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CHANGES IN THE SEASONAL DISTRIBUTION OF BIRTHS AND DEATHS IN 1750—1984 IN CENTRAL MORAVIA (CZECHOSLOVAKIA)

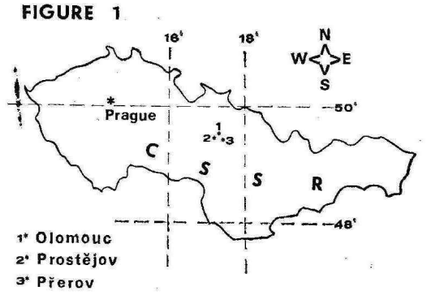
ABSTRACT — The problems of secular changes in the seasonal distribution of births and deaths have been studied for some time. The secular trends have been investigated from many aspects—dependence on weather, economic conditions, seasons in sexual activity, marriage rate, etc. Previously the seasonal distribution of births and deaths was studied separately. In the present work both problems are studied together, in one set of subjects.

KEY WORDS: Seasonal distribution of births and deaths — Secular trends — Relation between birth and death — Central Moravia — Czechoslovakia.

MATERIAL AND METHOD

The material for this paper was provided by the dates of births and deaths of 47,725 persons (25,733 men and 21,992 women) from Central Moravia, Czechoslovakia. The data on the births and deaths were obtained from municipal cemeteries in Olomouc, Prostějov and Přerov in 1979—84 (see Fig. 1). These cities are situated about 200 metres above sea level. The set comprises the data of the people born between 1700 and 1984. As the oldest years were not numerous enough, people who were born after 1750 or who died after 1800 were included in the survey. Frequencies of births and deaths in each month were corrected according to the number of days in the month. The index obtained in this way expressed the percentage of people born or deceased over the period of 30.4375 days of the corrected month. Percentual monthly indexes were then expressed in three months moving averages. According to the year of birth or the year of death all persons were divided into groups comprising the years 1750—99, 1800—49, 1850—99, 1900—49 and 1950—84.

FIGURE 1



RESULTS

I. Seasonal distribution of births in 1750—1984

Differences in the frequencies of births in various months of the year were first noticed by Villermé (1831). This author analyzed what was at that time an immense amount of data — 17 million births of people from the whole of Europe — from Petrograd to Sardinia. Quételet (1835) was the next researcher to deal with this problem. In this connection we would like to divert a little from the main problem. In some later works the names and surnames of the two authors were quoted as M. Villermé and M. Quételet, although their correct initials should be L. R. Villermé and A. L. Quételet. The mistake is apparently due to inattention. In early 19th century the author's name on the title page was given as "par M. Villermé", which means "par Monsieur Villermé" (or "par Monsieur Quételet"), and the authors then misquoted the first names.

The seasonal distribution of births is shown in Graphs 1—3. From the graphs it follows that the increased frequency of births can be observed in nearly all investigated groups in the period ranging from February to May. Only in the group "men" and in the group "both sexes" in the period of 1950—84 is the maximum of births in June. The early peaks in the groups are less prominent. Certain increase in frequency of births can be observed in the autumn (it is especially noticeable in men). When we compared the birth frequencies in each quarter of the year, we arrived at analogical conclusions (see *Table 1*). Except for the group of men from the years 1950—84, the first quarter (i.e. the 2nd—4th months of the year)

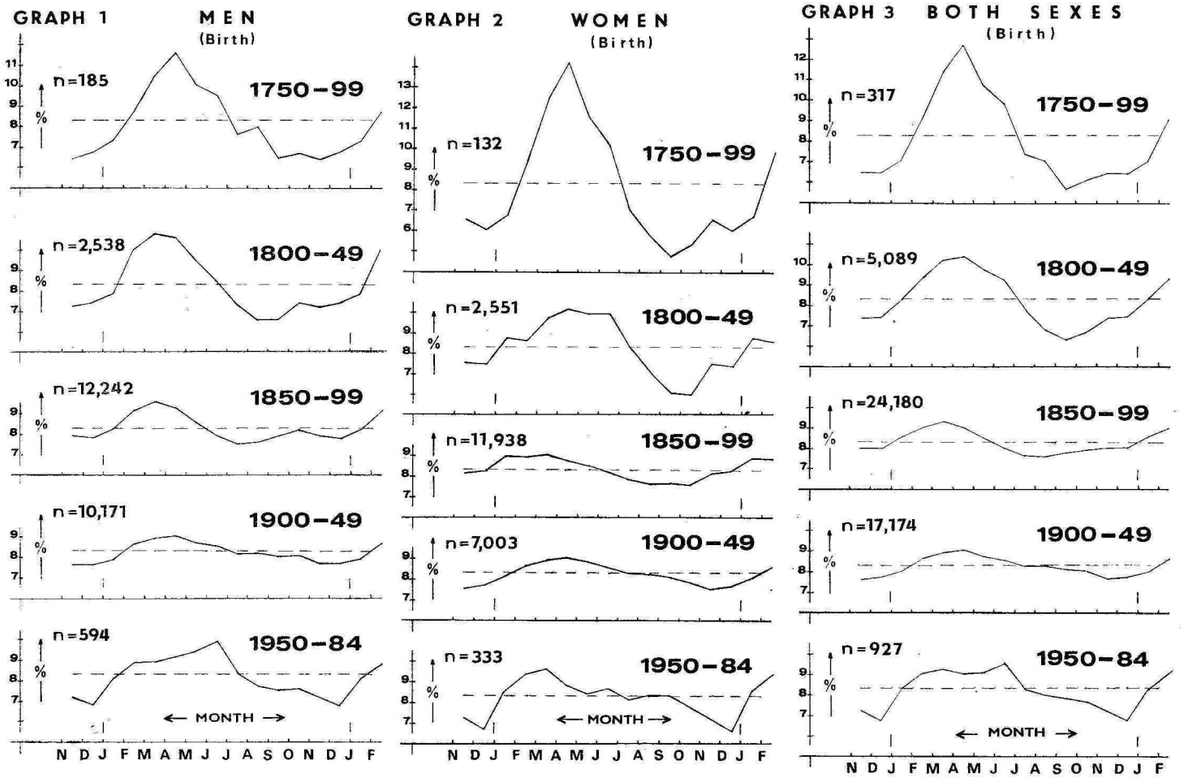


TABLE 1. *Frequency of births in various phases of the year — each quarter of the year in %*

Group	Men				Women				Both sexes			
Quarter	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
Month	2.—4.	5.—7.	8.—10.	11.—1.	2.—4.	5.—7.	8.—10.	11.—1.	2.—4.	5.—7.	8.—10.	11.—1.
1750—99	30.90	27.34	21.15	20.61	36.04	28.87	15.79	19.30	33.05	27.97	18.92	20.06
1800—49	31.44	25.35	20.62	22.59	28.57	28.36	19.28	23.78	30.00	26.87	19.94	23.19
1850—99	28.05	24.16	23.76	24.03	26.80	24.68	23.10	25.42	27.41	24.42	23.44	24.73
1900—49	26.66	25.48	24.45	23.40	26.56	25.76	24.28	23.40	26.62	25.60	24.38	23.40
1950—84	27.07	27.79	22.97	22.17	27.82	25.28	24.48	22.42	27.33	26.90	23.50	22.27

always ranks first. In 1950—84 the spring peak both in the group "men" and in the group "both sexes" is clearly extended into the summer period.

The differences in the seasonal distribution of births between the year's phases are put e.g. by Mayr (1914) into a relationship with increased procreative activity in the spring and early summer and then again in December ("behagliche Winterruhe, Feststimmung"). On the other hand, Gini (1912) says that in various nations the maximum of births falls into the 1st—3rd, 2nd—3rd, or as late as the 4th — 6th months and thus we cannot speak of increased procreative activity during the spring only.

The results achieved in the present work agree with the conclusions of the other authors. For the period 1750—1825 Villermé (1831) puts the peak of births mostly into the spring months, especially March. The exceptions are Sweden, Finland, and the cities of Copenhagen and Petrograd, with maximum frequencies of births in September and October, or perhaps in August (see *Table 2*). For the region of Görlitz in 1675—1816, Miura and Richter (1981) also report mostly prominent double — peak curves, with the spring peak usually predominating. Miura, Richter, Hori and Shimura (1982) give for the Heidelberg region in 1592—1900 much smoother curves of seasonal distribution, with one prominent peak — the spring. This corresponds to our own conclusions. Boháč (1928 and 1937) says that in 1923—27 the increased number of births could be observed from February to June, with the maximum of births in March and April, which agrees with our own findings. As we said above,

TABLE 2. *Frequency of births after Villermé 1831. (Months are listed according to the decreasing frequency of birth.)*

Region	Years	Months	
		Maximum	Minimum
Saint Pétersbourg	1814—18	10, 1, 3	6
Suéde	1747—60	9. 3. 1	6
Suéde et Finlande	1775—95	9, 3, 1	7
Ville de Copenhague	1711 1788—1807	8, 5, 2 3, 5, 1	11 8
Anciens départements francais	1810—1812	3, 1, 2	6
Francfort sur le Mein	1821—23	3, 1, 4 et 12	10
Ville de Munich	1791—1800	3, 8, 1	11 et 4
Royaume de Wurtemberg	1821—25	1, 3, 11 et 10	6
Toute la France	1817—24	3, 1, 2	6
Ville de Paris	1669—1788	3, 1, 2	6
Dép. de la Seine	1807—17	3, 4, 1	6
Montmorency	1700—70	3, 1, 11	6
Ville de Meaux	1790—97	1 et 12, 4	6
Hollande Toutes les Villes Toutes les communes rurales	 1815—26 1815—26	 3, 1, 2 3, 1, 2	 7 7
Vevey, en Suisse	1704—64	1, 2, 3	6
Anciens départ. des Etats Sardes at de l'Italie	1810—13	3, 2, 1	6
Ville de Florence	1451—1774	3, 1, 2	6

for years 1950—84 the late spring to summer peak is characteristic of our population. Similar conclusions were made in the study of data of the Czechoslovak Federal Bureau of Statistics for this period. Also Richter, Miura and Nakamura (1982) put the peak for boys and girls born in 1970 in Görlitz into the spring and summer. Also Shimura, Richter and Miura (1981) found out the summer peak in the population of Osaka in 1971—75. The registered shift of the maxima in seasonal distribution of births must be connected, in our opinion, with the increased procreative activity in the period from June to September, i.e. when most people take their holidays.

It is interesting to note that in 1831 Villermé found out that in most northern regions of Europe in 1750—1825 the peaks of birth frequencies were in September, October and August. Also Shimura, Richter and Miura (1981) find a remarkable late autumn peak in Osaka in this period, and so does Cowgill (1966) for the northern parts of the USA.

When we follow the curves of seasonal distribution of births in each fifty-year period, we find out the maximum and minimum values in earlier periods differed more than they do now. This fact was noticed by Srb, Kučera and Růžička (1971) and explained to a certain degree by the opposing trends — partly because at present some families plan the birth of the child, partly because 40 % of children are born before nine months have elapsed from the wedding, that is, it is a not planned parenthood. Also inside marriage many children are born in an unplanned way. Swoboda (1977) confirms that in one third of just getting married couples the child is already expected and that there is high accumulation of births in the 5th—7th months of the marriage. In our opinion, however, the smoother curve in the patterns of the last 50—100 years is a statistical, not only a biological and social phenomenon. With a greater amount of data the curves become smoother, with no prominent ups and downs. This opinion is supported by the study of curves by Miura, Richter, Hori and Shimura (1982), who find that curves based on the data from several thousand people are smoother than curves consisting of data provided by a few hundred people only.

Graphs 1—3 reveal another interesting fact: in all examined groups the frequency of births is lower in December than in January. The question is, how much this is due to biology and how much, especially in earlier times, it was affected by other factors, e.g. manipulation of data. This problem cannot be solved any more. Benini as early as 1896 and 1913 pointed out that in Italy there was a custom to record in children born in the last few days of December the date of birth to the first of January of the next year. The same finding was made by Livi (1929). For the population of Czechoslovakia Boháč (1928 and 1936) confirmed a decrease of births between 27th and 31st of December, 1925—30, and an increase in the number of births on the 1st or 2nd January the next year. Boháč (1936) adds that this intentional falsification of dates can be proved by comparing the dates of births of children announced by the parents with the dates announced by midwives in their own notifications of births. The reason that made the parents shift the dates is obvious from the aspect of "practical use" — the military service can start one year later, and girls become "younger" by one year.

This manipulation of dates can also be due to the belief that some months or even some day (!) is lucky or unlucky. Boháč (1936) says that still greater shifts of births than those at the end of the year can be found in April births. Births from late April were shifted to early May. In 1925—30 May 1 was in Czechoslovakia the day with the record number of births. Over that period on January 1 a total of 2,702 children, but on May 1 a total of 2,955 children was born. Although it was thus proved that some births from late December were shifted to January 1, on that day 9.36 % fewer children were born than on May 1.

Also on the thirteenth day of each month in the period of 1925—30 according to Boháč (1936) fewer children (as many as 4σ fewer) were born than was the average of the other days — again "thanks to" the parents and their manipulation of the dates (number 13 is regarded to be unlucky).

Even though in the present work there is a greater frequency of births in April than in May — in each investigated group, the question is how much the manipulation and shift in the dates in the earlier

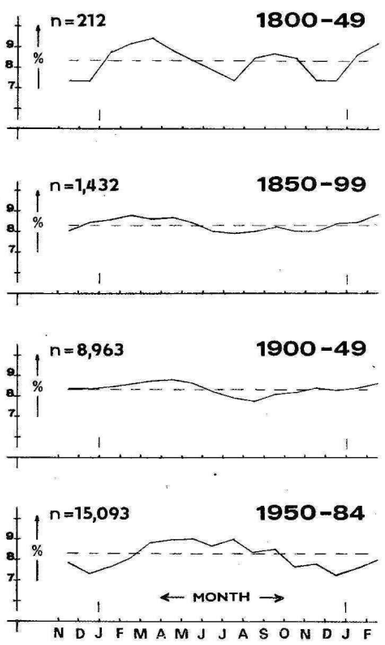
fifty years affect the conclusions made by us as well as the other authors. Manipulation of dates went on in other countries as well. An interesting falsification was shown up to exist in Italian population by Livi (1929), who points out that religious festivals have a great attraction. For instance, the curve of births of girls in the province of Syracuse suddenly dropped on the 16th and 17th December and rose on the 18th December. On the 18th December celebrations are held of the feast of St Lucia, the patroness of Syracuse, and so the date of birth of many girls born one or two days earlier was shifted to 18th December. To a smaller degree the attraction of this feast could be demonstrated on the curves of births of boys. The most interesting fact about it is that the day which is really dedicated by Church (see the church calendar) to Santa Lucia is December 13, but in the province of Syracuse the folk festival is held and the day is celebrated on the 18th December.

II. Seasonal distribution of deaths in 1800—1984

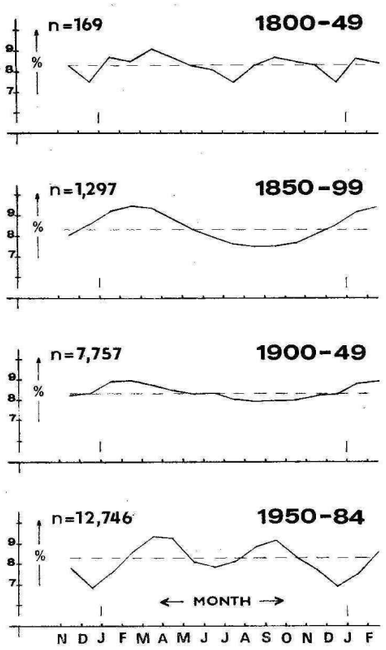
Because of the small amount of data available before 1800, the seasonal distribution is studied only for the period after 1800. The seasonal distribution of deaths in each fifty-year period is shown by Graphs 4—6. The evaluation of the frequency curves of deaths during the year reveals basically the same trends in men and in women. The maxima of death are in the spring months: February—April in men and February—March in women. In men there is a certain drop in November and then also in June, July and September. In women the minimum is in November too, then in June and September. In the men of the 1950—84 group a certain increase in the frequency of death can be found at the turn of the summer and autumn. The question is why this increase. For example Palát and Štukovský (1980) point out to a gradual increase in nonlethal myocardial infarctions during the summer months towards the autumn (after the preceding February maximum). The increase in the death frequency at the turn of summer and autumn is undoubtedly partly due to fatal accidents during the holidays and to other factors.

Our findings agree with long — term trends in death frequency in various phases of the year. For 17th and 18th centuries, Čáňová (1980) observed increased death frequency in the spring, for the 18th century Pražáková (1980) in March to May, for 1750 to 1800 Bělohlávek (1980) in April and August, and for 1750—99 Répasová (1980) in December to March. For Austria—Hungary of the 19th century Madai (1972) reports February as the peak and August as the minimum. For Czechoslovakia Boháč (1928) reports March, April, and sometimes May as the peaks. The latter author believes that the minimum is far less prominent and appears in summer till autumn months; from December the death frequency begins to rise, reaching the maximum in March and April. The data of the Czechoslovak Federal Bureau of Statistics for 1950—84 agree with our own findings. The maxima of deaths are in these sources mostly specified as March to April, less often some other months, e.g. December and January. When we

GRAPH 4 MEN (Death)



GRAPH 5 WOMEN (Death)



GRAPH 6 BOTH SEXES (Death)

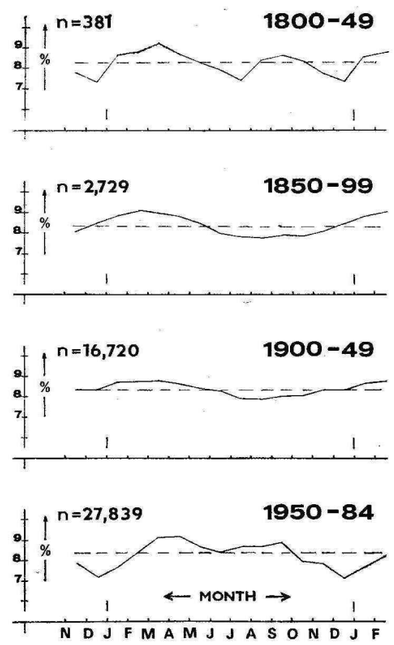


TABLE 3. *Frequency of deaths in various phases of the year — each quarter of the year in %*

Group	Men				Women				Both sexes			
Quarter	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
Month	2.—4.	5.—7.	8.—10.	11.—1.	2.—4.	5.—7.	8.—10.	11.—1.	2.—4.	5.—7.	8.—10.	11.—1.
1800—49	27.35	23.58	25.63	23.44	26.23	23.87	25.44	24.46	26.87	23.72	25.54	23.87
1850—99	26.16	24.41	24.33	25.10	27.60	23.90	22.64	25.86	26.84	24.18	23.54	25.44
1900—49	26.13	24.70	24.02	25.15	26.11	24.66	23.82	25.41	26.12	24.68	23.93	25.27
1950—84	25.87	26.72	24.60	22.81	27.17	24.12	26.37	22.34	26.46	25.56	25.40	22.58

evaluate each quarter according to the diminishing death frequency, then both in men and women the first quarter (i.e. the 2nd to 4th month of the year) ranks first. See *Table 3.*

III. Relation between the month of the birth and the month of the death

In the present paper is also studied the problem whether there is a certain "coincidence" between the month of the birth and the month of the death. For the study of this relationship three fifty-year periods (1800—49, 1850—99, and 1900—49), with the largest number of people, were chosen. The persons were classified into these groups according to the year of their birth, irrespective of the year they died in. In the tables is given horizontally the month of the death, vertically the month of the birth. Thus in each person there are 144 slots of classification according to the month of his or her birth and death. This is the Cartesian product of two variables getting their values in the set of months January—December. In *Tables 4—9* are given absolute frequencies of differences between the month of death and the month of birth.

TABLE 4. *Absolute frequencies of differences between the month of death and month of birth — men born in 1800—49*

		Month of death												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
Month of birth	1	18	18	20	20	20	21	13	10	13	22	17	20	212
	2	30	15	14	20	31	17	16	9	16	21	13	12	214
	3	18	23	32	27	27	20	29	26	45	50	19	15	331
	4	25	24	23	28	20	13	19	17	21	36	21	14	261
	5	22	18	18	17	17	19	24	6	42	19	12	13	227
	6	15	15	21	16	19	15	18	17	29	32	14	21	232
	7	9	15	14	16	14	14	18	18	24	24	10	17	193
	8	7	11	10	13	16	6	12	18	17	12	9	8	139
	9	7	7	18	18	14	12	17	18	16	23	12	11	173
	10	23	21	16	24	13	21	11	10	14	15	12	16	196
	11	14	17	14	14	16	13	7	16	19	20	28	16	194
	12	17	12	18	16	19	8	13	7	10	21	13	12	166
Total		205	196	218	229	226	179	197	172	266	295	180	175	2,538

TABLE 5. *Absolute frequencies of differences between the month of death and month of birth — men born in 1850—99*

		Month of death												Total
		1	2	3	4	5	6	7	8	9	10	11	12	
Month of birth	1	102	76	120	89	94	71	70	71	86	80	78	84	1,021
	2	100	93	89	90	98	89	80	79	88	90	67	83	1,046
	3	103	111	99	113	101	106	86	94	129	107	97	108	1,254
	4	110	93	103	100	105	81	101	69	78	109	91	112	1,152
	5	112	82	95	71	75	95	96	85	90	83	73	82	1,039
	6	91	84	91	78	76	84	80	65	90	67	75	90	971
	7	69	75	103	72	87	70	84	56	85	93	77	69	940
	8	84	71	74	99	76	59	73	90	68	61	60	70	885
	9	100	85	73	86	83	88	72	73	81	94	87	71	993
	10	108	112	91	110	84	77	70	80	82	92	69	86	1,061
	11	113	68	105	73	74	94	64	50	73	83	73	86	956
	12	82	65	91	65	99	83	68	72	72	67	90	70	924
Total		1,174	1,015	1,134	1.046	1.052	997	944	884	1,022	1,026	937	1,011	12,242

TABLE 6. *Absolute frequencies of differences between the month of death and month of birth — men born in 1900—49*

Month of birth	Month of death 1	2	3	4	5	6	7	8	9	10	11	12	Total
1	83	77	80	98	66	73	79	57	60	65	66	75	879
2	51	74	64	66	76	66	49	58	60	68	64	68	764
3	68	77	101	80	90	75	87	71	102	83	63	84	981
4	82	68	84	71	102	73	81	83	69	71	50	85	919
5	77	66	79	68	82	77	87	73	63	83	63	68	886
6	77	57	77	69	58	65	81	84	62	79	68	66	843
7	73	64	66	87	84	75	83	77	62	92	67	71	901
8	72	78	64	70	60	71	56	70	56	66	60	56	779
9	74	64	79	62	74	64	70	65	73	85	67	66	843
10	66	82	77	67	69	78	92	60	66	75	61	81	874
11	68	64	71	68	77	59	61	58	56	56	52	64	754
12	76	59	56	67	74	55	67	51	55	72	51	65	748
Total	867	830	898	873	912	831	893	807	784	895	732	849	10,171

TABLE 7. *Absolute frequencies of differences between the month of death and month of birth — women born in 1800—49*

Month of birth	Month of death 1	2	3	4	5	6	7	8	9	10	11	12	Total
1	14	22	12	20	9	17	12	8	15	10	13	22	174
2	17	16	20	24	23	17	16	13	19	19	17	25	226
3	14	29	15	23	33	12	20	26	19	34	14	14	253
4	19	11	13	25	28	12	25	19	26	35	21	15	249
5	22	24	19	20	24	25	27	16	32	29	20	25	283
6	10	24	16	18	22	18	19	17	25	28	15	19	231
7	13	12	16	24	11	17	17	20	46	39	12	31	258
8	12	9	16	7	18	10	18	10	17	20	7	12	156
9	9	21	12	14	8	6	12	13	8	15	10	10	138
10	16	20	15	24	19	11	12	8	15	14	11	14	179
11	14	10	15	12	9	14	12	8	11	14	13	11	143
12	30	18	12	25	23	24	25	27	14	24	18	21	261
Total	190	216	181	236	227	183	215	185	247	281	171	219	2,551

TABLE 8. *Absolute frequencies of differences between the month of death and month of birth — women born in 1850—99*

Month of birth	Month of death 1	2	3	4	5	6	7	8	9	10	11	12	Total
1	114	101	86	90	78	74	81	80	77	74	77	94	1,026
2	99	96	77	84	111	84	95	69	73	71	90	95	1,044
3	119	102	81	93	83	86	75	74	71	103	91	102	1,080
4	106	105	103	94	91	72	84	81	77	87	60	91	1,051
5	103	72	93	110	71	84	82	75	83	93	85	93	1,044
6	81	102	82	76	107	71	73	65	77	77	71	74	956
7	79	86	96	99	73	76	75	75	72	81	61	101	974
8	73	83	101	86	78	61	88	82	60	69	59	82	922
9	88	72	81	70	75	67	70	79	65	76	68	70	881
10	112	92	94	87	78	70	72	53	65	83	93	88	987
11	88	72	95	75	85	68	79	63	50	69	64	74	882
12	95	99	106	101	85	85	84	105	76	84	79	92	1,091
Total	1,157	1,082	1,095	1,065	1,015	898	958	901	846	967	898	1,056	11,938

TABLE 9. *Absolute frequencies of differences between the month of death and month of birth — women born in 1900—49*

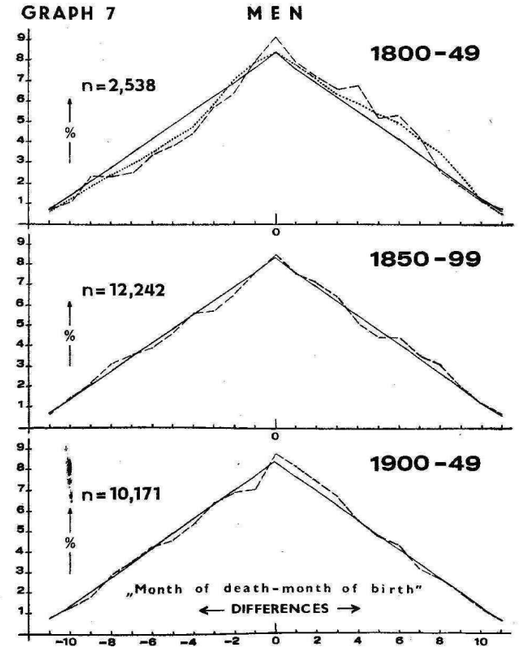
Month of birth	Month of death 1	2	3	4	5	6	7	8	9	10	11	12	Total
1	51	66	48	43	56	52	39	59	37	56	31	59	597
2	47	48	52	42	51	37	50	40	43	56	39	37	542
3	59	51	65	54	58	56	47	58	47	55	53	53	656
4	61	54	40	56	61	37	58	55	47	46	62	54	631
5	48	56	51	42	55	36	63	51	57	60	56	49	624
6	48	50	45	44	65	55	48	39	48	56	43	56	597
7	57	49	54	48	54	43	42	47	48	50	51	53	596
8	60	54	42	48	54	46	49	44	38	52	38	43	568
9	51	38	52	52	51	56	59	47	33	48	50	53	590
10	43	54	61	42	44	47	46	39	34	50	51	50	561
11	43	51	43	39	45	32	42	38	36	42	37	50	498
12	55	48	54	47	45	41	50	51	39	44	35	34	543
Total	623	619	607	557	639	538	593	568	507	615	546	591	7,003

Table 10 surveys the differences between the month of death and the month of birth. The differences can reach values ranging from −11 to +11. The table is transformed into triangular Graphs 7 and 8, where each subject is defined by a monodimensional index, that is the difference "month of death — month of birth". This factual frequency is expressed by a dashed line.

Table 11 expresses the theoretically expected frequencies of differences between the month of death and the month of birth. This table is corrected according to the number of days in each month. The theoretically expected probability H_o in this table is derived when two assumptions are valid:

1. The death and birth are two mutually independent phenomena.
2. There are not seasonal fluctuations in births and deaths.

The probability H_o that a subject selected by chance was born in the month "i" and died in the month "j", $i, j \in (1, 2, \ldots, 12)$ equals the product $\frac{d(i)}{365} \cdot \frac{d(j)}{365}$, where $d(i)$ and $d(j)$ are the numbers of days in months "i" and "j". The curves of theoretically expected frequencies derived from this table are expressed by a full line in Graphs 7 and 8.



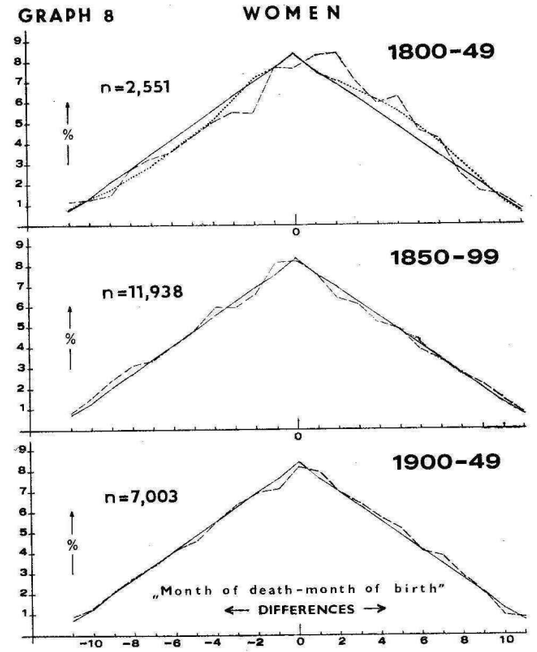


TABLE 10. *Frequencies of differences between the month of death and month of birth*

		Differences												
		−11	−10	−9	−8	−7	−6	−5	−4	−3	−2	−1	0	1	2	3	4	5	6	7	8	9	10	11
Men																								
1800—49 n = 2,538	n	17	26	58	58	63	86	97	113	145	163	208	232	202	185	169	175	134	136	110	67	50	29	20
	%	0.67	1.02	2.29	2.29	2.48	3.39	3.82	4.45	5.71	6.42	8.00	9.14	7.96	7.29	6.66	6.90	5.28	5.36	4.33	2.64	1.97	1.14	0.79
1850—99 n = 12,242	n	82	178	267	382	432	480	572	694	711	807	932	1,043	931	872	793	642	550	550	439	385	255	161	84
	%	0.67	1.45	2.18	3.12	3.53	3.92	4.67	5.67	5.81	6.59	7.61	8.52	7.61	7.12	6.48	5.24	4.49	4.49	3.59	3.15	2.08	1.32	0.69
1900—49 n = 10,171	n	76	127	186	294	355	429	462	534	641	697	707	894	824	756	683	567	484	439	318	276	213	134	75
	%	0.75	1.25	1.83	2.89	3.49	4.22	4.54	5.25	6.30	6.85	6.95	8.79	8.10	7.43	6.71	5.57	4.76	4.31	3.13	2.73	2.09	1.32	0.74
Women																								
1800—49 n = 2,551	n	30	32	38	69	83	91	110	127	141	188	196	195	211	215	177	149	160	118	107	63	41	38	22
	%	1.18	1.25	1.49	2.71	3.25	3.57	4.31	4.98	5.53	5.41	7.68	7.64	8.27	8.43	6.94	5.84	6.27	4.63	4.19	2.47	1.61	1.49	0.86
1850—99 n = 11,998	n	95	187	290	376	399	500	568	716	715	784	977	988	897	769	733	621	585	467	409	330	266	172	94
	%	0.80	1.57	2.43	3.15	3.34	4.19	4.76	6.00	5.99	6.57	8.18	8.28	7.51	6.44	6.14	5.20	4.90	3.91	3.43	2.76	2.22	1.44	0.79
1900—49 n = 7,003	n	55	91	148	195	243	291	317	391	443	486	495	579	551	487	448	402	363	284	268	200	148	68	59
	%	0.79	1.30	2.11	2.78	3.47	4.15	4.53	5.58	6.33	6.94	7.07	8.14	7.87	6.95	6.40	5.74	5.18	4.06	3.83	2.86	2.11	0.97	0.84

In the study of Graphs 7 and 8 we find that curves of real and theoretically expected frequencies of differences between the month of death and the month of birth in 1850—99 and 1900—49 differ only very little. This also corresponds to our conclusions made in the study of the season rate of births and deaths in the investigated periods — see *Tables 5, 6, 8, 9.* The curves expressing the seasonality of births and deaths in these periods are without any prominent ups and downs. Greater deviations in curves of real and theoretically expected frequencies are found in 1800—49. This conclusion corresponds to the curves expressing the seasonality of births and deaths, which are derived from *Tables 4 and 7.*

To verify whether these deviations in curves in Graphs 7 and 8 are due to some interrelationship between the month of death and the month of birth or whether they are due to the fluctuation of births and deaths in each season of the year, we chose the fifty years of 1800—49, when these differences in the curves are the greatest. Therefore we made *Table 12 and 13,* in which the independence of the months of birth and death is assumed but the seasonality established for births and deaths is respected. The tables were constructed from percentages from *Tables 4 and 7,* corrected to the length of the month. The resulting product in each slot of *Tables 12 and 13* was divided by 10,000. The curves derived from *Tables 12 and 13* are expressed in Graphs 7 and 8 by a dotted line. The curves depart from the curves of theoretically expected frequencies analogically as the curves of real frequencies. It can be thus concluded that the results achieved agree well with the hypothesis of independence of the seasons of birth and death, i.e. that the person who was born in a particular month has the same chance to die in any month, like the person who was born in a different month. The mutual deviations of curves in Graphs 7 and 8 are thus only a manifestation of the seasonal fluctuation of births and deaths and not an outcome of any dependence of the two phenomena.

CONCLUSION

In this paper was studied the seasonality of births and deaths in a set of 47,725 persons from Central Moravia, Czechoslovakia.

Increased frequency of births was observed in the period of February to May. In some groups a certain increase can be observed in the autumn. Only in the group of "men" and in the group of "both sexes" in the period 1950—84 the peak of births is shifted to the month of June.

Increased frequency of deaths can be observed in men in February to April, in women in February to March. A smaller increase in curves can be observed in the autumn. The minima of deaths in the groups mostly occur in November. In the 1950—84 group the maximum of deaths in "men" shifted to May.

Our findings are in good agreement with the conclusions of other authors.

Finally we studied the possibility of the existence of a relationship between the year's phase of birth

TABLE 11. *Theoretically expected frequencies of differences between the month of death and month of birth on the assumption of an independence of the month of death from the month of birth and nonexistence of seasonality of death and birth*

Month of birth	Month of death											
	1	2	3	4	5	6	7	8	9	10	11	12
1	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213
2	0.006 515	0.005 885	0.006 515	0.006 305	0.006 515	0.006 305	0.006 515	0.006 515	0.006 305	0.006 515	0.006 305	0.006 515
3	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213
4	0.006 981	0.006 305	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981
5	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213
6	0.006 981	0.006 305	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981
7	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213
8	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213
9	0.006 981	0.006 305	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981
10	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213
11	0.006 981	0.006 305	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981	0.006 981	0.006 755	0.006 981	0.006 755	0.006 981
12	0.007 213	0.006 515	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213	0.007 213	0.006 981	0.007 213	0.006 981	0.007 213

TABLE 12. *Theoretically expected frequencies of differences between the month of death and month of birth on the assumption of an independence of the month of death from the month of birth and respecting the seasonality of death and birth — men born in 1800—49*

Month of birth	Month of death											
	1	2	3	4	5	6	7	8	9	10	11	12
1	0.006 519	0.006 830	0.006 929	0.007 518	0.007 183	0.005 872	0.006 257	0.005 471	0.008 452	0.009 386	0.005 913	0.005 569
2	0.007 228	0.007 572	0.007 682	0.008 335	0.007 963	0.006 510	0.006 937	0.006 065	0.009 371	0.010 406	0.006 556	0.006 174
3	0.010 108	0.010 667	0.010 820	0.011 741	0.011 217	0.009 170	0.009 772	0.008 544	0.013 199	0.014 657	0.009 234	0.008 697
4	0.008 302	0.008 699	0.008 824	0.009 575	0.009 147	0.007 478	0.007 781	0.006 967	0.010 764	0.011 953	0.007 580	0.007 092
5	0.006 981	0.007 314	0.007 419	0.008 051	0.007 691	0.006 288	0.006 700	0.005 858	0.009 051	0.010 050	0.006 332	0.005 964
6	0.007 371	0.007 723	0.007 834	0.008 501	0.008 121	0.006 639	0.007 075	0.006 186	0.009 556	0.010 612	0.006 686	0.006 297
7	0.005 938	0.006 222	0.006 311	0.006 848	0.006 542	0.005 349	0.005 699	0.004 983	0.007 699	0.008 549	0.005 386	0.005 073
8	0.004 275	0.004 479	0.004 543	0.004 930	0.004 709	0.003 850	0.004 103	0.003 587	0.005 542	0.006 154	0.003 877	0.003 652
9	0.005 500	0.005 763	0.005 846	0.006 343	0.006 060	0.004 954	0.005 279	0.004 616	0.007 131	0.007 919	0.004 989	0.004 699
10	0.006 034	0.006 322	0.006 413	0.006 958	0.006 648	0.005 435	0.005 791	0.005 063	0.007 823	0.008 687	0.005 473	0.005 154
11	0.006 169	0.006 463	0.006 556	0.007 114	0.006 797	0.005 557	0.005 921	0.005 177	0.007 998	0.008 881	0.005 595	0.005 270
12	0.005 102	0.005 346	0.005 423	0.005 884	0.005 622	0.004 596	0.004 897	0.004 282	0.006 615	0.007 346	0.004 628	0.004 359

TABLE 13. *Theoretically expected frequencies of differences between the month of death and month of birth on the assumption of an independence of the month of death from the month of birth and respecting the seasonality of death and birth — women born in 1800—49*

Month of birth	Month of death											
	1	2	3	4	5	6	7	8	9	10	11	12
1	0.004 898	0.006 110	0.004 663	0.006 285	0.005 849	0.004 871	0.005 541	0.004 764	0.006 579	0.007 243	0.004 556	0.005 641
2	0.006 974	0.008 700	0.006 640	0.008 949	0.008 328	0.006 936	0.007 890	0.006 783	0.009 368	0.010 313	0.006 487	0.008 033
3	0.007 120	0.008 883	0.006 779	0.009 136	0.008 503	0.007 081	0.008 055	0.006 925	0.009 565	0.010 529	0.006 623	0.008 201
4	0.007 237	0.009 029	0.006 890	0.009 286	0.008 643	0.007 197	0.008 187	0.007 039	0.009 722	0.010 702	0.006 732	0.008 336
5	0.007 961	0.009 932	0.007 579	0.010 215	0.009 507	0.007 917	0.009 006	0.007 743	0.010 694	0.011 772	0.007 405	0.009 169
6	0.006 718	0.008 381	0.006 396	0.008 620	0.008 023	0.006 681	0.007 600	0.006 534	0.009 025	0.009 934	0.006 249	0.007 738
7	0.007 259	0.009 056	0.006 911	0.009 314	0.008 669	0.007 219	0.008 212	0.007 060	0.009 751	0.010 734	0.006 752	0.008 361
8	0.004 386	0.005 472	0.004 176	0.005 628	0.005 238	0.004 362	0.004 962	0.004 266	0.005 892	0.006 486	0.004 080	0.005 052
9	0.004 013	0.005 007	0.003 821	0.005 150	0.004 793	0.003 991	0.004 540	0.003 903	0.005 391	0.005 935	0.003 733	0.004 623
10	0.005 037	0.006 284	0.004 795	0.006 463	0.006 015	0.005 009	0.005 698	0.004 899	0.006 766	0.007 448	0.004 685	0.005 801
11	0.004 159	0.005 189	0.003 960	0.005 337	0.004 967	0.004 137	0.004 706	0.004 046	0.005 588	0.006 151	0.003 869	0.004 791
12	0.007 339	0.009 156	0.006 988	0.009 418	0.008 765	0.007 299	0.008 303	0.007 138	0.009 859	0.010 853	0.006 827	0.008 454

and the year's phase of death. Our findings exclude such a relationship. A person born in a particular month has the same probability of dying in any month as the person born in another month.

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