science + Business Media B.V., Taylor & Francis, UK, and the Leibniz Institute for the Social Sciences.

At the opening ceremony, the President of JGU, *Georg Krausch*, initiated the European Population Conference in the auditorium of the hosting university. Afterwards, Francesco C. Billary, outgoing president of EAPS, presented his welcoming speech. The first paper, about population ageing and the need for generational friendliness, was presented by Günter Krings (State Secretary of the German Ministry of the Interior). Norbert F. Schneider (Director of the Federal Institute for Population Research) made a speech entitled 'Family Change in Europe: Convergence or Divergence?'

The conference programme was divided into 123 sessions which were arranged into 14 thematic groups. Each session included four or five papers and lasted 90 minutes. Up to twelve sessions were held concurrently. Fortunately, it is possible to get at least a general idea of their content from the extended or short abstracts published on the website dedicated to the conference (http://epc2016.princeton.edu/).

Each presentation lasted approximately 20 minutes. The remaining 30 minutes of the session were devoted to discussion and final remarks. Each session was led by a chair who introduced all the presenters and also moderated the discussion. In addition to oral sessions, there were three poster sessions organised with on average 80 posters per section. The thematic range of the sessions was very wide and sometimes it was very difficult to decide which one to choose, because most of them promised very interesting posts. Most of the sessions (19) were devoted to the issue of fertility. Among the many other topics were, for instance, 'Families and Households', 'International Migration and Migrant Populations', and 'Health, Well-being and Morbidity'.

Besides these, the main points of the conference, there were several other side meetings for representatives of major research institutions or universities, who used the conference to organise their workshops or negotiations. In addition, during the congress some other events or exhibitions took place – for example, the presentation of selected institutions associated with demographic research (e.g. Federal Institute for Population Research, Germany, Hungarian Demographic Research Institute, Max Planck Institute for Demographic Research, Springer, IPUMS-International, Institut National d´Études Démographiques), workshops (GIS Workshop, Improving Mortality Forecasts and Training workshop on web, social media, data and demographic research), and the Career Mentoring Event.

During the 15th General Assembly of EAPS Marc Luy (Secretary-General and Treasurer) introduced the Report on EAPS activities of the last four years as well as the financial status of the association. The latest statistics on the *European Journal of Population*, which primarily documented the effort to reduce the time it takes to review of articles, were presented by Helga de Valk (the journal's Editor-in-Chief). The above-mentioned journal is one the other activities of EAPS (together with The European Doctoral School of Demography, an initiative of Population Europe, and the Working Group on Health, Morbidity and Mortality). A large part of the General Assembly was dedicated to the transfer from the old to the new Council. The new Council is made up of the following members: *Zsolt Spéder* (President), Jane Falkingham (Vice-President / President elect), Hill Kulu (Secretary-General and Treasurer), Tomáš Sobotka and Helga de Valk (Members). An interesting moment at the General Assembly was the announcement of the location of the 14th EPC. Vriije Universiteit in Brussels will host this conference in 2018 (6–9 June).

The Czech Republic was relatively well represented at the conference. Representatives of all Czech universities and research institutions associated with demography and population studies attended the conference. Although the list is not necessarily comprehensive, papers or posters were presented by: Boris Burcin, Dagmar Dzúrová, Ludmila Fialová, Klára Hulíková Tesárková, Dan Kašpar, Jiřina Kocourková, Barbora Kuprová, Michala Lustigová, Tereza Pachlová, Jitka Rychtaříková, Anna Šťastná (all from the Charles University in Prague), Kornélia Cséfalvaiová, Tomáš Fiala, Jitka Langhamrová, Martina Miskolczi, Markéta Pechholdová, Jana Vrabcová Langhamrová, Pavel Zimmermann (all from the University of Economics, Prague), Jindra Reissigova (from the Institute of Computer Science, Czech Academy of Sciences), Renata Kyzlinková (from the Research Institute for Labour and Social Affairs), Beatrice Chromková Manea, Martin Guzi, Martin Lakomý, Marcela Petrová Kafková, Ladislav Rabušic, Lada Železná a Zuzana Žilinčíková (from Masaryk University, Brno), Mariola Pytlíková (from the Center for Economic Research and Graduate Education – Economics Institute), and Jan Šulák (from the Technical University of Ostrava). The conference was also attended by Czech colleagues working at institutions abroad, such as Klará Čapková (from Stockholm University), Tomáš Sobotka (from the Vienna Institute of Demography) and Kryštof Zeman (from the Wittgenstein Centre).

The Closing Ceremony was introduced by the speech of the new President of EAPS Zsolt Spéder. Five prizes were awarded during this ceremony. Wolfgang Lutz (Director of the Wittgenstein Centre for Demography and Global Human Capital), author and editor of 28 books and more than 200 refereed articles, received the EAPS Award for Population Studies for his ground-breaking contributions to the study of population. The Dirk J. Van de Kaa Award for Social Demography was awarded to Brienna Perelli-Harris (University of Southampton) for her research work on couples and (non-marital) births in Europe. The Traiblazer Award for Demographic Analysis 2016 went to Emilio Zagheni (University of Washington) for his work in innovative data science approaches for demography and the use of formal demographic methods. The Gunther Beyer Award for the best paper of a young scholar was awarded to Ezgi Berktaş from Hacettepe University Ankara (the paper was titled 'Does Housework Rule? Fertility Intentions of Women in Turkey from a Gender Equity Perspective'). The following contributions were evaluated as the best posters in each section: P1 – 'Does Housework Rule? Fertility Intentions of Women in Turkey from a Gender Equity Perspective' (*Emilien Dupont*, Ghent University), P2 – 'The U-shape Link between Education and Childlessness in Hungary – a New Central European Phenomenon' (Laura Szabó, Hungarian Demographic Research Institute), and P3 – 'The Spatialities of Ageing in Britain: Is Residential Age Segregation Increasing?' (Albert Sabater, University of St Andrews). At the end of the EPC the outgoing President, Francesco C. Billary, thanked the organisers and assessed the conference as very successful.

The lovely town of Mainz also contributed to the positive atmosphere of the conference. In future years, let's wish the conference much success, and let's wish the Czech Republic sufficient funds to expand its database, without which Czech demographers will have a hard time keeping up with elite European scholars.

Dan Kašpar – Barbora Kuprová – Tereza Pachlová

The 8th Conference of 'Young Demographers' Will Take Place in February 2017

Traditionally the Conference of Young Demographers offers an exceptional opportunity to spend two days discussing current demographic issues and above all an opportunity for students and young scientists to learn and get opinions and advice from their more experienced counterparts, colleagues, and teachers from all over the world or at least Europe. The 8th annual Conference of Young Demographers will take place on **16 and 17 February 2017** in Prague at the Faculty of Science (Albertov 6, Prague 2). The traditional topic of the conference, 'Actual Demographic Research of Young Demographers (not only) in Europe', is as widely conceived as possible, so that the conference can be open to demographers and scientists with various research interests and orientations.

Along with the Young Demographers group, the event is supported by the Department of Demography and Geodemography, the Geographical Institute (Faculty of Science of Charles University in Prague), and the Czech Statistical Office.

At the conference all the participants will have an opportunity to present their current research and discuss it with colleagues from other countries or fields of study. Although the conference is primarily intended for PhD students of demography, all young (or slightly older) researchers (not just demographers) are welcome. The working language of the conference is English.

At the end of the conference the SAS Institute of the Czech Republic and the Institute of Sociology of the Czech Academy of Sciences, the partners of the conference, will hand out an award for the best presentation using SAS software and the best presentation with a social context.

A session for non-demographers is planned again. This session plans to be centred on topics on which demographers may share common scientific ground with researchers from other fields and new areas of cooperation may also be developed.

Programme of the conference will be released in January 2017. More information about the conference can be found online (http://www.demografove.estranky.cz/en) or you can follow us on Facebook (http://www.facebook.com/young.demographers) or Google+ (http://plus.google.com/u/0/102665514822224781605/posts).

In the case of any questions please feel free to contact us at: yd.demographers@gmail.com.

We are looking forward to seeing you in Prague! On behalf of the Organising Committee:

Klára Hulíková – Olga Kurtinová – Dan Kašpar – Barbora Kuprová – Tereza Pachlová

A Tribute to Felix Koschin

This year we mark 70 years since the birth of doc. RNDr. Felix Koschin, CSc.

In tribute to Koschin, who was one of the biggest Czech demographers, this year his family and friends laid a memorial plaque, bearing his name and dates of birth, death, and his fatal injury, in Symbolic Cemetery near Ostrva hill in the Tatry Mountains. It is located close to the place where

in 2009 he had a serious accident that ultimately led unfortunately to his death.

If you ever take a journey to the Tatry Mountains and areas nearby, stop and visit the cemetary for a few moments to see the plaque and remember this great person.

Petr Mazouch

Prof. Milan Myška, Dr. h. c. (* 13. 4. 1933 – † 8. 7. 2016)

One of the most significant Czech economic historians, Professor Milan Myška, passed away on July 8th, 2016. He was one of the most influential researchers in Czechia (and in the former Czechoslovakia) specializing in the historical processes of industrialization and proto-industrialization. He was born in Vítkovice (part of Ostrava), a place that appeared to predestine his later career; Vítkovice was a factory town built around a huge ironworks complex founded by the renowned financier Salomon Rothschild. It was no surprise that the subject of Milan Myška's first book was the Vítkovice iron and steel works (*Založení a počátky Vítkovických železáren 1828 – 1880* [*The foundation and early years of the Vítkovice ironworks 1828 – 1880*], 1960).

The industrial region of Ostrava became the main topic of Milan Myška's research. He specialized in the metallurgical and textile industries, but he also inspired many other scholars to take an interest in different industries. In the 1960s Myška assembled a team of researchers to work on a project carrying out historical research on the Industrial Revolution in the Ostrava region, and he created the methodological and theoretical foundations for this research.[1] It is important to mention that he did not focus solely on economic history. He was also keenly aware

1) MYŠKA, Milan, Geneze ostravské průmyslové oblasti. Problémy, metody a projekt výzkumu. [The genesis of the Ostrava industrial region. Issues, methods and research project.] In: Geneze průmyslových oblastí. Vznik a vývoj ostravské průmyslové oblasti 1. [The genesis of industrial regions. The emergence and development of the Ostrava industrial region 1.] Ostrava 1967, pp. 171–196. See also *The Industrial Revolution: Bohemia, Moravia and Silesia.* In: Teich, Mikuláš, Porter, Roy (eds.), The Industrial Revolution in National Context. Europe and the USA. Cambridge 1996, pp. 247–267.

of the importance of social aspects of history, and this led him to take an interest in historical demography; he was the founder of demographic research at what was then the Pedagogical Faculty in Ostrava. It was Myška who introduced Louis Henry's demographic methods, and since that time demographic research has maintained a strong tradition at the University of Ostrava (founded 1991). Milan Myška even wrote some articles on historical demography; one of these studies deals with the huge migration of people who came from Galicia to Ostrava to work in the local coal mining industry.[2] This phenomenon of Galician migrants continues to fascinate researchers in economic, social and cultural history. After Milan Myška brought Lumír Dokoupil and his project team to Ostrava, he decided to pass on the baton of demographic research to Dokoupil, who continued to develop this line of research. A compact team of historical demographers – led by Professor Dokoupil – is still active in Ostrava today.

Myška continued to focus on economic history, but in 1972 he was fired from the Pedagogical faculty in Ostrava due to political reasons, and he remained unemployed for over ten years. He made his living by publishing scholarly papers and articles in journals abroad,[3] or in Czechoslovak periodicals – though here he had to publish under pseudonyms (such as his wife's name). He began to conduct intensive research on the phenomenon of proto-industrialization. He made a major impact on the audience at the 8th Economic History Congress in Budapest in 1982; he had been invited to the congress by its chairman Professor György Ránki, because he was not allowed to travel with the official Czechoslovak delegation. After the Velvet Revolution he returned to faculty life, heading the Department of History at the newly-established University of Ostrava. His books on proto--industrialization were published soon afterwards.[4]

In the 1990s Milan Myška responded to new trends in economic history and introduced new research methods; he also branched out to study entrepreneurship (including biographies of entrepreneurs and businessmen).[5] He was an inventive and imaginative historian. He trained many of his students and young researchers to become proficient scholars, and created what was essentially his own school of economic history in Ostrava. He continued to work right up until his death, and he was the driving force behind a large-scale project on the historical process of modernization – a project that unfortunately he did not live to see completed.

Radek Lipovski

2) MYŠKA, Milan, Fosfores ex Galicia. Udział emigrantów z Galicji w formowaniu się klasy robotniczej w górnictwie węglowym Morawskiej Ostrawy w drugiej połowie XIX wieku. [Fosfores ex Galicia. The role of Galician migrants in the formation of the working class in the coal mining industry of Moravian Ostrava in the second half of the 19th century.] Małopolskie Studia Historyczne 9, 1966, no. 3–4, pp. 55–78; Historicko-demografická charakteristika západní části ostravské průmyslové oblasti na konci 19. století. [Historical-demographic characteristics of the western part of the Ostrava industrial region at the end of the 19th century.] In: Ostrava 5. Ostrava 1969, pp. 86–97.

3) E.g. MYŠKA, Milan, *Pre-Industrial Iron Making in the Czech Lands: The Labour Force and Production Relations circa 1350 – circa 1840.* Past and Present 82, 1979, pp. 44–72.

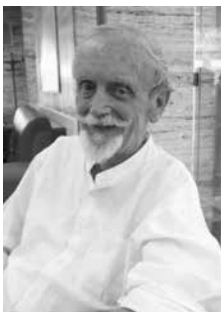
4) MYŠKA, Milan, *Opožděná industrializace. Lnářský a bavlnářský průmysl na Frýdecku a Místecku do počátků tovární výroby* [*Belated industrialization. The flax and cotton industries in the Frýdek and Místek region up to the beginnings of factory production*], Turnov 1991, Frýdek-Místek 22013; *Proto-industriální železářství v českých zemích.* [*Proto-industrial ironmaking in the Bohemian Crown Lands*] Ostrava 1992. See also *Proto-Industrialisierung in Böhmen, Mähren und Schlesien.* In: Cerman, Markus (Hg.), Protoindustrialisierung in Europa. Industrielle Produktion vor dem Fabrikszeitalter. (= Beiträge zur historischen Sozialkunde 5). Wien 1994, pp. 177–191, 209–236; *Proto-industrialization in Bohemia, Moravia and Silesia.* In: Ogilvie, Sheilagh, Cerman, Markus (eds.), European Proto-industrialization. Cambridge 1996, pp. 188–207.

5) See MYŠKA, Milan: Business History in der Tschechischen Republik. In: Teichová, Alice, Matis, Herbert, Resch, Andreas (Hg.), Business History. Wissenschaftliche Entwicklungstrends und Studien aus Zentraleuropa. Wien 1999, pp. 67–76. See also *Rothschild Manager Paul Kupelwieser, Creator of the Social System of an Industrial Town.* In: Zářický, Aleš (ed.), The Involvement of Businessmen in Local and Regional Public Life in Central Europe 1800–1914. Ostrava 2009, pp. 165–173.

The Outstanding Czech Sociologist Ivo Možný Has Passed Away

In mid-August I was sitting in the splendid Café Savoy in Brno with Ivo, debating about life, wine, society, and – last but not least – sociology. This was one of our frequent, pleasant friendly meetings that had occurred almost regularly in recent years, alternating between Brno and Prague, tasting Moravian wines, and endlessly in discussion. The next such meeting was planned for mid-September. Unfortunately, no 'next' meeting took place and never will do.

I regret the unexpected event, as most certainly do dozens of Možný's current and previous colleagues and in all likelihood hundreds of his former students.



Ivo Možný was an outstanding figure in contemporary Czech sociology – a scholar, a founder and a public figure. He started as a sociologist/journalist at a courageous radio station in the late 1960s, surviving honestly as a sociology lecturer at Brno University the two inert decades of the normalisation period in the 1970s. In the limited conditions of the time, the informal meetings of researchers on 'the socialist way of life as a social reality' that he convoked in the 1980s provided rare occasions for open debate. His doctoral thesis, *The Families of University Graduates*, published by the university press in 1983, marked the start of his focus on family sociology, which he continued to advance in later decades.

Beginning in 1990, the rich and prolific potential of this man virtually exploded. He started to write, teach, and organise with remarkable energy and astonishing commitment. Completed already by 1990, his elucidating essay *Why So Easy ... on Some Family Roots of the Velvet Revolution* soon became the most quoted book in Czech sociology and has remained so ever since.

When the doors to the world swung open he was able to profit from some invitations from prestigious foreign institutions: The Netherland Institute for Advanced Studies in Wassenaar, the Institute for Human Sciences in Vienna, Collegium Budapest. Each of the fellowships provided him with an otherwise rare quiet time in which to write. The main focus was on family. His books *Sociology of Family* (1999) and *Family and Society* (2006) remain the main sources of the discipline. The book *Czech Society: the Most Important Facts about the Quality of Our Life* (2002) presented a unique picture of the problems of the nation.

Not only was Možný a founding-father of an important sociological discipline in the country, he was also key agent in building an important sociological institution – the Faculty of Social Studies of Masaryk University in Brno. The idea started out as the School of Social Science within the Faculty of Philosophy and soon it led to the creation of a new Faculty of Social Studies. As its first Dean he managed to find a core of respectable professors and they established the institutes of sociology, political science, psychology, environmental studies, and others. As a result of Možný's activity, the faculty moved to a stately residence that was skilfully reconstructed – again, according to his ideas and under his supervision.

Možný was also a genuine 'public intellectual' who made appearances in the media and at public forums. In frequent articles he worried about the demographic development of Czech population, issues of the family in the postmodern world, and the problems – if not the inertia – of Czech universities not developing as they were expected to as a result of inbreeding and irresolute management. He was a member and active in numerous committees, councils and institutes, and he was rightfully also a member of the *Learned Society of the Czech Republic*. In this prestigious body, sociology was still represented by three outstanding scholars in the early 2010s – Jiří Musil, Miloslav Petrusek, and Ivo Možný. Currently, there is no one.

Jiří Večerník

PhDr. Milan Aleš in Memoriam

On 12 November 2016 PhDr. Milan Aleš, a prominent Czech demographer and statistician, and a member of what was first the Czechoslovak and then the Czech Demographic Society, and an employee of the Federal and Czech Statistical Office, passed away at the age of 78.

Milan Aleš worked in the field of demographic research at the Czech Statistical Office for more than thirty years. He specialised in the study and analysis of population development, researching the causes, conditions, and consequences of demographic phenomena and the processes and changes these phenomena undergo, primarily in reference to changes occurring in society as a whole. Milan Aleš also worked on numerous fundamental methodological and conceptual studies, including work on issues connected with the international comparability of demographic data. He made an extraordinary contribution to the field through his work and efforts in searching for, refining, and publishing historical time series of demographic statistics dating all the way back to 1785. He was also a long-time member of the Editorial Board of *Demography* and for several decades he had an influential hand in shaping the direction and maintaining the scientific standards of this journal.

Milan Aleš will long be remembered for his enormous contribution to Czech demography and as a distinguished figure in the field's recent history.

Jiřina Růžková

Health Surveys in the Czech Republic: EHIS and EHES 2014

J. E. Purkyně Czech Medical Association (Česká lékařská společnost Jana Evangelisty Purkyně), the Society for Social Medicine and Healthcare Management (Společnost sociálního lékařství a řízení péče o zdraví), and the Institute of Health Information and Statistics of the Czech Republic (Ústav zdravotnických informací a statistiky České republiky) jointly organised a seminar titled 'Surveys on Health in the Czech Republic – EHIS and EHES 2014', which took place on 26 October 2016.

The seminar had a very rich programme. To begin, participants welcomed Eva Gottvaldová from the Ministry of Health of the Czech Republic, who in her keynote speech emphasised the importance of population health. The entire seminar was moderated by Šárka Daňková from the Czech Institute of Health Information and Statistics (IHIS), who in her opening paper presented basic information about the EHIS and EHES 2014 surveys.

EHIS (European Health Interview Survey) is a unique survey that provides information about health and health-related issues. In some fields of research EHIS is almost the only way to obtain information on health, and it allows for multiple different issues to be surveyed in combination. Because it is fielded in all the countries of the European Union using the same methodology and principles, it is possible, within some limits, to compare individual countries with each other. *Šárka Daňková* also highlighted the position of EHIS in health statistics. She talked about the history of HIS type surveys in the Czech Republic and described the E(HIS) survey in an international context. She noted the practical applications of EHIS data at the regional, national, and international levels. She then discussed the organisation of EHIS 2014 in the Czech Republic and the course and content of the survey, and described the Minimum

European Health Module (MEHM), the questions from which are part of other survey instruments (SILC). Detailed information on EHIS is available at: http://www.uzis.cz/ehis.

The next paper presented at the seminar was by *Simona Měřínská* from the Department for the Coordination of Household Surveys at the Czech Statistical Office and was titled 'The EHIS 2014 Health Survey'. She described the cooperation between the Czech Statistical Office and the Czech Institute of Health Information and Statistics on the EHIS 2014 survey. IHIS was responsible for the survey methodology and the Czech Statistical Office was in charge of field work, technical support, and the initial data processing. The questionnaire was created in cooperation between these two institutions. The survey was implemented in the third and fourth quarters of 2014, and the field surveying ran from 15 June 2014 to 31 January 2015. The survey was carried out in all the regions and districts of the Czech Republic and was linked to the Integrated Survey of Households (IŠD). A total of 9561 randomly selected household members were contacted who had taken part in earlier waves of the IŠD, and 6737 of them were surveyed.

A paper titled 'Using EHIS Data to Assess Screening Programmes for Tumour Diseases in the Czech Republic' was presented by *Ondřej Ngo* from the Institute of Biostatistics and Analysis (Institut biostatistiky a analýz) of Masaryk University together with members of IHIS. He focused in detail on the issue of screening programmes for colorectal cancer, breast cancer, and cervical cancer. The Institute of Biostatistics and Analysis of Masaryk University processes the data and provides informational support, monitors epidemiological data on the population, screening processes at screening centres, and screening programmes. The paper reported on the coverage of the target group of the population for breast cancer screening in individual years and in the framework of age groups and also in the regions and districts. Ngo also highlighted the use of EHIS 2014 data to assess the screening programmes for neoplasm diseases. EHIS is important for the evaluation of preventive programmes, as it can be used to describe the group of people who do not participate in screening programmes. Important factors determining participation in screenings are age, education, and net household income.

After a short break the seminar continued with a paper by *Šárka Daňková*, who focused first on the issue of data processing. She drew attention to the problem of the use of weighting in the results calculations in reference to the type of sample and response rates. Analyses at the national level adhere to the list of recommended indicators formulated by Eurostat. Daňková focused on the accessibility and presentation of data and the results published by Eurostat. The pointed out that for presenting data for the Czech Republic a new webpage devoted to the surveys will be available on the IHIS website.

The next paper, titled 'The European Health Examination Survey', was presented by *Jana Kratěnová* from the National Institute of Public Health (Státní zdravotní ústav) in Prague. The European Health Examination Survey (EHES) ties in with EHIS. EHES is a medical survey in which measurements are taken of respondents' height, weight, waste circumference, and blood pressure, and a blood sample and analysis (total and HDL cholesterol and glycated haemoglobin for determining long-term glucose levels). The EHES only concerns respondents aged 25–64 years and is an international project that many European countries takes part in. EHES was designed to unify the methodology of examinations in Europe, initiate a uniform sustainable system of collecting comparable and good-quality national data on the health and health risks of the European adult population. The main focus is the prevalence of risk factors, especially cardiovascular diseases. It identifies, among other things, how large a share of the regular population is unaware of their risk factors or are not receiving proper treatment. Kratěnová also focused on the history of EHES. She highlighted the relationship between EHES and EHIS and mentioned that EHES lacks support in legislation. Joint implementation of EHES and EHIS would be considered the optimum approach.

Kristýna Žejglicová, from the National Institute of Public Health, presented a paper titled 'The EHES Study – Results'. She acquainted participants with the results of EHES. She focused on the issue of hypertension as the most common forms of coronary disease and one of the main risk factors for cardiovascular illnesses. She also dealt with the problem of hypercholesterolemia, where high cholesterol is also a significant risk factor for cardiovascular disease,

and with the problems of diabetes mellitus, obesity, and cardiovascular risk based on abdominal obesity. She compared the results of EHES and EHIS data. Žejglicová highlighted the fact that the results of the EHES survey provide internationally compatible data that are not accessible from other sources. The results are important for the preparation and implementation of preventive measures in the field of health.

Šárka Daňková concluded the seminar by summing up how important it is for the implementation of the EHIS and EHES surveys to continue. The next survey is planned for 2019 and work on preparing the survey will already begin next year and will be aimed at ensuring the continued high quality of collected data and the comparability of data internationally and across time.

The questionnaire forms from EHIS 2014 were available for viewing at the seminar, along with the showcards for respondents and the survey guidelines. The state of health of the Czech population was described in the EHES 2014 study that was published by the National Institute of Public Health in Prague in 2016.

Detailed information about EHIS 2014 is available on the website of IHIS (http://www.uzis.cz/ehis/). Presentations from the seminar are also available there.

The seminar was very successful and provided participants with a clear and intelligible introduction and overview of the EHIS and EHES surveys in 2014.

Jitka Langhamrová – Jana Vrabcová Langhamrová

Population and vital statistics of the Czech Republic: 2015, cohesion regions and regions

Cohesion region (NUTS 2), region (NUTS 3)	Population 1 July	Population 31 December	Marriages	Divorces	Live births	Abortions	Deaths			Increase (decrease)			Marriages	Divorces	Live births	Deaths	Total increase
							Total	Within 1 years	Within 28 days	Natural	Net migration	Total	per 1,000 inhabitants				
Česká republika	10,542,942	10,553,843	48,191	26,083	110,764	35,761	111,173	272	165	–409	15,977	15,568	4.6	2.5	10.5	10.5	1.5
Praha	1,262,507	1,267,449	6,073	2,983	14,759	3,880	12,420	26	16	2,339	6,031	8,370	4.8	2.4	11.7	9.8	6.6
Střední Čechy	1,320,721	1,326,876	5,903	3,670	14,602	4,641	13,049	34	22	1,553	10,024	11,577	4.5	2.8	11.1	9.9	8.8
Jihozápad	1,212,957	1,214,450	5,525	3,045	12,461	4,277	13,240	34	23	–779	2,806	2,027	4.6	2.5	10.3	10.9	1.7
Severozápad	1,121,887	1,120,654	4,964	2,864	11,044	4,737	12,506	46	20	–1,462	–1,149	–2,611	4.4	2.6	9.8	11.1	–2.3
Severovýchod	1,506,669	1,507,209	6,878	3,814	15,567	5,188	15,834	30	16	–267	663	396	4.6	2.5	10.3	10.5	0.3
Jihovýchod	1,683,070	1,684,500	7,747	3,819	18,120	5,315	17,284	35	22	836	916	1,752	4.6	2.3	10.8	10.3	1.0
Střední Morava	1,219,922	1,219,394	5,560	2,838	12,345	3,801	13,290	35	24	–945	–633	–1,578	4.6	2.3	10.1	10.9	–1.3
Moravskoslezsko	1,215,209	1,213,311	5,541	3,050	11,866	3,922	13,550	32	22	–1,684	–2,681	–4,365	4.6	2.5	9.8	11.2	–3.6
Hlavní město Praha	1,262,507	1,267,449	6,073	2,983	14,759	3,880	12,420	26	16	2,339	6,031	8,370	4.8	2.4	11.7	9.8	6.6
Středočeský kraj	1,320,721	1,326,876	5,903	3,670	14,602	4,641	13,049	34	22	1,553	10,024	11,577	4.5	2.8	11.1	9.9	8.8
Jihočeský kraj	637,292	637,834	2,887	1,583	6,600	2,252	6,933	21	17	–333	867	534	4.5	2.5	10.4	10.9	0.8
Plzeňský kraj	575,665	576,616	2,638	1,462	5,861	2,025	6,307	13	6	–446	1,939	1,493	4.6	2.5	10.2	11.0	2.6
Karlovarský kraj	298,506	297,828	1,392	747	2,731	1,050	3,268	9	4	–537	–928	–1,465	4.7	2.5	9.1	10.9	–4.9
Ústecký kraj	823,381	822,826	3,572	2,117	8,313	3,687	9,238	37	16	–925	–221	–1,146	4.3	2.6	10.1	11.2	–1.4
Liberecký kraj	439,152	439,639	2,031	1,235	4,683	1,880	4,558	10	5	125	663	788	4.6	2.8	10.7	10.4	1.8
Královéhradecký kraj	551,270	551,421	2,465	1,360	5,582	1,816	5,836	10	7	–254	85	–169	4.5	2.5	10.1	10.6	–0.3
Pardubický kraj	516,247	516,149	2,382	1,219	5,302	1,492	5,440	10	4	–138	–85	–223	4.6	2.4	10.3	10.5	–0.4
Kraj Vysočina	509,507	509,475	2,333	1,049	5,349	1,544	5,178	13	10	171	–591	–420	4.6	2.1	10.5	10.2	–0.8
Jihomoravský kraj	1,173,563	1,175,025	5,414	2,770	12,771	3,771	12,106	22	12	665	1,507	2,172	4.6	2.4	10.9	10.3	1.9
Olomoucký kraj	635,094	634,718	2,864	1,515	6,498	1,979	7,000	14	8	–502	–491	–993	4.5	2.4	10.2	11.0	–1.6
Zlínský kraj	584,828	584,676	2,696	1,323	5,847	1,822	6,290	21	16	–443	–142	–585	4.6	2.3	10.0	10.8	–1.0
Moravskoslezský kraj	1,215,209	1,213,311	5,541	3,050	11,866	3,922	13,550	32	22	–1,684	–2,681	–4,365	4.6	2.5	9.8	11.2	–3.6

Radek Havel

Population and vital statistics of the Czech Republic in towns with population above 50 thousands: 2015

Town	Population 1 July	Population 31 December	Marriages	Divorces	Live births	Abortions	Deaths	Increase (decrease)			Marriages	Divorces	Live births	Deaths	Total increase
								Natural	Net migration	Total	per 1,000 inhabitants				
Praha	1,262,507	1,267,449	6,073	2,983	14,759	3,880	12,420	2,339	6,031	8,370	4.8	2.4	11.7	9.8	6.6
Brno	376,915	377,028	1,846	929	4,405	1,252	4,053	352	−764	−412	4.9	2.5	11.7	10.8	−1.1
Ostrava	293,531	292,681	1,297	874	3,004	988	3,488	−484	−1,035	−1,519	4.4	3.0	10.2	11.9	−5.2
Plzeň	169,499	169,858	813	437	1,867	545	1,893	−26	851	825	4.8	2.6	11.0	11.2	4.9
Liberec	102,825	103,288	494	309	1,181	480	1,030	151	575	726	4.8	3.0	11.5	10.0	7.1
Olomouc	99,884	100,154	466	254	1,220	384	1,020	200	145	345	4.7	2.5	12.2	10.2	3.5
České Budějovice	93,416	93,513	442	265	1,077	416	1,023	54	174	228	4.7	2.8	11.5	11.0	2.4
Ústí nad Labem	93,362	93,248	433	332	1,033	451	999	34	−195	−161	4.6	3.6	11.1	10.7	−1.7
Hradec Králové	92,692	92,891	439	236	976	334	937	39	44	83	4.7	2.5	10.5	10.1	0.9
Pardubice	89,683	89,638	396	228	976	244	1,016	−40	−15	−55	4.4	2.5	10.9	11.3	−0.6
Zlín	75,051	75,171	362	193	776	261	841	−65	124	59	4.8	2.6	10.3	11.2	0.8
Havířov	74,479	74,101	393	220	658	308	863	−205	−743	−948	5.3	3.0	8.8	11.6	−12.7
Kladno	68,458	68,466	304	215	721	365	752	−31	−55	−86	4.4	3.1	10.5	11.0	−1.3
Most	67,038	67,002	303	170	677	369	759	−82	−5	−87	4.5	2.5	10.1	11.3	−1.3
Opava	57,617	57,676	272	139	599	214	575	24	−120	−96	4.7	2.4	10.4	10.0	−1.7
Frýdek-Místek	56,874	56,879	266	181	608	224	600	8	−74	−66	4.7	3.2	10.7	10.5	−1.2
Karviná	55,571	55,163	214	125	490	209	700	−210	−612	−822	3.9	2.2	8.8	12.6	−14.8
Jihlava	50,504	50,714	256	110	688	185	501	187	6	193	5.1	2.2	13.6	9.9	3.8
Teplice	50,024	49,959	207	114	520	230	580	−60	−60	−120	4.1	2.3	10.4	11.6	−2.4

Radek Havel

LIFE EXPECTANCY IN DISTRICTS OF THE CZECH REPUBLIC FROM 2001 TO 2015

Jana Křesťanová[1)]

INTRODUCTION

The Czech Statistical Office recently constructed mortality tables for districts of the Czech Republic for the period from 2011 to 2015 (published in July 2016 on www.czso.cz). To eliminate random fluctuations, the tables for smaller territorial units are constructed for a multiannual period; for districts it is for a five--year period. The tables for the Czech Republic are also processed for a five-year period for the purpose of comparison. These are normally calculated for each calendar year. The aim of the paper is to evaluate the main output of mortality tables, i.e. life expectancy, from a regional perspective in a given period and compare it with the two previous periods: 2001–2005 and 2006–2010.[2)] The article begins by describing regional differences in life expectancy at birth, revealing the differences in overall mortality, and proceeds then to describe, first, regional differences in life expectancy at age 45 and age 65 and, second, regional variability in mortality and the changes therein by sex.

The mortality tables for districts in the given years that are published by the Czech Statistical Office were used as the sources of data. The territorial division of input data always respects the territorial structure of the relevant year. During the whole observed period the district borders changed (in conformity with Government Decree No. 513/2006 Coll., which came into force on 1 January 2007). The district the population belonged to changed in 119 municipalities. This affected 35 districts and in most of them the population has not changed significantly, except in Praha-východ (Prague-East), Plzeň-město (Pilsen--City), Brno-venkov (Brno-Rural) and Ostrava-město (Ostrava-City), which saw sizeable increases in population size, and the districts Plzeň-jih (Pilsen-South), Břeclav, and Frýdek-Místek, where was a greater decline in population size. It is necessary to point out that the time comparison of indicators may be affected by this administrative change.

REGIONAL DIFFERENCES IN LIFE EXPECTANCY AT BIRTH

The level of mortality in the Czech Republic is still decreasing and this is due to many factors, such as the improving quality of medical care and prevention and changes in environment and lifestyle. Life expectancy at birth is one of the basic indicators for the assessment of mortality and mortality trends. This indicator has been rising in the Czech Republic. Between 2001–2005 and 2011–2015 life expectancy at birth increased by 3.0 years for men and by 2.5 years for women (see Table 2).

During the whole observed period, interregional differences in life expectancy at birth maintained some similar characteristics; in particular, the regional variability of this indicator did not change significantly during the decade. The level of mortality in most districts corresponded with the national level of mortality: life expectancy at birth in almost half of all districts (among men) and in up to 70%

1) Czech Statistical Office, contact: jana.krestanova@czso.cz.

2) From 2009 the Czech Statistical Office constructs mortality tables for districts (and for municipalities with extended competencies) annually. They were published only aggregate outcomes. For three observed periods, the complete mortality tables are already available on www.czso.cz/csu/czso/umrtnostni_tabulky.

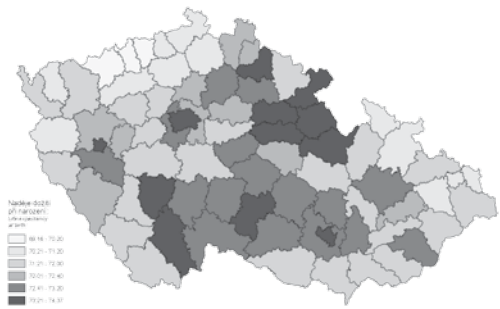
of districts (among women) did not differ by more than one percent from the figure for the Czech Republic as a whole (see Table 1). During the whole observed period differences between districts in terms of life expectancy were also not significant. The difference between the minimum and maximum figures in districts was approximately 5 years for men and approximately 4 years for women (see Table 2). The slightly greater differentiation of life expectancy that can be observed among men (rather than women) also indicates higher values of standard deviation and higher values of coefficient of variation. Regional view of mortality over time was also more stable for men than for women.

Table 1 Distribution of districts according to life expectancy at birth (e0) in the Czech Republic, men, women, 2001–2015

Relation between e_0 in district and e_0 in the Czech Republic	Men			Women		
	2001–2005	2006–2010	2011–2015	2001–2005	2006–2010	2011–2015
<98% CR	11	11	9	4	4	5
98–99% CR	12	13	15	9	11	11
99–101% CR	38	37	37	57	55	54
101–102% CR	11	13	13	7	7	7
>102% CR	5	3	3	0	0	0

Source: Czech Statistical Office; author´s calculations.

Figure 1 Life expectancy at birth in districts of the Czech Republic, men, 2001–2005



Source: Czech Statistical Office.

Figure 2 Life expectancy at birth in districts of the Czech Republic, women, 2001–2005

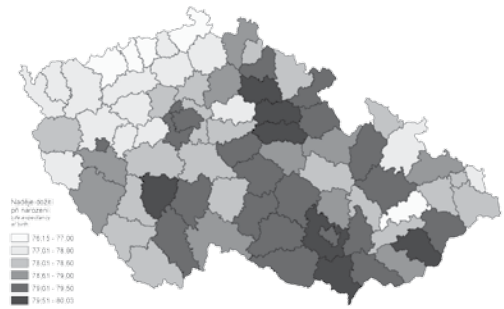
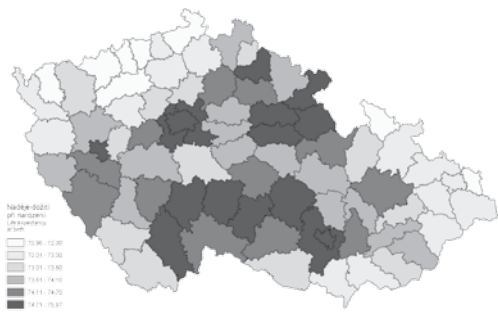


Figure 3 Life expectancy at birth in districts of the Czech Republic, men, 2006–2010



Source: Czech Statistical Office.

Figure 4 Life expectancy at birth in districts of the Czech Republic, women, 2006–2010

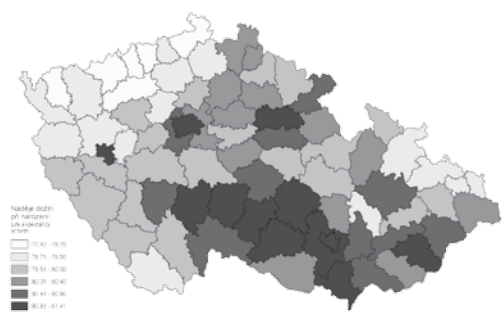


Figure 5 Life expectancy at birth in districts of the Czech Republic, men, 2011–2015

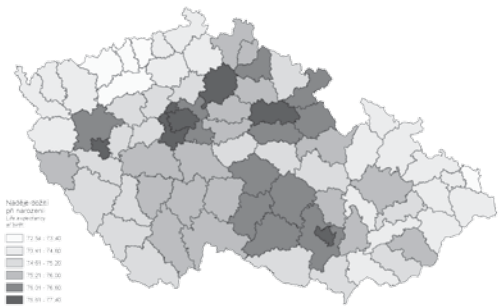
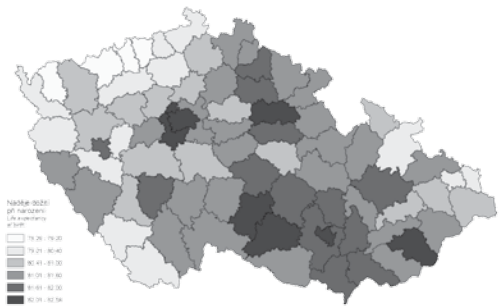


Figure 6 Life expectancy at birth in districts of the Czech Republic, women, 2011–2015



Source: Czech Statistical Office; author´s calculations.

In all three observed five-years periods there remains a higher level of mortality in North and Northwest Bohemia, while a lower level of mortality is in the districts of major cities (see Figure 1 to Figure 6). More specifically, throughout the three periods the lowest life expectancies at birth for men are found in districts in the Ústecký (Ústí nad Labem) and Karlovarský (Karlovy Vary) regions and in North Moravia (especially in districts in the Moravskoslezský/Moravia-Silesia region). The highest life expectancies at birth were in the districts of larger cities (Hlavní město Praha/Capital City of Prague, Brno, Plzeň/Pilsen) and district Hradec Králové (see Annex 1). Furthermore, in years 2001–2005 and 2006–2010 the highest figures for this indicator for men were in districts in the Jihočeský (South Bohemia) region and the Vysočina region and throughout the Královéhradecký (Hradec Králové) region, while in the most recent period the importance of these areas diminished slightly. In the case of women, in all three periods lower life expectancies at birth are found (as with men) in districts in North and Northwest Bohemia, but are slightly higher in North Moravia. According to data for the 2011–2015 period, the highest life expectancies at birth for women (and also for men) are in the districts of major cities; however, in the first five-year period (2001–2005) life expectancy at birth was highest in other areas, namely in districts in the Jihomoravský (South Moravia) region (especially in the area around district Brno-město/Brno-City) and also in the Vysočina region and Královéhradecký (Hradec Králové) region. Alongside these areas Zlín district can also be included among the districts where the level of this indicator is higher (among women) in all three periods.

The slight changes in the regional variability of life expectancy at birth during the given periods can be specifically demonstrated using Spearman's rank correlation coefficients, which express the degree of ranking consensus of the districts by life expectancy at birth between two selected periods. The closer the coefficient is to +1, the stronger the consensus is. The coefficients for men reached 0.91 and 0.89 between two adjacent periods and 0.90 between the first and the last period; for women it was 0.84 and 0.88 and then 0.84, respectively (see Table 2). However, in case of some districts their order changed quite significantly. Between 2001–2005 and 2011–2015 the order by figures for life expectancy at birth for men worsened and 15 districts fell in the ranking by 10 or more places; and 2 districts fell by more than 20 places (Kutná Hora and Karlovy Vary). For women the order by indicator worsened in 16 districts which fell in the ranking by 10 or more places. In the districts of Chrudim, Přerov and Plzeň-jih (Pilsen-South) the decline was even by as much as 20 or more places. However, due to the territorial changes in 2007 there was a population decline in Plzeň-jih (Pilsen-South), which may have contributed to the change in ranking. The order change reflected the transfer of a given district from a group of districts with an above-average level of life expectancy in the 2001–2005 period to a group of districts with a below-average life expectancy in the 2011–2015 period. However, the level of life expectancy in that district did not itself decrease. Conversely, between the first and the last period 11 districts improved by 10 or more places in the ranking in the case of men and 13 districts did so in the case of women.

Table 2 Life expectancy at birth in districts of the Czech Republic in selected statistical indicators, 2001–2015

Indicators	Males			Females		
	I	II	III	I	II	III
	2001–2005	2006–2010	2011–2015	2001–2005	2006–2010	2011–2015
Life expectancy at birth in the Czech Republic*)	72.3	73.9	75.3	78.7	80.1	81.2
Maximum in districts	74.4	76.0	77.4	80.0	81.4	82.5
Minimum in districts	69.2	71.0	72.4	76.2	77.4	78.3
Standard deviation	1.06	1.13	1.05	0.82	0.80	0.89
Coefficient of variation (%)	1.47	1.53	1.39	1.04	1.00	1.09
Difference between the two periods	I–II	II–III	I–III	I–II	II–III	I–III
Spearman´s rank correlation coefficient	0.91	0.89	0.90	0.84	0.88	0.84

Note: Figures are given for five-year periods.
Source: Czech Statistical Office; author´s calculations.

A similar picture is provided by the ranking of districts according to the highest and lowest life expectancy figures (see Table 3 and Table 4). In all three periods Hradec Králové, Hlavní město Praha (Capital City of Prague) and Plzeň-město (Pilsen-City) were among the five districts with the highest life expectancies for men. The same five districts were in case found with the lowest levels of life expectancy at birth: Chomutov, Most, Teplice, Karviná, and Louny. It was similar for women: in the three observed periods the lowest life expectancies for women were in Teplice and Most. The districts where women's life expectancy at birth is highest have changed over the years (see Table 4). Districts that in all three periods had a relatively high life expectancy included Jihlava, Brno-město (Brno-City), Brno-venkov (Brno-Rural), and Zlín.

Between the 2001–2005 period and the 2011–2015 period life expectancy at birth increased in all districts for both men and women. The biggest increase in life expectancy at birth between the first and the third observed period was in the case of males in the Plzeň-sever (Pilsen-North) district (4.3 years), which was significantly different from the increases in other districts, where the increases were lower by more than 0.4 years (see Table 5). For women, life expectancy at birth grew most, by 3.7 years, in Domažlice. Conversely, the smallest increases were in Kutná Hora for men (1.7 years) and in Sokolov for women (1.1 years). The increases between 2006–2010

Table 3 Districts with the highest and the lowest life expectancy at birth, Czech Republic, men, 2001–2015

Highest life expectancy					
2001–2005		2006–2010		2011–2015	
Hradec Králové	74.4	Hradec Králové	76.0	Hlavní město Praha/*Capital City of Prague*	77.4
Hlavní město Praha/*Capital City of Prague*	74.1	*Hlavní město Praha/Capital City of Prague*	75.9	Hradec Králové	76.8
Brno-město/*Brno-City*	74.0	Praha-západ/*Prague-West*	75.5	Praha-západ/*Prague-West*	76.8
Náchod	73.9	Plzeň-město/*Pilsen-City*	75.3	Brno-město/*Brno-City*	76.7
Plzeň-město/*Pilsen-City*	73.8	Rychnov nad Kněžnou	75.3	Plzeň-město/*Pilsen-City*	76.7
Lowest life expectancy					
2001–2005		2006–2010		2011–2015	
Chomutov	69.2	Teplice	71.0	Chomutov	72.5
Most	69.8	Chomutov	71.4	Teplice	72.6
Teplice	70.1	Most	71.5	Most	72.9
Karviná	70.3	Karviná	71.6	Karviná	73.0
Louny	70.5	Louny	71.7	Louny	73.1

Source: Czech Statistical Office.

Table 4 The districts with the highest and the lowest life expectancy at birth, Czech Republic, women, 2001–2015

Highest life expectancy					
2001–2005		**2006–2010**		**2011–2015**	
Zlín	80.0	Jihlava	81.4	Brno-město/*Brno-City*	82.5
Brno-venkov/*Brno-Rural*	79.9	Pelhřimov	81.3	Hradec Králové	82.3
Břeclav	79.8	Třebíč	81.1	Hlavní město Praha/*Capital City of Prague*	82.2
Jičín	79.8	Hradec Králové	81.1	Praha-západ/*Prague-West*	82.2
Písek	79.7	Brno-město/*Brno-City*	81.0	Jihlava	82.1
Lowest life expectancy					
2001–2005		**2006–2010**		**2011–2015**	
Teplice	76.2	Teplice	77.4	Most	78.3
Most	76.3	Most	77.7	Teplice	78.5
Chomutov	76.8	Louny	78.3	Chomutov	78.8
Děčín	76.9	Sokolov	78.3	Sokolov	78.9
Louny	77.3	Děčín	78.5	Karviná	79.3

Source: Czech Statistical Office.

Table 5 Districts with the largest and the smallest increases in life expectancy at birth between 2001–2005 and 2011–2015 (in years), Czech Republic

Largest increases				Smallest increases			
Men		**Women**		**Men**		**Women**	
Plzeň-sever/*Pilsen-North*	4.3	Domažlice	3.7	Kutná Hora	1.7	Sokolov	1.1
Příbram	3.9	Beroun	3.6	Ústí nad Orlicí	2.4	Karviná	1.6
Praha-východ/*Prague-East*	3.8	Česká Lípa	3.4	Náchod	2.4	Plzeň-jih/*Pilsen-South*	1.6
Děčín	3.8	Karlovy Vary	3.3	Pelhřimov	2.4	Břeclav	1.8
Praha-západ/*Prague-West*	3.7	Jablonec nad Nisou	3.2	Písek	2.4	Brno-venkov/*Brno-Rural*	1.8

Source: Czech Statistical Office.

and 2011–2015 were slightly smaller than the increases between 2001–2005 and 2006–2010; the pace of the increase in life expectancy has slowed slightly. From the 2001–2005 period to the 2006–2010 period in the increase in life expectancy for the country as a whole was 1.6 years for men and 1.4 years for women; between 2006–2010 and 2011–2015 it was 1.4 years for men and 1.1 years for women (see Table 2).

REGIONAL DIFFERENCES IN LIFE EXPECTANCY AT AGE 45 AND AGE 65

The life expectancy indicator can also be studied at the district level for each age. Since the life tables created for the 2001–2005 period the Czech Statistical Office has been constructing district mortality tables with one-year age intervals (prior to that they were constructed for five-year age groups). To analyse mortality in middle age the age 45 was chosen; to study mortality at older ages the age 65 was chosen. The structure of the districts by the highest and the lowest levels of life expectancy at age 45 and age 65 (see Annex 2 and 3) was very similar to the structure at age 0. The ranking of districts by life expectancy at age 45 was almost identical to the distribution of life expectancy at birth. At age 65 slight differences appeared, as evidenced by the lower Spearman's coefficients for this age. However, no district showed dramatic differences in their life expectancy by age, i.e. no district had an above-average life expectancy at birth and a below-average indicator at age 65, and vice versa.

The differentiation between districts by life expectancy grows with age. The coefficient of variation at age 65 was in every case/district higher than at age 45, which in turn was higher than at age 0; again

Table 6 Life expectancy at age 45 and 65 in districts of the Czech Republic in selected statistical indicators, 2001–2015

Age	Indicators	Males			Females		
		I	II	III	I	II	III
		2001–2005	2006–2010	2011–2015	2001–2005	2006–2010	2011–2015
45	Life expectancy at age 45 in the Czech Republic*)	29.5	30.8	31.9	34.9	36.1	37.0
	Maximum in districts	31.1	32.4	33.7	36.1	37.2	38.4
	Minimum in districts	26.8	28.4	29.4	32.7	33.8	34.5
	Standard deviation	0.92	0.95	0.92	0.73	0.69	0.81
	Coefficient of variation (%)	3.14	3.10	2.89	2.11	1.92	2.20
	Difference between two periods	I–II	II–III	I–III	I–II	II–III	I–III
	Spearman's rank correlation coefficient	0.91	0.87	0.86	0.83	0.88	0.82
65	Life expectancy at age 65 in the Czech Republic*)	14.1	15.1	15.8	17.3	18.3	19.1
	Maximum in districts	15.2	16.1	17.0	18.3	19.3	20.4
	Minimum in districts	12.0	13.4	14.1	15.6	16.6	17.1
	Standard deviation	0.62	0.62	0.60	0.54	0.55	0.66
	Coefficient of variation (%)	4.48	4.20	3.85	3.16	3.3	3.49
	Difference between two periods	I–II	II–III	I–III	I–II	II–III	I–III
	Spearman's rank correlation coefficient	0.87	0.76	0.74	0.78	0.81	0.77

Note: Figures are given for five-year periods.
Source: Czech Statistical Office; author´s calculations.

Table 7 Districts with the largest and the smallest increases in life expectancy at age 45 from 2001–2005 and 2011–2015 (in years), Czech Republic

Largest increases				Smallest increases			
Men		Women		Men		Women	
Plzeň-sever/*Pilsen-North*	3.6	Domažlice	3.3	Rokycany	1.3	Sokolov	1.0
Děčín	3.6	Jablonec nad Nisou	3.1	Kutná Hora	1.5	Plzeň-jih/*Pilsen-South*	1.4
Prachatice	3.5	Beroun	3.0	Teplice	1.8	Karviná	1.5
Příbram	3.2	Karlovy Vary	2.8	Pelhřimov	1.8	Břeclav	1.5
Praha-západ/*Prague-West*	3.2	Brno-město/*Brno-City*	2.8	Plzeň-jih/*Pilsen-South*	1.8	Prachatice	1.6

Source: Czech Statistical Office.

Table 8 Districts with the largest and the smallest increases in life expectancy at age 65 from 2001–2005 and 2011–2015 (in years), Czech Republic

Largest increases				Smallest increases			
Men		Women		Men		Women	
Plzeň-sever/*Pilsen-North*	2.7	Domažlice	2.9	Kutná Hora	0.8	Sokolov	0.6
Děčín	2.7	Jablonec nad Nisou	2.9	Prostějov	0.9	Karviná	1.1
Mladá Boleslav	2.3	Karlovy Vary	2.5	Písek	1.0	Plzeň-jih/*Pilsen-South*	1.1
Jeseník	2.3	Praha-západ/*Prague-West*	2.4	Vsetín	1.1	Rychnov nad Kněžnou	1.2
Prachatice	2.3	Beroun	2.4	Kroměříž	1.1	Rokycany	1.2

Source: Czech Statistical Office.

the coefficient was higher for men than for women (see Table 6). The differences between the life expectancy levels in districts slightly decreased between 2006–2010 and 2011–2015 in the case of men, while in the case of women variation in the coefficient had a slightly increasing trend in the last five years. The lower Spearman's rank correlation coefficients for the indicator at age 65 indicate a smaller consensus in district ranking by life expectancy at this age (smaller than at age 0 and age 45).

The differentiation between districts by life expectancy grows with age. The coefficient of variation at age 65 was in every case/district higher than at age 45, which in turn was higher than at age 0; again the coefficient was higher for men than for women (see Table 6). The differences between the life expectancy levels in districts slightly decreased between 2006–2010 and 2011–2015 in the case of men, while in the case of women variation in the coefficient had a slightly increasing trend in the last five years. The lower Spearman's rank correlation coefficients for the indicator at age 65 indicate a smaller consensus in district ranking by life expectancy at this age (smaller than at age 0 and age 45).

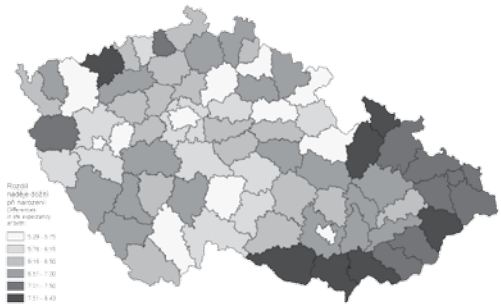
During the observed years, life expectancy at age 45 and 65 increased; it was relatively greater than at age 0. In the Czech Republic between 2001–2005 and 2011–2015 life expectancy at age 45 increased by 2.5 years (by 8%) for men and 2.2 years (by 6%) for women; at age 65 it increased by 1.7 years (12%) for men and 1.8 years (10%) for women (see Table 6). The largest increase (absolutely and relatively) in life expectancy for men at age 45 and 65 was in the Plzeň-sever (Pilsen-North) and Děčín districts and for women it was in Domažlice (see Table 7 and Table 8); this was the same as in the case of life expectancy at birth (see Table 5). As with life expectancy at birth for women, a significantly smaller increase at age 45 and age 65 was observed in Sokolov district. Between 2006–2010 and 2011–2015 the increases for both ages were slightly smaller than they were between years 2001–2005 and 2006–2010.

REGIONAL DIFFERENCES BETWEEN SEXES

The structure of districts by excess mortality, i.e. the difference in life expectancy at birth between women and men, is more difficult to define regionally (see Figure 7 to Figure 9). However, it is possible to see that the most significant disproportion between men and women was found in districts in Moravia throughout the period. In the first two periods higher excess male mortality was observed in districts in the Moravskoslezský (Moravia-Silesia) region, Zlínský (Zlín) region, and the southern part of Jihomoravský (South Moravia) region; and in the third period they were joined by Olomoucký (Olomouc) region (except in the district of Přerov). From a district perspective, in 2011–2015 the biggest difference was in Šumperk district (7.5 years); in the two previous periods it was in Břeclav district (see Table 9). While in Břeclav the difference was caused by an improvement in women's mortality, in Šumperk district men had, in a national comparison, a slightly worse mortality level and women had a slightly better mortality level, so the difference was not clearly caused by just one side. In districts in North and Northwest Bohemia the differences were about average in all three periods (except in the district of Chomutov, which in the first and the second period ranked among the districts with higher excess male mortality). The higher mortality rates that characterise this area were more similar for both sexes in this area. The smallest differences were found mainly in the districts of larger cities (especially in the districts of Hlavní město Praha/Capital City of Prague and Plzeň/Pilsen), which was mainly due to the much better mortality level of men in a national comparison. In 2001–2005 the districts with the smallest differences came to include also Vysočina, where both sexes reached similar above-average values. In 2006–2010 small differences were also observed in the area of eastern Bohemia, which was again due to a significant improvement in men's mortality. In the last period the smallest difference was found in the Plzeň-sever (Pilsen-North) district (4.2 years), where from a national perspective men had an above-average level of mortality and women had a more below-average level, which had the effect of minimising the difference between sexes.

During the observed years the differences between sexes at birth and at age 45 declined; at age 0

Figure 7 The difference in life expectancy between men and women at age 0 in districts of the Czech Republic, 2001–2005



Source: Czech Statistical Office.

Figure 8 The difference in life expectancy between men and women at age 0 in districts of the Czech Republic, 2006–2010

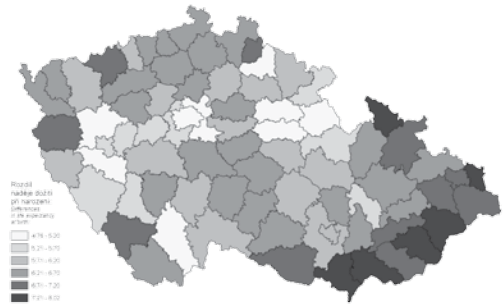
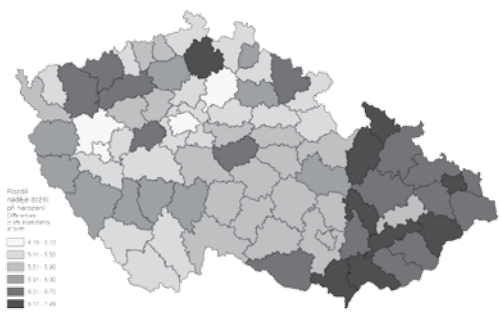


Figure 9 The difference in life expectancy between men and women at age 0 in districts of the Czech Republic, 2011–2015



Source: Czech Statistical Office.

the average difference decreased from 6.5 years in 2001–2005 to 5.9 years in 2011–2015; and at age 45 from 5.5 years to 5.1 years. At age 65 the difference did not have a clear development trend; the differences in life expectancy between men and women in the observed periods were similar (see Table 10). The regional variability of the difference (measured by coefficient of variation) was the highest at age 65 in all three periods. The lower Spearman's rank correlation coefficients indicate the small consensus in district order by difference between men and women in life expectancy at the given ages, especially at age 65 and between the 2006–2010 and 2011–2015 periods.

Table 9 The largest and smallest differences in life expectancy between men and women (in years) by district, Czech Republic, 2001–2015

Largest differences					
2001–2005		2006–2010		2011–2015	
Břeclav	8.4	Břeclav	8.0	Šumperk	7.5
Vsetín	7.8	Hodonín	7.8	Hodonín	7.4
Hodonín	7.7	Jeseník	7.7	Vsetín	7.0
Šumperk	7.7	Vsetín	7.5	Břeclav	7.0
Znojmo	7.6	Karviná	7.3	Ostrava-město/*Ostrava-City*	6.8
Smallest differences					
2001–2005		2006–2010		2011–2015	
Hradec Králové	5.3	České Budějovice	4.8	Plzeň-sever/*Pilsen-North*	4.2
Ústí nad Orlicí	5.3	Plzeň-sever/*Pilsen-North*	5.0	Hlavní město Praha/*Capital City of Prague*	4.8
Hlavní město Praha/*Capital City of Prague*	5.4	Rychnov nad Kněžnou	5.0	Mladá Boleslav	4.9
Brno-město/*Brno-City*	5.4	Hlavní město Praha/*Capital City of Prague*	5.0	Plzeň-město/*Pilsen-City*	5.1
Plzeň-město/*Pilsen-City*	5.5	Semily	5.1	Rychnov nad Kněžnou	5.1

Source: Czech Statistical Office.

Table 10 Differences in life expectancy between men and women at ages 0, 45, and 65 in districts of the Czech Republic in selected statistical indicators, 2001–2015

Indicator	0 years			45 years			65 years		
	2001–2005	2006–2010	2011–2015	2001–2005	2006–2010	2011–2015	2001–2005	2006–2010	2011–2015
Maximum	8.4	8.0	7.5	7.4	6.5	6.3	4.4	4.0	4.4
Minimum	5.3	4.8	4.2	4.4	4.0	3.8	2.5	2.3	2.2
Mean	6.5	6.2	5.9	5.5	5.3	5.1	3.3	3.3	3.4
Standard deviation	0.68	0.72	0.61	0.62	0.6	0.56	0.4	0.4	0.45
Coefficient of variation (%)	10.48	11.54	10.37	11.29	11.18	10.84	12.29	12.22	13.23
Difference between two periods	I–II	II–III	I–III	I–II	II–III	I–III	I–II	II–III	I–III
Spearman´s rank correlation coefficient	0.69	0.57	0.66	0.67	0.52	0.61	0.55	0.33	0.38

Note: Figures are given for five-year periods.
Source: Czech Statistical Office.

CONCLUSION

In the Czech Republic the mortality rates are decreasing. Between 2001–2005 and 2011–2015 life expectancy at birth increased by 3.0 years for men and by 2.5 years for women. Between 2006–2010 and 2011–2015 the increases were slightly lower than between 2001–2005 and 2006–2010; the pace of the increase in life expectancy has slowed slightly. The improvement in mortality is not spread evenly across regions; however, during the observed years the inter-district variability was relatively low and did not change significantly. There remains a higher level of mortality in North and Northwest Bohemia, while mortality continues to be lower in the districts of larger cities (Hlavní město Praha/Capital City of Prague, Brno, Plzeň/Pilsen). Higher life expectancy figures are found in districts in Southeast Bohemia and South Moravia. Differences also persist between men and women's mortality rates, but the differences between sexes at birth and at age 45 decreased over the three observed periods (by 0.6 years at age 0 and by 0.4 years at age 45); there was no clear trend observed between periods for the difference at age 65. However, there was greater variability in the difference between men and women than there was in the life expectancy of life expectancy for men and for women in selected years. The smallest differences between sexes were mainly found in the districts of major cities (Hlavní město Praha/Capital City of Prague, Plzeň/Pilsen), while excess male mortality continues to be higher in the districts of Moravia.

Annex

Annex 1 Life expectancy at birth in districts of the Czech Republic, males, females, 2001–2015

Area			Men			Women		
Region	**District**	**code LAU1**	**2001–2005**	**2006–2010**	**2011–2015**	**2001–2005**	**2006–2010**	**2011–2015**
Praha	**Hlavní město Praha**	CZ0100	74.1	75.9	77.4	79.5	80.9	82.2
Středočeský kraj	**Benešov**	CZ0201	71.9	73.3	75.2	78.1	79.6	80.8
Středočeský kraj	**Beroun**	CZ0202	71.7	74.3	74.8	77.9	79.7	81.4
Středočeský kraj	**Kladno**	CZ0203	71.7	73.4	74.7	78.1	79.4	80.5
Středočeský kraj	**Kolín**	CZ0204	71.8	73.8	75.4	78.2	80.0	81.0
Středočeský kraj	**Kutná Hora**	CZ0205	72.9	73.7	74.6	79.2	80.1	81.1
Středočeský kraj	**Mělník**	CZ0206	72.1	73.1	75.1	78.4	79.7	80.5
Středočeský kraj	**Mladá Boleslav**	CZ0207	73.0	74.2	76.6	78.7	80.3	81.5
Středočeský kraj	**Nymburk**	CZ0208	72.2	73.7	75.4	78.0	80.3	80.9
Středočeský kraj	**Praha-východ**	CZ0209	72.3	75.0	76.2	78.5	80.1	81.3
Středočeský kraj	**Praha-západ**	CZ020A	73.1	75.5	76.8	79.1	80.7	82.2
Středočeský kraj	**Příbram**	CZ020B	71.5	73.6	75.4	78.4	79.7	80.6
Středočeský kraj	**Rakovník**	CZ020C	71.8	73.0	74.9	78.0	79.7	80.5
Jihočeský kraj	**České Budějovice**	CZ0311	73.5	75.1	76.0	79.1	79.9	81.4
Jihočeský kraj	**Český Krumlov**	CZ0312	71.8	73.2	74.8	78.1	79.5	80.1
Jihočeský kraj	**Jindřichův Hradec**	CZ0313	72.8	74.6	75.5	78.7	80.5	81.3
Jihočeský kraj	**Písek**	CZ0314	73.3	74.3	75.7	79.7	80.6	81.9
Jihočeský kraj	**Prachatice**	CZ0315	71.3	73.0	74.8	78.1	79.8	80.1
Jihočeský kraj	**Strakonice**	CZ0316	71.8	74.1	74.6	78.5	79.6	80.6
Jihočeský kraj	**Tábor**	CZ0317	72.6	74.9	75.4	79.3	80.8	81.4
Plzeňský kraj	**Domažlice**	CZ0321	71.8	74.0	75.4	77.9	80.0	81.6
Plzeňský kraj	**Klatovy**	CZ0322	72.1	74.5	75.1	78.7	80.0	81.1
Plzeňský kraj	**Plzeň-město**	CZ0323	73.8	75.3	76.7	79.2	80.9	81.7
Plzeňský kraj	**Plzeň-jih**	CZ0324	72.7	74.6	75.1	78.7	79.7	80.3
Plzeňský kraj	**Plzeň-sever**	CZ0325	72.0	74.1	76.3	77.9	79.0	80.5
Plzeňský kraj	**Rokycany**	CZ0326	72.4	73.6	74.9	78.0	78.9	80.2
Plzeňský kraj	**Tachov**	CZ0327	71.1	72.3	74.0	78.2	79.0	80.0
Karlovarský kraj	**Cheb**	CZ0411	71.4	72.9	74.4	77.7	79.4	80.0
Karlovarský kraj	**Karlovy Vary**	CZ0412	71.9	73.2	74.4	77.5	79.2	80.9
Karlovarský kraj	**Sokolov**	CZ0413	70.8	71.7	73.4	77.8	78.3	78.9
Ústecký kraj	**Děčín**	CZ0421	70.6	72.0	74.4	76.9	78.5	79.9
Ústecký kraj	**Chomutov**	CZ0422	69.2	71.4	72.5	76.8	78.5	78.8
Ústecký kraj	**Litoměřice**	CZ0423	71.0	72.9	73.7	77.5	79.2	79.8
Ústecký kraj	**Louny**	CZ0424	70.5	71.7	73.1	77.3	78.3	79.5
Ústecký kraj	**Most**	CZ0425	69.8	71.5	72.9	76.3	77.7	78.3
Ústecký kraj	**Teplice**	CZ0426	70.1	71.0	72.6	76.2	77.4	78.5
Ústecký kraj	**Ústí nad Labem**	CZ0427	70.7	72.7	74.2	77.8	79.1	79.8
Liberecký kraj	**Česká Lípa**	CZ0511	70.7	72.6	74.2	77.6	79.0	80.9
Liberecký kraj	**Jablonec nad Nisou**	CZ0512	72.1	73.5	75.4	78.3	80.3	81.5
Liberecký kraj	**Liberec**	CZ0513	72.2	73.9	75.6	78.8	80.3	81.0

(continue)

Area			Men			Women		
Region	**District**	**code LAU1**	**2001–2005**	**2006–2010**	**2011–2015**	**2001–2005**	**2006–2010**	**2011–2015**
Liberecký kraj	**Semily**	CZ0514	73.7	74.9	76.1	79.2	79.9	81.6
Královéhradecký kraj	**Hradec Králové**	CZ0521	74.4	76.0	76.8	79.7	81.1	82.3
Královéhradecký kraj	**Jičín**	CZ0522	72.8	74.3	75.8	79.8	80.2	81.7
Královéhradecký kraj	**Náchod**	CZ0523	73.9	75.2	76.2	79.4	80.5	81.4
Královéhradecký kraj	**Rychnov nad Kněžnou**	CZ0524	73.4	75.3	76.1	79.3	80.3	81.3
Královéhradecký kraj	**Trutnov**	CZ0525	71.7	74.1	75.1	78.3	79.9	81.4
Pardubický kraj	**Chrudim**	CZ0531	72.2	73.7	75.0	78.9	79.8	80.9
Pardubický kraj	**Pardubice**	CZ0532	73.5	75.3	76.2	79.6	80.5	81.7
Pardubický kraj	**Svitavy**	CZ0533	71.8	73.8	75.0	78.6	79.7	81.0
Pardubický kraj	**Ústí nad Orlicí**	CZ0534	73.5	74.2	75.9	78.8	79.9	81.5
Kraj Vysočina	**Havlíčkův Brod**	CZ0631	73.0	74.3	76.2	79.1	80.7	81.8
Kraj Vysočina	**Jihlava**	CZ0632	73.4	75.1	76.3	79.5	81.4	82.1
Kraj Vysočina	**Pelhřimov**	CZ0633	73.0	74.8	75.4	78.6	81.3	81.1
Kraj Vysočina	**Třebíč**	CZ0634	73.0	74.5	76.3	79.4	81.1	82.0
Kraj Vysočina	**Žďár nad Sázavou**	CZ0635	73.1	75.1	76.2	79.4	80.9	81.9
Jihomoravský kraj	**Blansko**	CZ0641	72.7	73.8	76.0	78.9	80.2	81.7
Jihomoravský kraj	**Brno-město**	CZ0642	74.0	75.2	76.7	79.4	81.0	82.5
Jihomoravský kraj	**Brno-venkov**	CZ0643	73.0	75.0	76.0	79.9	80.8	81.7
Jihomoravský kraj	**Břeclav**	CZ0644	71.4	72.8	74.7	79.8	80.8	81.6
Jihomoravský kraj	**Hodonín**	CZ0645	71.8	72.7	74.4	79.4	80.5	81.8
Jihomoravský kraj	**Vyškov**	CZ0646	72.7	74.2	75.2	79.3	80.5	81.7
Jihomoravský kraj	**Znojmo**	CZ0647	71.8	73.3	75.1	79.4	80.3	81.5
Olomoucký kraj	**Jeseník**	CZ0711	70.8	71.9	74.0	78.4	79.6	80.8
Olomoucký kraj	**Olomouc**	CZ0712	72.7	74.3	75.5	79.4	80.6	81.8
Olomoucký kraj	**Prostějov**	CZ0713	71.9	73.9	74.5	78.6	79.5	81.2
Olomoucký kraj	**Přerov**	CZ0714	72.3	73.3	74.9	78.8	79.8	80.7
Olomoucký kraj	**Šumperk**	CZ0715	71.6	73.5	74.0	79.2	80.1	81.4
Zlínský kraj	**Kroměříž**	CZ0721	71.7	73.7	74.3	78.5	80.5	81.0
Zlínský kraj	**Uherské Hradiště**	CZ0722	71.8	73.2	74.9	78.9	80.2	81.5
Zlínský kraj	**Vsetín**	CZ0723	71.5	72.9	74.3	79.3	80.4	81.3
Zlínský kraj	**Zlín**	CZ0724	72.6	73.7	75.6	80.0	81.0	82.0
Moravskoslezský kraj	**Bruntál**	CZ0801	70.7	72.2	73.5	78.0	79.0	79.9
Moravskoslezský kraj	**Frýdek-Místek**	CZ0802	71.3	73.0	74.4	78.5	80.1	80.8
Moravskoslezský kraj	**Karviná**	CZ0803	70.3	71.6	73.0	77.8	79.0	79.3
Moravskoslezský kraj	**Nový Jičín**	CZ0804	71.0	72.9	74.5	78.5	80.0	80.9
Moravskoslezský kraj	**Opava**	CZ0805	71.4	72.8	74.4	78.7	79.5	81.0
Moravskoslezský kraj	**Ostrava-město**	CZ0806	70.9	72.4	73.4	78.1	79.4	80.3

Source: Czech Statistical Office.

Annex 2 Life expectancy at age 45 in districts of the Czech Republic, males, females, 2001–2015

Area			Men			Women		
Region	**District**	**code LAU1**	**2001–2005**	**2006–2010**	**2011–2015**	**2001–2005**	**2006–2010**	**2011–2015**
Praha	**Hlavní město Praha**	CZ0100	30.9	32.4	33.7	35.5	36.8	37.9
Středočeský kraj	**Benešov**	CZ0201	29.4	30.4	32.0	34.1	35.8	36.8
Středočeský kraj	**Beroun**	CZ0202	29.0	31.1	31.5	34.1	35.7	37.1
Středočeský kraj	**Kladno**	CZ0203	28.9	30.2	31.4	34.1	35.1	36.3
Středočeský kraj	**Kolín**	CZ0204	29.1	30.5	31.9	34.4	35.9	36.8
Středočeský kraj	**Kutná Hora**	CZ0205	29.8	30.4	31.4	35.0	36.1	36.8
Středočeský kraj	**Mělník**	CZ0206	29.2	30.0	31.7	34.5	35.8	36.4
Středočeský kraj	**Mladá Boleslav**	CZ0207	29.9	31.0	33.0	34.7	36.2	37.4
Středočeský kraj	**Nymburk**	CZ0208	29.4	30.4	31.9	34.1	36.3	36.7
Středočeský kraj	**Praha-východ**	CZ0209	29.5	31.5	32.4	34.5	35.9	37.1
Středočeský kraj	**Praha-západ**	CZ020A	30.1	32.0	33.3	35.4	36.5	38.1
Středočeský kraj	**Příbram**	CZ020B	28.6	30.5	31.8	34.2	35.6	36.6
Středočeský kraj	**Rakovník**	CZ020C	28.9	30.2	31.4	33.8	35.5	36.4
Jihočeský kraj	**České Budějovice**	CZ0311	30.5	31.8	32.8	35.2	36.0	37.4
Jihočeský kraj	**Český Krumlov**	CZ0312	28.8	29.7	31.4	34.1	35.5	36.1
Jihočeský kraj	**Jindřichův Hradec**	CZ0313	29.9	31.4	32.2	34.9	36.4	37.2
Jihočeský kraj	**Písek**	CZ0314	30.6	31.3	32.5	36.0	36.6	37.8
Jihočeský kraj	**Prachatice**	CZ0315	28.4	30.2	31.8	34.2	35.6	35.8
Jihočeský kraj	**Strakonice**	CZ0316	29.2	30.8	31.5	34.6	35.7	36.6
Jihočeský kraj	**Tábor**	CZ0317	30.1	31.8	32.1	35.4	36.6	37.3
Plzeňský kraj	**Domažlice**	CZ0321	29.0	30.7	31.8	34.1	35.8	37.4
Plzeňský kraj	**Klatovy**	CZ0322	29.4	31.0	31.8	34.8	36.0	37.0
Plzeňský kraj	**Plzeň-město**	CZ0323	30.7	31.9	33.2	35.1	36.8	37.6
Plzeňský kraj	**Plzeň-jih**	CZ0324	29.9	31.2	31.7	34.8	35.6	36.2
Plzeňský kraj	**Plzeň-sever**	CZ0325	28.9	30.6	32.6	34.1	35.2	36.4
Plzeňský kraj	**Rokycany**	CZ0326	30.1	30.5	31.5	34.5	35.2	36.1
Plzeňský kraj	**Tachov**	CZ0327	28.4	29.8	30.6	34.2	35.1	35.8
Karlovarský kraj	**Cheb**	CZ0411	28.8	30.1	31.3	33.9	35.6	36.0
Karlovarský kraj	**Karlovy Vary**	CZ0412	29.1	30.4	31.4	34.1	35.4	36.9
Karlovarský kraj	**Sokolov**	CZ0413	28.1	28.9	30.2	34.1	34.5	35.0
Ústecký kraj	**Děčín**	CZ0421	28.0	29.1	31.6	33.5	34.8	36.0
Ústecký kraj	**Chomutov**	CZ0422	26.8	28.6	29.7	33.4	34.6	35.0
Ústecký kraj	**Litoměřice**	CZ0423	28.6	30.1	30.6	34.0	35.4	35.9
Ústecký kraj	**Louny**	CZ0424	27.9	29.1	30.2	33.5	34.7	35.5
Ústecký kraj	**Most**	CZ0425	27.1	28.5	30.1	32.7	34.0	34.5
Ústecký kraj	**Teplice**	CZ0426	27.6	28.4	29.4	32.7	33.8	34.5
Ústecký kraj	**Ústí nad Labem**	CZ0427	28.0	29.6	31.1	34.2	35.2	36.0
Liberecký kraj	**Česká Lípa**	CZ0511	28.2	29.6	31.2	34.0	35.0	36.7
Liberecký kraj	**Jablonec nad Nisou**	CZ0512	29.4	30.7	31.9	34.5	36.3	37.7
Liberecký kraj	**Liberec**	CZ0513	29.2	30.7	32.2	34.8	36.3	36.9
Liberecký kraj	**Semily**	CZ0514	30.5	31.5	33.0	35.1	35.5	37.1
Královéhradecký kraj	**Hradec Králové**	CZ0521	31.1	32.4	33.4	35.9	37.0	38.1
Královéhradecký kraj	**Jičín**	CZ0522	30.0	31.0	32.5	35.7	36.2	37.6

(continue)

Area			Men			Women		
Region	**District**	**code LAU1**	**2001–2005**	**2006–2010**	**2011–2015**	**2001–2005**	**2006–2010**	**2011–2015**
Královéhradecký kraj	**Náchod**	CZ0523	30.7	31.7	32.8	35.5	36.6	37.1
Královéhradecký kraj	**Rychnov nad Kněžnou**	CZ0524	30.1	31.9	32.6	35.4	36.3	37.2
Královéhradecký kraj	**Trutnov**	CZ0525	28.9	31.1	31.7	34.5	35.7	37.1
Pardubický kraj	**Chrudim**	CZ0531	29.3	30.7	32.0	35.2	35.8	37.0
Pardubický kraj	**Pardubice**	CZ0532	30.4	32.2	32.7	35.7	36.3	37.4
Pardubický kraj	**Svitavy**	CZ0533	29.1	30.8	31.9	34.7	35.7	37.0
Pardubický kraj	**Ústí nad Orlicí**	CZ0534	30.3	31.0	32.5	34.8	36.0	37.3
Kraj Vysočina	**Havlíčkův Brod**	CZ0631	29.7	31.3	32.9	35.0	36.3	37.5
Kraj Vysočina	**Jihlava**	CZ0632	30.2	31.9	32.7	35.6	37.2	37.9
Kraj Vysočina	**Pelhřimov**	CZ0633	30.1	31.8	31.9	34.8	36.9	37.4
Kraj Vysočina	**Třebíč**	CZ0634	30.5	31.2	32.9	35.5	36.9	37.9
Kraj Vysočina	**Žďár nad Sázavou**	CZ0635	30.3	31.7	32.8	35.6	36.8	37.7
Jihomoravský kraj	**Blansko**	CZ0641	29.8	30.9	32.5	34.9	36.3	37.4
Jihomoravský kraj	**Brno-město**	CZ0642	30.8	31.9	33.2	35.6	37.0	38.4
Jihomoravský kraj	**Brno-venkov**	CZ0643	30.0	31.7	32.7	35.9	36.7	37.6
Jihomoravský kraj	**Břeclav**	CZ0644	28.4	30.0	31.4	35.8	36.5	37.3
Jihomoravský kraj	**Hodonín**	CZ0645	29.0	30.2	31.4	35.6	36.5	37.7
Jihomoravský kraj	**Vyškov**	CZ0646	29.3	30.8	31.8	35.4	36.2	37.4
Jihomoravský kraj	**Znojmo**	CZ0647	29.0	30.2	31.6	35.6	36.1	37.5
Olomoucký kraj	**Jeseník**	CZ0711	27.9	29.2	31.1	34.5	35.7	36.7
Olomoucký kraj	**Olomouc**	CZ0712	30.0	31.4	32.2	35.6	36.6	37.7
Olomoucký kraj	**Prostějov**	CZ0713	29.3	30.7	31.2	34.8	35.5	37.1
Olomoucký kraj	**Přerov**	CZ0714	29.5	30.2	31.6	35.2	36.1	36.8
Olomoucký kraj	**Šumperk**	CZ0715	29.0	30.8	31.1	35.4	36.4	37.4
Zlínský kraj	**Kroměříž**	CZ0721	29.3	30.6	31.1	35.0	36.6	37.2
Zlínský kraj	**Uherské Hradiště**	CZ0722	29.1	30.4	32.1	35.2	36.4	37.6
Zlínský kraj	**Vsetín**	CZ0723	28.9	29.9	31.0	35.3	36.4	37.2
Zlínský kraj	**Zlín**	CZ0724	29.6	30.6	32.2	36.1	36.8	37.8
Moravskoslezský kraj	**Bruntál**	CZ0801	28.1	29.2	30.1	34.3	35.3	36.2
Moravskoslezský kraj	**Frýdek-Místek**	CZ0802	28.4	29.9	31.2	34.6	36.2	36.8
Moravskoslezský kraj	**Karviná**	CZ0803	27.7	29.0	29.7	34.0	35.1	35.5
Moravskoslezský kraj	**Nový Jičín**	CZ0804	28.3	29.8	31.2	34.8	36.1	36.7
Moravskoslezský kraj	**Opava**	CZ0805	28.5	29.4	31.1	34.9	35.5	36.7
Moravskoslezský kraj	**Ostrava-město**	CZ0806	28.0	29.2	30.2	34.2	35.5	36.2

Source: Czech Statistical Office.

Annex 3 Life expectancy at age 65 in districts of the Czech Republic, men, women, 2001–2015

Area			Men			Women		
Region	**District**	**code LAU1**	**2001–2005**	**2006–2010**	**2011–2015**	**2001–2005**	**2006–2010**	**2011–2015**
Praha	**Hlavní město Praha**	CZ0100	15.1	16.1	17.0	17.8	19.0	19.9
Středočeský kraj	**Benešov**	CZ0201	13.5	14.4	15.3	16.4	17.7	18.6
Středočeský kraj	**Beroun**	CZ0202	13.5	15.0	15.1	16.6	17.7	19.0
Středočeský kraj	**Kladno**	CZ0203	13.6	14.6	15.4	16.6	17.4	18.5
Středočeský kraj	**Kolín**	CZ0204	13.9	14.8	15.6	16.9	18.2	18.9
Středočeský kraj	**Kutná Hora**	CZ0205	14.1	14.4	15.0	17.1	18.0	18.5
Středočeský kraj	**Mělník**	CZ0206	13.9	14.3	15.4	17.1	18.1	18.4
Středočeský kraj	**Mladá Boleslav**	CZ0207	14.2	15.3	16.6	17.2	18.2	19.4
Středočeský kraj	**Nymburk**	CZ0208	13.8	14.7	15.5	16.6	18.2	18.5
Středočeský kraj	**Praha-východ**	CZ0209	13.8	15.1	15.7	16.7	18.0	18.9
Středočeský kraj	**Praha-západ**	CZ020A	14.3	15.6	16.5	17.5	18.5	19.9
Středočeský kraj	**Příbram**	CZ020B	13.4	14.6	15.2	16.6	17.8	18.6
Středočeský kraj	**Rakovník**	CZ020C	13.6	14.4	15.1	16.4	17.8	18.2
Jihočeský kraj	**České Budějovice**	CZ0311	14.6	15.3	16.1	17.5	18.1	19.3
Jihočeský kraj	**Český Krumlov**	CZ0312	13.4	14.2	15.2	17.0	17.9	18.3
Jihočeský kraj	**Jindřichův Hradec**	CZ0313	14.0	15.3	15.7	17.1	18.4	19.2
Jihočeský kraj	**Písek**	CZ0314	14.7	15.4	15.7	17.8	18.5	19.5
Jihočeský kraj	**Prachatice**	CZ0315	13.1	14.5	15.4	16.7	18.0	18.1
Jihočeský kraj	**Strakonice**	CZ0316	13.6	15.0	15.4	16.8	17.7	18.5
Jihočeský kraj	**Tábor**	CZ0317	14.1	15.5	15.7	17.6	18.5	19.0
Plzeňský kraj	**Domažlice**	CZ0321	13.5	14.6	15.4	16.4	18.0	19.4
Plzeňský kraj	**Klatovy**	CZ0322	13.6	15.0	15.5	17.1	18.2	19.0
Plzeňský kraj	**Plzeň-město**	CZ0323	14.5	15.6	16.4	17.3	18.7	19.5
Plzeňský kraj	**Plzeň-jih**	CZ0324	14.0	14.9	15.2	16.9	17.5	18.0
Plzeňský kraj	**Plzeň-sever**	CZ0325	13.3	14.5	16.1	16.4	17.4	18.3
Plzeňský kraj	**Rokycany**	CZ0326	14.0	14.6	15.2	16.8	17.4	18.1
Plzeňský kraj	**Tachov**	CZ0327	13.2	13.8	14.3	16.5	17.4	18.1
Karlovarský kraj	**Cheb**	CZ0411	13.4	14.5	15.3	16.8	18.0	18.3
Karlovarský kraj	**Karlovy Vary**	CZ0412	13.8	14.7	15.4	16.7	17.7	19.2
Karlovarský kraj	**Sokolov**	CZ0413	12.9	13.9	14.6	17.0	17.4	17.6
Ústecký kraj	**Děčín**	CZ0421	13.1	13.8	15.8	16.2	17.5	18.4
Ústecký kraj	**Chomutov**	CZ0422	12.0	13.4	14.1	16.2	17.3	17.7
Ústecký kraj	**Litoměřice**	CZ0423	13.3	14.5	14.8	16.6	17.7	18.3
Ústecký kraj	**Louny**	CZ0424	13.0	13.9	14.5	16.2	17.0	17.5
Ústecký kraj	**Most**	CZ0425	12.3	13.4	14.5	15.6	16.7	17.1
Ústecký kraj	**Teplice**	CZ0426	12.4	13.5	14.1	15.7	16.6	17.1
Ústecký kraj	**Ústí nad Labem**	CZ0427	13.1	14.4	15.4	16.7	17.8	18.5
Liberecký kraj	**Česká Lípa**	CZ0511	13.3	14.4	15.0	16.8	17.3	18.8
Liberecký kraj	**Jablonec nad Nisou**	CZ0512	14.0	15.3	15.7	17.0	19.0	19.9
Liberecký kraj	**Liberec**	CZ0513	13.9	15.0	16.0	17.3	18.7	19.0
Liberecký kraj	**Semily**	CZ0514	14.8	15.4	16.6	17.5	17.8	19.1
Královéhradecký kraj	**Hradec Králové**	CZ0521	15.2	15.8	16.6	17.9	18.9	19.8
Královéhradecký kraj	**Jičín**	CZ0522	14.1	14.9	16.0	17.8	18.5	19.4

(continue)

Area			Men			Women		
Region	**District**	**code LAU1**	**2001–2005**	**2006–2010**	**2011–2015**	**2001–2005**	**2006–2010**	**2011–2015**
Královéhradecký kraj	**Náchod**	CZ0523	14.7	15.7	16.2	17.5	18.5	19.0
Královéhradecký kraj	**Rychnov nad Kněžnou**	CZ0524	14.4	15.7	15.8	17.7	18.2	18.9
Královéhradecký kraj	**Trutnov**	CZ0525	13.5	15.1	15.4	16.8	18.0	19.0
Pardubický kraj	**Chrudim**	CZ0531	13.8	14.6	15.9	17.2	17.8	18.8
Pardubický kraj	**Pardubice**	CZ0532	14.6	16.1	16.1	18.0	18.4	19.3
Pardubický kraj	**Svitavy**	CZ0533	13.7	15.1	15.7	17.1	18.0	19.1
Pardubický kraj	**Ústí nad Orlicí**	CZ0534	14.4	15.1	15.9	17.0	17.9	19.1
Kraj Vysočina	**Havlíčkův Brod**	CZ0631	13.9	15.0	16.0	17.2	18.2	19.2
Kraj Vysočina	**Jihlava**	CZ0632	14.3	15.7	16.0	17.6	19.3	19.8
Kraj Vysočina	**Pelhřimov**	CZ0633	14.1	15.4	15.5	16.9	18.7	18.9
Kraj Vysočina	**Třebíč**	CZ0634	14.8	15.2	16.5	17.5	18.7	19.7
Kraj Vysočina	**Žďár nad Sázavou**	CZ0635	14.6	15.6	16.2	17.6	18.5	19.4
Jihomoravský kraj	**Blansko**	CZ0641	14.2	15.1	16.4	17.3	18.5	19.4
Jihomoravský kraj	**Brno-město**	CZ0642	15.2	16.1	16.8	18.1	19.1	20.4
Jihomoravský kraj	**Brno-venkov**	CZ0643	14.2	15.6	16.1	18.0	18.8	19.4
Jihomoravský kraj	**Břeclav**	CZ0644	13.5	14.5	15.4	17.9	18.4	19.2
Jihomoravský kraj	**Hodonín**	CZ0645	13.6	14.7	15.3	17.8	18.5	19.3
Jihomoravský kraj	**Vyškov**	CZ0646	13.9	15.2	15.3	17.5	18.3	19.5
Jihomoravský kraj	**Znojmo**	CZ0647	14.0	14.6	15.7	17.7	18.4	19.7
Olomoucký kraj	**Jeseník**	CZ0711	13.0	14.2	15.3	17.2	17.9	19.0
Olomoucký kraj	**Olomouc**	CZ0712	14.4	15.6	16.1	17.9	18.9	19.8
Olomoucký kraj	**Prostějov**	CZ0713	14.3	15.3	15.2	17.2	17.8	19.3
Olomoucký kraj	**Přerov**	CZ0714	14.4	15.0	15.6	17.5	18.3	19.1
Olomoucký kraj	**Šumperk**	CZ0715	14.0	15.5	15.3	17.7	18.9	19.7
Zlínský kraj	**Kroměříž**	CZ0721	14.0	15.0	15.2	17.3	18.8	19.1
Zlínský kraj	**Uherské Hradiště**	CZ0722	13.9	14.9	16.0	17.2	18.5	19.4
Zlínský kraj	**Vsetín**	CZ0723	14.1	14.8	15.2	17.6	18.6	19.4
Zlínský kraj	**Zlín**	CZ0724	14.6	15.2	15.9	18.3	18.9	19.8
Moravskoslezský kraj	**Bruntál**	CZ0801	13.1	14.1	15.0	17.0	17.7	18.7
Moravskoslezský kraj	**Frýdek-Místek**	CZ0802	13.6	14.8	15.5	17.2	18.6	18.9
Moravskoslezský kraj	**Karviná**	CZ0803	13.1	14.1	14.5	16.9	17.8	18.0
Moravskoslezský kraj	**Nový Jičín**	CZ0804	13.5	14.6	15.5	17.3	18.5	18.7
Moravskoslezský kraj	**Opava**	CZ0805	13.7	14.2	15.1	17.3	17.7	18.7
Moravskoslezský kraj	**Ostrava-město**	CZ0806	13.5	14.4	15.0	17.2	18.2	18.9

Source: Czech Statistical Office.

Abstracts of Articles Published in Demografie in 2016 (Nos. 1–3)

Ladislav Kážmér

SOCIO-SPATIAL INEQUALITIES IN MORTALITY AMONG THE POPULATIONS OF LARGE CZECH TOWNS IN 2001–2011

Research on the spatial distribution of population mortality and its social and economic determinants occupies an important place in both social and epidemiological science, in particular owing to its practical implications. The aim of this paper is to evaluate the structural and spatial mortality distribution of selected Czech urban populations (Prague, Brno, Plzeň, and Ostrava) during the inter-censual period of 2001–2011. It also relates mortality conditions to the specific social characteristics of the population living in a given area.

Keywords: mortality, urban population, socioeconomic inequalities, spatial analysis, Bayesian mapping, ecological approach

Demografie, 2016, **58: 5–28**

Markéta Arltová – Michaela Antovová

STATISTICAL ANALYSIS OF SUICIDALITY IN THE CZECH REPUBLIC FROM THE PERSPECTIVE OF TIME SERIES

Suicide is a common feature in society today and a very controversial topic worldwide. The suicide rate is one of the indicators in the mental and physical health indexes of societies. It is possible to take steps to combat this phenomenon. These steps can be based on analyses of trends in suicide rates and the factors that contribute to suicide. This article focuses on assessing these trends in the Czech Republic and identifying potential factors that could impact suicide rates.

Keywords: suicide, statistics, time series, modelling, Czech Republic

Demografie, 2016, **58: 29–48**

Lucie Vidovićová – Marcela Petrová Kafková

REGIONAL APPLICATION OF THE ACTIVE AGEING INDEX (AAI)

This paper introduces the Active Ageing Index into the context of the Czech Republic through an analysis of the index and its application at the regional level (Regional Active Ageing Index – RAAI). The strengths and limitations of the Active Ageing Index are discussed, particularly with respect to its limited applicability for policy-making. The regional application to NUTS2 is done using SHARE data. The results show regional and gender disparities in RAAI, with the region of Prague reaching the top ranking.

Keywords: Active Ageing Index (AAI), regional, population ageing, older people, Czech Republic, SHARE

Demografie, 2016, **58: 49–66**

Renáta Kyzlinková – Anna Šťastná

REPRODUCTIVE PLANS OF YOUNG MEN IN THE CZECH REPUBLIC

The paper discusses the circumstances and structural conditions of the male transition between childlessness and the first child based on an extensive sample survey 'Životní a pracovní dráhy 2010' (Life and Work Trajectories 2010). The analysis revealed that the chances that a man plans children in his life is significantly influenced particularly by his level of education, partner history and his views on the value of having children in life. Men with a university education who have a partner and believe that a life without children cannot be as fulfilling as a life with children were shown to have the highest chances of having children in the future.

Keywords: fatherhood, male fertility, logistic regression, reproductive plans, childlessness

Demografie, 2016, **58: 111–128**

Michaela Klapková – Luděk Šídlo – Branislav Šprocha

THE CONCEPT OF PROSPECTIVE AGE AND ITS APPLICATION TO SELECTED INDICATORS OF DEMOGRAPHIC AGEING

Demographic ageing is often called a phenomenon of the 21st century. However, it is a natural process, which we more or less consciously influence. Population ageing is the result of improvements to the health status of the population and the enhancement of the quality of human life that began in the 18th century as part of the demographic revolution. Current concerns about the sustainability of national welfare systems in the context of population ageing are obviously reasonable, but these concerns are based on the standard characteristics of the age structure, which often use a fixed age of entry into the final stage of life. However, with the lengthening of human life the natural boundaries of old age change. Alternative indicators based on the concept of prospective age do not use the number of years a person has already lived, but the number of years that a person will probably live. This paper presents the concept of a prospective age using data on the population of the Czechia, Slovakia, Sweden and Italy in the years 1950–2013, focusing on a comparison of the development of standard and prospective indicators of demographic ageing in time.

Keywords: prospective age, demographic ageing, alternative measures of population ageing, natural boundary of old age

Demografie, 2016, **58: 129–141**

Jana Křesťanová

AN ANALYSIS OF FERTILITY TRENDS IN THE CZECH REPUBLIC FROM 1950 TO THE PRESENT USING DECOMPOSITION METHODS

This paper seeks to trace fertility trends in the Czech Republic from 1950 to 2013 using decomposition methods. These methods provide deeper insight into changes in fertility. The results show that the reasons for the differences in fertility rates between selected years lie in the intensity of fertility and in the age structure. The paper also explores changes in fertility rates in relation to differences in marital status structure and differences in birth order and in the timing of reproduction.

Keywords: fertility, decomposition methods, birth order, timing of fertility, Czech Republic

Demografie, 2016, **58: 142–158**

Ondřej Nývlt

WOMEN IN FAMILY HOUSEHOLDS WITH CHILDREN AND THEIR POSITION IN THE LABOUR MARKET IN THE CONTEXT OF DEVELOPMENT SINCE 1989

The period since 1989 in the Czech Republic has been characterised by significant changes in demographic behaviour that affect household structure. The postponement of entry into a partner household combined with a decline in fertility has resulted in a decline in the number of women living with children in partner households. Conversely, the rising divorce rate has led to an increase in the number of women living with children in one-parent households. One of the objectives of this study is to capture the trends in the cohabitation structure of families with children in the Czech Republic in the last twenty years. Other objectives of the study are to shed light on the conditions for for achieving a work/life balance in the Czech Republic, especially in recent years, and to analyse how care for a child of preschool age affects the participation of mothers in the labour market and how this is reflected in higher unemployment. The study also aims to analyse the phenomenon in the context of the division of work and family responsibilities between partners. For this purpose use was made of data from the Labour Force Survey (LFS), which focuses primarily on the labour market.

Keywords: family households with children, household, work/life balance, Labour Force Survey

Demografie, 2016, **58: 197–212**

Markéta Růžičková – Dana Hamplová

AN ANALYSIS OF THE RELATIONSHIP BETWEEN RELIGIOUS BELIEF AND FERTILITY IN THE 2011 CENSUS (INCLUDING THE INFLUENCE OF OTHER VARIABLES)

The article explores the relationship between the number of live-born children women have and the women's religious affiliation based on 2011 Census data. First, it describes how religious groups differ according to the number of live-born children women have and the differences by women's marital statuses. Second, it employs Poisson regression to estimate the average number of live births to women in different religious groups, controlling for age, marital status, education, and municipality size.

Keywords: religious belief, fertility, census

Demografie, 2016, **58: 213–229**

Branislav Šprocha

THE TRANSFORMATION OF NUPTIALITY IN THE CZECH REPUBLIC AND THE SLOVAK REPUBLIC IN A TRANSVERSAL AND A COHORT PERSPECTIVE

The apparent decline in first-marriage rates and the dynamic increase in the mean age at first marriage in the Czech Republic and the Slovak Republic has been described as one of the great reproduction changes in the last quarter century. Despite significant changes in matrimonial behaviour and fertility legitimacy, nuptiality is still very important for the level of demographic reproduction. The transversal approach and the cohort approach in particular point to a historically unprecedented increase in the proportion of permanently single men and women in the Czech Republic and the Slovak Republic. In addition, we are witnessing a continuous extension of the period in which these people remain single thanks to the continuous postponement of marriage. The main aim of this paper is to analyse the transformation of nuptiality in the Czech Republic and the Slovak Republic in a transversal and a cohort perspective with a focus on changes in quantum and tempo in intensity of nuptiality and timing since the early 1990s and therefore particularly among the cohorts born after 1965. The final part of the paper attempts to construct projection scenarios of the possible development of the cohort proportion men and women who have been married and were born between 1965 and 1985 in the Czech Republic and the Slovak Republic.

Keywords: nuptiality, transformation, transversal and cohort approach, the Czech Republic, the Slovak Republic

Demografie, 2016, **58: 230–248**

Michaela Němečková – Anna Šťastná

THE DETERMINANTS OF MISSING DATA ON FATHERS IN BIRTH REPORTS

The article deals with statistics relating to the data on live-born children´s fathers and whether the fathers are or are not listed on the statistical birth report if the child is born outside marriage. It evaluates the share of anonymous fathers out of total live births and live births outside marriage, depending on specific variables such as the age or educational attainment of women or the birth order of the child, and in relation to regional level (NUTS3).

Keywords: births outside marriage, live births, father, region, Czech Republic

Demografie, 2016, **58: 249–262**

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- *Potraty*. 2005. Prague: Ústav zdravotnických informací a statistiky.

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- Bakalář, E. and Kovařík, J. 2000. 'Fathers, Fatherhood in the Czech Republic.' *Demografie*, 42, pp. 266–272.

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References

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Syrovátka, A. 1962a. 'Injuries in the Household.' *Czech Paediatrics*, 17, pp. 750–753.

Syrovátka, A. 1962b. 'Child Mortality from Automobile Accidents in the Czech Lands.' *Czech Medical Journal*, 101, pp. 1513–1517.

In-text references

(*Srb*, 2004); (*Srb*, 2004: pp. 36–37); (*Syrovátka et al.*, 1984).

Table and figure headings

Table 1: Population and vital statistics, 1990–2010

Figure 1: Relative age distribution of foreigners and total population of CR, 31 Dec 2009

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