Some epidemiological data on spontaneous abortion in Hungary, 1971-80

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SUMMARY A population based survey of women who had spontaneous abortion in Hungary between 1971 and 1980 has been evaluated. Individual data sheets completed by specialists in obstetrical institutions were used. The ratio of spontaneous abortions was 13.1% during the whole period studied but declined during the decade. The maximum occurrence was in the fifth to eighth week of gestation, when more than 40% of all spontaneous abortions occurred. Thereafter spontaneous abortion ratios decreased gradually with duration of pregnancy. The distribution of spontaneous abortions by calendar month shows characteristic seasonal changes, the minimum values being found from April to July whereas the maximum values were from October to February. The spontaneous abortion ratios increased significantly with the age of mother, over age 40 it approached 50%. They also increased with the pregnancy order, a minimum figure being registered at the first pregnancy of women in their 20s. The risk for women with a history of spontaneous abortion was 33%.

Spontaneous abortion is important from different medical aspects because it may be regarded as the most frequent untoward outcome of pregnancy. Fetal mortality seems to be the most definite manifestation of Darwinian selection¹; the changing occurrence of spontaneous abortions may modify the birth prevalence of congenital anomalies,^{2,3} so that the monitoring of congenital abnormalities^{4,5} will require the continuous evaluation of spontaneous abortions. The spontaneous abortion ratio has been justified as a useful health index in epidemiological studies of possible environmental hazards to man.⁶⁻⁸ Furthermore, the new Hungarian population policy, which came into force on 1 January 1974 (restricting the social indications of the previously liberal Abortion Law, 1956⁹), prompted us to study its consequences, as an experimental epidemiological model.

Definitions, materials, and methods

Spontaneous abortions are recognised and reported fetal deaths before the gestational age of 28 weeks when gestation is calculated from the first day of the

last menstrual period.¹⁰

Total births are live births plus late fetal death after 28 weeks, called stillbirths. *Total pregnancies* are total births plus spontaneous abortions and induced abortions. Multiple pregnancies are counted for each fetus delivered and hence total births and total pregnancies will exceed the number of women pregnant, but in Hungary the number of recognised multiple pregnancies are fewer than 1% of pregnant women, consequently the bias introduced is not great. Ectopic pregnancies are fewer than 4 per 1000 and are omitted altogether.

The *spontaneous abortion ratio* is the ratio of the number of spontaneous abortions to the number of total births plus spontaneous abortions; the *spontaneous abortion pregnancy ratio* is the ratio of the number of spontaneous abortions to total pregnancies; the *spontaneous abortion births ratio* is the ratio of spontaneous abortions to total births.

The data on spontaneous abortions were obtained from all the Hungarian obstetrical institutions where virtually all women having a spontaneous abortion should be treated, as in Hungary nearly 100% of all deliveries take place in hospital. Each patient was

interviewed by a physician or a trained member of the hospital staff in the department of obstetrics after the event. A pathological examination was performed on only one third of fetuses as this is compulsory only in the case of infant death.

The usual problems of measuring spontaneous abortions have to be considered. If a woman is not admitted to hospital the case is not registered. Misclassification may occur; either an illegal induced abortion may be registered as a spontaneous abortion or a live birth of less than 28 weeks' gestation who dies within a few minutes may be registered as a fetal death. Women worried about the signs of a threatened abortion may prefer to choose an induced abortion and thus the case is registered as an induced abortion though she would probably have had a spontaneous abortion. Other women who had a pregnancy terminated before the twelfth week might have aborted spontaneously later.

Results

Table 1 shows the outcome of all pregnancies in Hungary for 1971-80 and table 2 gives the various ratios for spontaneous abortions and the proportion of stillbirths and of very low birth weight to total births. The total number of pregnancies declined steadily from 368 000 in 1971 to 250 000 in 1980 and the proportion of induced abortions fell from 50% in 1971 to 30% in 1975, at which level it remained until 1980 when there was a slight increase to 32%. Live births rose from 150 000 in 1971 to 194 000 in 1975 and then fell to 149 000 in 1980. The spontaneous abortion pregnancy ratio seemed to remain constant over the decade except for a temporary rise in the period 1974-6. By contrast the spontaneous abortion birth ratio fell constantly until 1979 and then rose slightly in 1980. The spontaneous abortion ratio averaged 13.1% in the decade but fell

Table 1 *Pregnancy outcomes in Hungary, 1971-80*

Year	Induced abortions		Spontaneous abortions		Stillbirths		Live births		Total pregnancies
	No	%	No	%	No	%	No	%	
1971	187 425	50.9	28 450	7.7	1 519	0.4	150 640	40.9	368 034
1972	179 035	49.5	28 191	7.8	1 423	0.4	153 265	42.3	361 914
1973	169 650	47.7	28 171	7.9	1 399	0.4	156 224	44.0	355 444
1974	102 022	31.8	30 717	9.6	1 669	0.5	186 288	58.1	320 696
1975	96 212	30.0	28 244	8.8	1 607	0.5	194 240	60.7	320 303
1976	94 720	30.8	26 271	8.5	1 511	0.5	185 405	60.2	307 907
1977	89 096	30.5	23 504	8.1	1 578	0.5	177 574	60.9	291 752
1978	83 545	30.4	21 701	7.9	1 364	0.5	168 160	61.2	274 770
1979	80 767	30.7	20 509	7.8	1 313	0.5	160 364	61.0	262 953
1980	80 882	32.3	19 972	8.0	1 156	0.5	148 673	59.3	250 683
Total	1 163 354	37.3	255 730	8.2	14 539	0.5	1 680 833	54.0	3 114 456

Table 2 *Spontaneous abortion ratios (%) in Hungary, 1971-80 and some complementary figures*

Year	Spontaneous abortion ratios			Adjusted ratio for maternal age (%)	Adjusted ratio for parity (%)	Stillbirths per 1000 total births	Live births under 1000 g per 1000 live births	Induced abortion for medical reasons§	
	Pregnancy ratio* (%)	Birth ratio† (%)	Ratio‡ (%)					No	%
1971	7.7	18.7	15.8	15.8	15.8	10.0	6.2	5 400	2.9
1972	7.8	18.2	15.4	14.7	14.7	9.2	6.0	4 315	2.4
1973	7.9	17.9	15.2	14.6	14.6	8.9	6.4	3 984	2.3
1974	9.6	16.3	15.0	13.8	13.6	8.9	6.6	11 865	11.6
1975	8.8	14.4	12.6	12.1	12.2	8.2	5.5	10 234	10.5
1976	8.5	14.1	12.3	11.8	11.9	8.1	5.9	9 737	10.3
1977	8.1	13.1	11.6	11.3	11.5	8.8	5.4	10 266	11.5
1978	7.9	12.8	11.3	11.3	11.6	8.0	5.4	10 660	12.8
1979	7.8	12.7	11.3	11.4	11.7	8.1	4.7	13 111	16.2
1980	8.0	13.4	11.8	12.1	12.3	7.7	4.7	12 630	15.6
Total	8.2	15.1	13.1	12.8	12.9	8.6	5.7	92 202	7.9

*Pregnancy ratio = Spontaneous abortion/total pregnancies.

†Birth ratio = Spontaneous abortions/total births.

‡Spontaneous abortion ratio = Spontaneous abortions/total births plus spontaneous abortions.

§Medically induced abortion = Medically induced abortions/total induced abortions.

from 15.8% in 1971 to 11.3% in 1978 and rose to 11.8% in 1980; there was a particularly sharp fall in 1975. The ratio is closely associated with the birth ratio but not with the pregnancy ratio. The point is that the recent Hungarian spontaneous abortion ratio is similar to the 15% expected in other international studies.^{11 12}

The decrease in the spontaneous abortion ratio cannot be explained by changes in the proportion of live birth weights below 1000 g as these did not increase, nor could it be explained by a transfer to late fetal deaths—that is, stillbirths—as these also declined during the decade. We considered that a possible cause might be the decline in the number of older and multigravidae pregnant women so we adjusted the ratio to make allowance for these factors but the trends remained essentially unchanged.

The liberal Abortion Law of 1956 was amended in 1974 when the social indications for legal terminations were much more restrictive but the trend for the spontaneous abortion ratio to decline was not altered but rather there was a sharp drop in 1975 compared with 1974. At the same time the proportion of abortions induced for medical reasons increased sharply. Theoretically, terminations done for medical reasons would have caused a fall in the spontaneous abortion ratio, but we consider that many of these medical indications were not justified either teratologically or genetically.¹³

GESTATIONAL AGE AT SPONTANEOUS ABORTION
Table 3 shows the distribution of spontaneous abortions by gestational age. The proportion with unknown gestational age was 8.5% overall and varied between 20.2% in 1976 and 1.7% in 1980 which complicates the interpretation of the results. The peak incidence was in the second month, week 5–8,

and as this proportion was high at 40.8% (44.5% without unknown cases) it may be accepted with some confidence. In the third month, weeks 9–12, the proportion was 22.7% and in the next four months (weeks 13–27) 24.9%.

The proportion in the first month, 3.1%, is obviously low owing to under-diagnosis as women do not usually visit their doctor before the fourth week of gestation—that is, before the first missed menstrual period. The typical appearance for antenatal care is after eight weeks—that is, after the second missed menses. Nevertheless, the decreasing trend of these figures is striking in the decade studied.

The gestational age at which the termination of pregnancies is carried out may be important for the spontaneous abortion ratio. Nearly 70% of induced abortions occurred in the fifth to eighth weeks of gestation (table 3)—that is, the peak of induced and spontaneous abortions is in the same month of pregnancy. After the twelfth week of gestation the prescribed time limit according to the Abortion Law, induced abortions were rarely (0.7%) recorded.

The Hungarian data are inconsistent with most previously published figures^{14 15} that the maximum occurrence of reported spontaneous abortions may be observed around the tenth week of gestation. At the same time Hungarian data are in agreement with the recent report of Fantel *et al* in which the weekly means of the 2–8th, 9–13th, 14–18th, and 19–27th weeks of gestation were 65, 16, 19, and 6.¹⁶ Bierman *et al* also found nearly 46% of the total loss during the four to seven weeks after the last menstrual period.¹⁷

MONTHLY VARIATION

There was a significant monthly variation—that is, seasonality in the absolute number of spontaneous abortions (fig 1)—which was tested by χ^2_{11} test for

Table 3 Distribution of spontaneous abortions by gestational age

Year	Week of gestation					Unknown (%)	Total No
	<5 (%)	5–8 (%)	9–12 (%)	13–16 (%)	17–27 (%)		
1971	4.2	44.4	21.7		22.8	6.9	28 450
1972	4.3	43.6	21.7		23.2	7.2	28 191
1973	3.9	43.5	21.5		23.8	7.3	28 171
1974	3.2	40.4	22.8		27.2	6.4	30 717
1975	2.7	40.5	21.2		25.7	9.9	28 244
1976	2.4	34.5	20.0	9.3	13.6	20.2	26 271
1977	2.9	39.0	23.5	10.7	14.9	9.0	23 504
1978	2.8	39.5	24.6	10.8	14.5	7.8	21 701
1979	2.5	38.9	25.8	10.4	15.9	6.6	20 509
1980	1.8	42.3	27.2	11.2	15.8	1.7	19 972
Total	3.1	40.8	22.7		24.9	8.5	255 730
Induced abortion	2.4	68.7	26.9	0.7		1.3	1 163 354

heterogeneity between months, by Edwards's¹⁸ sine test and by the rank sum method of Hewitt *et al* modified by one of us.²⁰ (Firstly, a transformation was introduced taking the monthly fluctuation of births into consideration. Secondly, a statistical estimation applying the least squares' method was given for the model of Edwards. Finally, a mistake in the rank sum method was corrected and a simple enumeration developed for the maximum rank sum.) The minimum of spontaneous abortions occurred from April to July, the maximum from October to February. Taking into consideration the peak of gestational age around the second month of pregnancy, the risk of spontaneous abortion may be lowest after conception from February to May, whereas it is highest after conception from August to December. (This pattern is incongruent with the seasonality of fertility rate which is lower in later winter and higher in late summer.²¹) The minimum stillbirth rate was recorded in July to October, whereas the maximum was from February to May. In stillbirths conception might have occurred eight months earlier, accordingly just the opposite tendency may be observed in the risk of estimated monthly conceptions. These findings show that rather different factors may cause the seasonality of spontaneous abortions and stillbirths. Other investigators also reported on the seasonal variations of spontaneous abortions²²⁻²⁴; however, the seasonality found in this material is more pronounced than in previous publications.

The monthly distribution of induced abortions in 1977-80, also showed a significant variation with lower figures from April to September.

MATERNAL AGE AND PREGNANCY ORDER

Spontaneous abortion ratios increase significantly with the age of the mother. The extent of this trend (table 4), however, is striking: the reported spontaneous abortion ratio approaches 50% in pregnant women over 40. The maternal age effect is more obvious in the induced abortion ratio, thus the spontaneous abortion pregnancy ratio shows a more moderate increasing trend with the advancing age of mothers (fig 2).

Fig 1 Monthly distribution of spontaneous abortions in Hungary 1971-80.

Fig 2 Occurrences of spontaneous and induced abortions by maternal age groups in Hungary 1971-80.

Table 4 Spontaneous abortions ratios percent by maternal age and pregnancy order

Age group	Pregnancy order						Total
	1	2	3	4	5	≥6	
<20	6.8	11.8	18.9	28.6	44.0	46.5	8.6
20-29	6.8	8.3	13.8	18.8	22.8	28.1	10.5
30-39	12.5	11.2	17.5	23.8	27.8	30.3	20.5
≥40	31.0	35.1	46.8	49.6	54.3	46.3	46.1
Total	7.2	9.2	15.45	21.6	26.6	31.6	13.1

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The spontaneous abortion ratios also increase significantly with the advancing pregnancy order (table 4). There is again a significant difference between the spontaneous abortion ratio and their pregnancy ratio in the trend of increase owing to the dramatic rise of induced abortions with advancing pregnancy order (fig 3).

Fig 3 Occurrences of spontaneous and induced abortions by pregnancy order in Hungary 1971–80.

The maternal age distribution of spontaneous abortion ratios as a function of the pregnancy order also shows a characteristic pattern. In the first pregnancy the spontaneous abortion ratios increase linearly with the advancing age of the mother. From the second pregnancy, however, the ratios are higher in the youngest age group under 19 than at ages 20–39. What is more, in the fifth and sixth or later pregnancies the 44.0% and 46.5% ratios registered for those under 19 were similar to the 46.1% ratio recorded in pregnant women over 40. The highest ratio may be found in the group of women in their 40s having their fifth pregnancy (54.3%). The minimum ratio is recorded in the first pregnancy of women aged 20–29 (6.8%).

The parity effect of spontaneous abortion ratio may be observed in almost all maternal age groups. It is linear in the under 19 and 20–29 groups. The spontaneous abortion ratio is especially high in the fourth or later pregnancies.

Spontaneous abortion ratio may be a sensitive index of the optimal maternal age of pregnancy. It has been confirmed by our cross sectional study. The outstanding advantages of women in their 20s and the disadvantages of teenagers and women in their 40s are evident. Nevertheless, contrary to expectation, the lowest value was found in the first and not in the second and third pregnancies. The importance of social factors is also obvious. In Hungary gipsy women may have four or more

pregnancies while still teenagers. Women of lower socioeconomic status may also be found in increased numbers among multigravidae aged over 40. On the other hand, this age group may have an increased proportion of couples with habitual abortion.²⁵ The increase in maternal age dependent spontaneous abortion ratios may effect the risk of prenatal diagnosis. Chromosome analysis of fetal cells is indicated in all pregnant women over 38 in Hungary, and spontaneous abortions after amniocentesis are attributed generally to medical intervention. As there are nearly 50% of spontaneous abortion ratios in pregnant women over 40, many may be due to other causes.

The associations of maternal age with spontaneous abortion had been recognised earlier.^{14 15 26–30} The findings of investigators differ concerning effect of pregnancy order. Roman and Alberman observed a definitely decreasing rate in British female medical doctors,³⁰ whereas Shapiro *et al.*,¹⁴ Harlap *et al.*,¹⁵ and others found an increasing tendency.

OUTCOME OF PREVIOUS PREGNANCY

The outcomes of pregnancies preceding spontaneous abortion was based on the history given by the women. Owing to the lack of adequate control groups, these figures were compared with national means of 1971–80. Out of 255 730 women who had had spontaneous abortions, 49 728 had no previous pregnancy and 16 110 index cases had no data. The distribution of previous pregnancy outcomes in the remaining 189 822 spontaneously aborted pregnant women was induced abortions 68 116; spontaneous abortions 40 870; stillbirths 1330; and livebirths 79 576 (within the latter the number of live births with birth weight below 2500 g was 5405; however, the birth-weight was unknown in 9284 live births). The percentage of induced abortions (35.9) in the previous pregnancy was not higher than the national figure in the 1970s. In 33.6% of spontaneous abortions studied the previous obstetrical event had also been a spontaneous abortion. This is about 2.6 times the population figure (13.1%). The previous pregnancy outcome for 1.1% was a stillbirth, which was about 1.3 times the Hungarian figure (0.86%). Strikingly, the 4.4% of known low birth weight infants in previous pregnancy lags far behind the national 11% value. The pregnancy outcomes of all previous pregnancies showed an obvious tendency for spontaneous abortions to recur. The expected figures of one, two, three, and four or more previous spontaneous abortions were 16 399, 2148, 281, and 42, whereas the observed figures were 42 823, 14 522, 5599, and 4366. The differences are three, seven, 20, and at least 104 showing the relative risks.

In general the medical importance of spontaneous

abortions is underestimated. Anomalies of the surviving offspring raise more serious problems for society than those "selected out" prenatally. Nevertheless, in order to prevent all types of birth defects more attention should be attributed to the medical analysis of spontaneous abortions.³¹

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