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POPULATION DEVELOPMENT IN THE CZECH REPUBLIC IN 2013

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ABSTRACT

The article describes the demographic situation in the Czech Republic in 2013 and evaluates it in the context of development in the past decade. However, the main focus is on the last year-on-year change. The study analyses the background to the population decrease that occurred after a ten-year period of increases, the processes of the changing age and marital status structures, trends in nuptiality, the divorce rate, fertility, the abortion rate, mortality (including analysis of cause-of-death mortality), and international migration. The article concludes with a short overview of the position of the CR within the EU in the context of current demographic developments.

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

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Population development in the Czech Republic experienced a decline in population size in 2013. The number of inhabitants went down from 10,516,100 to 10,512,400, i.e. by 3,700. This was the first drop after a ten-year period of population increase (2003–2012). The Czech Republic lost inhabitants by natural change and by international migration. The natural change was negative (2,400) after a seven-year period of natural increase and the migration balance was in the red (−1,300) for the first time since 2002.

Total population decline occurred in the age group between 15 and 64 years. The number of children aged 14 and under and the number of people aged 65 and more has continued to increase. Ongoing population ageing reflected in the increased average age of inhabitants (by 0.2 years to aged 41.5) and the index of ageing (rising from 113.3 to 115.7). The structure of the population by marital status has also continued to change: again fewer people were found to be living in marriage and more people as 'singles' in 2013 than 2012.

The number of marriages, live births, and abortions slightly decreased in a year-on-year comparison. Conversely, the number of divorces and deaths was higher in 2013 than in 2012. But life expectancy at birth has risen further (by 0.2 years to 75.2 years for males and 81.1 years for females) and the total fertility rate was also slightly higher (1.46). The mean age of mothers has continued to rise (to 29.9 years).

POPULATION BY AGE AND MARITAL STATUS

At the end of 2013 the population of the Czech Republic comprised 7,109,400 people aged 15–64, 1,577,500 children aged 0–14, and 1,825,500 people aged 65 or more. In total, there were 3,700 fewer people than at the beginning of the year, but the entire year-on-year population decline occurred in the 15–64 age group, which decreased by 78,800. The least numerous generations born at the turn of the 21st century have begun to reach productive age, while the large generations born after the Second World War have begun to reach the age of 65 or more. The share of people of productive age (15–64) has been decreasing since 2007 when it was 71.2%. At the end of 2013 it was 67.6%.

Although since 2009 the number of live births has had a decreasing trend, the number of 0–14 year-old-children has continued to rise (since 2008) and gained another 17,200 people in 2013; most of them were aged 6–14. The share of children in the population

Table 1 **Population and vital statistics and the main analytic indicators of demographic development, 2003–2013**

Indicator	2003	2005	2008	2009	2010	2011	2012	2013
				Population and vital statistics				
Live births	93,685	102,211	119,570	118,348	117,153	108,673	108,576	106,751
Deaths	111,288	107,938	104,948	107,421	106,844	106,848	108,189	109,160
under 1 year of age	365	347	338	341	313	298	285	265
Marriages	48,943	51,829	52,457	47,862	46,746	45,137	45,206	43,499
Divorces	32,824	31,288	31,300	29,133	30,783	28,113	26,402	27,895
Abortions	42,304	40,023	41,446	40,528	39,273	38,864	37,733	37,687
induced abortions	29,298	26,453	25,760	24,636	23,998	24,055	23,032	22,714
Immigrants	60,015	60,294	77,817	39,973	30,515	22,590	30,298	29,579
Emigrants	34,226	24,065	6,027	11,629	14,867	5,701	20,005	30,876
Natural increase	−17,603	−5,727	14,622	10,927	10,309	1,825	387	−2,409
Net migration	25,789	36,229	71,790	28,344	15,648	16,889	10,293	−1,297
Total increase	8,186	30,502	86,412	39,271	25,957	18,714	10,680	−3,706
Mid-year population (thousands)	10,202	10,234	10,430	10,492	10,517	10,497	10,509	10,511
				Analytic indicators				
Total first marriage rate – males (%)	62.5	62.8	59.6	56.1	54.9	53.5	53.2	51.4
– females (%)	68.7	69.1	66.1	62.7	61.6	61.0	60.6	59.0
Mean age at first marriage – males	30.3	30.8	31.4	32.0	32.2	32.2	32.3	32.3
– females	27.7	28.1	28.8	29.2	29.4	29.6	29.6	29.8
Total divorce rate (%)	48.0	47.3	49.6	46.8	50.0	46.2	44.5	47.8
Mean duration of marriage at divorce	11.8	12.2	12.3	12.5	12.7	12.9	12.8	13.0
Total fertility rate	1.18	1.28	1.50	1.49	1.49	1.43	1.45	1.46
Mean age of mothers at birth	28.1	28.6	29.3	29.4	29.6	29.7	29.8	29.9
Mean age of mothers at 1st birth	25.9	26.6	27.3	27.4	27.6	27.8	27.9	28.1
Share of live births outside marriage (%)	28.5	31.7	36.3	38.8	40.3	41.8	43.4	45.0
Net reproduction rate	0.57	0.62	0.72	0.73	0.72	0.69	0.70	0.71
Total abortion rate	0.56	0.53	0.54	0.53	0.51	0.52	0.51	0.52
Total induced abortion rate	0.39	0.35	0.34	0.33	0.32	0.32	0.31	0.32
Life expectancy at birth – males	72.0	72.9	74.0	74.2	74.4	74.7	75.0	75.2
– females	78.5	79.1	80.1	80.1	80.6	80.7	80.9	81.1
Infant mortality rate (‰)	3.1	3.4	2.8	2.9	2.7	2.7	2.6	2.5

increased to 15.0% at the end of 2013. The last time it was above 15% in 2003. The number of people aged 65 and more experienced the most marked change in 2013 (by 3%, i.e. 57,900). In 2013 they came to exceed 17% of the population for the first time when their share increased from 16.8 to 17.4%. The biggest population increase was in the age group 65–74 years.

Continuing population ageing is evident in all the analytic indicators of the age structure. The average inhabitant of the Czech Republic aged by 0.2 years (both men and women) and reached the age of 41.5. The median age shifted even more, by 0.4 years to reach 40.8 years during 2013. The index of ageing (the number of people aged 65+ per 100 children aged 0–14) went up from 113.3 to 115.7. Owing to the unfavourable ratio of elderly people to people of productive age, the age dependency ratio increased again.

The population structure by marital status also continued to undergo significant changes in 2013. There were fewer married people and more people with the marital status of 'single' or 'divorced'.

Table 2 **Age distribution of the population, 2003–2013 (31 Dec)**

Age group/Indicator	2003	2005	2008	2009	2010	2011	2012	2013
				Population (thousands)				
Total	10,211	10,251	10,468	10,507	10,533	10,505	10,516	10,512
0–14	1,554	1,501	1,480	1,494	1,518	1,541	1,560	1,577
15–64	7,234	7,293	7,431	7,414	7,379	7,263	7,188	7,109
65+	1,423	1,456	1,556	1,599	1,636	1,701	1,768	1,826
				Share of the total population (%)				
0–14	15.2	14.6	14.1	14.2	14.4	14.7	14.8	15.0
15–64	70.8	71.1	71.0	70.6	70.1	69.1	68.4	67.6
65+	13.9	14.2	14.9	15.2	15.5	16.2	16.8	17.4
				Characteristics of age distribution				
Index of ageing[1)]	91.6	97.0	105.1	107.0	107.8	110.4	113.3	115.7
Age dependency ratio[2)]	41.2	40.6	40.9	41.7	42.7	44.6	46.3	47.9
Average age	39.5	40.0	40.5	40.6	40.8	41.1	41.3	41.5
Median age	38.5	38.9	39.2	39.4	39.6	40.1	40.4	40.8

Note: 1) The number of people aged 65 or more per 100 children aged 0–14.
2) The number of children aged 0–14 and people aged 65 or more per 100 people aged 15–64.

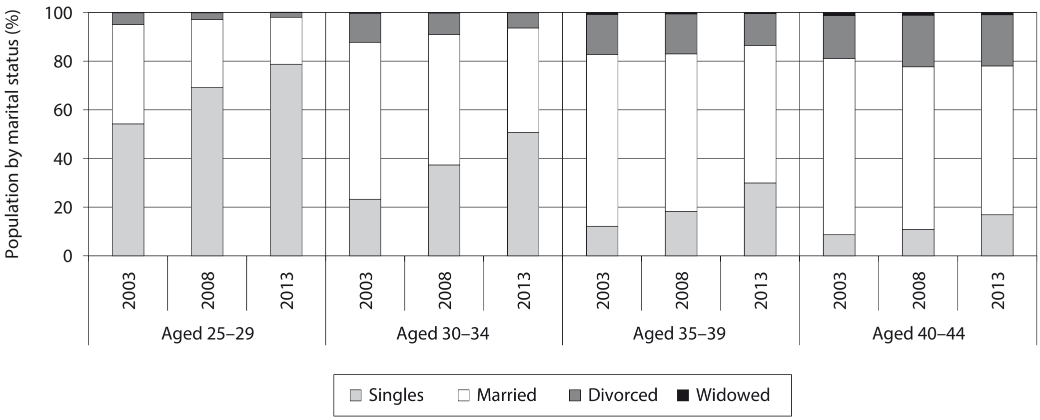
The proportion of married men (in the population 15+) fell below one-half for the first time, the level it has been at for women since 2008 and for the whole population since 2010. At the end of 2013, 48.2% of people aged 15 and over were married, 30.5% were single, 12.8% were divorced, and 8.5% were widowed.

Most changes in the population structure by marital status occurred among people between the ages of 30 and 40. The age when married people become the most populous group and the age when the share of married people is the largest have been shifting to higher ages. This is the result of continuous decline in the rate of nuptiality, which in turn is connection with the shift in the mean age at first marriage and the persistently high divorce rate, while the average duration of marriage at divorce is growing longer and male mortality is decreasing faster. Between 2003 and 2013 the age at which married people first begin to form the majority group increased from 30 to 35 years among men and from 27 to 31 among women. In 2013, the largest proportion of married men (77.4%) was in the 70–74 age group, whereas in 2006 it was in the 65–69 age group at 81.8%. Among women the peak is reached earlier:

Table 3 **Population 15+ years by marital status, 2003–2013 (31 Dec)**

Marital status	2003	2005	2008	2009	2010	2011	2012	2013
				Population (thousands)				
Single	2,320	2,429	2,626	2,670	2,696	2,685	2,706	2,725
Married	4,675	4,612	4,583	4,548	4,502	4,410	4,366	4,309
Divorced	892	949	1,026	1,046	1,070	1,107	1,124	1,145
Widowed	769	759	752	749	746	763	759	756
				Share of the total population (%)				
Single	26.8	27.8	29.2	29.6	29.9	30.0	30.2	30.5
Married	54.0	52.7	51.0	50.5	49.9	49.2	48.8	48.2
Divorced	10.3	10.8	11.4	11.6	11.9	12.3	12.5	12.8
Widowed	8.9	8.7	8.4	8.3	8.3	8.5	8.5	8.5

Figure 1 **Population in selected age groups by marital status (%), 2003–2013 (31 Dec)**



in the 40–44 age group in 2003 and in the 55–59 age group in 2013, the respective shares being 73.8% and 66.0%. Among the oldest age group of women widows form the majority.

NUPTIALITY

After a one-year stagnation, the number of couples marrying decreased again, by 1,700 to 43,500 in 2013. The decrease was more pronounced in higher-order marriages, the number of which was down by 5-6% compared to a 3% decrease in first marriages. This led to a growth in the share of protogamous marriages (both of the people marrying are single) to 66.4%. A similar level was last recorded in the middle of the 1990s. Three quarters of brides (33,000 in 2013) and grooms (32,700) were entering into their first marriage. In higher-order marriages, most partners (95 out of 100) were divorced and were entering into their second marriage.

In the last eleven years nuptiality was the highest in 2007, when the total first marriage rate reached 64.5% for males and 71.1% for females and the total marriage rate of divorcees was 47.9% (males) and 46.6% (females). Since then nuptiality has decreased every year. According to the 2013 nuptiality life tables, 51.4% of men and 59.0% of women will remain single till their 50th birthday and only 34.7% of divorced men and 33.5% of divorced women will remarry. Simultaneously, the mean age at first marriage and the average amount of time elapsing between

Table 4 **Marriages by order, 2003–2013**

Indicator		2003	2005	2008	2009	2010	2011	2012	2013
Total marriages		48,943	51,829	52,457	47,862	46,746	45,137	45,206	43,499
Protogamous marriages		31,471	33,446	32,830	30,315	30,095	29,045	29,684	28,877
– share of total (%)		64.3	64.5	62.6	63.3	64.4	64.3	65.7	66.4
First order marriages	– males	36,016	38,347	38,038	34,865	34,414	33,371	33,816	32,743
	– females	36,371	38,605	38,117	35,203	34,734	33,443	34,175	33,029
First marriages (%)	– males	73.6	74.0	72.5	72.8	73.6	73.9	74.8	75.3
	– females	74.3	74.5	72.7	73.6	74.3	74.1	75.6	75.9
Second and higher order marriages	– males	12,927	13,482	14,419	12,997	12,332	11,766	11,390	10,756
	– females	12,572	13,224	14,340	12,659	12,012	11,694	11,031	10,470

Table 5 **Nuptiality indicators, 2003–2013**

Indicator		2003	2005	2008	2009	2010	2011	2012	2013
Total first marriage rate (%)	– males	62.5	62.8	59.6	56.1	54.9	53.5	53.2	51.4
	– females	68.7	69.1	66.1	62.7	61.6	61.0	60.6	59.0
Mean age at first marriage	– males	30.3	30.8	31.4	32.0	32.2	32.2	32.3	32.3
	– females	27.7	28.1	28.8	29.2	29.4	29.6	29.6	29.8
Total marriage rate of divorcees (%)	– males	40.4	41.7	44.5	40.4	38.4	36.9	36.4	34.7
	– females	39.1	40.7	44.0	38.9	37.2	36.6	34.9	33.5
Average elapsed time from divorce	– males	6.5	7.0	7.5	7.5	7.5	7.5	7.6	8.0
	– females	6.7	7.3	7.8	7.9	7.8	7.8	8.0	8.3

divorce and remarriages has been increasing. The mean age at first marriage rose by two years in 2003–2013 to 32.3 years for males and 29.8 years for females. But the regular annual increases in the mean age were interrupted when figures stagnated in 2010–2011 for males and 2011–2012 for females. Similarly, in the 2003–2013 period the average amount of time elapsing from divorce to remarriage grew by 1.5 to 8.0 and 8.3 years respectively for men and women in 2013.

The decline in nuptiality is the result of the postponement of marriage to a higher age or (more) people remaining single for their entire life. Marriage frequencies have been decreasing among all ages under 30–35 and there has only been a very small recuperation among higher ages. In 2013 the highest nuptiality rate was at age 30 for males (51 per thousand) and at age 28 for females (69 per thousand) in 2013. In 2003 the peak was reached earlier and at a higher level: 69‰ at age 28 for males and 91‰ at age 26 for females.

DIVORCE

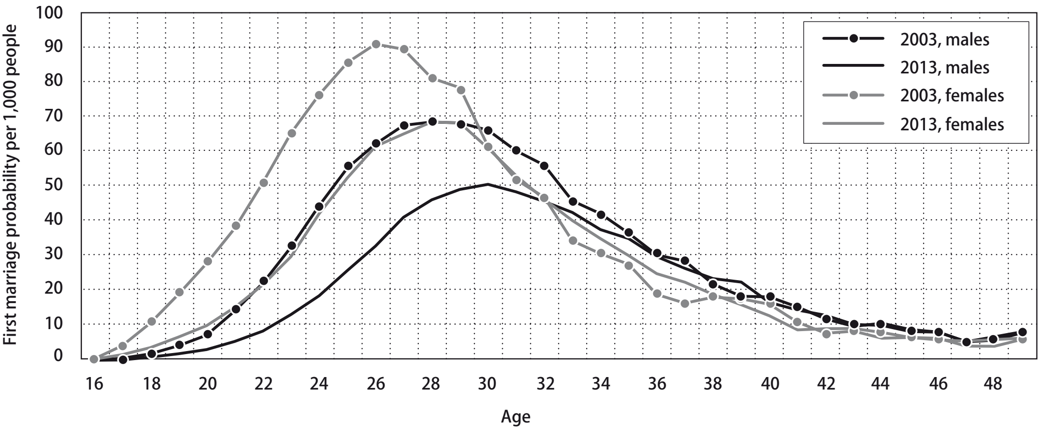
A total of 27,900 marriages ended in divorce in 2013, which is 1,500 more than in 2012. Like in previous years, four-fifths were first-order divorces. The share of divorcing couples with minors went down (from 63.1% to 57.1% in 2003–2013), as did the number of minors in divorcing marriages. In 2013, divorces affected 24,335 minors, whereas in 2003 the figure was 6,600 higher. This decline in the number of minors resulted from the low fertility and the growing number of divorces after 20 or more years of marriage, when the children are often already adult. In the last three years, three-tenths of divorces were to marriages of this duration, whereas at the start of the 21st century the figure was two-tenths. However, when looked at in terms of five-year groups of marriage lengths, divorces after 5–9 years were always the most numerous in the reference period.

Similarly, the highest divorce rate occurred between 3 and 5 years of marriage. In 2013, the maximum was 2.76 divorces per 100 marriages after 4 years of marriage. The total divorce rate was 47.8%. Historically, the highest total divorce rate was recorded in 2010 at 50.0%. Since 2002 it has ranged between 45–50%, and only in 2012 was it slightly lower (44.5%). This means that roughly every second marriage ends in divorce in the Czech Republic. The average duration of a marriage ending in divorce grew from 11.8 to 13.0 years in 2003–2013.

FERTILITY

A total of 106,800 live births were recorded in the Czech Republic in 2013. This was 1,800 less than the year before. In recent years, the number of newborn children has declined from the historic high of 119,570 in 2008. However, in a longer, ten-year perspective, it has grown from 93,700 recorded in 2003. In comparison with 2012 there were fewer first- and second-order births, but more third- and higher-order births.

Figure 2 **First marriage probabilities* by sex and age, 2003 and 2013**



Note: *) Based on the nuptiality life tables for singles.

Table 6 **Divorce rate indicators, 2003–2013**

Indicator	2003	2005	2008	2009	2010	2011	2012	2013
Divorces	32,824	31,288	31,300	29,133	30,783	28,113	26,402	27,895
Share of repeated divorces (%)								
– males	19.1	19.9	19.3	19.4	19.5	19.4	19.4	20.0
– females	19.0	19.1	18.9	19.0	18.8	19.1	19.1	19.1
Divorces without minors	12,119	12,078	13,104	12,282	13,143	12,282	11,213	11,974
Divorces with minors	20,705	19,210	18,196	16,851	17,640	15,831	15,189	15,921
– share of total (%)	63.1	61.4	58.1	57.8	57.3	56.3	57.5	57.1
Number of minors in divorced marriages	30,927	28,732	27,034	25,094	26,483	23,716	22,982	24,335
Total divorce rate (%)	48.0	47.3	49.6	46.8	50.0	46.2	44.5	47.8
Mean duration of marriage at divorce (years)	11.8	12.2	12.3	12.5	12.7	12.9	12.8	13.0
Duration of marriage (years)	**Divorce rates (per 100 marriages)**							
0–4	2.3	2.1	2.3	2.2	2.3	2.1	2.0	2.1
5–9	2.6	2.5	2.5	2.3	2.4	2.2	2.1	2.3
10–14	1.8	1.8	1.8	1.7	1.8	1.6	1.6	1.8
15–19	1.3	1.3	1.4	1.3	1.5	1.3	1.3	1.4
20–24	0.9	0.9	1.0	1.0	1.0	1.0	0.9	1.0
25–29	0.5	0.5	0.5	0.5	0.6	0.6	0.5	0.6
30+	0.3	0.3	0.4	0.4	0.5	0.5	0.4	0.5

The number of live births to single mothers increased from 40,600 in 2012 to 41,700 in 2013. On the other hand, the number of children born to married mothers decreased from 61,500 to 58,800. The share of live births outside marriage has been increasing markedly: from 28.5% to 45.0% between 2003 and 2013. Mainly single women have driven this trend (there were only 20,800 children born to single

Table 7 **Live births by birth order and by marital status of the mother, 2003–2013**

Indicator	2003	2005	2008	2009	2010	2011	2012	2013
Live births	93,685	102,211	119,570	118,348	117,153	108,673	108,576	106,751
– first order	45,363	49,930	56,941	56,039	54,331	50,989	51,476	51,092
– second order	34,823	37,993	45,291	45,206	45,514	42,156	41,826	40,078
– third and higher order	13,499	14,288	17,338	17,103	17,308	15,528	15,274	15,581
Marital status of mother								
Single	20,753	25,753	35,541	38,060	39,529	38,666	40,581	41,655
Married	66,972	69,802	76,113	72,394	69,989	63,252	61,488	58,751
Divorced	5,668	6,354	7,617	7,610	7,389	6,514	6,299	6,134
Widowed	292	302	299	284	246	241	208	211
Share of live births outside marriage (%)	28.5	31.7	36.3	38.8	40.3	41.8	43.4	45.0
– first order	35.4	40.0	46.2	49.5	51.1	53.1	54.5	55.7
– second order	18.8	20.8	25.2	26.9	28.8	29.9	31.6	33.4
– third and higher order	30.2	31.7	33.1	35.2	36.5	37.0	38.1	39.3

mothers in 2003, whereas it was 41,700 children in 2013). First-order births are more common outside marriage than higher-order births. Since the year 2010 half of all first-order births were to unmarried mothers and the share increased to 55.7% in 2013. Only 33.4% of second-order births were outside marriage and 39.3% of third- and higher-order births. However, the share of live births outside marriage has been increasing in every birth order over the past decade.

Other major differential characteristics of extramarital births are the age and educational attainment of the mothers. Unmarried motherhood is more common at a younger age, between 15 and 19 years (94.7% in 2013) and between 20 and 24 years (73.8% in 2013). Conversely, it is less often in the 30–39 age group (36.5% in 2013). The share of live births outside marriage decreases with higher levels of education. In 2013, over three out of four women with basic education gave birth to extramarital children. Among higher-educated women the figure was only 26.4%. But extramarital births were relatively more common in every age group of women and every category of educational attainment in 2013 than they were ten years ago.

The larger share of live births outside marriage does not mean that mothers less often cohabitate with a partner. The expert view that despite the increasing proportion of children born outside marriage the majority of these children nonetheless grow up with both parents is backed by records on the children's fathers. For only about one-fifth (in 2013) of children born outside marriage were the demographic characteristics of the father not given in the Report on Birth. Non-response was higher among less educated and younger women.

Fertility intensity measured by the total fertility rate (TFR) slightly increased, from 1.45 children per woman in 2012 to 1.46 one year later. In the past decade the TFR peaked in 2008 (1.50) and was at its lowest level in 2003 (1.18). The increase in the TFR between 2003 and 2013 by 0.28 was mainly the result of an increase of first-order (by 0.16) and second-order (by 0.10) fertility. This increase was due in part to the postponement of childbearing intentions in the previous years. The share of first-order and second-order fertility that accounts for the TFR has not changed significantly. The net reproduction rate increased from 0.57 in 2003 to 0.72 in 2008, and then it stagnated.

That the trend of postponing childbirth is continuing was indicated by a further increase in the mean age of mothers at childbirth, which rose from 28.1 to 29.9 years between 2003 and 2013. The increase was more profound during the first five years of this ten-year span. The mean age of mothers at first-order birth increased the most: by 2.2 years in the last ten years, while for second-order births it increased by 2.0 years

Figure 3 **Share of live births outside marriage, 2003–2013**

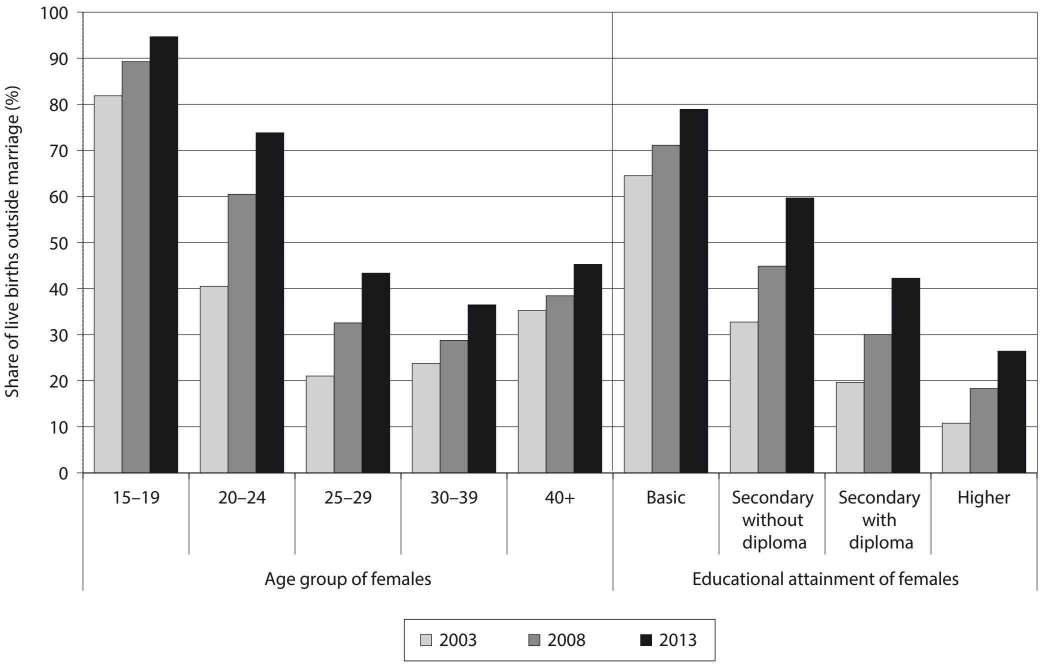
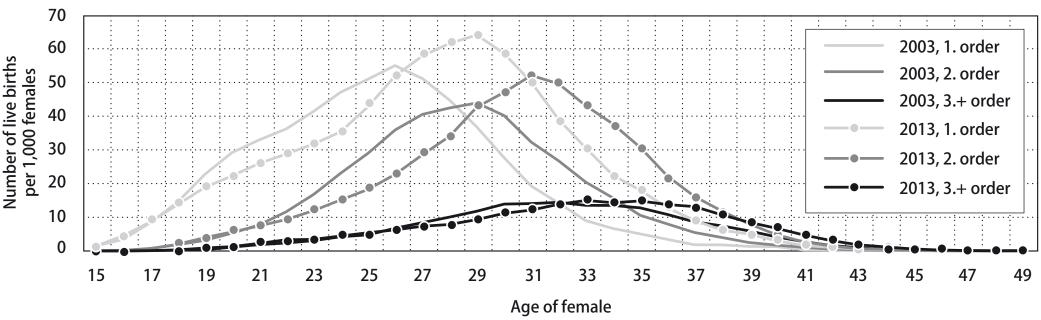


Table 8 **Fertility indicators, 2003–2013**

Indicator/Age group	**2003**	**2005**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Total fertility rate – total	1.18	1.28	1.50	1.49	1.49	1.43	1.45	1.46
– first order	0.57	0.63	0.73	0.73	0.72	0.70	0.72	0.73
– second order	0.43	0.46	0.55	0.55	0.56	0.54	0.54	0.53
– third and higher order	0.18	0.19	0.21	0.21	0.21	0.19	0.19	0.20
Net reproduction rate	0.57	0.62	0.72	0.73	0.72	0.69	0.70	0.71
Mean age of mother at childbirth – total	28.1	28.6	29.3	29.4	29.6	29.7	29.8	29.9
– first order	25.9	26.6	27.3	27.4	27.6	27.8	27.9	28.1
– second order	29.0	29.6	30.5	30.6	30.7	30.9	31.0	31.0
– third and higher order	32.4	32.8	33.3	33.3	33.2	33.3	33.3	33.2
Age group:	**Fertility rates (per 1,000 females)**							
15–19	11.5	10.9	11.5	11.8	11.5	11.3	12.0	11.7
20–24	53.8	48.7	47.9	46.8	45.7	42.4	42.5	41.9
25–29	94.5	100.9	106.0	102.8	99.7	93.6	93.4	92.4
30–34	57.4	72.1	96.3	97.1	99.0	95.7	98.1	98.2
35–39	17.6	22.8	34.5	36.2	38.4	37.2	38.4	40.0
40–44	3.1	3.7	5.3	5.6	5.9	6.1	6.6	7.1
45–49	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3

Figure 4 **Age-specific fertility rates by age of females, 2003–2013**

Figure 5 **Age-specific fertility rates by age of females and by birth order, 2003 and 2013**



and for third- and higher-order births only by 0.8 years. In 2003, the highest age-specific fertility rate was at age 27 (100.1 births per 1,000 women). Five years later it was at age 30 (124.6 births per 1,000 women) and it was age 30 again in 2013 (116.8 births per 1,000 women). Fertility rates decreased most significantly in the 20–24 age group (from 53.8 to 41.9 births per 1,000 women) and increased substantially in the 30–34 age group (from 57.4 to 98.2 births per 1,000 women) and 35–39 age group (from 17.6 to 40.0 births per 1,000 women) between 2003 and 2013. The group that accounted for the largest share of the total fertility was not 25-29-year-old mothers like in 2003 (39.7%), but mothers aged 30–34 years (33.7%).

In 2003, 26-year-old women had the highest age-specific fertility rates among first-order births (55.0 births per 1,000 women), while ten years later it was 29-year-old women (64.1 births per 1,000 women). The shift of motherhood towards older ages was also significant among second-order births: from 29 years (43.9‰ in 2003) to 31 years (52.1‰ in 2013). The changes among third- and higher-births were less significant: from 32 years (14.4‰ in 2003) to 33 years (15.0‰ in 2013).

ABORTION

In 2013, the number of registered abortions declined for the fifth consecutive year. The figure was 37,700 abortions[1]; the year-on-year number changed only by several dozen. In the last decade there was an increase in the number only in 2007 and 2008

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

because of the higher number of pregnancies. Out of the total number of abortions, 60.3% were induced[2)], and 36.4% were spontaneous[3)], and 3.3% were terminations of ectopic pregnancies. The share of induced abortions decreased from 69.3% in 2003; on the other hand, the share of spontaneous abortions increased from 27.6%.

In 2013 there were more abortions to single women (18,000 abortions) than in 2003 (14,700 abortions). The number of induced abortions among these women increased by one thousand in the last decade, while spontaneous abortions increased by 2,200. The main reason cannot be the higher intensity of abortions in this specific sub-population, it is rather the changing structure of women by marital status – a larger share of women in the age group most common for pregnancies are staying single. This fact has also affected the number of abortions to married women. They had 14,700 abortions in 2013, which was by 7,500 fewer than in 2003. This decrease accounted for 88% of the decline in the number of induced abortions.

The share of induced abortions decreased in all the categories of women's marital status and educational attainment between 2003 and 2013. The decrease of this indicator was more pronounced among married women (by 11.9 percentage points) and higher-educated women (by 14.4 p. p.). These groups currently have the lowest share of induced abortions: 52.9% among married and 46.2% among higher-educated women in 2013. The share of induced abortions decreases as education levels rise.

The intensity of abortions measured by the total abortion rate decreased from 0.56 abortions per woman in 2003 to 0.52 ten years later. However, the trend was not continual; in 2007 and 2008 there was an increase in the total abortion rate and it has stagnated in the last five years. The decrease in the abortion rate was driven by the decrease

Table 9 **Abortions, 2003–2013**

Indicator	2003	2005	2008	2009	2010	2011	2012	2013
Abortions	42,304	40,023	41,446	40,528	39,273	38,864	37,733	37,687
– induced abortions	29,298	26,453	25,760	24,636	23,998	24,055	23,032	22,714
– spontaneous abortions	11,660	12,245	14,273	14,629	13,981	13,637	13,515	13,708
– ectopic pregnancy	1,288	1,324	1,413	1,263	1,287	1,172	1,186	1,265
Abortions – single females	14,662	14,942	16,849	16,822	16,706	17,269	17,373	18,050
– married females	22,233	19,548	19,081	18,297	17,274	16,347	15,393	14,705
– divorced females	4,830	4,823	4,654	4,539	4,410	4,264	3,949	3,928
Induced abortions – single females	10,852	10,646	11,562	11,271	11,283	11,693	11,566	11,883
– married females	14,404	11,901	10,556	9,873	9,296	8,993	8,385	7,774
– divorced females	3,668	3,469	3,184	3,067	2,991	2,915	2,622	2,620

2) 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 up to the 24th week of gestation.

3) Spontaneous abortions as of 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 foetus or only the decidua was extracted.
Spontaneous abortions as of 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.

in the rate of induced abortions (from 0.39 abortions per woman in 2003 to 0.32 in 2013). On the other hand, the total spontaneous abortion rate increased from 0.15 to 0.18 in the same period. The mean age at abortion increased in connection with the rising age at pregnancy. However, the trend differed according to the type of abortion. The mean age at induced abortion has stagnated over the last ten years between 29.5 years and 29.7 years, while the mean age at spontaneous abortion has increased from 29.7 years to 31.1 years.

By age the biggest decrease in the abortion rate in the past decade was among women aged 20–29. In the case of induced abortion the decrease was greatest between the ages of 27 and 35. Moreover, a decline has been observed in almost every age group. Spontaneous abortion rates were more concentrated within a shorter age interval and were similar to the age-specific fertility curve. Only a slight decrease in these rates was observed among women aged 19–27, but a significant increase among older women between the ages of 30 and 38, which resulted in an increase in the total spontaneous abortion rate.

Table 10 **Abortion indicators, 2003–2013**

Indicator/Age group	2003	2005	2008	2009	2010	2011	2012	2013
Total abortion rate	0.56	0.53	0.54	0.53	0.51	0.52	0.51	0.52
Total induced abortion rate	0.39	0.35	0.34	0.33	0.32	0.32	0.31	0.32
Total spontaneous abortion rate	0.15	0.16	0.18	0.19	0.18	0.18	0.18	0.18
Mean age at abortion	29.7	29.8	29.9	30.1	30.2	30.1	30.2	30.1
Mean age at induced abortion	29.7	29.6	29.5	29.7	29.7	29.7	29.7	29.5
Mean age at spontaneous abortion	29.7	30.0	30.6	30.7	31.0	30.9	31.0	31.1
Age group:	**Induced abortion rates (per 1,000 females)**							
15–19	8.3	7.7	7.9	7.5	7.0	7.1	6.8	7.2
20–24	15.4	14.2	14.1	13.0	12.7	13.3	12.9	12.9
25–29	16.8	14.5	13.8	13.3	13.1	13.5	13.3	13.5
30–34	17.8	15.8	14.3	13.6	13.2	13.6	13.3	13.0
35–39	13.7	12.8	12.4	12.0	12.0	11.8	11.3	11.3
40–49	3.2	3.1	3.0	3.0	2.9	3.0	2.9	2.9

Figure 6 **Abortion rates by type of abortion, 2003–2013**

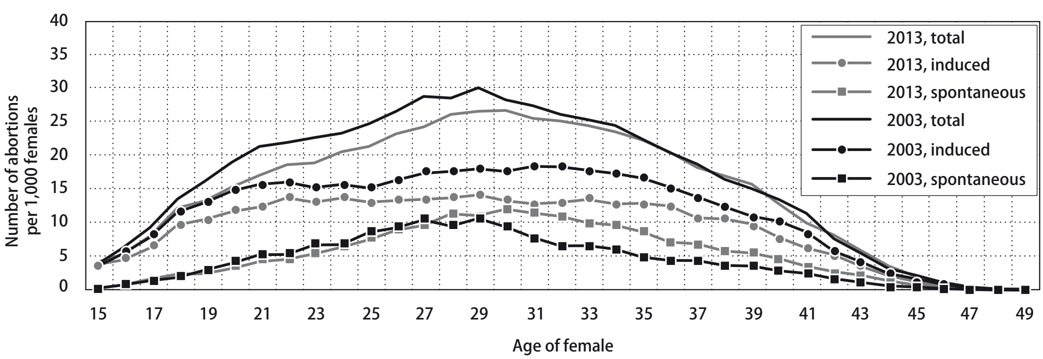


Table 11 **Deaths, 2003–2013**

Indicator		2003	2005	2008	2009	2010	2011	2012	2013
Deaths		111,288	107,938	104,948	107,421	106,844	106,848	108,189	109,160
– males		55,880	54,072	53,076	54,080	54,150	54,141	54,550	55,098
– females		55,408	53,866	51,872	53,341	52,694	52,707	53,639	54,062
– under 1 year of age		365	347	338	341	313	298	285	265
Infant mortality rate (‰)		3.9	3.4	2.8	2.9	2.7	2.7	2.6	2.5
Share of deaths at the age 80 and over (%) – males		24.7	26.1	28.0	29.4	30.0	30.5	31.5	32.0
– females		48.3	50.3	53.4	54.6	55.5	56.2	57.2	57.6
Life expectancy of males at age:	0	72.03	72.88	73.96	74.19	74.37	74.69	75.00	75.23
	65	13.84	14.38	15.13	15.17	15.26	15.47	15.59	15.68
	80	5.91	6.13	6.62	6.68	6.62	6.84	6.97	7.19
Life expectancy of females at age:	0	78.51	79.10	80.13	80.13	80.60	80.74	80.88	81.13
	65	17.14	17.55	18.38	18.33	18.71	18.82	18.91	19.09
	80	6.86	7.06	7.57	7.52	7.91	7.94	7.97	8.20

MORTALITY

The number of deaths increased by one thousand annually and reached 109,200 in 2013. This was by two thousand less than in 2003. Deaths under one year of age decreased by 20 to 265 in the last year, which is by one hundred less than ten years ago. The infant mortality rate also decreased to 2.5 deaths per 1,000 live births (a historical low). The higher share of deaths shifted to older ages in 2013: 32.0% of males died at the age 80 and over (24.7% in 2003) and 57.6 % of women died in this age group (48.3% in 2003).

The life expectancy at birth has increased in the long term for both sexes. Women's life expectancy at birth increased by 0.23 years and men's by 0.25 years in the last recorded year. Between 2003 and 2013 it increased in total by 3.20 years for men and by 2.63 years for women. The decrease in the mortality of women aged 70 and over and men between the ages of 50 and 79 contributed the most to the rise in life expectancy at birth over the last decade.

The difference between women and men in life expectancy at birth shrank from 6.48 years in 2003 to 5.91 years in 2013. A total of 63.6% of this last year's difference was made up of the difference in male and female mortality among people aged 55–79.

Mortality by causes of death

In 2013, a modified system of cause-of-death data collection was introduced in the Czech Republic. The new death certificate and its submission to the relevant places are defined by new regulations. In conformity with international recommendations, the death certificate has a new fourth line in Part I for certifying the cause of death. The information on causes of death is no longer sent to Registry Offices, which until 2013 sent all information about a deceased person to the Czech Statistical Office (as of 2013 they send only administrative data), but to the Institute of Health Information and Statistics of the CR. This information is then passed to the Czech Statistical Office, where both data sources are linked and the causes of death are coded, including the selection of underlying causes of death. The introduction of the fourth line for certifying causes of death led to a rise in the number of certified causes on death certificates (by 16% in 2013 in Part I; in addition, the number of diagnoses given in Part II increased even more significantly). Two-way data collection and the linking of both data sets means that causes of death were not available for fewer than 0.5% of deceased persons in 2013[4)]

4) No information on cause of death is generally available for Czech residents who died abroad. The given share 0.5% does not include Czech residents who died abroad.

('Other ill-defined and unspecified causes of mortality (R99)' is assigned as the underlying cause of death in such cases). An automated system for coding the underlying cause of death (IRIS) has been used in the Czech Republic for data since 2011 and is updated annually (with ICD-10 updates).[5] All the above-mentioned issues should be considered in an analysis of cause-of-death mortality and its time trends.

Diseases of the circulatory system, which have in the long term been the most common causes of death for both sexes, were the cause of 23,700 deaths of men (43.0% of the total number of deaths of men) and 28,000 deaths of women (51.8% of all deaths of women) in 2013. These figures are both absolutely and relatively lower than a year ago. Thus the total share of deaths from those diseases has continued to decrease, reaching 47.4% (a decline in the last ten years of almost 5 percentage points). A year-on-year decrease was also observed in the relative proportion of deaths from neoplasms, the second most common cause of death, although this decrease was smaller than that of diseases of the circulatory system. In 2013, they were the cause of death of 15,200 men (27.6%) and 12,200 women (22.6%). A slight decrease in the absolute and relative proportion of neoplasms as a cause of death was also observed across the 2003-2013 period (from 26.4% of all deaths in 2003 to 25.1% in 2013). The third most common cause-of-death category in 2013 was diseases of the respiratory system, which first switched third spot with external causes of death in 2009 and then remained there in the following years, except in 2011. They were the cause of 6.3% of deaths (i.e. 6,800) in 2013, which is 16% more than in 2012. This was probably due to the influenza epidemic of 2013, but the share of diseases of the respiratory system out of all deaths had an overall increasing trend throughout the 2003–2013 period. In 2013 diseases of the respiratory system were the third most common cause even among men (for the first time), but deaths from external causes were only very slightly less common. Among women deaths from injuries and poisonings ranked in the fifth position; the fourth position belonged to endocrine, nutritional and metabolic diseases (these were the sixth most common causes among men, after diseases of the digestive system). This was the result of a decrease in mortality from external causes and mainly from a rise in the number of deaths from diabetes mellitus. The latter was significantly connected with the methodological changes, namely with the addition of a fourth line to the death certificate and the implementation of ICD-10 updates in effect since 2013. The total number of deaths from diabetes mellitus (E10-E14) increased by two-thirds between 2012 and 2013.

The highest year-on-year decline in the standardised mortality rate concerned diseases of the circulatory system and in the case of men also external causes and in the case of women neoplasms (a decrease by 4% or 5%). A general decrease in mortality from diseases of the circulatory system and external causes of death has been going on for more than two decades. In the case of mortality from neoplasms the decrease was more intensive in the last decade. Out of the four most frequent cause-of-death groups, which were responsible for 84% of all deaths in 2013, the least significant decreases between 2012 and 2013 were in mortality from neoplasms for men and mortality from external causes for women. Mortality from diseases of the respiratory system rose.

The long-term and recent year-on-year reduction of mortality from diseases of the circulatory system have mainly been driven by the decrease in mortality from acute myocardial infarction and cerebrovascular diseases. The recent drop in mortality from atherosclerosis was primarily a consequence of the implementation of a system of automated selection of an underlying cause of death. Methodological changes were also behind the rise in mortality from hypertension since 2007, which was intensified by an increase in deaths from hypertensive heart disease in 2013 due to the ICD-10 updates coming into effect, and behind breaks in time series of mortality from heart failure.

Within the ICD-10 category of neoplasms, a generally positive trend was recorded in 2003–2013 in mortality from the most common neoplasms as causes of death in the Czech Republic, which are malignant neoplasms of the bronchus and lung, colon and rectum, prostate

5) The second edition of ICD-10 came into operation on 1 January 2009.

and breast. The exception was female mortality from cancer of the bronchus and lung, where the opposite trend was observed; however, between 2012 and 2013 a decrease of five percentage points in the standardised mortality rate due to neoplasms of the bronchus and lung was registered. In the last three years, mortality from malignant neoplasms of the prostate stagnated.

Between 2003 and 2013 one-fourth of the decrease in mortality from external causes among men and just under one-seventh among women was the result of a decrease in mortality from transport accidents. Thus they accounted for only 14% of deaths from external causes in 2013, whereas the figure was 20% in 2003. Mortality from another category of external causes of death under special attention – intentional self-harm – showed no clear trend in the last decade, or rather it was decreasing in the first half of the decade, and later an overall increase was observed in the data.

Mortality from the most common cause-of-death categories is higher for men. The greatest relative difference is in the case of external causes, where the standardised mortality rate of men in 2013 was 2.7 times higher than the rate of women. Conversely, the least difference was for mortality from endocrine, nutritional and metabolic diseases (about 25%). The difference was about 40% for diseases of the circulatory system and about 75% for neoplasms.

INTERNATIONAL MIGRATION

Since 2002 the first negative balance in international migration was registered in 2013. The number of emigrants exceeded the number of immigrants by 1,300 as a result of a large increase in the recorded volume of emigration. According to data 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, in 2013 a total of 29,600 people moved to the Czech Republic from abroad (by 0,700 fewer than in 2012), but a total of 30,900, i.e. 10,900 more than in 2012, migrated in the opposite direction. However, net migration in 2013 was negative only for males (–1,600); for females it remained positive (0,300). In terms of age, the number of emigrants exceeded the number of immigrants in the 35–49 and 50–64 age groups.

Among international migrants people of productive age dominate, especially in the 15–34 age group. In the same interval, the highest emigration rate in 2013 was observed among people aged 28 and 29 (7‰). On the other hand, there is a very small proportion (less than 3%) of migrants aged 65 years and over. Consequently, the people moving across the borders of the Czech Republic are younger than the average inhabitant of the CR (32.4 years compared to 41.5 years).

The largest numbers of immigrants in 2003-2013 were citizens of Ukraine (167,300 immigrants in total), Slovakia (103,500), Viet Nam (52,300), and Russia (40,400). In 2013, Slovaks were the most numerous (6,500), followed by Ukrainians (3,700), and Russians (3,100). These nationalities have ranked among the three most numerous every year since 2009. Statistics for emigrants by citizenship showed a more diverse trend. In total, for the whole period of 2003–2013, most emigrants were Ukrainians (66,600), Slovaks (57,200), and Czechs (25,600), but in 2008, for example, the number of Ukrainians recorded emigrating was just 0,200 while Czechs were the most numerous emigrants (2,200) followed by the Germans (2,000). In 2013 the order was Ukrainians (11,000), Czechs (3,700), and Russians (3,200). Net migration by citizenship in 2013 peaked on the positive side with Slovaks (4,800) and Germans (1,300) and hit lows on the negative side with Ukrainians (–7,200) and Czechs (–2,000).

The significant year-on-year changes in the numbers of migrants were the result of the different economic conditions (the depression after 2008), different legislative conditions for obtaining a residence permit (especially in the case of Vietnamese), and from the changes to the system used to collect data and in the source of the data for statistics produced by the Czech Statistical Office. In 2001–2007 data on the international migration of foreigners were drawn from the CIS and from 2008 to the middle of 2012 the ISEO was the source. As of July 2012, the ISEO only has data on Czechs and on foreign nationals who are the immediate relatives of a Czech and are living in the Czech Republic (e.g. partners, children) and the Czech Statistical Office again uses data provided by the CIS for statistics on the migration of foreigners.

Table 12 Standardised mortality rates by cause of death (per 100,000 people), 2003–2013

Underlying cause of death (ICD-10 code)	2003	2005	2008	2009	2010	2011	2012	2013
Males, total	2,091.0	1,933.2	1,758.5	1,752.3	1,711.3	1,682.1	1,658.8	1,647.3
Neoplasms (C00–D48)	524.5	487.3	447.2	441.8	438.1	412.9	403.8	394.2
Malignant neoplasm of colon, rectum and anus (C18–C21)	88.0	79.7	68.0	67.6	64.8	60.1	58.5	56.5
Malignant neoplasm of trachea, bronchus and lung (C33–C34)	122.6	117.4	103.4	103.0	101.4	98.7	94.8	90.2
Malignant neoplasm of prostate (C61)	63.9	56.4	48.4	48.0	47.2	45.0	44.8	44.7
Diseases of the circulatory system (I00–I99)	1,137.8	1,019.8	899.5	897.2	877.2	850.2	833.0	798.3
Hypertensive diseases (I10–I15)	19.9	21.6	28.4	28.4	31.0	29.8	29.7	37.3
Ischaemic heart diseases (I20–I25)	453.0	450.6	468.8	445.7	437.5	456.8	445.3	453.8
Acute myocardial infarction (I21–I22)	184.5	144.5	123.5	117.3	113.6	117.0	107.8	104.4
Heart failure (I50)	24.5	37.8	34.0	32.3	27.8	69.8	70.6	48.8
Cerebrovascular diseases (I60–I69)	312.0	263.0	185.8	193.3	170.0	158.1	157.2	148.7
Atheroslerosis (I70)	238.8	166.7	91.6	100.6	117.0	56.1	52.9	31.1
Diseases of the respiratory system (J00–J99)	114.9	127.1	115.7	122.4	114.6	109.9	104.4	120.3
Diseases of the digestive system (K00–K93)	73.6	77.3	69.6	70.2	65.9	63.9	60.5	63.6
External causes (V01–Y98)	131.9	107.5	101.9	100.7	98.1	96.9	94.6	90.4
Transport accidents (V01–V99)	22.3	19.1	16.9	14.9	13.6	12.7	12.3	11.8
Intentional self–harm (X60–X84)	32.2	28.0	24.1	25.5	25.6	27.0	28.3	26.7
Other	108.3	114.2	124.6	120.0	117.4	148.1	162.4	180.5
Diabetes mellitus (E10–E14)	22.1	21.0	28.9	28.3	26.7	31.4	30.8	51.3

Note: The new European standard of Eurostat was used to calculate the standardised rates.

Table 12 **Standardised mortality rates by cause of death (per 100,000 people), 2003–2013**

Underlying cause of death (ICD-10 code)	**2003**	**2005**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Female, total	1,366.8	1,274.2	1,148.8	1,155.2	1,112.8	1,090.9	1,089.3	1,074.9
Neoplasms (C00–D48)	284.9	266.0	248.8	244.8	240.6	236.0	235.5	227.0
Malignant neoplasm of colon, rectum and anus (C18–C21)	45.3	39.1	33.1	31.7	31.7	30.1	29.8	27.7
Malignant neoplasm of trachea, bronchus and lung (C33–C34)	28.1	28.1	29.3	28.3	29.8	31.6	32.2	30.5
Malignant neoplasm of breast (C50)	42.1	40.3	32.9	32.2	32.5	33.1	31.4	31.8
Diseases of the circulatory system (I00–I99)	835.0	763.9	669.3	682.4	648.4	615.7	609.9	577.7
Hypertensive diseases (I10–I15)	19.1	19.4	26.6	25.8	25.9	25.7	26.5	36.7
Ischaemic heart diseases (I20–I25)	279.9	298.1	320.9	314.4	289.1	302.7	299.7	302.1
Acute myocardial infarction (I21–I22)	93.4	74.1	65.0	65.3	58.6	60.0	58.5	54.6
Heart failure (I50)	18.1	27.4	21.3	23.1	20.6	46.8	51.1	35.3
Cerebrovascular diseases (I60–I69)	266.8	219.6	164.1	166.1	153.5	138.2	131.0	123.8
Atherosclerosis (I70)	186.5	137.0	70.5	80.9	87.0	45.2	43.2	23.4
Diseases of the respiratory system (J00–J99)	62.6	68.3	59.1	63.4	59.1	51.3	53.7	58.9
Diseases of the digestive system (K00–K93)	45.7	44.6	41.8	42.5	39.8	39.0	39.1	38.2
External causes (V01–Y98)	58.5	45.7	40.0	36.1	37.1	37.2	35.2	34.1
Transport accidents (V01–V99)	6.9	6.0	5.6	5.1	3.7	4.1	3.6	3.2
Intentional self-harm (X60–X84)	7.0	5.7	4.8	4.4	4.8	4.7	5.1	5.2
Other	80.1	85.6	89.7	86.0	87.9	111.6	115.8	139.1
Diabetes mellitus (E10–E14)	19.3	18.1	23.7	22.4	22.6	26.7	23.7	40.2

Note: The new European standard of Eurostat was used to calculate the standardised rates.

Table 13 **International migration, 2003–2013**

Indicator	**2003**	**2005**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Immigrants	60,015	60,294	77,817	39,973	30,515	22,590	30,298	29,579
at the age: 0–14	4,506	4,297	5,944	4,813	4,750	3,087	3,399	3,592
15–64	55,005	55,497	71,037	34,553	25,169	18,974	26,318	25,299
15–34	34,635	34,255	47,860	23,842	17,523	13,416	16,960	16,950
65+	504	500	836	607	596	529	581	688
Emigrants	34,226	24,065	6,027	11,629	14,867	5,701	20,005	30,876
at the age: 0–14	1,285	1,489	472	535	758	873	1,645	2,402
15–64	32,721	22,328	5,301	10,715	13,683	4,617	17,966	27,791
15–34	19,536	12,909	2,338	4,243	5,634	2,250	9,028	13,914
65+	220	248	254	379	426	211	394	683
Volume of international migration	94,241	84,359	83,844	51,602	45,382	28,291	50,303	60,455
Net migration	25,789	36,229	71,790	28,344	15,648	16,889	10,293	−1,297
– males	15,783	23,354	45,193	14,532	5,532	9,331	5,153	−1,573
– females	10,006	12,875	26,597	13,812	10,116	7,558	5,140	276
Net migration by citizenship*)								
– Slovakia	5,573	8,161	7,007	1,442	−1,338	3,389	3,959	4,841
– Germany	194	1,332	2,274	173	364	972	1,050	1,299
– Bulgaria	125	392	950	440	524	464	703	872
– United States	273	628	2,200	2,454	1,673	1,311	765	102
– Russia	834	1,994	5,728	4,106	3,670	2,123	1,566	−181
– Vietnam	2,649	3,489	13,299	2,269	1,386	655	−92	−1,185
– Czech Republic	1,554	−551	−540	−505	83	−1,316	−1,640	−1,988
– Ukraine	10,062	12,483	18,575	8,051	3,432	1,889	−1,814	−7,221

Note: *) Citizenships whose net migration ranked among the three largest in the 2003–2013 period.

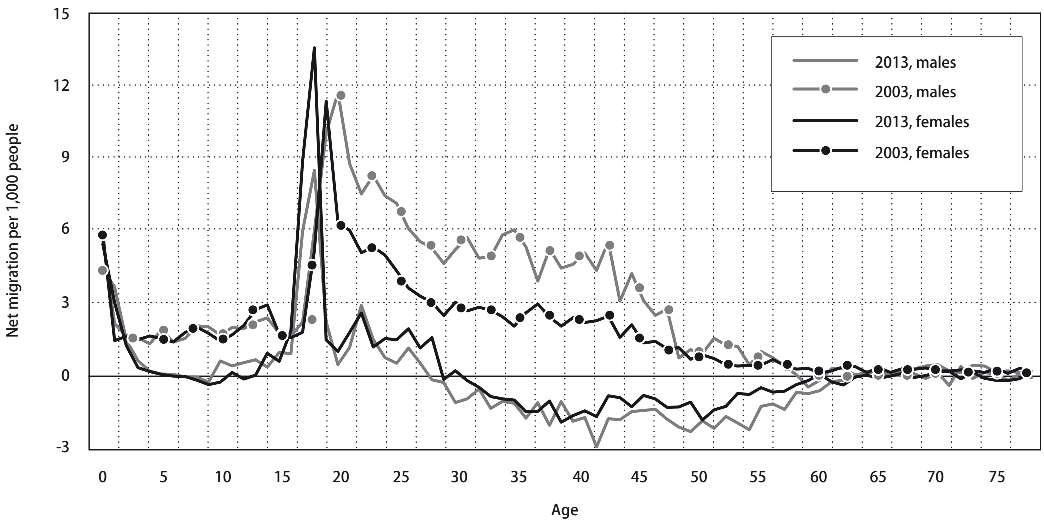
THE CURRENT DEMOGRAPHIC SITUATION IN THE CR IN AN INTERNATIONAL (EU) PERSPECTIVE[6)]

In 2013, the total population of the EU28 rose. But the Czech Republic ranked in the group of thirteen member states in which a population decrease was recorded (but its decrease was smallest in this group (−0.4‰)) and among the ten countries with both natural and migration decreases. The highest total increase was recorded in Luxemburg (23.3‰), Malta (9.5‰) and Sweden (9.3‰), and the biggest decreases were in Latvia (−11.1‰), Lithuania (−9.6‰) and Cyprus (−9.1‰). The total population increase of the EU as a whole was mainly driven by positive net migration, while natural increase accounted for only one-tenth of the total increase in 2013, although there was a positive natural change in the majority of states (fifteen) as well as a positive migration balance.

The age structures of the population of individual EU countries significantly differ. The share of children aged 15 and under as of 1 January 2013 ranged from 13.1% in Germany and 21.9% in Ireland, whereas the average for the whole of the EU28 was 15.6%, which was more than in the Czech Republic (14.8%; the 11th lowest). The share of children in the population was also large in France (18.4%) and was also very small in Bulgaria (less than 14%). The largest share (more than 20%) of elderly persons aged 65 and over was in Italy, Germany and Greece and the lowest (less than 14%) in Ireland, Slovakia

6) Data source: Eurostat database. Absolute numbers on population, births, deaths and migration and the relevant crude rates were available for 2013 (at the time of preparation of the article); for other indicators the latest available were data for 2012.

Figure 7 **Net migration rates by sex and age, 2003 and 2013**



and Cyprus. In the Czech Republic, persons aged 65 and over accounted for 16.8% of the total population, which is a noticeably lower figure than the EU28 average (18.2%). The 0–14 age category was larger than the 65+ category in only eight member states, while in the other states, including the CR, the opposite was true. Seniors outnumbered children the most in Germany and Italy, where the number of persons aged 65 and more was 1.5 times higher than the number of children aged 14 and under.

The current intensity of nuptiality in the Czech Republic is relatively low within the EU, but there are other countries where it is even lower (e.g. Bulgaria, Portugal, Spain, Slovenia, Hungary). The highest crude marriage rate[7)] was in Lithuania, Cyprus and Malta in 2012. The average age at first marriage is still for the most part lower in the Czech Republic, as well as in other countries of Central and Eastern Europe, than in Western, Southern and Northern Europe, by an average of 2–3 years. In the case of divorce rate the situation is different: according to this demographic indicator (crude divorce rate), the CR was one of the countries (together with Latvia, Lithuania, Denmark, Belgium and Sweden) with the highest divorce rate in 2012. At the opposite end of the spectrum, the lowest rates were in countries such as Malta and Ireland, where the crude divorce rate is more than twice as low as that in the CR.

Only two EU member states, Ireland and France, had a total fertility rate very close to the replacement level in 2012 (2.01, 2.00 respectively). A rate significantly above the EU average (1.58) was also observed in the United Kingdom (1.92) and Sweden (1.91). The fertility rate in the Czech Republic (1.45), despite somewhat recovering recently, is still lower than the EU28 average, like in other post-communist countries, with the exception of Lithuania (1.60) and Slovenia (1.58). A low total fertility rate was also observed in Southern Europe (Portugal, Spain, Greece, Cyprus, Italy and Malta) and Central Europe (Germany and Austria). The average age of mothers remains generally lower in Eastern countries than in Western Europe, but it is highest in the Czech Republic, together with Slovenia, among the first-mentioned group

7) Methodologically higher-quality indicators such as the total first marriage rate and total divorce rate were not available even for 2012 or for all Member States.

Table 14 **Selected demographic indicators for EU28 Member States, 2012/2013**

Country	Crude rate of natural change of the population (2013)	Crude rate of net migration*) (2013)	Index of ageing (1.1.2013)	Crude marriage rate (2012)	Crude divorce rate (2012)	Total fertility rate (2012)	Mean age of mothers at birth of first child (2012)	Proportion of live births outside marriage (2012)	Male life expectancy at birth (2012)	Female life expectancy at birth (2012)
European Union (28 countries)	**0.2**	**3.3**	**116.5**	**[1)]4.6**	**.**	**1.58**	**.**	**[1)]39.2**	**77.5**	**83.1**
Belgium	1.5	2.3	103.2	3.6	2.5	1.79	.	52.3	77.8	83.1
Bulgaria	–5.2	–0.2	141.0	2.9	1.6	1.50	25.6	57.4	70.9	77.9
Czech Republic	–0.2	–0.1	113.3	4.3	2.5	1.45	27.9	43.4	75.1	81.2
Denmark	0.6	3.8	102.3	5.1	2.8	1.73	29.0	50.6	78.1	82.1
Germany	–2.6	5.8	158.4	4.8	2.2	1.38	29.1	34.5	78.6	83.3
Estonia	–1.3	–2.0	115.1	4.5	2.4	1.56	26.5	58.4	71.4	81.5
Ireland	8.5	–5.6	56.0	[1)]4.3	0.6	2.01	29.3	35.1	78.7	83.2
Greece	–1.6	–4.7	137.2	4.5	.	1.34	29.7	7.6	78.0	83.4
Spain	0.8	–5.5	116.5	3.5	2.2	1.32	30.3	35.5	79.5	85.5
France	3.4	0.8	96.4	3.7	[1)]2.1	2.00	.	[1)]55.0	78.7	85.4
Croatia	–2.5	–1.2	121.5	4.8	1.3	1.51	27.8	15.4	73.9	80.6
Italy	–1.4	19.7	151.4	3.5	[1)]0.9	1.43	.	28.0	79.8	84.8
Cyprus	4.7	–13.9	80.7	6.7	2.4	1.39	28.8	18.6	78.9	83.4
Latvia	–4.0	–7.1	129.9	5.5	3.6	1.44	26.0	45.0	68.9	78.9
Lithuania	–3.9	–5.7	124.2	6.9	3.5	1.60	26.6	28.8	68.4	79.6
Luxembourg	4.2	19.0	82.3	3.4	.	1.57	29.6	37.1	79.1	83.8
Hungary	–3.6	0.6	118.9	3.6	2.2	1.34	27.7	44.5	71.6	78.7
Malta	1.9	7.6	117.9	6.7	1.1	1.43	28.1	25.7	78.6	83.0
Netherlands	1.8	1.2	98.1	4.2	2.1	1.72	29.3	46.6	79.3	83.0
Austria	0.0	6.6	125.3	4.6	2.0	1.44	28.7	41.5	78.4	83.6
Poland	–0.5	–0.5	94.7	5.3	1.7	1.30	26.6	22.3	72.7	81.1
Poland	–2.3	–3.5	131.1	3.3	2.4	1.28	28.6	45.6	77.3	83.6
Romania	–3.5	–0.3	103.8	5.4	1.6	1.53	25.7	31.0	71.0	78.1
Slovenia	0.9	0.2	118.1	3.4	1.2	1.58	28.5	57.6	77.1	83.3
Slovakia	0.5	0.4	85.5	4.8	2.0	1.34	26.8	35.4	72.5	79.9
Finland	1.2	3.3	114.2	5.3	2.4	1.80	28.5	41.5	77.7	83.7
Sweden	2.4	6.9	113.4	5.3	2.5	1.91	29.1	54.5	79.9	83.6
United Kingdom	3.2	3.1	97.7	4.4	[1)]2.1	1.92	30.8	47.6	79.1	82.8

Note: Crude rates are per 1,000 inhabitants; Index of ageing and Proportion of live births outside marriage in %;
Total fertility rate per 1 women.
*) Plus statistical adjustment.
1) Data for 2011.

of states, so these two countries ranks approximately in the middle of the EU28 countries according to this indicator. A middle position is nowadays also typical for the Czech Republic with respect to the share of live births outside marriage (43% in 2012, which was a little above the EU28 average), which in 2012 varied across the EU28 from 8% in Greece to 58% in Estonia. More than half of all births were extramarital in seven countries (Estonia, Slovenia, Bulgaria, France, Belgium, Sweden and Denmark) while at the opposite end of the spectrum were Croatia, Cyprus, and Poland, as well as Greece, with less than one-quarter of all births occurring outside marriage.

Despite the considerable improvement in mortality in many countries in Eastern Europe, the situation in Western Europe remains better. Male life expectancy at birth of 75.1 years in the Czech Republic in 2012 was almost 5 years less than in Italy or Sweden, which were the countries with the longest life expectancy for males within the EU28, and 4.2–4.5 years less (81.2 years[8)]) than for women living in France or Spain. Out of the former socialist countries, only Slovenia in the case of men and Slovenia and Estonia in the case of women had higher life expectancies. The worst mortality situation among the EU countries was in Romania and Bulgaria, where in 2012 the life expectancy of newborns was respectively 5 and 3 years shorter than that of newborns in the CR. By contrast, the infant mortality rate in the Czech Republic was lower than in most EU states.

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8) The figure for female life expectancy in the Czech Republic in 2012 given by Eurostat is 0.1 years higher than the life expectancy calculated using the national methodology applied in the Czech Republic (described in the section 'Mortality' of this article).

THE YOUNG HOUSEHOLDER DEFICIT IN ITALY COMPARED TO FRANCE

Elwood D. Carlson

ABSTRACT

Few men and women between ages 20 and 29 appeared as independent householders in the 2001 census of Italy, compared to people at the same ages in the 1999 census of France. This Italian householder deficit occurred despite closely-matched timing in the two countries for finishing school, securing employment and getting married, refuting popular perceptions of avoidance by young Italians of these other adult roles as an explanation for the householder gap. Region-level data within these countries allow further evaluation of macro-level supply-side (housing) and demand-side (employment) explanations for the householder deficit. The demand-side hypothesis finds more empirical support than the supply-side hypothesis across regions in these countries, but both factors leave an important part of the inter-country difference in household headship unexplained.

Keywords: householder, transition to adulthood, housing supply, housing demand, housing tenure, employment rate, NUTS-2 regions, Italy, France, IPUMS-I

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THE ITALIAN HOUSEHOLDER DEFICIT

Empirical evidence confirms a widespread perception that one particular aspect of the transition to adulthood (*Kobrin*, 1973; *Modell – Furstenberg – Hershberg,* 1976; *Goldscheider – DaVanzo,* 1985; *Hogan – Astone,* 1986; *Goldscheider,* 1997; *Arnett,* 1998; *Cook – Furstenberg,* 2002; *Gauthier,* 2007) occurs later in Italy than in many other European societies. The 2001 Italian census (see Table 1) enumerated only 19% of men and only 32% of women living as independent householders at ages 20 through 29. By contrast, the 1999 census in neighboring France showed an average of 51% of men and 68% of women living as single heads or as couples in their own independent households in the same 20–29 age range. These ages are of critical interest to demographers because if transitions to adulthood are significantly delayed during or beyond this third decade of life, even if the transition occurs

Table 1 **Household Headship by Sex, Ages 20–29 Italy 2001 and France 1999**

	Men Ages 20–29		Women Ages 20–29	
	Italy 2001	**France 1999**	**Italy 2001**	**France 1999**
Total	4,055,300	4,043,940	3,972,500	3,961,880
Householders	777,020	2,051,780	1,302,360	2,709,600
Dependents	3,278,280	1,992,160	2,670,140	1,252,280
Percent Householders	19.2%	50.7%	32.8%	68.4%
(Italian deficit)	–31.6%		–35.6%	

Source: IPUMS-I samples, Italy 2001 and France 1999.

subsequently at later ages, the impact on union formation, birth rates and population growth are dramatic.

Data from other years may show slight shifts in timing of transition events, but the precise time point selected is not critical to the substantive issues explored below. In both Italy and France, the age range from 20 through 29 captures the heart of the transition to adulthood, and comparison of these two countries illustrates particularly well a highly instructive contrast in household formation as one dimension of that transition process.

Household formation (*Laslett,* 1972; *Hajnal,* 1982; *Santi,* 1990; *Billari et al.,* 2002) is closely related to reproductive decisions, but unlike many other kinds of social groups, also refers to specific physical, spatial locations. Households relate not only to the family, work and school roles of people, but also to the built residential environment (*Winkler,* 1992; *Berrington – Murphy,* 1994; *Mulder – Clark – Wagner,* 2006). The institutionalized system for controlling rights and access to residential property forms the background upon which each society draws its patterns of household headship, just as kinship serves as a background for marriage patterns, and the economic system forms the background for labor force roles of individuals. Roles such as renter, landlord, or owner-occupant form a distinct dimension of social organization based on the control of residential property. The relation between household headship and other role dimensions of adulthood can be seen in terms of structural details of this property system (*Carliner,* 1975; *Haurin – Hendershott – Kim,* 1993; *Mulder – Billari,* 2010) and its articulation with other transitions involving schooling, marriage, or labor force participation (*Aquilino,* 1990; *Cordon,* 1997; *Reher,* 1998).

While household headship for young adults implies separation from parental households, it involves more than simply leaving home, another event widely studied in this context (*Glick – Lin,* 1986; *Goldscheider – LeBourdais,* 1986; *DeVos,* 1989; *DeJong Gierveld – Liefbroer – Beekink,* 1991; *Avery – Goldscheider – Speare,* 1992; *Goldscheider – Goldscheider,* 1993; *Cherlin – Scabini – Rossi,* 1997; *Billari – Mazuc – Ongaro,* 2002; *Mulder – Clark – Wagner,* 2002; *Gutman – Pullum-Pinon – Pullum,* 2002; *Billari – Liefbroer,* 2007). Some young adults who leave parental homes become heads of their own new households, but others simply become dependents in another household headed by someone else or lodgers in non-family household settings such as dormitories or barracks. This analysis places special emphasis on household headship as a dimension of adulthood related to a society's institutionalized system for controlling residential property, because such headship creates important conditions supporting other adult roles such as parenthood.

Well-known difficulties plague the use of census data on household headship (*Laslett,* 1972; *Freguja – Valente,* 2010). Use of this concept ordinarily assumes a definition of what constitutes a household as a residential grouping, and also sometimes implies that one person in each household can be identified unambiguously as its head. This is decided in most contexts with reference to responsibility for the majority of household expenses. Some people enumerated as household heads live without intimate partners, however, and in the case of unrelated roommates sharing expenses equally, identification of a household head may become arbitrary. Further, many systems for recording household composition automatically assign headship to the male partner when a heterosexual couple share a household. These problematic features of the "head of household" measure have hindered its use in contemporary research, despite its widespread availability.

To overcome some of these limitations, whenever a household head was identified as living with a spouse or other cohabiting partner, both the person identified as head of household and also his or her partner were counted in this analysis as householders, since couples share the responsibility of maintaining an independent household. Unmarried cohabitation as well as formal marriage here qualifies both partners for householder status. This approach to the concept of householder status is in line with other recent attempts to capture the growing flexibility and diversity of household roles and structures. When a head of household did not report a partner, other members of the household were counted as dependents. While this may produce a slight undercount of householders in the case of roommates who share effective headship, this effect on overall household composition patterns is insignificant.

THEORETICAL EXPLANATIONS FOR THE ITALIAN HOUSEHOLDER DEFICIT

Three possible explanations are compared here for lower levels of independent household formation among young Italians compared to young French men and women. The first of these may be called the Mammismo explanation, from a term used in the Italian popular press. The Mammismo explanation attributes the Italian householder deficit to a supposed resistance to assuming adult roles and responsibilities among young people themselves, perhaps aided and abetted by a desire on the part of parents to postpone the departure of their children (*Dalla Zuanna,* 2001; *Livi Bacci,* 2001; *Dalla Zuanna – Micheli,* 2004). This perspective sees prolonged coresidence by children as a familistic cultural preference. As such, extended coresidence preferences could be expected to be more fully realized by families with more resources to support dependent young adults.

A second explanation advanced in a number of previous studies (*Castiglioni – Dalla Zuanna,* 1994; *Pinelli,* 1995; *Dalla Zuanna,* 2001; *Ongaro,* 2001; *Bernardi,* 2005) links delays in the Italian transition to adulthood to problems in the supply of housing. This explanation also has been suggested in other societal contexts (*Krishnan – Krotki,* 1993, *Mulder – Wagner,* 2001; *Mulder,* 2006, *Lauster – Fransson,* 2006; *Mulder – Billari,* 2010). Housing stocks and financing mechanisms have been linked in other research (summarized in *Mulder – Billari,* 2010) to childbearing and marriage as outcomes, but this theoretical reasoning can be applied with equal or even greater force to the question of household headship. Since household headship explicitly involves the built environment, it should reflect the effects of variations in that residential context more than any other transition process. Mulder and Billari suggest that two features in particular of what they call the housing regime in a society are of crucial interest—the share of residential units that are owner-occupied, and the availability of financial mechanisms (chiefly mortgages) allowing access to such ownership. They distinguish four such regimes in which ownership is more or less prevalent on one hand, and in which financing is readily available or scarce on the other. They place Italy in the "difficult" regime because financing is scarce and most of the residential households are owner-occupied and so not available for renting. They place France in the "elite" regime because financing is also scarce, but the extent of owner occupancy is lower and more places to live are available for rent, allowing young adults more possibilities of entry into households of their own—and so, in the current context, into household headship. This explanation looks beyond the households of individual young adults and their parents, to consider the built residential environment in the communities where they live.

A third explanation relates more dependent coresidence with parents among young unmarried Italians to a lack of paid employment in their communities. Without jobs and income, people may lack effective demand for housing whether it is available or not (*Whittington – Peters,* 1996; *Ermisch – DiSalvo,* 1997; *Del Boca – Chiuri,* 2008). Like the housing explanation, this employment explanation must look beyond individual households, to consider available opportunities for jobs in local labor markets facing young French and Italian men and women.

The supply-side housing explanation and the demand-side employment explanation both focus on the social context facing young adults, rather than any assumptions of cultural distinctiveness such as a preference by young adults or their parents for prolonged dependent coresidence. These three explanations are considered sequentially, to show their relative explanatory power and the "value added" by each of them to the overall understanding of the Italian householder deficit.

DATA FROM INTERNATIONAL PUBLIC USE MICRODATA CENSUS SAMPLES

While most contemporary research on the transition to adulthood takes advantage of the detailed and sophisticated content of specialized sample surveys, this exploratory study turns to recently-assembled international public use microdata samples (IPUMS-I [1]) taken from censuses of many countries

1) Integrated Public Use Microdata Samples – International

around the world. The French IPUMS-I data set used below comes from a 5% sample of the 1999 census of population in France, and contains 2,934,758 individual records from 1,219,323 households. The Italian IPUMS-I data set used below is based on a 5% sample of the 2001 census of population in Italy, and contains 2,990,739 individual records from 1,168,044 households. These data sets are hundreds of times larger than any of the most popular sample survey data sets. Even within the age range from 20 through 29, each national census sample used here includes more than 400,000 individual person records. Figures shown in tables here use IPUMS-I weights to weight up each sample to represent the total population of each country. The very large number of cases allows more reliable estimates of statistical significance for observed relationships, and permits disaggregation of household and economic measures to the subnational regional (NUTS-2) level within each country.

The IPUMS-I samples of individuals enumerated in the 1999 census of France and the 2001 census of Italy do not allow direct examination of cultural attitudes such as a preference for prolonged coresidence by adult children, but these public use samples do contain a wealth of other information that allows us to test the three explanations considered above, even without recourse to attitude measures. The aim of this study is to demonstrate the relative merits of the three considered theoretical explanations in basic terms, and the IPUMS-I census samples are ideal for this purpose. Working from the basic perspective established here, it would be possible to follow up more detailed specific hypotheses arising from this study by using more complex and specialized data sets, but all the evidence needed to address the issues considered here can be found in these public use microdata samples.

METHODS FOR EVALUATING THE THREE EXPLANATIONS

The notion of familistic cultural preferences—the Mammismo explanation—suggests that not only household headship but all institutionalized adult role alternatives to prolonged coresidence and dependency on parents (*Courgeau – Lelièvre,* 1992; *Del Boca,* 2003; *Coppola,* 2004) might be delayed for young Italians. To determine whether this was actually the case, information was considered from the IPUMS-I samples on these other transitions to adulthood including completion of formal education, participation in the paid labor force, and current marital status. While unmarried cohabitation qualifies partners as householders, it is not appropriate to include cohabiting partners in the formal definition of a married spouse. Columns in the top panel of Table 2 (see below) sum to 100% of the young men or women in each country, $\Sigma_i d_i = 100\%$, where *d* represents the percentage distribution of young adults over the various combinations of school, work and marital statuses and *i* represents cross-classified categories of school, work and marriage.

Within each such combination of student, spouse and worker roles, the middle panel in Table 2 shows the share of young adults who were enumerated as householders (either head of household or partner of head) in each country. These percentages are specific to each such role combination ($p_i = \frac{H_i}{T_i}$) where *p* represents the propensity to achieve householder status, *H* includes household heads and partners of heads, *T* represents all young adults from age 20 through age 29, and *i* represents each cross-classified category of school, work and marriage roles. These propensities do not sum to any meaningful quantity in columns or rows.

Is the Italian householder deficit paralleled by similar deficits among young Italians in the share of people who have ever married, who have found paid employment, and perhaps who have completed formal schooling? To evaluate this possibility, component decomposition produces two components that sum to the total householder deficit observed in Table 1 above for Italians of each sex. The distribution component (ΔD) multiplies the difference between distribution percentages for France and Italy in each role combination category (the top panel of Table 2) times the average for France and Italy of propensities to be householders for people in that category (the middle panel of Table 2):

$$\Delta D = (d_i^I - d_i^F) \cdot \left[\frac{(p_i^I + p_i^F)}{2}\right], \quad (1)$$

where *d* represents the percentage distribution of young adults over the various combinations of school, work and marital statuses, *p* represents the propensity to achieve householder status in each such role combination, *i* represents the categories of school, work and marriage roles, *I* is Italy and *F* is France.

The other half of the decomposition yields the propensity component (ΔP), which multiplies the difference between percentages of householders within each role combination category for France and Italy (the middle panel of Table 2) times the average for France and Italy of percentages of young adults in each category (the top panel of Table 3):

$$\Delta P = \left[\frac{(d_i^I + d_i^F)}{2}\right] \cdot (p_i - p_i^F)\,, \qquad (2)$$

where all symbols are as in equation 1 above. The decomposition is conducted for men and for women separately.

If the Mammismo explanation has merit, the ΔD component should capture most of the observed Italian householder deficit. All aspects of the transition to adulthood would be affected by a presumed cultural preference for extended coresidence of adult children with their parents. Exits from formal schooling and entry into marriage and employment should exhibit the same delays observed for household formation. To the extent that the ΔP component captures any of the observed Italian householder deficit, household formation is disconnected from the other dimensions of the transition to adulthood, and must then be explained by some other mechanism.

To test the macro-level housing explanation, information is required about the socio-economic environment beyond characteristics of individual households. Since the crucial distinction between France and Italy for the housing explanation involves ownership versus renting (rather than availability of financial mechanisms for buying homes) we concentrate on residential tenure statistics to test this idea. The IPUMS-I census samples for Italy in 2001 and France in 1999 confirm the classification suggested by Mulder and Billari at the aggregate national level. In Italy 71.3% of all residences with 71.6% of all individual respondents were reported as owner-occupied. In France only 54.7% of all residences with 57.2% of all individual respondents were owner-occupied. Italy, the country with less housing available for renting, is also the country with more unmarried young adults remaining in parental homes as predicted.

The large number of cases in the IPUMS-I data sets allows us to go beyond this aggregate national comparison, to take advantage of the fact that Italy is divided for statistical purposes into 19 regional areas and France is divided into 22 regional areas (the European NUTS-2 boundaries). This geographic detail allows OLS regression of proportions of persons 20 to 29 who were living as dependents with at least one parent and/or grandparent householder on proportions of owner-occupied households, using sub-national regions as cases. Other results (see below) from testing the Mammismo explanation show that nearly all the observed Italian householder deficit concentrates among unmarried young adults, so these regression models consider proportions living as adult lineal dependents among unmarried persons only. Most married young adults in both countries lived as householders. The regression is fitted first for France, then for Italy, and finally for all the regions in both countries taken together, with a variable added to distinguish between the two countries. If the housing explanation has merit, a statistically significant positive relationship should appear between dependency and owner-occupancy across the regions within each country. If this explanation is powerful and generalizable enough, the coefficient for the variable distinguishing between the two countries might even lose statistical significance.

To consider the employment explanation, measures taken from IPUMS-I data files for the Italian 2001 census and the French 1999 census included employed/unemployed status as well as inclusion in the labor force. To measure a possible lack of effective demand for housing, the unemployed are combined with those outside the labor force. Dividing never-married persons without jobs by the total never-married population at ages 20 through 29 yields a proportion of never-married young adults without paid employment. Nearly half (41%) of unmarried men at ages 20 through 29 in Italy were either unemployed or outside the labor force, compared to just over one-third (36%) of unmarried French men at these ages. Over half (55%) of unmarried women at ages 20 through 29 in Italy had no jobs, compared to less than half (46%) of young French women. Italy, the country with more joblessness among young unmarried adults, is also the country with more unmarried young adults remaining in parental homes.

As for the housing explanation, a detailed test of the employment explanation regresses proportions living as dependent adults with their parents on proportions without paid employment across the 19 regions of Italy and the 22 regions of France. The regression is fitted first for France, then for Italy, and finally for all the regions in both countries taken together, with a variable added to distinguish between the two countries. If the employment explanation has merit, a statistically significant positive relationship should appear between dependency and lack of employment for never-married persons across the regions within each country. If this explanation is powerful and generalizable enough, the coefficient distinguishing between the two countries might even lose statistical significance.

The housing and employment explanations represent competing supply versus demand models of macro-economic conditions, tested using very similar data and logic. If percentages owner-occupied for dwellings and percentages of unmarried young adults without jobs are not themselves too strongly correlated across sub-national regions, both factors can be added to a final regression model simultaneously, fitting the model to all the considered regions in both Italy and France with a variable added to distinguish between the two countries. This allows direct assessment of the relative statistical power of these two explanations.

If the factors representing the housing and/or employment explanations exhibit strong and significant positive coefficients in these final models, and particularly if the country coefficient recedes into insignificance, one or both of these explanations would be strongly supported by the evidence.

FINDINGS FROM ANALYSIS OF IPUMS-I DATA FOR FRANCE AND ITALY

Columns in the top panel of Table 2 show the percentage distribution in France and in Italy of young adults aged 20 through 29 across all possible combinations of school, work and marriage roles. The largest percentages for both sexes in each country appear in the "single worker" category, which includes people out of school, working in the labor force, but not yet married. Percentages for unmarried students are a distant second for men in both countries, followed by even smaller shares of men who have already married as well as getting jobs, and then those who are trying to combine all three roles of student, worker and spouse. For women in both countries, since they typically marry earlier than men, the second and third categories reverse the order for men, with more married workers and fewer single students among women. The most noticeable thing about this top panel of Table 2 is that percentages in these various role combinations are very similar in Italy compared to France, for men as well as for women.

The middle panel of Table 2 shows percentages of people within each combination of school, work and marriage roles who had managed to set themselves up as householders (that is, who were enumerated as heads of household or partners of heads). The "average" row shown at the bottom of this panel duplicates the overall shares of householders reported in Table 1 above.

Here the first four never-married role combinations contrast dramatically with the last four ever-married combinations. Householder status clearly is the norm for ever-married men and women in both Italy and France. Only ever-married male students without jobs in both countries fall below two-thirds of their numbers as householders. The percentages of ever-married young Italians living as householders is slightly lower than in France, but in all four ever-married categories for both sexes, the country differences are relatively minor.

On the other hand, a tremendous gap in householder status separates unmarried men as well as women in Italy from their unmarried counterparts in France. In the two largest never-married categories (single worker and single student) the share of householders for both men and women in France is five or more times higher than the share in Italy. Observers familiar with French and Italian societies doubtless will be reminded by these results that unmarried cohabitation is much more common in France than in Italy. More will be said about this in the discussion below. It suffices at this point to say that this fact does not conflict in any way with the findings and conclusions reported here.

The component decomposition establishes conclusively that differences in transitions out of formal

Table 2 Household Headship by Other Adult Roles, Ages 20–29 in France 1999 and Italy 2001

	Italian	French	Italian	French
Percent by roles:	**Men**	**Men**	**Women**	**Women**
single only	1.6%	2.6%	2.6%	4.4%
single student	16.5%	16.8%	20.9%	18.5%
single worker	62.1%	61.3%	42.3%	47.0%
single student worker	6.9%	4.4%	5.6%	4.6%
married only	0.2%	0.3%	9.9%	5.3%
married student	0.1%	0.3%	0.8%	0.7%
married worker	11.7%	14.0%	16.6%	19.0%
married student worker	0.8%	0.4%	1.4%	0.6%
Total	*100.0%*	*100.0%*	*100.0%*	*100.0%*
Percent householders:				
single only	12.1%	17.0%	26.6%	68.7%
single student	4.9%	30.9%	4.7%	37.9%
single worker	10.5%	48.1%	12.0%	66.8%
single student worker	11.3%	40.9%	13.4%	54.9%
married only	77.4%	54.1%	91.0%	95.3%
married student	57.8%	63.0%	83.7%	81.3%
married worker	85.2%	94.4%	86.7%	96.4%
married student worker	78.3%	88.4%	88.2%	93.8%
Average	*19.2%*	*50.7%*	*32.8%*	*68.4%*
(France – Italy)		**31.6%**		**35.6%**
Δ*D* Role distribution effect[1)]		1.1%		–1.1%
Δ*P* Propensities within roles[2)]		30.5%		36.7%
(of which):				
single only		*0.1%*		*1.5%*
single student		***4.3%***		***6.5%***
single worker		***23.2%***		***24.5%***
single student worker		*1.7%*		*2.1%*
married only		*–0.1%*		*0.3%*
married student		*0.0%*		*0.0%*
married worker		*1.2%*		*1.7%*
married student worker		*0.1%*		*0.1%*

Source: IPUMS-I microdata samples of censuses for France (1999) and Italy (2001). All percents are averages of percents for single years of age 20–29, to remove differences in age structure within the 20–29 age range.
Note: 1) role distribution effect = differences between countries in percents by roles, times average across countries in householder percents within categories.
2) propensity effect = differences between countries in householder percents within categories, times average across countries in percents by roles.

schooling and into marriage and employment do not explain the householder gap. As shown in the bottom panel of Table 2, only about one percentage point out of the Italian deficit of 32 percentage points for men or 36 percentage points for women can be attributed to the ΔD component reflecting differences in timing of leaving school, finding jobs and getting married. This result is not surprising, given the close similarity of the other transition processes noted for the two countries.

Differences between Italy and France in the ΔP component, measuring propensities to form households within each of these combinations of other roles, actually capture the overwhelming share of the observed householder gap. Looking more closely at propensity components for specific role combinations, almost all of the Italian householder deficit can be traced to living arrangements of young never-married workers and students. The single worker effect is greater than the single student or single student worker effect chiefly because few young men and women are students but many are workers in this age range. Since the Italian householder deficit originates almost entirely *within* specific combinations of other adult transition roles, these other aspects of the transition to adulthood explain almost none of the deficit.

Looking beyond characteristics of individual households, a macro-social perspective on economic environments faced by these young adults leads to the supply-side housing explanation and the demand-side employment explanation. As discussed above, France and Italy fit nicely into both of these macro-level explanations at the aggregate national level.

However, regression of percentages of unmarried young adults living with their parents on percentages of dwellings that were owner-occupied (taking sub-national regions as units of analysis) produces puzzling and less satisfactory results. Table 3 shows OLS regression results across sub-national regions for men in France and Italy, while Table 4 shows results for women in the two countries. In each table, the first three panels report models testing the housing explanation, the second three panels report models testing the employment explanation, and the bottom panel combines both explanations so they may be tested against each other simultaneously.

The negative coefficients for the housing variable in the top two panels of Table 3 show that regions in each country with more owner-occupied housing had lower levels of coresidence with parents for young men aged 20–29, rather than higher levels as predicted and as observed at the aggregate national level. Inside both France and Italy, the housing explanation does not fit the facts for sub-national regions. The negative coefficients in these models cannot be viewed as significant since their standard errors are so large, but there is certainly no sign of any significant positive coefficient in support of the housing explanation. Both countries appear in the same category of financial access to housing according to *Mulder and Billari* (2010), so it is unlikely that additional measures of that aspect of the housing situation would improve these models.

The other important feature of these models testing the housing explanation is that the negative coefficients are of about the same (insignificant) magnitude, so that the main difference between France and Italy is observed in the model intercepts. This important residual difference is confirmed by the third panel of the table based on all regions in both countries, which repeats the negative but insignificant coefficient for the percent of residences owner-occupied. The very statistically significant coefficient for the "Italy" variable predicts a level of dependent co-residence for young Italian men ages 20–29 almost twice as high as observed in France, for equivalent regional levels of residential owner-occupancy.

In both France and Italy, the coefficients for joblessness shown in the next three panels of Table 3 correlate positively with the extent of dependent co-residence. In Italy this coefficient is significant at the 95% confidence level or higher, while in France the level of significance does not rise quite as high. In both cases the coefficients are positive as expected, meaning that sub-national regions with more young adults lacking jobs also have more young adults living with their parents. This provides at least some modest support of the employment explanation for at least part of the Italian householder deficit.

However, the intercepts of these employment models for France and Italy again remain far apart. The estimation of a model including all regions in both countries, with a variable added to distinguish between Italy and France, again finds that more of the difference in forming independent households is accounted for by the unexplained "Italy" variable than by the variable based on employment levels. The extent of dependent coresidence with parents is predicted to be about twice as high in Italian regions as in French regions with equivalent levels of joblessness.

When both housing and jobs are considered simultaneously, along with the variable distinguishing between

Table 3 Percent Dependent in Sub-National Regions by Housing Tenure and Employment, Never-Married Men Ages 20–29

	B	σ (B)	T	pr (t)	Adj. R^2
% owner-occupied (Fr)	–0.15	0.191	–0.79	0.436	
Intercept	0.57	0.109	5.21	0.000	–0.0179
% owner-occupied (It)	–0.09	0.267	–0.33	0.748	
Intercept	0.93	0.199	4.67	0.000	–0.0052
Italy	0.40	0.031	–12.97	0.000	
% owner-occupied	–0.12	0.160	–0.75	0.457	
Intercept	0.55	0.091	6.20	0.000	0.9483
% no job (Fr)	0.39	0.211	1.85	0.079	
Intercept	0.34	0.075	4.60	0.000	0.1037
% no job (It)	0.28	0.048	5.89	0.000	
Intercept	0.75	0.021	36.18	0.000	0.6519
Italy	0.36	0.011	34.01	0.000	
% no job	0.29	0.050	5.72	0.000	
Intercept	0.38	0.019	19.87	0.000	0.9718
Italy	0.35	0.025	13.94	0.000	
% owner-occupied	0.10	0.125	0.80	0.429	
% no job	0.30	0.053	5.66	0.000	
Intercept	0.32	0.079	4.20	0.000	0.9716

Source: Proportions for sub-national regions from IPUMS-I data from 1999 census of France and 2001 census of Italy.

the two countries, the employment variable remains positive and significant as predicted by the employment explanation, but the housing variable does not have a statistically significant coefficient, and by far the largest part of the Italian householder deficit is left unexplained, hiding within the unexplained “Italy” variable rather than contributing to either considered explanation.

Results shown in Table 4 for young women are generally very similar to those shown in Table 3 for young men, but there are some notable exceptions. As for men, the coefficient for the percentage of residences owner-occupied generally fails to reach statistical significance whether considered by itself or in combination with the employment variable. One exception to this pattern appears among young French women, however, where the negative coefficient for the housing variable actually achieves quite high statistical significance. This means that in France, young women definitely are more likely to remain in the homes of their parents in regions where the availability of rental housing is higher, rather than lower. This result directly contradicts the housing explanation.

In Italy and in the combined model for both countries, as for men, more young women without jobs appears to translate into more young women living with parents. Coefficients for this variable in the fourth and fifth panels of Table 4 are positive and statistically significant, as for men in Table 3. Young women in France again go against this pattern with a statistically significant negative coefficient for joblessness as a predictor of dependent co-residence. However, when all regions in both countries are combined in the final model that includes both owner-occupancy and joblessness as predictors, the results are essentially the same as for men. Overall, more joblessness significantly predicts more dependent coresidence. More owner-occupancy is statistically unrelated to this outcome. The unexplained “Italy” variable again captures the lion’s share of the difference between France and Italy, meaning that for women as well as for men, neither the housing nor the employment explanations can "explain away" all of the Italian householder deficit.

Table 4 **Percent Dependent in Sub-National Regions by Housing Tenure and Employment, Never-Married Women Ages 20–29**

	B	σ (B)	T	pr (t)	Adj. R^2
% owner-occupied (Fr)	–0.50	0.195	–2.57	0.018	
Intercept	0.63	0.111	5.63	0.000	0.2196
% owner-occupied (It)	0.02	0.295	0.06	0.954	
Intercept	0.85	0.219	3.89	0.001	–0.0586
Italy	0.57	0.034	16.63	0.000	
% owner-occupied	–0.25	0.176	–1.39	0.172	
Intercept	0.48	0.101	4.76	0.000	0.9664
% no job (Fr)	–0.57	0.231	–2.46	0.023	
Intercept	0.71	0.150	4.73	0.000	0.1938
% no job (It)	0.26	0.039	6.64	0.000	
Intercept	0.72	0.023	30.70	0.000	0.7055
Italy	0.54	0.014	39.54	0.000	
% no job	0.22	0.052	4.27	0.000	
Intercept	0.20	0.035	5.58	0.000	0.9761
Italy	0.57	0.029	19.80	0.000	
% owner-occupied	–0.15	0.150	–1.01	0.321	
% no job	0.22	0.053	4.70	0.000	
Intercept	0.29	0.097	2.95	0.006	0.9762

Source: Proportions for sub-national regions from IPUMS-I data from 1999 census of France and 2001 census of Italy.

DISCUSSION OF FINDINGS ABOUT THE ITALIAN HOUSEHOLDER DEFICIT

Popular media and the public imagination sometimes take a sensationalist approach to explaining the deficit of household headship among young Italians. It even has been described as a kind of moral failure of the young, variously including selfishness, fearfulness, or simply immaturity. The popular press in Italy even has coined the term *mammismo* to describe this timidity and immaturity. Young people are described as sitting at home with their mothers who continue to feed them, wash their clothes, and allow them to avoid the struggles of independent adult existence – a perpetual adolescence. According to this interpretation, parents enable such behavior because they and their children share a familistic desire for extended multi-generational coresidence.

If this Mammismo explanation were true, differences in achieving household headship might be matched by differences in other dimensions of the transition to adulthood. Young Italians might be leaving school later, marrying less, and/or participating less in the paid labor force. Staying home longer with parents would be only one of several symptoms of this consistent tendency toward prolonged dependence as a cultural preference, which would be more convenient and more often achieved by those with higher levels of personal and family resources.

The component decomposition in Table 2 shows that all aspects of the transition to adult roles (leaving school, getting a job, getting married) *except* household formation itself are nearly parallel in France and in Italy. Virtually none of the Italian householder deficit can be linked to similar delays in these other transitions. Almost all of it can be traced to less household formation among young never-married students and workers who continue living at home in Italy but not in France. The nearly equal shares of young adults in France and Italy who have in fact gotten married and found jobs are also almost equally likely to head their own households.

At this point the matter of unmarried cohabitation in France must be dealt with as a possible complication. One approach to measuring and studying unmarried cohabitation sometimes treats this social arrangement as an innovative or marginal category of marital status, as shown by extensive debates about how to include it as a category within variables that also include single (never married), currently married, widowed, divorced, and other marital statuses. In the IPUMS-I data files, multiple codings for marital status are available that include or exclude cohabitation as one of the possible options. The variable that includes cohabitation as a marital status is designated as the "European" variant, since this practice has been adopted most widely in European countries. According to this perspective, if the role combinations in Table 2 above were expanded to include unmarried cohabitation as a separate alternative to formal marriage, the cohabitation variable might capture much of the explanation for the Italian householder deficit since unmarried cohabitation is much less common in Italy than in France.

This view of unmarried cohabitation is misguided. Scholars of marriage and family patterns long have wrestled with the awkward fact that unmarried cohabitation is not actually a category of marital status at all. Complicating marital status measures with a category for unmarried cohabitation loses important information about the people put into this category, because partners in every cohabiting couple also have separate marital statuses. Some are never married, some are currently married (and in some cases cohabiting with someone other than a spouse) and some are widowed or divorced. Cohabiting partners may each have different marital statuses. Even non-cohabiting persons have a separate marital status, and some married spouses and other couples do not cohabit – these are the couples "living apart together" who figure in some recent research. In short, cohabitation should not be considered as a category of marital status at all.

When examined carefully, what in fact is meant by cohabitation? This term reflects nothing else except the relationship of people to their built residential environment. Cohabitation is simply another word for two persons who live together as a couple in the same household, no matter what their individual marital statuses may be. Saying that unmarried young adults in France are more likely to form cohabiting unions does not explain "why" they have a higher level of household headship, because cohabitation is itself a measure of that headship status. The association between cohabitation and householder status is a tautology.

Attention to people's relationships with their built environment actually offers a new, more theoretically sound perspective from which to study unmarried cohabitation, and makes it possible to ground this social behavior in an entirely separate institutionalized sphere of life reflecting how people relate to their residential surroundings. This seems both theoretically and methodologically better than trying with frustrating results to force unmarried cohabitation into the measurement of marital status where it does not belong.

Looking beyond the parental households where young adults may remain as dependents well into the third decade of their lives, other scholars consider broader social-structural explanations based on availability of housing and jobs to sustain independent young couples. In this comparison of Italy and France, the large size of the IPUMS-I census public use samples allows analysis of such patterns across sub-national regions. Tables 3 and 4 above show similar (though not identical) patterns for young men and young women at ages 20 through 29.

Although the country with less rental housing (Italy) also has more young adults remaining as dependents in parental homes, this pattern predicted by the supply-side housing explanation does not extend down to the level of sub-national regions in either Italy or France. In each country considered separately, the share of owner-occupied housing (the complement of housing available for rental) never gives a positive and statistically significant prediction of the share of coresident dependent young adults in each region. Young women in France actually are significantly *less* likely to remain with parents in regions with more owner-occupied homes – the opposite of what the housing explanation predicts. When all regions in both countries are included in the model, the coefficient for this housing variable fails to predict significant differences in extended coresidence for either young men or young women, and remains negative rather than positive as expected. When included in the final model in each table along with the employment variable, the negative sign on the housing variable disappears for men though not for women, but this explanatory factor still fails to show any statistical significance in predicting extended coresidence with parents.

The demand-side housing explanation fairs rather better. Regions in each country with less employment at ages 20 through 29 also have significantly more young men still living as dependents with their parents. This is true also for young women in Italy, but young women in France fail to fit predictions from this explanation just as they did for the housing explanation. When all regions in both countries are included in a combined model, this coefficient for lack of jobs remains positive and statistically significant for both men and women. When included in the final model at the bottom of each table along with the housing variable, the non-employment variable again remains statistically significant and positive as expected. Jobs do seem to help most young adults in both countries to move out into their own households.

However another story also emerges from Table 3 and Table 4 when regions in both countries are combined in a single model (the third, sixth and bottom panels in each table). These models include an indicator variable for Italy versus France, and this variable which has nothing to do with either the supply-side housing or the demand-side employment explanations retains more predictive power in all models than we can attribute to the explanations themselves. In all three such combined models, simply living in Italy predicts that the share of coresident dependents will be 35 to 40 percentage points higher for young men and over 50 percentage points higher for young women, even after accounting for variations in housing and employment. Clearly some powerful additional explanations remain unaccounted for in these models.

It may be that the Mammismo explanation, as described by Livi-Bacci and by Dalla Zuanna more than a decade ago, still has something to do with the Italian householder deficit among young adults. A very special and peculiar kind of cultural preference or tolerance for extended dependency, hypothesized for Italy but not for France, may apply to the decision to move out and set up new separate and independent households, even though it does not apply to the timing of finishing school, entering the paid labor force or even getting married in Italy. Along all these other dimensions of the transition to adulthood, France and Italy remain virtually identical. A cultural explanation along these lines must explain why the delay should apply only to householder status, and not to roles of student, worker or even spouse. Research using the more detailed information to be found in more specialized sample surveys in these countries may clarify some of the anomalous patterns uncovered here.

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A FEW NOTES ON THE LEXIS DIAGRAM: THE 100TH ANNIVERSARY OF THE DEATH OF WILHELM LEXIS[1)]

Klára Hulíková Tesárková – Olga Kurtinová

ABSTRACT

This paper provides a brief introduction to Wilhelm Lexis, his life, and the basic demographic tool that is named after him: the Lexis diagram. This topic is chosen to commemorate the centenary of the death of Wilhelm Lexis, who had an unquestionable influence on demographic research. The Lexis diagram, which is used to display demographic events in a dual time dimension, is an essential instrument for working correctly with demographic data. Therefore, it is not far from the truth to claim that demographers all around the world would be unable to imagine demography without the Lexis diagram, in spite of the fact that the diagram's ties to Lexis are not so direct.

Keywords: Wilhelm Lexis, lexis diagram, demographic model, demographic events, time

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1. INTRODUCTION

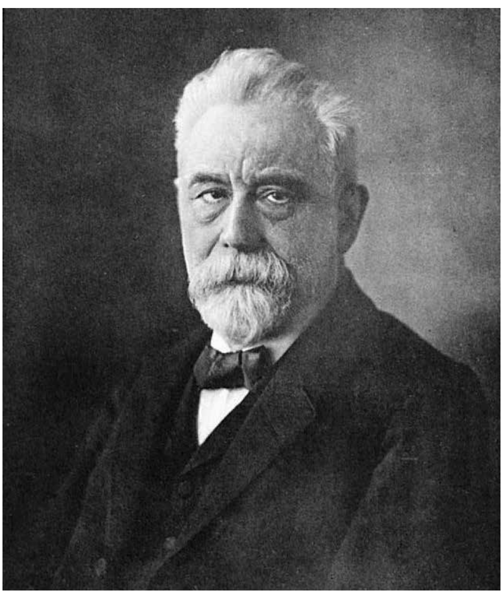
Wilhelm Lexis left an important legacy for demography in the form of what is today known as the Lexis diagram. The diagram allows us to deal, according to their structure or aggregation, with demographic events such as births, deaths, marriages, etc. in two basic time dimensions, age and calendar time (period), where a third dimension (cohort) can also be traced. It became popular above all in the second half of the 20th century due to the work of Pressat (*Caselli et al.*, 2005). Although the Lexis diagram is taken for granted in our research nowadays, the path to the diagram in the form in which it is used today was not so straightforward. It was quite the other way around and it may have escaped the notice of some demographers that the diagram we use widely today may not be entirely identical to the diagram proposed by Wilhelm Lexis. The roots of this graphic tool can be found in the work of other demographers and scientists in the second half of the 19th century, but, as we will show, the role of Lexis himself was very important. Therefore, the aim of this paper is to commemorate the 100th anniversary of Wilhelm Lexis's death and to introduce briefly the documented evolution of the Lexis diagram. The goal of this paper is also to demonstrate how the most common diagrams are used and how the probabilities and rates are calculated using the diagram; that means, how the Lexis diagram and its various forms can be used in practice and what the advantages and disadvantages of these different forms are. It is impossible within the scope of this brief paper to devote enough space to all the known variants of the diagram and detailed specifications of it. Therefore, the two versions of the diagram used in the Czech school of demography were selected for this article.

1) This article was written with the support of the Czech Science Foundation as part of work on project no. P404/12/0883 'Cohort life tables for the Czech Republic: data, biometric functions, and trends/Generační úmrtnostní tabulky České republiky: data, biometrické funkce a trendy'.

2. WILHELM LEXIS

Eschweiler in Germany is a town located not far from Aachen, which is known for several notable figures who were born or lived there. Wilhelm Lexis[2)] is one of them. He was born on 17 July 1837 into the family of physician Ernst Joseph Lexis and his wife Gertrud Stassen. Given the range of his interests he was known as a Renaissance man. He first studied law at the University of Bonn. Later on, he devoted himself to mathematics and natural sciences there. He graduated from the University of Bonn in 1859 and earned his doctoral degree in philosophy for his thesis on analytical mechanics (*Johnson – Kotz*, 1997; *Drechsler – Kattel*, 1997). He obtained a degree in mathematics also and for some time he taught mathematics at a gymnasium in Bonn and worked as a librarian and a journalist. Despite his background, Lexis also obtained experience in Bunsen chemical laboratory in Heildeberg (*Hertz*, 2001). Lexis married Pauline Emilie Lindenberg from Remscheid and had three children (*von Collani*, 2014).

Figure 1 Wilhelm Lexis



Source: Wikipedia: The Free encyclopaedia, 2014a.

In 1861 Wilhelm Lexis left for Paris, where he started to study the social sciences and political economy. This departure marked a turning point in his life and professional career, because it led to Lexis's first publication devoted to French export policies (*Die französischen Ausfuhrprämien im Zusammenhange mit der Tar-ifgeschichte und Handelsentwicklung Frankreichs seit der Restauration: volkswirthschaftliche Studien*, Bonn 1870). He pointed out that economic theory should base on quantitative data and expressed scepticism of 'pure economics' utilising only descriptive mathematical models (*Heiss*, 2014). The Franco-German War (1870–1871) forced him to return to Germany where later he became involved in the reform of German universities. In 1872 Lexis was appointed to the post of associate professor in political economy at the University of Strasbourg, which had just been established. At that time he published an introduction to the theory of statistical demography (*Einleitung in die Theorie der Bevölkerungsstatistik*, Strasbourg 1875), in which he included his well-known diagram. Lexis then left Strasbourg for Dorpat[3)] in the Russian Empire, where he was appointed as professor of geography, ethnology, and statistics. At the University of Dorpat, which belonged to the group of German-language universities till 1895, he spent only two years there and published a demographic essay on the sex ratio of births and probability theory (*Das Geslechtsverhältniss der Geborenen und die die Wahrscheinlichkeitsrechnung in: Jahrbuch für Nationalökonomie und Statistik*, 1876). In the following years, from 1876 to 1884, Lexis took up the position of chair of political economy at the University of Freiburg im Breisgau in Baden-Württemberg. Considering the list of his publications, this was a fruitful period in his career. Around this time he published works on statistics (e.g. *Zur Theorie der Massenerscheinungen in der menschlichen Gesellschaft*. Freiburg im Breisgau 1877; *Über die Theorie der Stabilität statistischer Reihen, in Jahrbch für Nationalökonomie und Statistik* 1879) and articles on economics (e.g. *Gewerkvereine und Unternehmerverbände in Frankreich: ein Beitrag zur Kenntniss der socialen Bewegung*, Leipzig 1879)

2) Full name: Wilhelm Hector Richard Albrecht Lexis.

3) Now Tartu in Estonia.

(*Drechsler – Kattel*, 1997; *Seneta*, 2014; *Heiss*, 2014). In 1884 Lexis was appointed for the chair of statistics at the University of Breslau[4] and remained there till 1887. Afterwards he moved to work at the University of Göttingen and from 1891 he became the chief editor of *Jahrbuch für Nationalökonomie und Statistik*. He died in Göttingen a few days after the beginning of the First World War, on 24 August 1914.

Wilhelm Lexis is famous for his contribution to theoretical statistics focusing on the application of the calculus of probabilities to statistical data. His pioneering work on dispersion resulted in a study of variance and his rejection of the assumption of statistical homogeneity in sampling supported Adolphe Quetelet,[5] who is known as the author of the rules for modern population censuses, and his followers. Unlike them, Lexis stressed the fluctuations in different demographic time series and proposed a dispersion coefficient Q[6] as a ratio of the empirical variance of the series to the assumed theoretical variance. 'Normal' dispersion corresponds to Q equals 1 and is related only to chance. If the coefficient differs from 1, then fluctuations will be caused by the 'physical' component rather than chance. $Q > 1$ denotes, in his concept, *hypernormal dispersion* and $Q < 1$ denotes *hyponormal dispersion*. He also demonstrated that social data usually have hypernormal dispersion. The coefficient Q, which he discovered while studying qualitative changes in populations over time, was a forerunner of the statistics of K. Pearson and R. A. Fisher and the analysis of Chi-squared variance (*Seneta*, 2014; *Johnson – Kotz*, 1997).

In addition, Wilhelm Lexis was a scholar in the field of economics and finance and published several articles on the educational system (e.g. *Die neuen französischen Universitäten*, Munich, 1901; *Die Reform des höheren Schulwesens in Preussen*, Halle, 1902). In addition, he contributed several papers to the field of tuberculosis statistics (*Zur Statistik der Tuberkulose, Bericht über die Statistik der Tuberkulose*) and established the first German actuarial institute (*Königliches Seminar für Versicherungswissenschaften*) (*de Gans – van Poppel*, 2000).

3. THE LEXIS DIAGRAM AND ITS DEVELOPMENT

The Lexis diagram can, according to *Siegel* (2012, p. 945), be defined as '[a] *graph relating time and age and thus illustrating how, with the passage of time, the age references of a birth cohort change. If the diagram is shown in three dimensions, actual population values may be depicted*.' The importance of the Lexis diagram can be expressed by the fact that in demography it is often important to follow all three dimensions or to make the correct choice of methodological approach to the analysis (i.e. selecting the primary set to which import data are aggregated). In a certain point of view, the fact that all the dimensions (time/period, age and cohort/time of birth) are logically connected and tied simplifies a great deal, but on the other hand it could lead to some methodological problems (e.g. in the age-period-cohorts models). The interconnection of the three dimensions was expressed by *Keiding* (2011: 405): *'In demography and epidemiology, a central issue in studying fertility, morbidity, and mortality, is to keep track of the three different time variables age x of the individual, calendar time t at birth (cohort), and current calendar time* $\tau = t + x$*, often termed period.'*

Among demographers it is well known that graphical representation can be useful for answering some methodological question as well as for obtaining an initial orientation in data and also for presenting results. *'To track the simultaneous development of age, period, and cohort it is helpful to use graphs, nowadays usually the so-called Lexis diagram which is just a (time, age)-coordinate system in which individuals are represented by line segments of slope 1 starting at (time at birth, 0) and ending at (time at death, age at death).'* (*Keiding*, 2011: 406). However, the Lexis diagram, as mentioned by *Keiding* (2011), had its own development, and moreover, it cannot solely be associated with the name of Lexis. On the other hand, the diagram Lexis proposed (see below) was pioneering in some aspects that are still important today, and it was also used in practice, above all before the 1960s, when Pressat introduced his modified version (see below).

4) Now Wroclaw in Poland.

5) His full name was Lambert Adolphe Jacques Quetelet.

6) A similar coefficient of divergence was constructed independently by French statistician Emile Dormoy in 1874.

The first works dealing with the graphical representations of demographic data often also included the first formal representations – usually related to the process of mortality. Those works could be traced to approximately the last quarter of the 19th century (*Keiding*, 2011). *Zeuner* (1869) was probably the first to deal with the issue of the graphical representation of population development in his work (*Keiding*, 2011). He focused on the possible ways of graphically expressing the life history of various cohorts, or simply speaking of groups of people born in a defined time period. Based on the graphs he developed, he defined the survival function as we know it today and many other relations. The basic equation behind it is the relation expressing the number of individuals born in the time interval from t_1 to t_2 who are still alive at age x (*Zeuner*, 1869: 12; *Keiding*, 2011: 406):

$$V(x) = \int_{t_1}^{t_2} f(t, x)\mathrm{d}t$$

In his work, *Zeuner* (1896) proposed a way in which to express the life history of a population graphically. He worked with a system of axes in a three-dimensional space, where the two horizontal axes stand for age and the time of birth and the vertical axis represents the number of individuals. The most important curves in the coordinate system illustrated the mortality process, which means the population size decreasing by mortality. The system of axes in this way is more useful for the study of birth cohorts. For the study of the population structure in a defined time, it is necessary to use the diagonal horizontal lines representing time (see Figure 2).

Moreover, in the diagram introduced above (the Zeuner sheet, Fig. 2) *Zeuner* (1869, Figures 4–6 in his original work) also showed the three primary sets of deaths defined by:

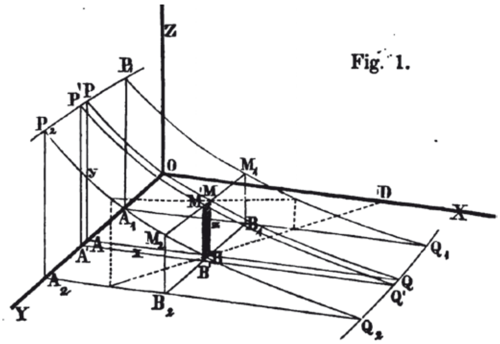
1) cohort and age (the 1st primary set of events),

2) cohort and period (the 2nd primary set of events) and

3) period and age (the 3rd primary set of events).

Those sets of deaths were found by projecting the corresponding change in 'mortality curves' to the bottom side of the graph. This means that the corresponding change in 'mortality curves' was bordered by cohort, age or period, depending on the selected primary set.

Figure 2 **Graphical representation of the survival curve according to *Zeuner* (1869) – the 'Zeuner Sheet'.**



Note: 'Vertical axis (Z) stands for the number of individuals born in time Y or still alive at age X. The horizontal lines denoted as P_1P_2 in the figure are called the 'birth curves' (*Keiding*, 2011: 407), which are the individuals who were born in the time period from Y = A_1 to A_2. The decreasing curves PQ represent the 'mortality curves', or survival functions in contemporary terminology. For each age X then it is easy to find the number of individuals who are still alive (curve BM in the Figure 2) (*Keiding*, 2011: 407). The dashed diagonal line BD represents the defined constant time.
Source: Zeuner, 1869: 9.

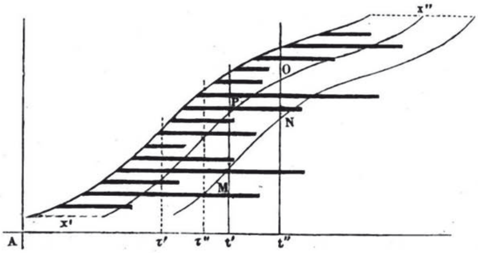
In his work, Zeuner (1869, cit. in *Keiding*, 2011) argues that in statistics or registers it is necessary also to collect information about the year of birth of a person, and not only the age and the year of death. In other words, using only the information of year of the event (death) and age, we cannot do any cohort analysis or define unambiguously an individual's cohort (the time or year of birth).

Based on the above, it is clear that Zeuner focused especially on graphical representations of the whole population and changes to the population in time or with age. He also developed formal expressions for these changes. On the other hand, there is a different way in which to study the changes in a population, namely, the study of individual life lines. Knapp (1869, 1874 cit. in *Keiding*, 2011: 408) was probably the first to use the graphical representations of individual life lines and also the first to study the individual lengths of life as the main goal.[7] He simply drew individual

7) Vandeschrick (2001) states that Knapp proposed his version of the diagram already in 1868.

lines in a graph using the time scale (see Figure 3). These lines represented the human's life from birth to death. He also took into account the number of births (*Vandeschrick*, 2001). Based on this graphical representation, Knapp (1874, cit. in *Keiding*, 2011) developed the calculus usable for the mortality analysis. However, given the way it is shown in the diagram (Figure 3), it is clear that using this graphical representation in practice was not very straightforward.

Figure 3 **The life lines proposed by Knapp (1874)**

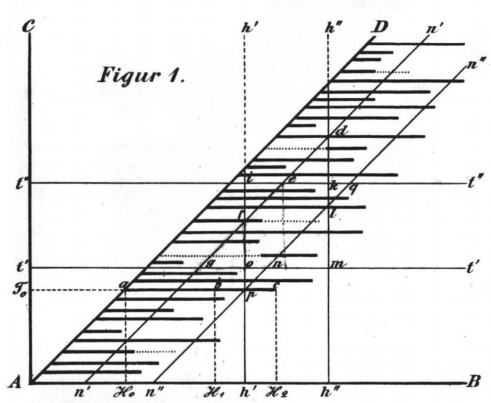


Note: *'This diagram has a line segment for each individual plotted against calendar time, ranging from birth to death of the individual. The right endpoints in the area MNOP represent the deaths during the time interval [t´;t´´] of individuals aged between x´ and x´´.'* (*Keiding*, 2011: 409)
Source: Keiding, 2011: 409.

In the diagrams above, in fact only two perspectives are used (time and age used by Knapp in 1874, or cohort and age in the diagram of Zeuner, 1869, which is combined with the population size). The other dimensions can be found in the diagrams, though they were not the main subject of study of their authors (like the time/period perspective in Zeuner, 1869, Figure 2).

Becker (1874) was probably the first to combine in some way all three perspectives – the time/period, cohort and age dimensions (*Keiding*, 2011). He followed the idea of Knapp (1874, cit. in *Keiding*, 2011), and the basic objects in the graph, as he proposed it, are the life lines. These are the horizontal lines, all of them start at the time of birth, and the age at birth is logically equal to zero. This means that age increases in a horizontal perspective going from left to right. In Figure 4 the constant values of age are represented by the diagonal curves, and the first of them (in Figure 4) is equal to age D = 0. Then the time of birth (cohort) can be read on the vertical axis and the calendar time on the horizontal axis. Because the time of birth has to be equal to the same calendar time, the diagonal curves have to be under a 45 degree slope (Figure 4).

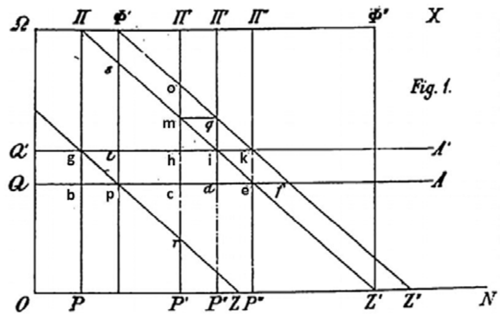
Figure 4 **The period-cohort diagram proposed by Becker (1874)**



Note: 'Becker (1874) worked also with the possibility of emigration or immigration (the dotted lines in the diagram.
'The three primary sets of dead are indicated: (cohort, age) as the parallelogram eqng, (cohort, period) as the rectangle ikmo, (period, age) as the parallelogram dlpf.' (*Keiding*, 2011: 409)
Source: Becker, 1874: 77; Keiding, 2011: 409.

In Becker's diagram (1874) the ends of the life lines represent the event of death. Based on their occurrence in the diagram he was able to relatively easily define the three primary sets of events (deaths). In contrast to Zeuner (1869), Becker´s (1874) diagram is much easier to work with because it is defined as only a two-dimensional representation. The population size is not included in the diagram. This also means a greater possibility of this type of diagram being of practical use. This simple way of defining all three primary sets of events (deaths) could also be important today. However, when considering contemporary practical usage of this type of diagram, it must be mentioned that there is usually no need to draw the individual life lines, and moreover, particularly, for example, when studying the process of mortality, we need to express the sets of events for one time period or one cohort and to define the population size at risk of death. Drawing both these variables in Becker´s diagram would be quite spatially-demanding and it would probably be difficult for the user to gain an orientation

Figure 5 **The Lexis diagram (Lexis, 1875)**



Note: The primary set defined by cohort and age can be illustrated by a rectangle within the diagram (for example, rectangle bhcg). The parallelogram (for example, ekom) stands for the primary set defined by cohort and period and the parallelogram (for example, peig) represents the primary set defined by age and period (*Keiding*, 2011: 410).
Source: Lexis, 1875: 139; Keiding, 2011: 410, author´s modification of the letters in the figure.

in them (the deaths of persons in the youngest cohorts would be at the top of the diagram; age does not have its own axis, etc.).

Lexis (1875) studied (Lexis, 1880 cit. in *Vandeschrick*, 2001) the work of Zeuner independently (*Keiding*, 2011).[8] However, he did not work specifically with the life lines and their depiction in the diagram. The individual life histories or development of the population was not the main object in his study, which is obvious from his interests listed above. Instead of that he focused specifically on the graphical representation of the key information: the time of death (or other events), the age at the time of the event (the age at the time of death), and the time of birth of the studied individual (*Vandeschrick*, 2001). In his proposed diagram, the main feature is the possibility to read easily when a person (or group of people) was born (the time of birth/cohort – on the horizontal axis) and what is the age of the person/sub-population or age at the time of the event (the age at the time of death); he defined the 'birth points' and 'death points' and the lines separating them (*Keiding*, 2011). This feature also fully corresponds to the contemporary needs of demographic analysis and the data definitions we still need today. Instead of some time- or period- axis, he used diagonal lines with a slope of 135 degrees to represent fixed (constant) calendar time periods (e.g. moments of the census) (see Figure 5; *Vandeschrick*, 2001). However, if we wanted to draw a period axis in the diagram, it would lead from the bottom left to the upper right side of the diagram, diagonally, with a slope of 45 degrees (*Roubíček*, 1958).

It is theoretically possible to draw individual life lines in the Lexis (1875) diagram very easily. They would be vertical lines, all of them starting on the horizontal axis (age = 0), each would end at different age (could be read on the vertical axis), and the time of death would be bordered by the two following time lines. All the primary sets of events defined earlier could be used in this diagram and drawn again very easily (this will be described below in this text).

It could be said that this type of diagram could also be fully useful for contemporary needs of analysis – the lowest ages would be drawn in the bottom part of the graph (this means that the less certain higher ages do not need to be drawn in the diagram), the time lines precisely define the population size at the beginning as well as in the middle of the year (or more generally, in the studied time period; the time lines could also be drawn according to the defined studied time period, not necessarily for each calendar year), and all the primary sets of events could be drawn very easily. On the other hand, from Figure 5 it is already clear that this type of diagram would be especially suitable for cohort analysis – the cohorts are straight vertical lines, which can be easily followed across their history. However, in mortality (and the same holds also for most of the other demographic processes as well) we have to deal mostly with the period perspective. For example, if the studied time period should be one year of time, using the *Lexis* (1875) diagram (shown in Figure 5) we would need to define the calendar year with two time lines, which run from the bottom right to the upper left – the beginning of these time lines (the lowest ages) would lie at the extreme right

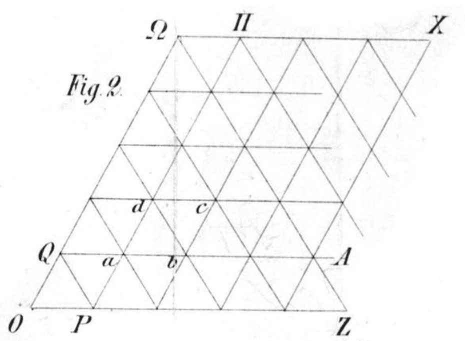
8) The construction and specific features of the Lexis diagram can be found in the work of Vandeschrick (2001).

of the graph; this method of graphical visualisation would be again relatively spatially-demanding. On the other hand, when illustrating the data structure only for the lowest ages, then the diagram is fully useful and practical (see Part 4 of this article).

However, *Lexis* (1875) noticed that not all the time dimensions (age, period and cohort) are represented symmetrically in the first proposed form of his diagram (described above, see Figure 5). If we consider the range of birth times (horizontal axis) as equal to 1 year, and the age interval (vertical axis) also as equal to 1 year, this means that both these lines would be of a length equal to 1. In this situation, the line that represents the time dimension (the distance between the two time lines in Figure 5) would be equal to $\sqrt{2}/2$. For this reason he proposed a slightly modified diagram (see Figure 6), an 'equilateral diagram' (*Keiding*, 2011: 410), where all the axes have the same scale. In this version of the diagram he 'only' changed the slope of the vertical axis (to 60 degrees). In the diagram itself then, not the axes, but the age-, time- (or period-) and cohort- (or time of birth-) lines are important. Those lines separate the different completed ages, time periods and cohorts (in today's terminology). In this modified Lexis diagram all the differences between two exact ages, periods or cohorts (which are all equal to the same value) are represented by equally long lines.

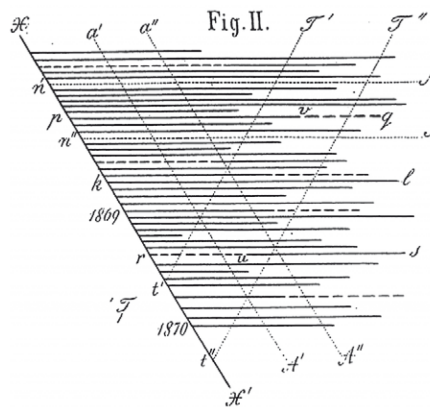
In this equilateral version of the Lexis diagram (Figure 6) it is also possible to draw life lines. This could be important for identifying the state of the population at the beginning of the year and in the middle of the year. These life lines would be parallel to cohort lines (a slope equal to 60 degrees). One year later, Lewin (1876, cit. in *Keiding*, 2011) continued to work with the Lexis diagram and added life lines to the diagram. At the same time, he also rotated the whole diagram so that the life lines run horizontally (see Figure 7). Moreover, he precisely defined the three primary sets of events as well as the two elementary sets defined by only one generation, age and calendar year. However, his work was criticised by his counterparts because of its unnecessarily excessive formal complexity (e.g. Zeuner, 1886 cit. in *Keiding*, 2011).

Figure 6 **Lexis 'equilateral' diagram (Lexis, 1875)**



Note: 'the horizontal lines represent age-lines (QA), the vertical lines running up and to the right represent the different times of birth, the cohort-lines (e.g. 0Q), and the vertical lines running up and to the left represent time-lines (PQ). Each age-line stands for an exact age, time-line and cohort-line corresponding to one exact moment in time.
Source: Lexis, 1875: 139; Keiding, 2011: 411.

Figure 7 **The diagram proposed by Lewin (1876)**



Note: 'The life lines are horizontal and parallel with the cohort-lines, the age-lines lead downwards and the time-line runs upwards and to the right. This is only the rotated version of the equivocal *Lexis* (1875) diagram (Figure 6).
Source: Keiding, 2011: 411.

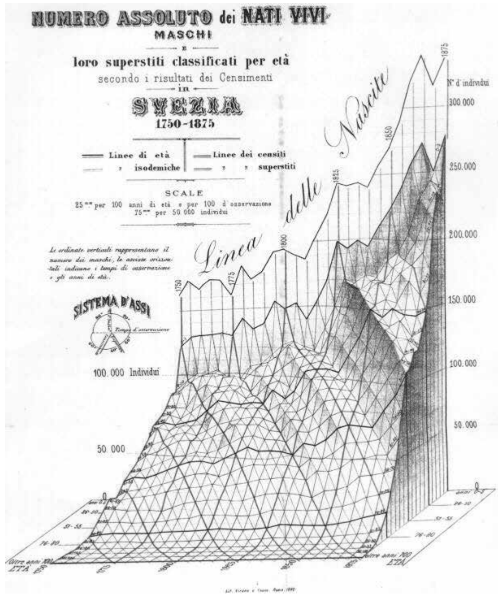
Based on the information above, it could be said that *Lexis* (1875) was probably the first author of a graphical expression of demographic processes and events who did not specifically consider life lines (although it is possible to draw them in his versions of the diagram), but instead used all three dimensions, which are still considered in the diagram: the age-, cohort- and period- (time-) dimension.[9] He moreover devoted consideration to the different lengths of the lines representing these dimensions in rectangular version of the diagram. His equivocal version of the diagram could even today be regarded as very precisely designed, reflecting its inner logic. It is very easy to draw all the primary sets of events as well as the elementary sets of events and also to define the beginning of the year (the initial population at risk) and the middle of the year (the exposed population). However, the equivocal version of the diagram would even today be more complicated for technical processing, so the rectangular version is more useful in this respect. This was probably the reason why the rectangular version was applied in practice more often.

Work on the graphical representation of demo graphic events and demographic development continued in the late 19th century and in the 20th century. There is a quite famous colour version of one form of the Lexis diagram representing the demographic development of Sweden (Perozzo, 1880a, cit. in *Keiding*, 2011; see Figure 8).

At the beginning of the 20th century, graphical representation of studied demographic events or processes was not very popular among demographers. If they considered using graphical presentation of data at all, they more often focused on three-dimensional illustrations (as shown, for example, in Figure 8). For example, Verrijn Stuart (1928, cit. in *de Gans – van Poppel*, 2000) did not expect the Lexis diagram to spread and to be used widely in demography at all. It could be said that the Lexis diagram is still known and used because of the work of Roland Pressat, although even before Pressat's work, published in the 1960s, the Lexis diagram was used occasionally. One example of this can be found also in Czech demographic literature.

Roubíček (1958) dealt with the Lexis diagram and stressed that using this graphical tool could simplify many problems involved in demographic analysis or in the construction of life tables. More specifically, in his work he mentioned the 'demographic grid' (*Roubíček*, 1958: 171), and the Lexis diagram as its most illustrative type. He introduced the original Lexis diagram, as shown in Figure 5. Roubíček also drew the life lines into the diagram as vertical lines, as described above. In this case, the life lines started on the horizontal axis (axis of cohorts) and crossed the age-lines proceeding from the left axis (the axis of age) to the right. The time lines (also called isochrones) are lines with a slope of 135 degrees. As already derived above, this type of the diagram is especially useful for cohort analysis, because cohorts are marked in this diagram by particular vertical lines. It is then easy to read the age of a studied group of people or set of events, but defining the time of the event is not so straightforward.

Figure 8 **Graphical representation of the demographic development of Sweden, 1750–1875**



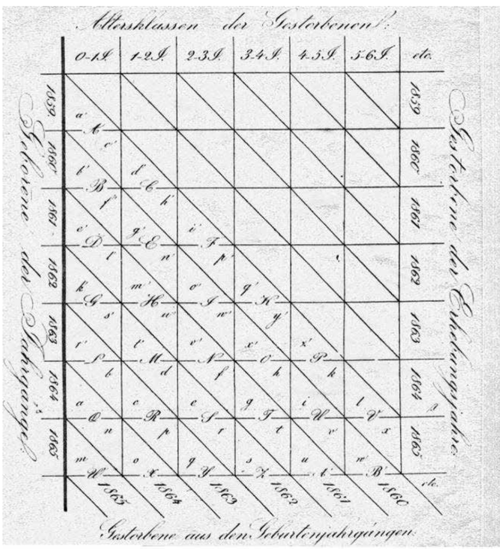
Note: *'This representation of the development of the Swedish population 1750–1875 was redrawn by Perozzo from a similar (black) stereogram by Berg (1860). The representation corresponds to Zeuner's stereograms with a (cohort, age) diagram in the horizontal plane.'* The bold lines leading up represent censuses (cross-sections at fixed calendar years) and the diagonal lines represent the survival of cohorts. (*Keiding*, 2011: 414)
Source: Wikipedia: The Free Encyclopaedia, 2014b.

9) Arguments against this statement are mentioned, for example, by Vandeschrick (2001), but with a particular uncertainty owing to the absence of certain historical documents that were not available or known of at that time.

Roubíček (1958) also showed the possibility of drawing the time axis in the diagram (as a line with a slope of 45 degrees). However, he also pointed out that this time axis is not usually used in the diagram because the time can be calculated using the cohort axis or using the known values of the age at the time of the event and the cohort.

Pressat's version of the Lexis diagram, simplified to two rectangular axes (age and time) and cohort lines with a slope of 45 degrees, was presented in Czech demographic literature by *Pressat* in translation of Pavlík (1968). However, *Vandeschrick* (2001) mentions that the version of the diagram corresponding to Pressat's work, and the one contemporarily used most often in the world, can already be traced in the work of Brasche (1870, cit. in *Vandeschrick*, 2001; see Figure 9), and that this author and his work was nearly forgotten in demography. This may be due to the fact that Brasche was not very explicit in his work and did not explain all the aspects of the diagram. Taking this into account, Brasche in 1870 (*ibid.*) was the first to propose the version of the diagram most often used today and Pressat in the 1860s 'only' reinvented it.

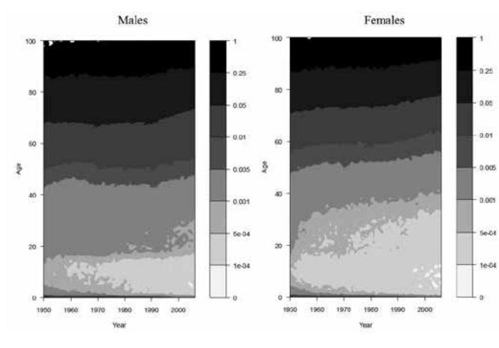
Figure 9 **The diagram proposed by Brasche (1870)**



Note: In fact this version of the diagram is nearly the same as the one we are used to today or that was described by Pressat (e.g. in 1968) – the only difference is its rotation (90 degrees to the right – the vertical axis in the figure is today traditionally depictured as a horizontal axis).
Source: Vandeschrick, 2001: 111.

The difference between the original *Lexis* diagram (proposed by Lexis, 1875, used, e.g., by *Roubíček*, 1958, and shown in Figure 5) and the modification described by Pressat is illustratively shown by *Dupâquier* (1999: 33). Pressat used the rectangular form of the Lexis diagram, and the values of age remained on the vertical axis. On the horizontal axis, Lexis originally proposed showing the values of cohorts (moments of birth), which corresponded more to the cohort approach to demographic analysis. Pressat used the horizontal axis for the time dimension, then the isochrones started on this horizontal axis and rose vertically. In the original Lexis diagram the life lines, like the cohort lines, went straight up. In Pressat's version, the life lines as well as the cohort lines have a slope of 45 degrees (*Dupâquier*, 1999). It could be said, that this version of the Lexis diagram is currently the one best known in the world (see Figure 11). This version of the diagram fully corresponds to the period approach to demographic analysis (often used because of data availability, etc.) and is also more practical for use with modern graphical and other types of software. Using the vertical line for the time dimension also enables an illustrative description of the development of some processes in time. This version of the Lexis diagram is also involved in the work of *Preston et al.* (2001).

Figure 10 **Mortality surfaces, age-specific mortality rates, Czech Republic, by sex, 1950–2006**



Note: Prepared in R software.
Source: Hulíková Tesárková, 2012.

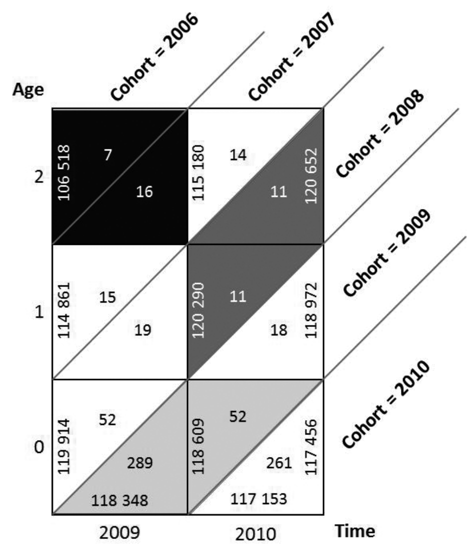
Nowadays, research in this field of study does not focus specifically on any changes or modifications of the Lexis diagram itself, but rather on the possible ways of constructing the diagram electronically using any information technologies or software. This is also the result of the greater availability of data in demographically developed countries, because it raised the problem of how to present the long development of any process briefly and illustratively. In such cases, the Lexis diagram was 'transformed' into a Lexis surface (surface or contour graphs in general, see Figure 10). The Lexis surface is often associated with the work of *Arthur* and *Vaupel* (1984). Another advantage of the contour map is its variability, it can be used to illustrate probably all demographic and other similar events and processes when they are organised by time and age (*Vaupel et al.*, 1998). Moreover, in this data structure, when using the contour diagram, the cohort effects can be showed. Some independent software has been published for the purpose of constructing the Lexis diagram (e.g. in *Vaupel et al.,* 1998). However, it would seem more effective for this topic to use more general statistical software – for example, with specific packages designed for constructing the Lexis diagram.[10] The possibilities of a graphical analysis of demographic data have also been described by *Hulíková Tesárková* (2011; 2012), and these focused on traditional mortality surface graphs and on three-dimensional graphs, where the third dimension stands for the population size or the intensity of any process.

4. COMPARISON OF THE TWO MOST COMMONLY USED LEXIS DIAGRAMS IN THE CZECH SCHOOL OF DEMOGRAPHY

As mentioned above, in the second half of the 20th century there were two types of Lexis diagram mentioned in Czech demographic literature and also used in practice. The first of them can be found in the work of *Roubíček* (1958), and this is in fact the version of the diagram originally proposed by *Lexis* (1875). The second type of diagram used is the version proposed by *Pressat* (e.g. 1968). In this part of the text a brief comparison of the usage of both of these approaches will be presented. This will help to better illustrate the practical application of each of them and also to describe their advantages and disadvantages.

By way of illustration, data for the Czech Republic and two calendar years were selected, 2009 and 2010,[11] for a period analysis of mortality at age 0, 1 and 2. Data were structured into all three primary sets and the calculation of age-specific mortality rates and probabilities will be described.

Figure 11 The Lexis diagram currently used most often in the world, data for the model calculation are imputed

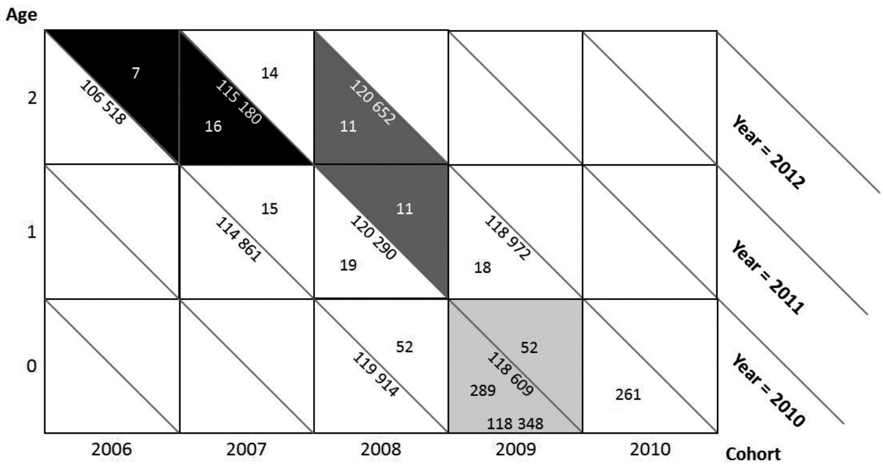


Note: The three primary sets of data are marked: the 1st set (age-cohort) is light grey, the 2nd set (cohort-period) is darker grey, and the 3rd set (period-age) is black.
Source of data: Czech Statistical Office, 2013; 2014.

10) For example, LexisSurface package for software R (https://sites.google.com/site/timriffepersonal/r-code/lexissurface).

11) These two years were selected on purpose, because they are not influenced by the presence of the population census or any data corrections, like the year 2011 (where the initial number of inhabitants does not correspond to the number at the end of the year 2010). Selection of any years with corrections would complicate the figures below.

Figure 12 **The Lexis diagram proposed by Lexis (1875) and introduced in the Czech school of demography by Roubíček (1958), data for the model calculation are imputed**



Note: The three primary sets of data are marked: the 1st set (age-cohort) is light grey, the 2nd set (cohort-period) is darker grey, and the 3rd set (period-age) is black.
Source of data: Czech Statistical Office, 2013; 2014.

Figure 11 shows the most commonly used version of the Lexis diagram nowadays. As noted above, this version of the diagram is especially useful for period data analysis. In the figure, three primary sets of data are also marked – the first set (defined by one cohort and one age) is light grey, the second set (defined by one cohort and one calendar year) is darker grey, and the third set (defined by one age and one calendar year) is black. The same primary sets are also marked in Figure 12, where the *Lexis* (1875) diagram is shown. In both diagrams (Figure 11 and 12) the same data were used and also the primary sets of events are defined and marked in the same way.

This demonstrates that Pressat's version (Figure 11) fully corresponds to period analysis and that the Lexis version (Figure 12) is more useful for cohort analysis. In this version of the Lexis diagram more space was needed to illustrate the data from only two calendar years. Also, in the original Lexis diagram (Figure 12) it is harder to define the initial population size (the population at the beginning of the year) and the exposed population (the population in the middle of the year).

To better illustrate usage of the diagrams, the ways of calculating the most important relations are shown below. For the first, second, and third primary sets of data the mortality rates and probabilities are calculated. Of course the results have to be the same; the purpose is only to help to provide a better orientation in the diagrams.

The first sets of data, marked in light grey in Figures 11 and 12, are defined by one year of birth (cohort) and one completed age. Because this set of data is more cohort-oriented, in the original Lexis diagram (Figure 12) it corresponds to a rectangle. In both diagrams shown this set corresponds to completed age 0. The probability of death in this set of data must be the total number of deaths under exact age 1 divided by the initial population size, which is the total number of live births. That means:

$$q_0^{\,I} = \frac{289 + 52}{118\ 348}$$

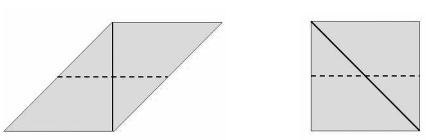
A slightly more complicated task could be the definition of the population size in the middle of the studied period (commonly representing the exposed population) in this set of data. There are two possible ways (in Figure 13 the solid line stands for the middle of the two calendar years covered by the first set of events, on the other side the dashed line better represents the supposed exposed population, on the assumption that the events are equally distributed within the age interval). Using the numbers from Figure 11 and 12, we can then define the mortality rate as:

$$m_0^I = \frac{289 + 52}{118\,609} = 0.00287499$$

or alternatively

$$m_0^{I*} = \frac{289 + 52}{[118\,348 + (118\,609 - 52)]/2} = 0.00287879$$

Figure 13 **The first primary set of data in the Lexis diagram according to Pressat (left) and according to Lexis (right), illustrating the two possible exposed populations (the solid line and the dashed line)**



For the second set of data the calculation is quite easy: in the case of probabilities we have to divide only the number of events by the initial population, i.e. the population size at the beginning of the year. Using the numbers from Figure 11 and 12:

$$q^{II}_{2010} = \frac{11 + 11}{120\,290}$$

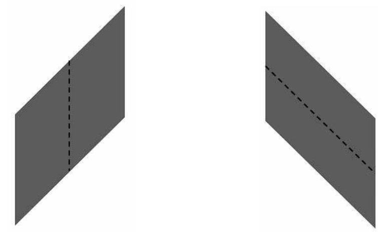
Age-specific mortality rates for the second set of data are also quite easily defined as:

$$m^{II}_{2010} = \frac{11 + 11}{(120\,290 + 120\,652)/2}$$

The exposed population (the population in the middle of the year) for the second set of data is defined clearly (see Figure 14).

In the third set of data the calculation is slightly more complicated in the case of the probability of death. The reason can be found in the different corresponding populations (cohorts) for each of the elementary sets of data (a triangle defined by one age, the cohort and the year of the event). Because the probabilities can be calculated for each triangle,

Figure 14 **The second primary set of data in the Lexis diagram according to Pressat (left) and according to Lexis (right), illustrating the exposed population (the dashed line)**



and they are independent probabilities, their multiples have to be subtracted:

$$q^{III}_{2} = \frac{7}{106\,518} + \frac{16}{115\,180 + 16} - \left(\frac{7}{106\,518} * \frac{16}{115\,180 + 16}\right)$$

Calculating the age-specific mortality rate is again quite easy for the third set of events (Figure 15):

$$m^{III}_{2} = \frac{7 + 16}{(106\,518 + 115\,180)/2}$$

Figure 15 **The third primary set of data in the Lexis diagram according to Pressat (left) and according to Lexis (right), illustrating the exposed population (the dashed line)**

5. CONCLUSION

The year 2014 marks the 100th anniversary of the death of Wilhelm Lexis, the German statistician, economist, journalist, and teacher who significantly influenced demographic research with the diagram that bears his name, which helps us to display demographic events reflecting a given time, age and cohort. Wilhelm Lexis's life was devoted to science and research, which is obvious not only from the bibliography but also from the list of all the places where he worked: the University of Bonn, the University of Strasbourg, the University of Tartu, the University of Freiburg im Breisgau, the University of Wroclaw, and the University of Göttingen. However, nowadays Lexis is known above all thanks to the 'Lexis diagram'. In everyday demographic practice we do not usually use the original form of the diagram proposed by Lexis, but this does not undermine the fact that Wilhelm Lexis has a firm place in the history of demography.

From the article, it is clear that work to devise some graphical tool that could be used to illustrate population development or demographic processes had already started several years before Lexis's work (1875). However, Wilhelm Lexis was among the first to combine all three dimensions (age, cohort and period) in one diagram. Also, the diagram proposed by Lexis (1875) did not change significantly during the development. In the 1960s Pressat 'only' changed the axes in the diagram (*Dupâquier*, 1999), or maybe publicised the historical version of the diagram originally proposed by Brasche in 1870 (*Vandeschrick*, 2001). As was shown above, both versions of the diagram (proposed by Lexis and by Pressat) could be used easily in practice and logically the results (rates or probabilities) have to be the same. The illustration of the practical application of the diagrams proved that both versions have their advantages as well as their disadvantages. The Lexis version of the diagram is more useful in the case of cohort analysis, where the cohorts are defined easily in the diagram. On the other hand, the diagram proposed by Pressat fully corresponds to the needs of the period approach to data analysis.

This paper presented not only some information about the life of Lexis, one of the best known demographers in the world and in the history of demography, but also about the life and development of the 'Lexis diagram'. To sum up it could be said that although it is now 100 years since the time Lexis passed and approximately 140 years since the Lexis diagram was proposed (regardless of who actually invented it), Lexis as well as the Lexis diagram still have their place in the field of demography and demographic analysis.

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MULTIPLE CAUSE-OF-DEATH DATA IN THE CZECH REPUBLIC: AN EXPLORATORY ANALYSIS[1)]

Markéta Pechholdová

ABSTRACT

Mortality studies are mostly based on a single cause of death, the underlying cause, which is defined as the beginning of the chain of diseases leading to death. In the multiple cause-of-death approach, all the conditions reported on the certificate are analysed, which makes it possible to study co-morbidity and lethal processes. This article is based on an individual-level dataset of multiple causes of death provided by the Institute for Health Information and Statistics. Using multiple perspectives, the author highlights the main co-morbidity patterns in the current Czech population.

Keywords: multiple causes of death, co-morbidity, mortality

Demografie, 2014, **56: 335–346**

INTRODUCTION

Multiple cause-of-death data represent the most complex source of statistical information about death. In the Czech Republic, like in many European countries, multiple-cause-of death data have never been analysed and everything we know about recent mortality trends is based on a single underlying cause of death. Statistics based on the underlying cause, however, tend to overestimate the importance of fatal diseases while masking information about broader health status. Moreover, the current practice of providing (underlying) cause-specific data until the open-ended age interval 85+ or 95+ undermines the study of causes of death among the oldest-old. In the elderly population in particular, which at present constitute the majority of the deceased, death is very rarely due to a single chain of pathologies, but more likely results from multiple degenerative, though not very lethal, processes. This article aims to explore this relatively new type of mortality data, making use of data collected by the Institute for Health Information and Statistics (IHIS). Studying multiple causes of death not only improves our understanding of observed mortality trends, but also makes it possible to analyse co-morbidity itself using specific and innovative methodological approaches

THE HISTORY AND THE SUBSTANCE OF MULTIPLE CAUSES OF DEATH

The history of multiple causes of death is as old as the history of the International Classification of Diseases (ICD), used since the late 19th century to compile and tabulate cause-of-death statistics. Advances in diagnostics and certification, along with the increasing number of recognised medical entities, have led – already since the second half of the 19th century – to conclusions that death is much more the result of multiple degenerative processes than it is the outcome of a single disease (*Srb – Haas*, 1956). In more and more cases, multiple causes of death have been appearing on death certificates, reflecting either

1) This work was supported by a research grant from the Czech Science Foundation GA CR P404/13-41382P.

Figure 1 **The international form of death certificate recommended by the WHO**

Cause of death			Approximate interval between onset and death
Part I Disease or condition directly leading to death*	a)	.... Due to (as consequence of)	....
Antecedent causes	b)	.... Due to (as consequence of)	....
Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	c)	.... Due to (as consequence of)	....
	d)	....	....
Part II Other significant conditions contributing to death, but not related to the disease or condition causing it		....	....
**This does not mean the mode of dying, e.g. heart failure, respiratory failure. It means the disease, injury or complication that caused death.*			

Source: WHO, 1992.

the physicians' uncertainty about deciding on a single major cause, or his or her willingness to report all the existing information about the train of events leading to death.

In spite of the complexity of morbidity processes, statisticians have always sought to reduce the information to a single cause. With the first revision of the ICD in 1900, Jacques Bertillon, the inventor of the ICD, was already proposing a set of rules to facilitate the statistical processing of death certificates where more than one disease is reported without distinguishing the main cause of death (*Fagot-Largeault*, 1998). The issue of so-called joint causes of death was then re-discussed at every revision conference, but an international agreement was not achieved. Meanwhile, countries developed and used their own systems. In 1914 the United States elaborated a complex selection tool called 'The Manual of Joint Causes of Death'. The creation of such a table had to be preceded by an ideological consensus on the importance of specific causes of death for statistical tabulation. Thus, for example, it was agreed that the initiating cause of death was to be given preference over the condition causing death directly (the immediate condition), and epidemic or puerperal diseases or accidents were to be preferred over other causes (e.g. influenza over heart disease) and so on. 'The Manual of Joint Causes of Death' was revised with each consecutive ICD revision, and was used in some countries, but never really became an internationally approved standard nor an integral part of the classification until its 6th decennial revision in 1948 (*WHO*, 1992). Compared to the changes in the classification both the death certificate and the coding rules remained relatively stable over time. The current death certificate form, as recommended by the World Health Organization (WHO), is shown in Figure 1.

Part I is intended to record the 'train of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury' (*WHO*, 1992), whereas the underlying cause that initiated the sequence is listed in the last line (d). Part II is reserved for conditions contributing but not causing the fatal outcome. The design of the certificate helps the certifying practitioner to determine the underlying cause of death. A properly completed cause-of-death section of the death certificate thus provides an etiologic explanation of the order, type, and association of events resulting in death. However, the death certificates are often filled incompletely or incorrectly, which forwards the task of determining the underlying cause of death onto the coding system.

A single underlying cause of death has been processed and tabulated for a long time. On one hand, the advantages of such an approach are clear: the underlying cause of death is the most valuable information for the prevention of disease and represents a simple, reliable, and internationally comparable statistical resource. On the other hand, when it is the result of the subjective decision of the certifier or is selected through actual coding rules, it is liable to reflect specific practices that are difficult to detect. These so-called coding practices change in time and considerably differ between individual countries (*Meslé*, 1995) and, consequently, negatively affect the comparability of the (underlying) cause-of-death data.

INCREASING THE USE OF MULTIPLE CAUSES IN MORTALITY AND MORBIDITY ANALYSIS

As today's populations age, deaths are occurring at more advanced ages and result more often from multiple degeneration processes, there is a growing interest in the circumstances of dying. Pioneer studies in the pre-war period pointed to the analytical potential of multiple causes of death (*Dublin – Van Buren*, 1924; *Janssen*, 1940). In the 1960s, further studies stressed the importance of multiple causes in mortality analysis and proposed diverse methodological tools (*Dorn – Moriyama*, 1964; *Guralnick*, 1966). In the following decade substantial attention was paid to the multiple causes life tables and to evaluating independence/dependence among causes of death (*Manton – Tolley et al.*, 1976, *Manton – Poss*, 1979).

It is now generally accepted that multiple causes of death improve the understanding of mortality trends (*Israel – Rosenberg et al.,* 1986). In the majority of studies, multiple causes of death are used to re-assess mortality from specific conditions. In this approach, every mention of the studied cause in the death certificate is recorded – these 'total mentions' are then compared to the mentions of an underlying cause (*Goldacre – Duncan et al.*, 2003; *Redelings – Sorvillo et al.*, 2006). Typically, the diseases studied include frequently contributing but less lethal conditions such as hypertension (*Wing – Manton*, 1981), diabetes (*Goldacre – Duncan et al.*, 2004), asthma (*Fuhrman – Jougla et al.*, 2009), chronic obstructive pulmonary disease (*Fuhrman – Jougla et al.*, 2006), musculoskeletal diseases (*Coste – Jougla*, 1994), tobacco and alcohol-related diseases (*Nizard and Munoz-Perez* 1993), suicide (*Rockett, Wang et al.* 2007) or ill-defined causes (*D'Amico – Agozzino et al.*, 1999), but major causes of death such as cancer (*Fink – German et al.*, 2012), and circulatory diseases (*Goldacre – Mant et al.*, 2005). Another research direction focuses on combinations or associations of causes, while the two approaches are often combined (*Désesquelles – Salvatore et al.*, 2010). Many studies focus solely on old ages (*Manton*, 1982; *Manton*, 1986; *Désesquelles – Meslé*, 2004).

In methodological studies, multiple causes of death are used to assess the effects of coding practices and misclassification. The efficacy of the coding rules using multiple cause of death was evaluated in (*Chamblee – Evans*, 1982). The influence of the coders' selection on underlying cause-of-death trends was discussed in (*Lindahl – Johansson*, 1994). Later on, multiple causes were used to explain sudden changes in the death counts of pneumonia and septicaemia, introduced with the 10th revision of ICD in France (*Meslé – Vallin*, 2008). The earliest studies were restricted to the territory of the United States, where these data were already being collected in the first half of the 20th century. At present, multiple causes of death are studied in numerous countries including the United States, France, Italy, Australia, the Netherlands, Israel, and Lithuania.

In the Czech Republic, multiple causes of death have received virtually no attention until recently, although the idea of incorporating multiple causes in the demographic analysis is not new – as early as in the 1960s, the Czech statisticians called for the increased use of multiple causes in statistics (*Maixne*r, 1960; *Maixner*, 1962; *Maixner*, 1962). However, these ideas have never come into praxis and multiple causes did not become a part of the statistical routine in the Czech Republic until recently with the innovation of the cause-of-death registration system in 2013.

Since 1998, however, multiple causes of death have been collected by the IHIS. We are using these data to explore the general profile of mortality and of co-morbidity and to assess the quality of Czech cause-of-death statistics via an international comparison of multiple causes of death.

DATA

The data used in the present study are the result of a combination of two information systems (IS). The first one is IS Deaths, administrated at the Czech

Statistical Office, and originating from statistical notifications of deaths recorded at registry offices. This information system collects the demographic information of the deceased. The second information system is the IS Death Certificate, administrated at the Institute for Health Information and Statistics. In this system, the information from the death certificate is collected, including the multiple causes of death (a maximum of six causes of death is retained). Selecting the underlying cause of death is the responsibility of the Czech Statistical Office, and the resulting underlying cause of death, which appears in the official mortality statistics, is sent back to the IHIS, where these two databases are linked on the basis of a unique personal identification number. The information available to the Czech Statistical Office is based on causes of death copied on the notifications of death in registry offices, and it is therefore possible that in some cases the selection of the underlying cause has not been performed using the same information as what the IHIS dataset contains (some causes of death may be skipped or misspelled, which was confirmed when the average number of diagnoses reported in notifications of death [2.9] were compared with the number reported in the IHIS database [3.4]). Moreover, multiple causes of death in the IHIS dataset were not coded based on valid multiple-cause-coding rules, they represent text diagnoses encoded into ICD10 codes.

The dataset provided by the IHIS contains the following variables: age, sex, date of death, place of death, marital status, education, autopsy status, NUTS-3 region, up to six multiple causes of death (max. three in part I and max. three in part II of the certificate), and the final underlying cause of death as selected by the Czech Statistical Office.

The IHIS database, however, is not complete, and two types of information loss are at play. First, a small number of death certificates never arrive at the IHIS; in these cases, there is no information in the IHIS database. A second type of information loss concerns cases where the linkage based on the personal identification number failed. These naturally include deaths of foreign citizens, who do not have a Czech personal identification number, and cases where the personal identification number was erroneously reported in one or another database.

Table 1 enumerates the size of the file and gives a calculation of the percentage of missing death certificates by type of loss. The MCOD dataset covers 94% percent of deaths.

Table 1 **The completeness of the MCOD data, 2009–2011**

	Official counts	IHIS counts	Linked	1. missing	2. unlinked	Completeness (%)
2009	107,421	103,833	100,652	3,588	3,181	93.7%
2010	106,844	102,924	100,163	3,920	2,761	93.7%
2011	106,848	102,385	99,937	4,463	2,448	93.5%

We have also checked the completeness of the MCOD database by age. In relative numbers, more missing deaths occur for younger age groups. The missing deaths for younger age groups mostly concern accidents, violent causes of death, or ill-defined causes, which undergo different paths of processing, often including police investigation.

METHODS

In the multiple cause-of-death analysis itself, three perspectives are applied: the average number of diagnoses, the total and underlying mentions of a given disease, and the associations between recorded conditions. We work with an abridged list of main ICD chapters, and with special shortlists of 27 or 74 conditions purposely selected for multiple cause-of-death analysis. We eliminate all asterisk and Z-codes.

As a measure of the underestimation of the role of the given disease in routine mortality statistics, we compute the SRMU (standardised ratio of the multiple to the underlying cause), defined as the ratio between the multiple-cause mortality rate and the underlying-cause mortality rate, both standardised by age and sex (*Désesquelles et al.*, 2010). For the SRMU calculation, duplicate ICD codes (or groups) are eliminated.

In order to evaluate the strength of the associations between given diseases, the CDAI (cause-of-death association indicator) is computed according to the following formula: (*Désesquelles et al.*, 2010):

$$CDAI_{u,c} = \frac{\sum_x \frac{{}_u d_{c,x}}{{}_u d_x} . \bar{d}_x}{\sum_x \frac{d_{c,x}}{d_x} . \bar{d}_x} * 100 ,$$

where ${}_u d_{c,x}$ = number of deaths observed at age x with underlying cause u and contributing cause c;
${}_u d_{x}$ = the number of deaths observed at age x with cause u as the underlying cause;
$d_{c,x}$ = the total number of deaths observed at age x with cause c as the contributing cause (regardless of the underlying cause);
d_x = the total number of deaths observed at age x (regardless of the underlying cause);
$\bar{d}_x$ = the standard number of deaths at age x (based on the 2009 WHO life table for high-income countries).

The CDAI thus measures the deviation from the independence between the two causes of death. Values significantly higher than 100 point at a non-random positive association between two causes. A little inconveniently, the indicator is strictly two-dimensional, allowing a comparison of only two causes at a time.

RESULTS

Average number of entries

Table 2 shows the structure of the death certificates by number of entries. Most death certificates (26%) contain three entries, while 69% of certificates contain between two and four entries. On average, a death certificate contains 3.4 entries, i.e., on average, information about 2.4 causes is lost when only the underlying cause of death is analysed.

Table 2 **Number of multiple causes of death per death certificate, Czech Republic, 2011**

Number of multiple causes per death certificate (%) - Ill-defined causes and mechanisms of death INCLUDED						Average number of multiple causes per death certificate
1	2	3	4	5	6+	
8.7	21.7	26.3	20.8	13.4	9.1	3.4

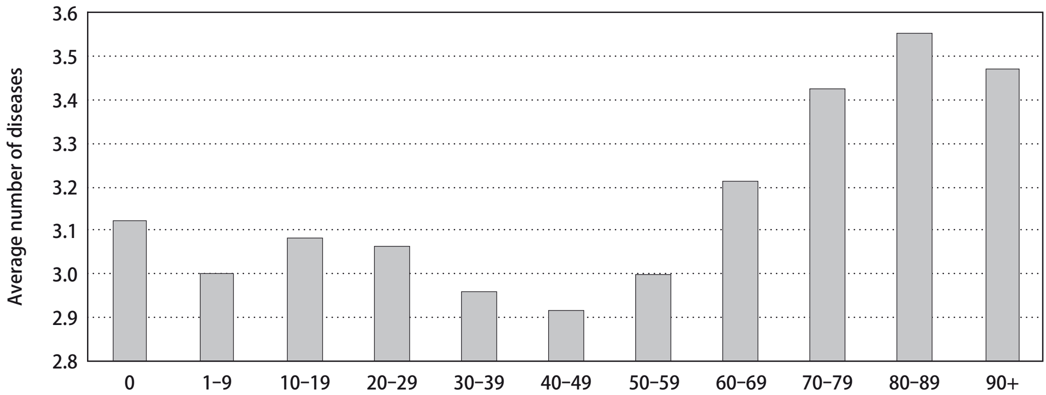
The number of entries on the death certificate depends on several factors. In Figure 2, we present the relationship between the number of reported diseases and age. Until age 59, the number of entries is around three. As of age 60, the number of reported diseases increases steadily until age 89, when in the very last age group it decreases again. The remarkable increase in the number of entries at a senior age can be connected to a real phenomenon: increasing co-morbidity, linked to a progressive worsening of a person's health status. The decrease of entries in the last age group can be due to selection effects (the most sick die off faster), but can also be an artefact of the different certification of deaths for the oldest-old.

The number of entries also varies with the underlying cause of death, as Figure 3 shows. The lowest number of entries (less than three) is observed for cancer of diverse types (e.g. stomach, lung, breast, prostate) and for diseases of infancy. Low co-morbidity can be explained by the early onset: cancer usually occurs earlier than common degenerative diseases and therefore has low co-morbidity. From a practical point of view, when cancer is reported on the death certificate, it will virtually always be selected as the underlying cause of death, and the certifying practitioner is not obliged to report other conditions less lethal than cancer itself.

Around three entries on death certificate occur with most cardiovascular diseases, pneumonia and cirrhosis. Cirrhosis and acute myocardial infarction are again typically premature conditions occurring at middle age. By contrast, heart failure, atherosclerosis, and pneumonia are common at very advanced ages. The low co-morbidity of these conditions can be explained by a lack of information on the death certificate: these diseases are rather ill-defined, suggesting insufficient certification of the real cause of death.

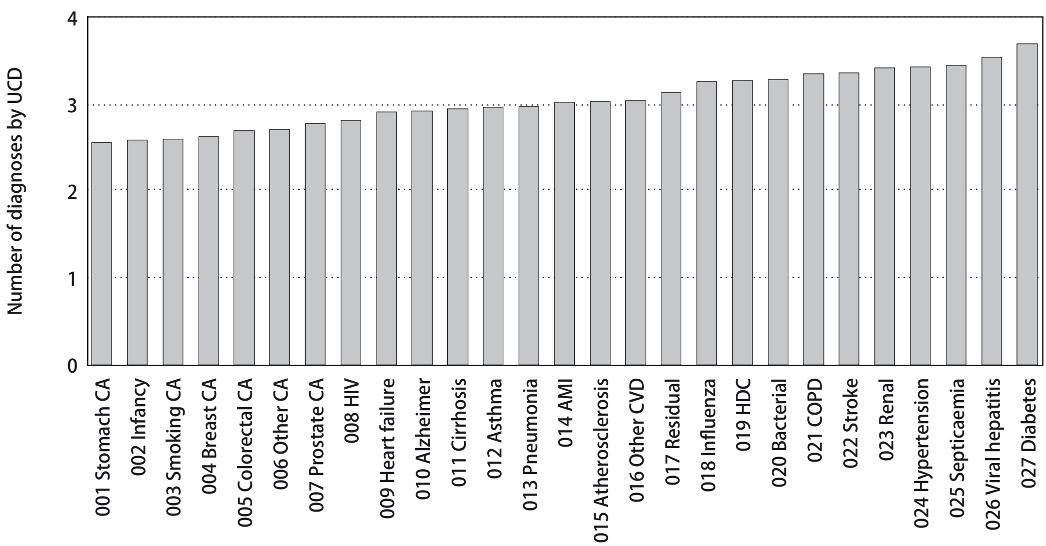
The highest co-morbidity was observed for diabetes. Diabetes is a disease of old age – the mean age at death for diabetes is 74 years – and the typical pathological chain for diabetes includes cardiovascular

Figure 2 **The average number of diseases on the death certificate by age, Czech Republic 2011**



disease, septicaemia, and pneumonia. Similarly, a high co-morbidity was found for other degenerative diseases of old age (chronic obstructive pulmonary diseases and stroke) and for wasting diseases, which are often part of a long-term pathological course, such as septicaemia or renal diseases.

Figure 3 **The average number of diseases on the death certificate by UCD, Czech Republic 2011**



Acronyms: CA – cancer, AMI – acute myocardial infarction, CVD – cardiovascular disease, HDC – heart disease complex (mainly chronic ischemic heart disease), COPD – chronic obstructive pulmonary disease.

Total and underlying mentions

By comparing total and underlying mentions for a given disease it is possible to assess the extent of under-estimation of the given disease in official statistics. The results of these analyses are presented for both sexes combined with two levels of detail: the main ICD chapters and a shortlist of 74 selected diseases (proposed in the framework of an international network of multiple causes of death, a detailed list with corresponding ICD codes available on request).

According to Table 3, the lowest values of SRMU are found in the most common disease categories: cancer (1.2), circulatory diseases (1.5), and accidents (1.5). The relative under-estimation of these conditions is therefore very low – if the condition appears on the death certificate, there is a high probability that it will be selected as the underlying cause of death due to its lethality and due to the preference for it in the coding rules and coding practices. The highest values of SRMU are found for diseases of the blood (14.1), diseases of the skin (11.7), and diseases of the musculoskeletal system (10.1). These diseases thus figure mostly as contributing causes in the pathological chains. However, even if total mentions are considered, the incidence of these diseases is still quite low and does not alter the ranking of diseases by incidence level. The situation is different situation for respiratory or endocrine diseases, the incidence of which is close to or even higher than mortality from cancer, when total mentions are considered.

Table 3 **Total and underlying mentions of the main ICD chapters, Czech Republic, 2011**

CAUSE OF DEATH	Underlying cause standardised rates per 100,000 (1)	Multiple cause standardised rates per 100,000 (2)	SRMU (2/1)
Infectious and parasitic diseases	16	101	6.4
Neoplasms	290	345	1.2
Diseases of the blood (-forming organs) & immunol.disorders	2	25	14.1
Endocrine, nutritional and metabolic diseases	33	209	6.4
Mental and behavioral disorders	13	64	4.8
Diseases of the nervous system	23	94	4.0
Diseases of the circulatory system	658	984	1.5
Diseases of the respiratory system	68	451	6.6
Diseases of the digestive system	49	124	2.5
Diseases of the skin and subcutaneous tissue	2	26	11.7
Diseases of the musculoskeletal system/connective tissue	2	16	10.1
Diseases of the genitourinary system	15	115	7.7
Other diseases	3	5	1.9
Symptoms, signs, abnormal findings, ill-defined causes and Mechanisms of death	17	-	-
External causes	58	90	1.5
Total		-	-

A more detailed tabulation with 74 diseases helps to explain the observed values (Table 3) and reveals the strong diversity within the main ICD chapters. With this level of detail, SRMUs higher than 20 were observed for several diseases, such as other mental and behavioural diseases (29.1), diseases of the thyroid gland (20.4), and rheumatoid arthritis (20.1). High SRMU values are also found for obesity (14.4), diseases of skin (11.9), hypertension (10.9), other diseases of the nervous system (8.7), or diabetes (6.2). The data show that these diseases are common in the co-morbidity profile and frequently impair health status without directly causing death. Another type of under-estimated conditions are diseases where the under-estimation is, in fact, desirable: end-stage diseases such as septicaemia (10.3), pneumonia (12.1) or renal failure (9.9).

Table 4 **Total and underlying mentions of 74 disease groups, Czech Republic, 2011**

group #	CAUSE OF DEATH	Underlying cause standardised rates per 100,000 (1)	Multiple cause standardised rates per 100,000 (2)	SRMU (2/1)
1	Tuberculosis	1	2	2.6
2	AIDS (HIV-disease)	0	0	1.0
3	Viral hepatitis	1	2	1.6
4	Septicaemia	9	88	10.3
5	Intestinal infectious diseases	4	6	1.8
6	Other infectious and parasitic diseases	2	8	4.6
7	Malignant neoplasm of lip, oral cavity, pharynx	7	8	1.2
8	Malignant neoplasm of oesophagus	5	5	1.2
9	Malignant neoplasm of stomach	11	14	1.2
10	Malignant neoplasm of small intestine, colon, rectum and anus, and other/ill-defined digestive organs	43	54	1.3
11	Malignant neoplasm of liver, the intrahepatic bile ducts, gallbladder and other unspecified parts of biliary tract	16	21	1.2
12	Malignant neoplasm of pancreas	21	23	1.1
13	Malignant neoplasm of larynx and trachea/ bronchus/lung	59	67	1.1
14	Malignant melanoma of skin	4	5	1.3
15	Malignant neoplasm of skin	2	3	2.0
16	Malignant neoplasm of breast	19	27	1.4
17	Malignant neoplasm of cervix uteri and other parts of uterus	8	10	1.3
18	Malignant neoplasm of ovary	7	8	1.2
19	Malignant neoplasm of prostate	15	23	1.5
20	Malignant neoplasm of kidney	11	15	1.4
21	Malignant neoplasm of bladder	8	11	1.5
22	Malignant neoplasm of lymph./haematopoietic tissue	20	25	1.3
23	Malignant neoplasm of eye, brain and other parts of central nervous system	7	10	1.3
24	Secondary malignant neoplasm	0	35	
25	Malignant neoplasm of ill-defined/unspecified/ independent (primary) multiple sites	13	51	3.9
26	Other malignant neoplasms	11	16	1.5
27	Benign neoplasms, In situ neoplasms and neoplasms of uncertain or unknown behaviour	4	14	3.2
28	Diseases of the blood(-forming organs) & immunological disorders	2	26	14.3
29	Diabetes mellitus	27	169	6.2
30	Malnutrition and other nutritional deficiencies	1	12	9.2
31	Obesity	1	10	14.4
32	Disorders of thyroid gland	0	8	20.4
33	Other endocrine, nutritional and metabolic diseases	3	30	10.7
34	Alcoholic psychosis/chronic alcohol abuse	1	7	5.0
35	Drug dependence, toxicomania	0	0	9.6

(Continued)				
group #	**CAUSE OF DEATH**	**Underlying cause standardised rates per 100,000 (1)**	**Multiple cause standardised rates per 100,000 (2)**	**SRMU (2/1)**
36	Dementias (excluding Alzheimer)	11	38	3.4
37	Other mental and behavioural disorders	1	21	29.1
38	Epilepsy	1	8	6.2
39	Alzheimer's disease	13	22	1.7
40	Parkinson's disease	3	10	3.9
41	Other diseases of the nervous system	7	59	8.7
43	Ischaemic heart diseases	337	551	1.6
44	Other heart diseases	70	479	6.8
45	Cerebrovascular diseases	140	245	1.8
46	Hypertensive diseases	26	288	10.9
47	Other diseases of the circulatory system	85	465	5.5
48	Influenza	1	2	1.7
49	Pneumonia	30	365	12.1
50	Other acute lower respiratory diseases	2	12	7.2
51	Asthma	1	5	4.7
52	Other chronic lower respiratory diseases	29	85	2.9
53	Lung diseases due to external agents	1	4	4.6
54	Other diseases of the respiratory system	4	37	8.4
55	Ulcer of stomach, duodenum and jejunum	5	17	3.2
56	Chronic liver disease	18	28	1.6
57	Other diseases of the digestive system	26	99	3.9
58	Diseases of the skin and subcutaneous tissue	2	26	11.9
59	Rheumatoid arthritis and osteoarthrosis	0	9	20.1
60	Other diseases of the musculoskeletal system/ connective tissue	1	8	7.2
61	Renal Failure	8	83	9.9
62	Other diseases of kidney and ureter	3	12	4.3
63	Hyperplasia of prostate	0	6	12.9
64	Other diseases of the genitourinary system	3	25	7.4
65	Other diseases	3	5	1.9
66	Senility	1	1	1.0
67	Mechanisms of the death	8	8	1.0
68	Other symptoms, signs, abnormal findings, ill-defined causes	7	7	1.0
70	Transport accidents	7	8	1.1
71	Accidental falls	10	13	1,4
72	Accidental poisoning	3	3	1,2
73	Suicide/intentional self-harm	13	15	1,1
74	Other external causes	25	104	4,1

Associations between diseases

Figure 4 shows the CDAIs computed at the level of the main ICD chapters, excluding ill-defined causes if they are reported as contributing. For illustrative reasons, the cells are shaded according to their values, with values lower than 100 (no association) kept white. We focus on the strength and the symmetry of the association. A symmetrical positive association suggests that the given conditions form a stable co-morbidity pattern.

The first significant pattern is a strong diagonal, implying that a disease is very frequently linked with other diseases of the same ICD chapter. This pattern is present for all ICD main chapters.

There are also particularly strong associations between infectious diseases and other disease groups. In most cases, these associations are also symmetrical (observed on both a horizontal and a vertical axis), which suggests that infectious diseases are a frequent complication of the morbidity process, regardless of the underlying cause, and that they frequently appear in combinations when they are also reported as underlying. The strongest association was observed between infectious and skin diseases, mostly due to the association between septicaemia and decubitus ulcer. More generally, this mutual link can be interpreted to mean that infectious disease is a frequent complication of a skin disease and skin is a frequent gateway for infection.

Following the vertical axis, diseases of the skin (such as the above-mentioned decubitus ulcer), musculoskeletal diseases (typically rheumatoid arthritis), genitourinary disorders (mainly renal failure), and endocrine diseases (diabetes, obesity, malnutrition) are other examples of diseases which frequently contribute to the morbid process. Conversely, external causes are almost never associated with other diseases when they are reported as contributing causes of death.

Figure 4 Associations between diseases, CDAI values for the main ICD chapters, Czech Republic 2011

UCD	MCD													
	INF	NEO	BLOOD	ENDOC	MENT	NERV	CIRC	RESP	DIGES	SKIN	MUSC	GENIT	OTHER	EXT
INF	366	62	122	127	96	97	87	89	275	308	145	209	137	46
NEO	83	296	205	99	48	66	85	95	123	33	79	98	80	25
BLOOD	293	63	683	110	45	123	86	87	138	53	157	143	31	30
ENDOC	237	53	125	153	100	81	107	107	93	250	117	234	20	42
MENT	126	30	60	122	317	125	96	179	69	322	137	89	0	59
NERV	123	43	73	98	453	220	80	155	61	245	142	104	146	59
CIRC	61	52	62	107	97	121	114	92	65	95	100	88	119	43
RESP	164	58	67	95	122	113	97	164	73	72	102	100	124	34
DIGES	359	61	170	90	81	62	82	83	547	34	34	129	98	40
SKIN	1275	10	69	155	167	67	89	74	81	445	202	153	0	11
MUSC	491	28	308	121	10	55	75	141	48	53	845	178	177	97
GENIT	511	54	183	111	79	39	97	85	96	140	96	402	108	37
OTHER	114	40	48	88	36	122	79	74	16	0	64	218	627	123
ILLDEF	69	71	25	63	129	151	100	56	54	128	179	48	165	82
EXT	77	37	67	64	107	105	71	112	46	181	69	58	29	1107

Note: Vertical axis: underlying cause of death.
Horizontal axis: multiple cause of death.

SUMMARY AND DISCUSSION

In this paper we have highlighted the possibilities and increasing interest in analysing multiple causes of death. We explored the MCOD data from the point of view of the extent of co-morbidity (expressed as the average number of entries on the death certificate), the underestimation of certain diseases in routine mortality statistics (by comparing total to underlying mentions), and the associations between diseases (based on the relative measure of their strength compared to random distribution). Using multiple analytic perspectives, we identified three main groups of diseases: 1) the most lethal and least underestimated (cancer, most circulatory conditions, external causes of death, diseases of infancy); 2) highly underestimated but frequently contributing to the morbidity process, impairing a person's health status (musculoskeletal diseases, endocrine diseases, mental, and neural disorders); and 3) a specific group of end-stage conditions, which are an integral part of the morbidity process, but represent rather the mode of death than additional co-morbidity information (septicaemia, renal failure, decubitus ulcer, pneumonia). Further analysis and interpretation of multiple causes of death must be conducted with respect to this division.

For reasons of space, the above analysis is far from exhaustive, but it reveals the main potential and the main issues of multiple cause-of-death analysis. As future work, a more focused analysis of co-morbidity should be conducted, focusing on advanced ages or selected diseases only. Further potential of multiple cause-of-death data lies in the assessment of the quality of cause-of-death coding. Finally, differential analysis of co-morbidity can be computed based on marital status, education, or region.

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THE MEETING OF THE GROUP OF EXPERTS ON POPULATION AND HOUSING CENSUS

Pavlína Habartová

On 23 to 26 September 2014 the 16th working meeting of the Group of Experts on Population and Housing Censuses, organised by the the United Nations Economic Commission for Europe (UNECE) and Eurostat , was held at the Palais des Nations in Geneva. The main purpose of the meeting was to discuss the draft version of the Conference of European Statisticians (CES) Recommendations for the 2020 Censuses of Population and Housing. The meeting was attended by 83 representatives from national statistical offices, representatives of international organisations (Eurostat, UN HCR, UN OHCHR, FAO, ILO, UNESCO, UNSD, ISC of the Commonwealth of Independent States), and scientific institutions. The Group of Experts was chaired by British representative Mr. Ian White, and Dutch representative Mr. Eric Schulte Nordholt was elected deputy chair.

The following topics were discussed at the meeting:

1. Census methodology;
2. Census technology;
3. Operational aspects of censuses;
4. Quality management;
5. Population bases;
6. Geographic characteristics;
7. Migration and ethno-cultural characteristics;
8. Economic characteristics and agriculture;
9. Educational characteristics;
10. Demographic, household and family characteristics;
11. Housing characteristics;
12. Disability.

The materials and papers are available at: http://www.unece.org/stats/documents/2014.09.census1.html.

During the meeting, participants learned about the work of the UNECE Task Forces, the Steering Group on Population and Housing Censuses, and were able to raise questions and comments in the subsequent discussions. Participants were also able to learn about experiences with the census in selected countries in the papers that were presented at the start of the discussions of some draft chapters. A representative of the Czech Statistical Office also took part.

Census methodology

The results of a questionnaire survey conducted among the statistical offices of UNECE member countries confirmed the already well-known fact that there is a transition from the traditional to the combined census. The draft Recommendations described three basic approaches to data collection:

(a) the traditional census;
(b) the combined census with registers and full field enumeration;
(c) the combined census with registers and sample field data;
(d) the register-based census.

The advantages and disadvantages of each approach were discussed along with the conditions necessary for implementing the given method of data collection (usually legislation) and possible implications for staging data collection.

Newly added to the Recommendations for 2020 is a section on Statistical Disclosure Control, with proposed possible methods of data protection.

One of the comments emphasised the problem of providing data for lower regional units as a major drawback of register-based censuses.

The presentations from the statistical offices in Italy and Estonia showed that some of the statistical offices began working several years ago on analysing the feasibility of a census based on registers in 2020.

Representatives of the Italian Statistical Office (ISTAT) presented its concept for the census in 2011 in Italy, which launched a methodological innovation leading to planning for the 2020 census based on registers. The 2011 census used 8,092 municipal population registers (MPRs) as a supplementary source, which together with the use of a long and a short questionnaire served to reduce the number of front-office staff by 40%. While in small communities the census forms were filled in by all households, in municipalities with at least 20,000 inhabitants data collection was only performed selectively (1/3 of households) and for the first time estimates of socioeconomic characteristics were produced in order to reduce the burden on respondents and to increase the so-called spontaneous response rate.[1)]

Given that data become rapidly obsolete, Italy is planning a new approach – the annual production of census-type data. MPRs will remain the main administrative source and will be used to count people usually resident in a place and for generating basic demographic dat on the population and households. Two surveys (C-sample and the D-sample) will then be used to correct MPR-based counts and for producing new data. The C-sample survey will be short form and will measure the coverage of MPRs and as of 2016 will used to create annual estimates. In 2021 a special round of this survey will be used to determine the 'legal population'. The D-sample survey will focus on estimating socioeconomic characteristics. Data on core topcis defined in EU Regulations and not provided by population registers should thus be obtained so that the long-form census need not be used. The survey will produce national-level and NUTS 1-level estimates, while both surveys will be the source of data for lower territorial units and will be carried out either once every ten years (C-sample) or once every 3–5 years (D-sample).

Representatives of the Estonian Statistical Office presented the results of their feasibility analysis, which ran from 2010–2013 and had the task of mapping registers and administrative sources of use for the 2020 census in Estonia based only on registers (REGREL), the objective being to fulfil the mandatory topics complying with EU Regulations. A total of 20 databases were analysed. Important findings from this analysis were that all the data sources can be linked on the basis of a personal ID, enterprise ID, and an address object ID, and that it is possible to base the next census only on registers as long as certain conditions are met, such as filling in missing variables in the registers (occupation, place of work and economic activity), obtaining more precise data on temporary residence, resolving the problem of missing data on relationships between persons living in the same dwelling (and not just at the same address), etc.

Census technology

In the section devoted to technologies used in the census, the draft Recommendations contain a detailed treatment of the issue of outsourcing some activities, which is intended to elucidate the possibility of using outsourcing during the preparation and implementation of the census and in the processing of outcome. A new chapter was added on GIS technologies that can be used during every stage of the census. It was noted that there are still many countries that provide only limited map outcomes for users or only make such outcomes available for higher-level territorial units. If possible, data should always be related to an address point so that outcome can be processed for any territorial unit.

In the follow-up discussion the subject of Big Data was also mentioned (e.g. data from mobile operators), which represent a potential source of data, but all the participants were aware of the problems surrounding their use and above all accessibility. The discussion also focused on applications using smartphones or other data sources (refuse collection, water supply, etc.), which may in the future represent another administrative source of data.

Population bases

The next section dealt extensively with approaches to defining a population, where it came out that there is a need to clarify the definition of certain terms and to better explain the table outlining the rules for determining the place of usual residence of workers and students living away from home. There was a debate about where to count students living away

1) Forms returned without a reminder from the commissioner.

from home – whether to follow the same rules as in the census in 2011 or whether to propose some compromise. There was surprisingly little discussion of the fact that some points in the definition of the place of usual residence are very difficult to adhere to, particularly in an administrative census (e.g. how to determine the intention to remain in a new place of residence for at least 1 year).

Geographic characteristics

In the discussion devoted to geographical characteristics a proposal was made to incorporate the topic of population grids as a derived core topic and the degree of urbanisation as a derived non-core topic. However, some states (Latvia, Russia and others.) did not agree with the mandatory use of grids, so how essential the mandatory topic is will be discussed again by the Task Force and Steering Group.

In the proposed alternative classifications of place of work, some countries noted the need for an 'offshore installation' category, since it is only relevant for coastal states.

A new item for classing the method of transport to work was proposed: 'no journey made or mode of transport not determined'. On this point the participants discussed the possibility of dividing it into two categories so as not to lose information about persons who do not commute to work (work at home).

Migration and ethno-cultural characteristics

With respect to migration characteristics, the Recommendations mainly propose terminology changes – such as 'persons with mixed parental background' and 'foreign-born population' instead of 'foreigners'.

Participants were also asked to discuss whether it is still necessary to identify 'persons with foreign/national background', but there was no conclusion, as this is only a non-core topic.

There was also a discussion of the need to identify place of birth as a core topic, since this information is primarily relevant for countries that originate out of the breakup of one state.

Operational aspects of censuses

This chapter is a new one proposed in the Recommendations, some sections were transferred here from other chapters (e.g. dissemination), and new sections include data archiving (which is considered very important), communication and promotion (the task of promotional campaigns to explain the importance of the census and the so-called '8 Es', which should be fulfilled), and the costs and benefits. The '8 Es' are:

(a) Engagement: to make people aware of the census;
(b) Education: to tell people about the benefits (to them and to the country) of the census;
(c) Explanation: to tell people what to do and when;
(d) Encouragement: to persuade people who have not yet responded to do so;
(e) Enforcement: to remind people about their legal obligation and duty to take part if they persistently refuse to do so;
(f) Expression of thanks for taking part; and
(g) Extolling the value of the data in order to expand the use of the Publisher results.

Representatives from Russia highlighted the negative effect of the use of SMS messaging for promoting the census and proposed excluding this from the possible options for promoting the census. Conversely, representatives from Italy pointed out the importance of social networks, which should not be overlooked.

Demographic, household and family characteristics

This chapter again proposes de facto marital status as a core topic and for the first time introduces a classification combining de facto and legal marital status. The proposed classification, however, was met with an ambivalent response. Most participants expressed an understanding of the idea of using de facto marital status, as it describes reality more than legal marital status, but some participants disagreed with the proposed classification. For countries using register-based censuses, it is very difficult or even impossible to identify such indicators.

Another comment that was raised during the discussion of demographic characteristics was the question of whether to include the 'sex undetermined' category from 'sex', so that the classification is able to respond better to the reality of the possibility of sex changes.

Almost no significant changes were made to the characteristics of families and households, except for homelessness, where the proposal is to make the following distinctions:

(1.0) Rooflessness – people living on the street and without shelter;
(2.0) Rootlessness – peole without a usual place of residence, who move frequently between different types of housing (e.g. dwellings, shelters, other residential spaces), but do have a roof over their heads; the category also includes people who report 'no usual address' on the census form, even if they live in a private dwelling.

This categorisation was not however met with a very positive response. For countries that use register-based censuses, even the actual counting of homeless persons poses a problem.

Housing characteristics

In addition to the homeless, who are limited to primary homeless (roofless) in the census, and abolishing the surveying of kitchen equipment, a bigger discussion was provoked by the proposed detailed typology of apartments and houses (e.g. housing arrangements). In the case of dwellings the classification was expanded to include the category 'dwellings with residents not included in the census', which is to be filled in separately. Some countries, however, expressed doubts as to how to even quantify such a category if the dwellings are inhabited by persons only temporarily present who are not included in the usually resident population. At the very least, register-based censuses are not able to capture such dwellings. A similar reaction was sparked by the proposed classification for unoccupied dwellings as vacant dwellings intended for sale, demolition, rent and other, which most participants disagreed with. The discussion concluded by reasoning that occupancy is defined in the Recommendations differently than in EU Regulations, where occupancy is based on the place of usual residence, so the classification of the occupancy status of conventional dwellings would not be binding for EU Member States.

In the section on the characteristics of housing and families, the Czech Statistical Office presented a paper outlining the most important stage of data processing in the 2011 Population and Housing Census –linking people, buildings and dwellings and assigning people into households. Since most countries face similar problems with linking entities and linking people from the forms and the registers, this paper and its concrete treatment of the topic very much caught the interest of participants, several interesting questions were raised pertaining to it, and it was followed by an intensive informal discussions.

Economic characteristics and agriculture

The biggest proposed changes were in the chapter on economic characteristics, which was drawn up ILO representatives. Most of the changes relate just to terminology – such as replacing 'economically active population' with the new term 'labour force' and 'economically inactive population' with the new 'outside the labour force', and using 'labour force status' in the place of 'current activity status', but the content remains the same.

In addition to changes in terminology a simplification was proposed, so that 'people who have never worked' is no longer distinguished among the unemployed, which was welcomed by some countries.

However, the most controversial subject of the meeting was the new mandatory topic 'persons in own-use of production of goods', which proposes identifying persons who carry out any activity that produces goods for their own consumption or for consumption by other members of the household (the production and processing of products from agriculture, hunting, fishing, gathering wood or other fuel for heating, fetching water, processing products for the household, construction and repair of the dwelling, etc.). While the former Soviet countries welcomed this idea, most European countries (excluding some countries of Eastern and Southeastern Europe) considered this topic to be irrelevant. Slovenia even voiced the concern of whether the census is not turning into a survey of the labour force, as each year it has more and more core topics relating to economic characteristics. One proposed solution was to retain the topic as core topic, but with the note that if the country finds surveying this information to be irrelevant it can be a non-core topic. However, most participants did not think this to be an appropriate solution, so the issue will be discussed further by the Task Force and Steering Group.

Other points

Another item on the agenda dealt with educational characteristics, for example, where only formal changes are proposed and most of them relate to internationally used classifications. Operational aspects of censuses.

Future work

The final draft text of the Recommendations will be prepared by December 2014. It will be submitted to the CES for revision by February 2015, and subsequently for adoption at a plenary meeting of the CES in June 2015. The next meeting of experts is scheduled for 30 September – 2 October 2015.

Another planned task is to set up the UNECE Census Wiki – websites for collecting information on the transition from one census methodology to another.

THE MEASUREMENT AND EVOLUTION OF MORTALITY: FOCUSING ON CURRENT RESEARCH

Markéta Pechholdová

'All who live must die. We study when and why so all may live longer.' These words simply summarise the topic and the purpose of a book published in 2014 as part of the European Studies of Population (ESPO) series under the auspices of the European Association for Population Studies (EAPS).[1)] According to the editors (*Jon Anson and Marc Luy*), the main idea of this volume is to reflect the progress in recent mortality research.

Mortality in an International Perspective is the title of this monograph with 359 pages and 85 illustrations. It consists of twelve regular contributions, and one introductory chapter written by the editors which presents a comprehensive overview of the 'hot' topics in current mortality research (based on a synthetic review of articles in five main demographic journals in 2010–2011). The editors critically discuss recent findings relating to socioeconomic differences, period and cohort perspectives, demographic methodology, and comparative analyses.

The individual contributions are based on papers that were presented at a meeting of the European Working Group on Health, Morbidity and Mortality held at the Vienna Institute of Demography in September 2011. Most of the contributing authors are from Europe—ranging from London and Madrid in the west to Moscow in the east, and with a few from further afield. The individual contributions cover a wide variety of recent topics in mortality research and geographic areas, and while Europe is the main sphere of interest, the United States, Cuba, Argentina, Turkey, and East Asia are also represented.

The first contribution, by *Peter Congdon*,[2)] a distinguished specialist in spatial demography, deals with the methodological issues of measuring old-age mortality in small populations (US counties), and looks for the links between economic status and mortality, concluding that richer counties have more favourable mortality trends than poorer ones, which leads to increasing disparities. Several of the contributions deal with the socioeconomic aspects of mortality. A paper by *Jeroen Spijker* proposes an innovative short-term mortality forecast separately for Eastern and Western Europe.[3)] The forecasts are based not only on the past trends, but also on 'exogenous factors": mainly socioeconomic environment and lifestyle (such as GDP per capita, level of education, smoking, and alcohol consumption, etc.). Based on a time series methodology, he investigates relationships and time lags between the exogenous variables and cause-specific mortality, and concludes that a further decline in mortality can be expected. The forecast is computed for total mortality, and additionally for lung cancer and circulatory mortality. Interestingly for Czech demographers, the Czech Republic is one of the countries included (the author already worked extensively on Czech mortality in his doctoral thesis[4)]). The next paper, by *Katalin Kovács*, deals with educational differences in cause-specific mortality in Hungary.[5)] The author bridges

1) Anson, J. – Luy, M. (dds.) 2014. 'Mortality in an International Perspective.' *European Studies of Population*, vol. 18, 359 p. Springer.
2) Estimating Life Expectancy in Small Areas, with an Application to Recent Changes in Life Expectancy in US Counties.
3) Socioeconomic Determinants of Mortality in Europe: Validation of Recent Models Using the Latest Available Data and Short-Term Forecasts.
4) Spijker, J. 2004. Socioeconomic determinants of regional mortality differences in Europe. PhD Thesis. Dutch University Press, Amsterdam, the Netherlands. ISBN: 90-3619-012-6.
5) Social Disparities in the Evolution of an Epidemiological Profile: Transition Processes in Mortality Between 1971 and 2008 in an Industrialized Middle Income Country: The Case of Hungary.

the cause-of-death series across several ICD revisions (with a simplified, regression-based procedure), estimates periods of increase, decrease, and stagnation, and classifies causes of death by education based on the similarity of these profiles. The research question is which causes of death have driven the increase in education-related differences in mortality observed since the 1980s in Hungary and evidence shows that the most plausible explanation is the nutrition theory.

A study based on individual data by *Vasunilashorn et al.*[6] demonstrates that a thoughtful categorisation of individuals according to the level of risk (expressed here by a combination of biomarkers and behavioural factors) provides reliable predictors for future mortality. Two more papers focus on mortality at advanced ages: *Gomez Redondo et al.*[7] provide a thorough investigation of long-term trends in the cause-specific mortality of the population aged 65 and over, and *Herm et al.* then point at the increased risk of death of the elderly after institutionalisation.[8]

Two papers are devoted to mortality in Russia. The first one focuses on the issue of alcohol, a well-known factor in the Russian health profile (*Semyonova et al.*).[9] The study includes not only deaths due to accidental alcohol poisoning, but also deaths due to degenerative alcohol-related conditions, which seem to be of greater significance in assessments of the role of alcohol in Russia. Based on a regional analysis, the authors also estimate the extent of under-reporting of alcohol-related mortality. The second study (*Sabgayda et al.*) dealing with Russian mortality investigates the past mortality trends through the concept of avoidable causes of death.[10] Conditions amenable to medical prevention and treatment are responsible for most of the fluctuations in Russian mortality and the authors call for more political attention to be devoted to questions of social inequalities and public health.

Finally, four papers focus on non-European middle-income countries. *Zhao et al.* describe long-term mortality trends in East Asia and compare them to the mortality history of Europe,[11] concluding that East Asia underwent a process of transformation identical to the epidemiological transition (i.e. infections and high child mortality were exchanged for circulatory diseases in old age). This transformation was rather rapid and was enabled by favourable economic conditions and efficient health policies. *Gomez et al.* describe mortality trends in Cuba,[12] concluding that Cuba has transitioned to a modern demographic regime with low mortality and low fertility, and moving towards exceptionally low excess male mortality. A study by *Yüksel-Kaptanoglu et al.* points at elevated levels of maternal mortality observed from survey data in Turkey.[13] Most of these deaths occur in socially disadvantaged groups and are avoidable by timely medical prevention or treatment – a finding that calls for health policy measures. *Pizzaro et al.* evaluate to what extent infant mortality levels and disparities were reduced in comparison to previously stated health policy targets,[14] and they sadly conclude that despite a halving of overall infant mortality, levels are still higher than expected and regional differences have not decreased at all.

The book thus covers a variety of recent mortality topics, geographic areas, and methodological approaches, including the treatment of spatial data, cause-of-death data, individual records, or survey data. The inclusion of a considerable amount of analyses dealing with central and eastern Europe is of particular interest for Czech demographers. The collection is valuable also for the great introductory chapter, and for a heterogeneity of covered topics, which often present the results of laborious studies that have not yet appeared in any demographic journal.

6) Predicting Mortality from Profiles of Biological Risk and Performance Measures of Functioning.
7) Changes in Mortality at Older Ages: The Case of Spain (1975–2006).
8) Excess Mortality Risks in Institutions: The Influence of Health and Disability Status.
9) Approaches to the Assessment of Alcohol-Related Losses in the Russian Population.
10) Variable Scales of Avoidable Mortality Within the Russian Population.
11) Long-term Mortality Changes in East Asia: Levels, Age Patterns, and Causes of Death.
12) Life Expectancy Differences in Cuba: Are Females Losing Their Advantage Over Males?
13) Avoidable Factors Contributing to Maternal Deaths in Turkey.
14) Infant Mortality Measurement and the Rate of Progress on International Commitments: A Matter of Methods or of Guarantees of Rights? Some Evidence from Argentina.

THE VIENNA YEARBOOK OF POPULATION RESEARCH 2012[1)]

Martina Miskolczi

The yearbook of the Vienna Institute of Demography for the year 2012 is dedicated to education and the global fertility transition. The seven contributions to the yearbook focus on theoretically and empirically examining the global fertility transition in the light of educational change. Education is important, as we already saw in the Vienna Yearbook in 2010. Special attention is given to the changes in basic and more advanced school attainment and the implications for the timing and outcome of fertility. Several key channels by which education growth affects fertility are investigated, such as the effects of education on female financial autonomy or on marriage markets characterised by high levels of educational homogamy. The studies address the whole range of fertility transitions, from the early high-fertility stages connected with low median school-leaving age in some less developed countries, to the low fertility and high median school-leaving age in developed countries. The connection between education and fertility should also be viewed in relation to child mortality and, therefore, within the larger framework of the demographic transition.

In the Introduction, the editors of the yearbook, *K. S. James* from the Institute for Social and Economic Change in Bangalore (India), *Vegard Skirbekk* from IIASA Laxenburg (Austria) and *Jan Van Bavel* from the University of Leuven (Belgium) present a long-term analysis of fertility, education and economic status, in one case even from the year 1300. They study the education-fertility link and its intensity in a high- and a low-fertility context. There are several ways to explain the causal pathways between education and fertility dynamics. Education often implies that reproductive behaviour is increasingly a rational behaviour – where decisions on the timing and quantum of fertility are weighed against perceived implications for other life goals, such as careers, consumption and self-fulfilment. Schooling can affect the optimal timing for initiating childbearing and also the perceived ideal number of children. Education is linked to better contraceptive use, changes in sexual behaviour, changes in preferences for 'child quality' and investments into children. Schooling can, on the other hand, increase the ability of a person to actually fulfil personal fertility preferences. However, it may also change a person's concept of 'social success' in life, where having many children may become less important than other opportunities and achievements. People with more education may place a higher emphasis on academic success, occupational prestige, self-fulfilment and other factors that could potentially be in conflict with parenting. Education is a key driver of skills and cognitive competences, and its effects, such as literacy and cognitive skills, can increase female empowerment and economic opportunities for women.

In the first article of this issue, **Women's education and fertility transition in sub-Saharan Africa** *David Shapiro* considers childbearing in sub-Saharan Africa. This region has some of the highest fertility rates in the world – and also some of the lowest education levels. The impact of education is explored in the context of declining infant and child mortality and changes in economic well-being and the author stresses the significant role of increasing enrolment in secondary and higher schools for the process of fertility transition.

In an article titled **A reassessment of the effects of female education and employment on fertility in Nigeria** *Onipede Wusu* examines the fertility

1) James, K. S. – Skirbekk, V. – Van Bavel, J. (ed.). 2013. *Vienna Yearbook of Population Research 2012.* Volume 10. Vienna: Vienna Institute of Demography, Austrian Academy of Science. Avalable at: http://www.oeaw.ac.at/vid/publications/VYPR2012/VYPR2012.shtml. ISBN 978-3-7001-7373-1.

of Nigerian women between 1990 and 2008. The author considers the relative impact of female education and labour force participation in terms of their effects on fertility. Although the proportion of illiterate women in the country declined from 57.2% to 35.8% in this period, fertility remained and remains high. The total fertility rate in Nigeria has been fluctuating between 6.6 and 5.6 children per woman since 1965. Given the country's TFR, Wusu argues that there is no sign that a sustainable fertility decline will be realised at some point. Wusu finds female education to be inversely related to the indicators of fertility, but the relationship with employment is less clear. He concludes that female education remains a valid channel through which sustainable fertility decline can be achieved in Nigeria.

Authors *Bernhard Nauck* and *Rokuro Tabuchi* study family change in Japan in the article **One or two pathways to individual modernity? The effects of education on family formation among women in Japan and Germany** Japan is a collectivistic country, Germany is a society characterised more by individualism. They compare the 'second demographic transition' model (Lesthaeghe, 2010) with that of 'family change' (Kağıtçıbaşı). They study how schooling has affected fertility over the last 60 years. Although the changes point in the direction predicted by the second demographic transition model, they find that the differences between the two societies have remained stable or even widened, in line with the family change model.

Another contribution, **Spousal and parental roles among female student populations in 55 low- and middle-income countries**, by *Albert Esteve, Jeroen Spijker*, *Tim Riffe* and *Joan García* concentrates at school enrolment and union status or parenthood among females aged 15–24 years (adolescents and young adults) in 55 selected countries characterised by low-income or middle-income. They find that higher shares of students are strongly negatively correlated with the population shares in spousal and parental roles – because students are less likely to marry or have children compared to non-students.

Valeria Bordone and *Daniela Weber* focus on the relationship between cognition and fertility in an in-depth study of the SHARE data for Europe in their contribution **The Number of children and cognitive abilities in later life**. The analyses focus on the older population, their cognitive ability level and how many children they have. They find a positive association between cognitive functioning and having children versus being childless. Interestingly, parents of two children show higher abilities than both parents of a single child and heads of large families.

In the last article of the Vienna Yearbook of Population Research 2012, *Jan van Bavel* presents a set of interrelated hypotheses about the implications of changes in relative education for fertility according to gender. In his work **The reversal of gender inequality in education, union formation and fertility in Europe** he shows that while men were better educated historically, in Europe, as well as in many other countries, there are now more highly educated women than men reaching reproductive age and looking for a partner. He discusses the effects on union formation patterns, where the traditional pattern of female hypergamy (i.e. women mating men who are at least as highly educated as themselves) is no longer compatible with the new gender distribution in education. He expects a new, education-specific mating pattern to emerge that will affect the process and outcome of assortative mating, which in turn is going to affect the timing, probability and stability of union formation. Further, he formulates hypotheses about the implications for future fertility trends and patterns in Europe and similar Western regions.

Looking at the role of education in contexts where the fertility transition is nearly achieved (or fertility is already low), the hypothesis that the education-fertility link is growing weaker cannot be confirmed. Although variations in fertility according to different educational levels are smaller in low-fertility countries, in absolute terms there is less variance left to be explained by education or anything else. Thus, it appears that the link between education and fertility is universal in nature, irrespective of culture, context, geography, or stage in the fertility transition.

The 6th Conference of Young Demographers Will Take Place in February 2015

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 advices from their more experienced counterparts, colleagues, and teachers from all over the world or at least Europe. The already 6th annual Conference of Young Demographers will take place on 12–13 February 2015 in Prague at the Faculty of Science (Albertov 6, Prague 2). The topic of the conference, *'Actual Demographic Research of Young Demographers (not only) in Europe'*, is as wide as possible so that the conference can be open to demographers and scientists with various research interests and orientations.

Except for the Young Demographers, the event is supported by the Department of Demography and Geodemography, Geographical Institute (Faculty of Sciences of Charles University in Prague), the Czech Statistical Office, and the 'Young Demography' research group of the German Association for Demography (DGD).

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 a bit older) researchers (not only demographers) are welcome. The working language of the conference is English and except for a few posters all presentations should be spoken.

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 conference's partners, will hand out an award for the best presentation using SAS software and the best presentation with a social context.

For the first time a session for non-demographers is planned this year. At this session topics on which demographers may share common scientific ground with researchers from other fields will be discussed and perhaps new areas of cooperation can be developed.

The deadline for applications (abstracts) for the conference is 30 November 2014. Applications should be submitted by e-mail to yd.demographers@gmail.com and should include the title of the proposed presentation, a short abstract in English, and several key words. The accepted papers will be announced before 19 December 2014 and the programme of the conference will be released in January 2015. More information about the conference can be found online (http://www.demografove.estranky.cz/en/articles/conferences/6th-demographic-conference-of-young-demography.html) or you can follow us on Facebook (https://www.facebook.com/young.demographers) or Google+ (https://plus.google.com/u/0/102665514822224781605/posts). In the case of any questions please feel free to contact us at the e-mail address above.

We look forward to meeting you in Prague!
On behalf of the Organizing Committee,

Klára Hulíková – Olga Kurtinová – Alena Filasová – Barbora Kuprová – Dan Kašpar

The Workshop of the EAPS Health, Morbidity and Mortality Working Group: 'Changing Patterns of Mortality and Morbidity – Age-, Time-, Cause- and Cohort-Perspectives'

We are pleased to announce that the Department of Demography and Geodemography of the Faculty of Science, Charles University in Prague, the Department of Economic Statistics of the Faculty of Informatics and Statistics, University of Economics, and the EAPS – European Association for Population Studies are organising the 2015 workshop of the EAPS Health, Morbidity and Mortality Working Group.

The workshop will host a group of experts dealing with topics on mortality, morbidity, and related issues from different countries all over the world. All the topics of discussion planned for the workshop can be covered under the title *'Changing Patterns of Mortality and Morbidity – Age-, Time-, Cause- and Cohort- Perspectives'*.

Throughout the 20th century, and particularly since the Second World War, there have been rapid and profound changes in morbidity and mortality in both developed and developing countries. These changes are clearly reflected in the indicators commonly used to generally describe both these processes, such as life expectancy, infant mortality rates, and cause-specific prevalence and incidence rates. However, in order to go beyond description and understand the reasons for these changes, which are unique in human history, we need to undertake a more detailed analysis, looking at the effects of age, time, and particular causes of death, as well as the way different cohorts have responded to the social changes that lie behind these developments. Mortality and morbidity declines are ongoing and ever evolving processes, but there are also setbacks as new causes appear, known causes transform, and inter- and intra-societal violence becomes ever more destructive. Understanding the way in which morbidity and mortality patterns develop is thus crucial, precisely because we have seen that they are amenable to change. If we wish to see this change continue in a positive direction, we need to understand the roots of these developments, as well as the reasons for reversals and their uneven distribution within and between different societies.

The workshop seeks to bring together demographers and other scientists dealing with these important topics, to present and discuss new results, ideas, and methods of analysis, and thus to contribute to our understanding of the changing patterns of mortality and morbidity and the factors behind these changes.

The workshop will take place on 16–18 September 2015 in Prague at the University of Economics. The deadline for abstracts is 31 March 2015 (applications should be sent to e-mail hmmwg2015@gmail.com). Anyone who would like to learn more about the workshop or is interested in taking part, information about applying, the workshop programme, and related issues can be found online at hmmwg2015.vse.cz, or by contacting the organisers by e-mail: hmmwg2015@gmail.com.

We are looking forward to a fruitful discussion on all the important issues of morbidity, health, and mortality in one of the most beautiful cities in the heart of Europe.

Klára Hulíková Tesárková
Department of Demography and Geodemography, Faculty of Science, Charles University in Prague
Petr Mazouch
Department of Economic Statistics, Faculty of Informatics and Statistics, University of Economics, Prague
Jon Anson
Ben-Gurion University, Israel

SOCIOLOGICKÝ ČASOPIS / CZECH SOCIOLOGICAL REVIEW 2014, ROČNÍK 50, ČÍSLO 3

Population and vital statistics of the Czech Republic 2013: towns with more than 50,000 inhibitants

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	1,244,762	1,243,201	5,531	3,002	13,867	4,239	12,149	1,718	–5,297	–3,579	4.4	2.4	11.1	9.8	–2.9
Brno	377,214	377,508	1,735	1,006	4,308	1,271	3,871	437	–1,256	–819	4.6	2.7	11.4	10.3	–2.2
Ostrava	296,308	295,653	1,164	805	2,951	1,095	3,315	–364	–1,404	–1,768	3.9	2.7	10.0	11.2	–6.0
Plzeň	167,701	168,034	730	498	1,668	748	1,768	–100	662	562	4.4	3.0	9.9	10.5	3.4
Liberec	102,159	102,301	456	334	1,127	459	1,008	119	69	188	4.5	3.3	11.0	9.9	1.8
Olomouc	99,272	99,489	479	273	1,153	374	1,019	134	–116	18	4.8	2.8	11.6	10.3	0.2
Ústí nad Labem	93,490	93,523	346	231	1,008	309	1,014	–6	–218	–224	3.7	2.5	10.8	10.8	–2.4
České Budějovice	93,291	93,253	399	276	982	407	964	18	–232	–214	4.3	3.0	10.5	10.3	–2.3
Hradec Králové	92,874	92,904	389	265	950	386	969	–19	–112	–131	4.2	2.9	10.2	10.4	–1.4
Pardubice	89,345	89,432	389	249	888	245	962	–74	39	–35	4.4	2.8	9.9	10.8	–0.4
Havířov	76,733	76,109	335	234	683	303	916	–233	–1,029	–1,262	4.4	3.0	8.9	11.9	–16.4
Zlín	75,239	75,278	319	215	708	257	827	–119	–158	–277	4.2	2.9	9.4	11.0	–3.7
Kladno	68,551	68,519	310	214	741	304	751	–10	–22	–32	4.5	3.1	10.8	11.0	–0.5
Most	67,308	67,332	258	180	634	336	737	–103	–55	–158	3.8	2.7	9.4	10.9	–2.3
Opava	57,938	57,931	239	162	539	261	548	–9	–114	–123	4.1	2.8	9.3	9.5	–2.1
Frýdek-Místek	57,299	57,135	252	175	547	241	579	–32	–356	–388	4.4	3.1	9.5	10.1	–6.8
Karviná	57,302	56,848	237	157	495	240	740	–245	–749	–994	4.1	2.7	8.6	12.9	–17.3
Jihlava	50,561	50,510	209	142	546	202	503	43	–131	–88	4.1	2.8	10.8	9.9	–1.7
Děčín	50,131	50,104	181	152	535	260	544	–9	–176	–185	3.6	3.0	10.7	10.9	–3.7
Teplice	50,235	50,024	221	129	457	258	567	–110	–196	–306	4.4	2.6	9.1	11.3	–6.1
Karlovy Vary	50,042	49,864	212	136	394	149	524	–130	–178	–308	4.2	2.7	7.9	10.5	–6.2

Radek Havel

Population and vital statistics of the Czech Republic 2013: 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 year	Within 28 days	Natural	Net migration	Total	per 1,000 inhabitants				
Česká republika	10,510,719	10,512,419	43,499	27,895	106,751	37,687	109,160	265	151	–2,409	–1,297	–3,706	4.1	2.7	10.2	10.4	–0.4
Praha	1,244,762	1,243,201	5,531	3,002	13,867	4,239	12,149	22	14	1,718	–5,297	–3,579	4.4	2.4	11.1	9.8	–2.9
Střední Čechy	1,297,209	1,302,336	5,252	3,793	14,218	5,038	12,924	23	11	1,294	9,226	10,520	4.0	2.9	11.0	10.0	8.1
Jihozápad	1,209,325	1,210,176	4,967	3,360	11,884	4,602	12,665	33	15	–781	1,659	878	4.1	2.8	9.8	10.5	0.7
Severozápad	1,126,841	1,125,429	4,461	3,131	10,886	4,959	12,463	32	18	–1,577	–1,484	–3,061	4.0	2.8	9.7	11.1	–2.7
Severovýchod	1,506,307	1,506,503	6,202	4,111	15,063	5,349	15,733	41	21	–670	–807	–1,477	4.1	2.7	10.0	10.4	–1.0
Jihovýchod	1,679,099	1,680,287	7,086	4,125	17,323	5,394	16,758	35	25	565	–135	430	4.2	2.5	10.3	10.0	0.3
Střední Morava	1,223,253	1,222,655	5,015	3,094	11,907	3,813	13,184	41	29	–1,277	–1,370	–2,647	4.1	2.5	9.7	10.8	–2.2
Moravskoslezsko	1,223,923	1,221,832	4,985	3,279	11,603	4,293	13,284	38	18	–1,681	–3,089	–4,770	4.1	2.7	9.5	10.9	–3.9
Hl. m. Praha	1,244,762	1,243,201	5,531	3,002	13,867	4,239	12,149	22	14	1,718	–5,297	–3,579	4.4	2.4	11.1	9.8	–2.9
Středočeský kraj	1,297,209	1,302,336	5,252	3,793	14,218	5,038	12,924	23	11	1,294	9,226	10,520	4.0	2.9	11.0	10.0	8.1
Jihočeský kraj	636,443	636,707	2,600	1,747	6,374	2,323	6,604	19	10	–230	326	96	4.1	2.7	10.0	10.4	0.2
Plzeňský kraj	572,882	573,469	2,367	1,613	5,510	2,279	6,061	14	5	–551	1,333	782	4.1	2.8	9.6	10.6	1.4
Karlovarský kraj	300,999	300,309	1,300	879	2,826	1,150	3,186	3	3	–360	–1,057	–1,417	4.3	2.9	9.4	10.6	–4.7
Ústecký kraj	825,842	825,120	3,161	2,252	8,060	3,809	9,277	29	15	–1,217	–427	–1,644	3.8	2.7	9.8	11.2	–2.0
Liberecký kraj	438,473	438,609	1,877	1,311	4,535	1,843	4,423	20	9	112	–97	15	4.3	3.0	10.3	10.1	0.0
Královéhradecký kraj	552,053	551,909	2,268	1,543	5,451	1,961	5,918	11	5	–467	–570	–1,037	4.1	2.8	9.9	10.7	–1.9
Pardubický kraj	515,781	515,985	2,057	1,257	5,077	1,545	5,392	10	7	–315	–140	–455	4.0	2.4	9.8	10.5	–0.9
Kraj Vysočina	510,522	510,209	2,043	1,125	4,920	1,619	5,129	6	6	–209	–789	–998	4.0	2.2	9.6	10.0	–2.0
Jihomoravský kraj	1,168,577	1,170,078	5,043	3,000	12,403	3,775	11,629	29	19	774	654	1,428	4.3	2.6	10.6	10.0	1.2
Olomoucký kraj	636,659	636,356	2,632	1,713	6,322	2,010	6,830	19	12	–508	–745	–1,253	4.1	2.7	9.9	10.7	–2.0
Zlínský kraj	586,594	586,299	2,383	1,381	5,585	1,803	6,354	22	17	–769	–625	–1,394	4.1	2.4	9.5	10.8	–2.4
Moravskoslezský kraj	1,223,923	1,221,832	4,985	3,279	11,603	4,293	13,284	38	18	–1,681	–3,089	–4,770	4.1	2.7	9.5	10.9	–3.9

Radek Havel

Abstracts of Articles Published in the Journal Demografie in 2014 (Nos. 1–3)

Kateřina Válková

THE FERTILITY TREND OF WOMEN UNDER THE AGE OF 25 IN THE CZECH REPUBLIC

This article aims to evaluate the fertility transformation in the youngest age group of women (up to the age of 25) in the 20th century and at the beginning of the 21st century in the Czech Republic. The circumstances and the causes of the transformation of fertility in this age group of women are described using theoretical concepts related to fertility issues in the youngest age group of women. The chosen period reveals a number of socioeconomic, political, and legislative changes. The rate and timing of fertility have been influenced by the transformation of society in the 20th century. The nature of young motherhood has also changed. The differences in the characteristics of fertility in the youngest age group of women resulting from social changes are demonstrated using a comparison of the trends in young women's fertility in the Czech Republic in six different periods.

Keywords: fertility, Czech Republic, young mother, age-specific fertility rate, marital and non-marital fertility

Demografie, 2014, **56: 04–20**

Pavlína Habartová – Klára Hulíková Tesárková – Olga Sivková

FORECAST OF THE NUMBER AND SIZE OF SELECTED HOUSEKEEPING HOUSEHOLDS IN THE CZECH REPUBLIC FOR THE PERIOD 2013−2040

The article focuses on forecasting the number and size of selected housekeeping households in the Czech Republic for the period 2013–2040. The main data sources are the 2011 Population and Housing Census and the official Population Projection to 2100 issued by the Czech Statistical Office in 2013. Given that the last census switched methodology from using a person's place of permanent residence to his or her place of usual residence, this forecast focuses on one-person households, one-couple families, and lone-parent families. A modified version of the headship rate method, which avoids the inconsistencies that occur when using the classic headship rate method, is used. The three d forecast variants presented in the article are based on the three variants of the population forecast. The results confirm the expectations of a decreasing average size of households and increasing number of one-person households. These trends are consequences of demographic ageing and changing lifestyles in the Czech Republic.

Keywords: household, forecast, Czech Republic, headship rate

Demografie, 2014, **56: 21–36**

Alena Filasová

THE IMPACT OF MARITAL DISSOLUTION ON FERTILITY IN THE CZECH REPUBLIC

This article analyses the fertility of people who experience divorce or the death of a spouse during reproductive age. The objective is to determine whether these people have more or fewer children than people whose marriage lasts until the age of 50 using data from the Generations and Gender Survey and employing the life table method and the Cox regression model. According to the results marital dissolution has a double effect on fertility, depending on a person's subsequent partnership situation.

Keywords: fertility, fertility of divorcees, fertility of widows and widowers, marital dissolution, partnership history, Generations and Gender Survey, Survival Distribution Function, Cox regression model

Demografie, 2014, **56: 107–125**

Petra Dupalová

SPORTS DEMOGRAPHY: APPLYING DEMOGRAPHIC ANALYSIS TO ESTIMATE THE LENGTH OF A TOP ATHLETIC CAREER

This article offers a brief introduction to selected demographic methods according to their application in sports and specifically athletics. The data analysed are on the length of a 'top' sports career rather than on the length of an individual's life. (In this article, 'top career' refers to the period of an athlete's career peak, when athletes give their peak athletic performance.) Life tables are thus calculated to show the length of the careers of men and women as top athletes in various athletic disciplines. The results of this analysis confirmed that men and women perform differently in individual disciplines and the expected duration of their careers as top athletes in individual disciplines also differs. The results basically represent an introduction to sports demography and confirm the applicability of the methods of demographic analysis in this field.

Keywords: sports demography, athletics, life tables, top career

Demografie, 2014, **56: 126–138**

Olga Nešporová – Dana Hamplová

THE RELATIONSHIP BETWEEN PARENTHOOD AND LIFE SATISFACTION IN THE CZECH REPUBLIC AND EUROPEAN UNION

The article investigates the relationship between parenthood and life satisfaction in the Czech Republic and in the European Union (EU 27). Erikson´s concept of generativity, together with the goals theory, was taken as the basis for the authors' assumption that parenthood should increase life satisfaction. An analysis using data from the European Values Study (EVS) 2008 provided no clear support for such a hypothesis and revealed significant differences in this respect across European countries.

Keywords: parenthood, motherhood, life satisfaction, happiness, Czech Republic, Europe

Demografie, 2014, **56: 185–202**

Ondřej Nývlt – Šárka Šustová

FAMILY ARRANGEMENTS WITH CHILDREN IN THE CZECH REPUBLIC FROM THE PERSPECTIVE OF SURVEYS IN HOUSEHOLDS

Household composition is still a relatively new and less frequently explored topic. There have been many changes in Czech demographic behaviour since the Velvet Revolution. There has been a decrease in nuptiality and an increase in cohabitation and extra-marital fertility. The timing of marriage and the birth of the first child has also changed. Moreover, the share of lone-parent families has grown. All these changes have significantly influenced household composition and family arrangements. In this article, the structure of family arrangements in the Czech Republic over the past twenty years is analysed using the Labour Force Survey and EU-SILC survey. The biggest advantage of these surveys is that unlike demographic statistics, which report on a mother's marital status at the time of birth of a child, they provide information about family arrangements by the age of the child. The advantage of these surveys over the census that is usually used for analyses of household composition is that data are available for every year.

Keywords: family arrangements, cohabitation, extra-marital fertility, LFS, EU-SILC

Demografie, 2014, **56: 203–218**

Branislav Šprocha

THE POSTPONEMENT AND RECUPERATION OF FERTILITY IN A COHORT PERSPECTIVE IN THE CZECH REPUBLIC AND SLOVAKIA

A society-wide transformation sparked in the Czech Republic and Slovakia by the political upheaval in 1989 significantly accelerated the onset and spread of changes in reproductive behaviour. The postponement of important reproduction-related life events has become the primary cause of changes in cohort fertility among women born in 1970s and 1980s. The aim of this article is to analyse the transformation of cohort fertility in the Czech Republic and Slovakia using the model of fertility postponement which involves a fertility decline at younger ages and subsequent recuperation as a compensatory fertility increase at higher ages.

Keywords: cohort fertility, postponement fertility, recuperation fertility, Czech Republic, Slovakia

Demografie, 2014, **56: 219–233**

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C. REFERENCES AND HEADINGS

Examples of reference formats:

Books

– Roubíček, V. 1997. *Úvod do demografie*. Prague: Codex Bohemia.
– Hantrais, L. (ed.). 2000. *Gendered Policies in Europe. Reconciling Employment and Family Life*. London: Macmillan Press.
– *Potraty*. 2005. Prague: Ústav zdravotnických informací a statistiky.

Articles in periodicals

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

For periodicals that use consecutive page numbering within a volume it is not necessary to indicate the issue number.

Chapter contributions

Daly, M. 2004. 'Family Policy in European Countries.' In *Perspectives on Family Policy in the Czech Republic*, pp. 62–71. Prague: MPSV ČR.

Electronic sources

1. Specify the medium (on-line, CD ROM, database, data set, CD)
2. date downloaded [cit. 29. 10. 2005]
3. web address (<http://www.czso.cz>)

Conference papers

Maur, E. '*Problems with the Study of Migration in the Czech Lands in Early Modern History.*' Paper presented at the conference 'The History of Migration in the Czech Lands during the Early Modern Period. Prague, 14. 10. 2005.

References

The list of references must be in alphabetical order. References to two or more works by the same author are listed in order of the year of publication. If two or more publications by one author date from the same year, distinguish between them adding the letter a, b, c, etc. to the year of publication. Example:

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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