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The Recent Trends in Multiple Births and Stillbirth Rates in Japan

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Abstract. The twinning rate remained nearly constant up to 1968, then decreased in 1974 and gradually increased with the year. The triplet birth rate remained nearly constant up to 1974, then increased up to 1982, where the rate was 1.8 times higher than in 1968, and decreased thereafter. On the other hand, the quadruplet birth rate remained nearly constant up to 1968, was eightfold in 1975, then decreased until 1984 and suddenly increased to 8 per million births in 1985. The higher multiple birth rates since 1974 was attributed to the higher proportion of mothers treated with ovulation-inducing hormones in Japan. The stillbirth rates decreased to 2/5 for male twins and to 1/3 for female twins during the 25-year period from 1960, to 2/5 for triplets and to 1/5 for quadruplets during the 34-year period from 1951.

Key words: Twinning rates, Multiple birth rates, Stillbirth rates

INTRODUCTION

It is well-known that the use of ovulation-inducing hormones brings a high rate of multiple births [13]. In Japan, ovulation-inducing hormones have been used since 1966, and since January 1975 the use of HMG (human menopausal gonadotropin) has been covered by the health insurance system. Bromocriptine has been commercially available since 1979. Accordingly, a higher multiple birth rate is expected, and the present study focuses attention on recent trends in multiple birth rates in Japan.

MULTIPLE BIRTH DATA

Imaizumi and Inouye [4,6] reported secular trends of multiple birth rate according to zygosity during the period from 1955 to 1967 and 1974 in Japan. The rates of MZ and DZ twin births and of triplet births slightly decreased during this period, whereas that of trizygotic triplets tripled. The rate of quadruplets was 3.5 times higher in 1974 than in 1951 to 1968 [8]. In this analysis, data were obtained from published vital statistics for the period 1951-1968[9]. Vital statistics on multiple births have also been available in computer files since 1968, and in this study the computerized data between 1974 and 1985 were analysed and compared with the previous trends. Another source of data is the "Survey on Socio-Economic Aspects of Vital Events-Plural Births in 1975" [10], the details of which were reported elsewhere [4].

SECULAR CHANGES IN MULTIPLE BIRTH RATES

Table 1 and Fig. 1 show the secular changes in the rates of twin births from 1951 to 1968 and from 1974 to 1985. The twinning rate per 1,000 births was 6.43 in 1951 and remained nearly constant up to 1968. The rate then decreased to 5.79 in 1974 and gradually increased to 6.53 in 1985.

Table 2 and Fig. 1 show the secular changes in the rates of triplet births during the periods 1951 to 1968 and 1974 to 1985. The triplet rate was nearly constant up to 1974, where the rate per million births was 58.3. The rate gradually increased with the year up to 1980 (76.2) rapidly increased up to 1982 (103.8), and decreased thereafter. The rate in 1982 was significantly higher than the rates from 1974 to 1980.

Table 3 and Fig. 2 show the secular changes in the rate of quadruplet births per million births. The average rate from 1951 to 1968 was 0.93, then increased to 3.27 in 1974 and 7.49 in 1975, and decreased thereafter. The differences between the average rate from 1951 to 1968 and the rates for the seven years, 1974-76, 1978-79, and 1981-82, are statistically significant at the 5% level.

Obviously administration of ovulation-inducing hormones has resulted particularly in higher multiple birth rates since 1974. In a nation-wide survey in Japan, Kurachi et al [11] examined the effect on the multiple birth rate of the ovulation-inducing hormones (combined use of HMG and human chorionic gonadotropin) during the period from 1975 to 1979. The multiple birth rate following treatment with HMG-HCG therapy was 20.5%, with 13% for twins, 4.4% for triplets, 1.76% for quadruplets, 1.10% for quintuplets, and 0.22% for sextuplets. On the other hand, the multiple birth rates were 4.5% for treatment with clomiphene and 1.1% for that with bromocriptine [1], both of which are less than a quarter of that resulting from the treatment with HMG-HCG. In the present study, the rate of multiple births has been declined since 1983 for triplets and since 1976 for quadruplets. According to Aono [2], the proportion of mothers treated with bromocriptine at the Osaka University Hospital has been gradually increasing with the year and the proportion is slightly higher than that of HMG-HCG treated mothers after 1981 (Fig. 3). The decline of the rates can be attributed to the change in the treatment, but no data are available as to trends in the treatment for all of Japan. According to Aono [3] another cause of the decline may be the combined use of estrogen monitoring and ultrasonic scan-

Table 1 - Secular change of twinning rate, 1951-1968 and 1974-1985

Year	Live births			Fetal deaths				Total	Twinning rate per 1,000 births
	Males	Females	Total	Males	Females	Unknown	Total		
1951	—	—	23,088	—	—	—	7,198	30,286	6.43
1952	—	—	21,326	—	—	—	6,688	28,014	6.34
1953	—	—	19,525	—	—	—	6,581	26,106	6.33
1954	—	—	18,869	—	—	—	6,441	25,310	6.47
1955	—	—	17,889	—	—	—	6,195	24,084	6.29
1956	—	—	17,410	—	—	—	6,040	23,450	6.36
1957	—	—	16,855	—	—	—	5,959	22,814	6.54
1958	—	—	17,386	—	—	—	6,248	23,634	6.43
1959	—	—	17,094	—	—	—	6,064	23,158	6.40
1960	8,198	8,353	16,551	3,157	2,484	126	5,767	22,318	6.25
1961	8,391	8,497	16,888	3,198	2,534	168	5,900	22,788	6.44
1962	8,623	8,640	17,263	3,104	2,397	144	5,645	22,908	6.38
1963	8,823	8,764	17,587	3,122	2,414	153	5,689	23,276	6.34
1964	9,646	9,375	19,021	2,889	2,275	151	5,315	24,336	6.46
1965	9,699	9,878	19,577	2,643	2,141	171	4,955	24,532	6.18
1966	7,626	7,731	15,357	2,391	1,787	161	4,339	19,696	6.53
1967	10,932	10,878	21,810	2,503	1,951	160	4,614	26,424	6.34
1968	10,321	10,201	20,522	2,190	1,797	185	4,172	24,694	6.13
1974	10,757	10,742	21,499	1,672	1,372	241	3,285	24,784	5.79
1975	10,342	10,273	20,615	1,590	1,162	243	2,995	23,610	5.89
1976	9,863	9,929	19,792	1,538	987	220	2,745	22,537	5.82
1977	10,026	10,189	20,215	1,449	1,057	232	2,738	22,953	6.20
1978	9,977	9,696	19,673	1,309	954	252	2,515	22,188	6.18
1979	9,659	9,783	19,442	1,324	968	273	2,565	22,007	6.38
1980	9,456	9,435	18,891	1,192	859	223	2,274	21,165	6.40
1981	9,351	9,275	18,626	1,188	783	255	2,226	20,852	6.48
1982	9,217	9,389	18,606	1,166	748	276	2,190	20,796	6.53
1983	9,222	9,229	18,451	1,079	765	302	2,146	20,597	6.52
1984	8,975	9,295	18,270	1,131	729	291	2,151	20,421	6.54
1985	8,718	8,894	17,612	1,073	631	295	1,999	20,053	6.53

ning of the ovary follicles. Taymor [12] reported a lower multiple birth rate with estrogen monitoring, and in Japan this was introduced in 1983. The scanning of the ovary of follicles has become widely used in Japan since 1983. The administration dose of the ovulation-inducing hormones can be adjusted by the combined use of estrogen monitoring and the ultrasonic scanning methods.

STILLBIRTH RATE IN MULTIPLE BIRTHS

According to Imaizumi and Inouye [5], the stillbirth rates in both MZ and DZ twins gra-

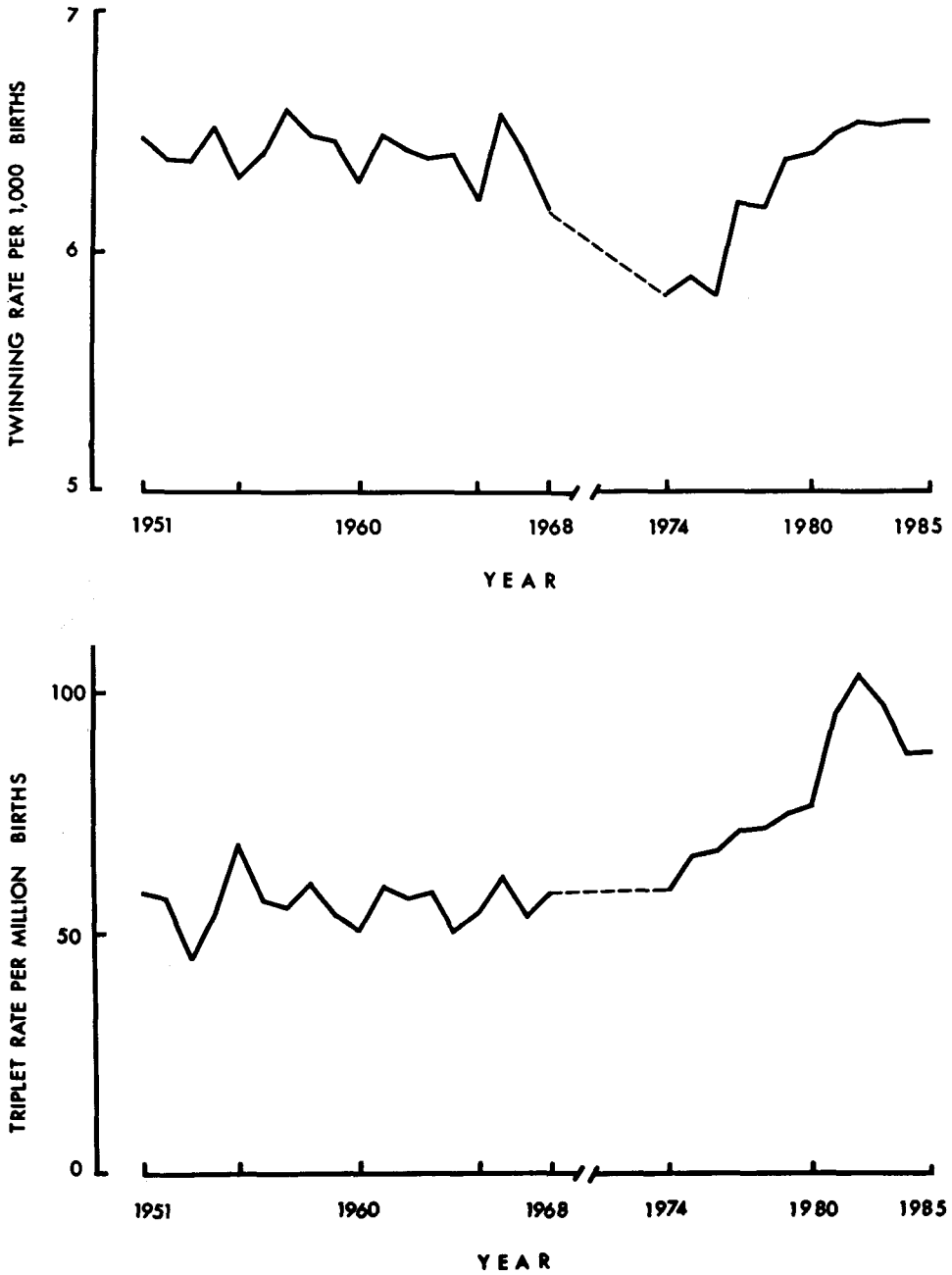


Fig. 1 - Secular change of birth rates in twins and triplets during 1951-1968 and 1974-1985.

Table 2 - Secular change of triplet rate, 1951-1968 and 1974-1985

Year	Live births			Fetal deaths				Total	Triplet rate per million births
	Males	Females	Total	Males	Females	Unknown	Total		
1951	—	—	191	—	—	—	217	408	58.13
1952	—	—	165	—	—	—	210	375	56.95
1953	—	—	139	—	—	—	134	273	44.43
1954	—	—	121	—	—	—	188	309	52.99
1955	—	—	193	—	—	—	197	390	68.00
1956	—	—	125	—	—	—	181	306	55.67
1957	—	—	131	—	—	—	157	288	55.44
1958	—	—	129	—	—	—	198	327	59.67
1959	—	—	112	—	—	—	173	285	52.89
1960	53	63	116	77	68	3	148	264	49.61
1961	55	56	111	104	91	3	198	309	58.60
1962	64	72	136	77	88	2	167	303	56.60
1963	78	75	153	76	82	4	162	315	57.59
1964	67	81	148	67	64	0	131	279	49.67
1965	78	95	173	64	81	3	148	321	54.24
1966	62	80	142	55	70	6	131	273	60.70
1967	85	97	182	58	84	6	148	330	53.10
1968	—	—	199	—	—	—	152	351	58.43
1974	98	133	231	65	61	15	141	372	58.30
1975	114	160	274	68	50	4	122	396	65.89
1976	125	147	272	42	62	12	116	388	66.84
1977	136	146	282	56	41	13	110	392	70.64
1978	145	172	317	32	29	8	69	386	71.66
1979	131	153	284	51	46	5	102	386	74.59
1980	148	141	289	43	38	8	89	378	76.16
1981	170	191	361	38	51	13	102	463	95.94
1982	183	180	363	68	52	13	133	496	103.75
1983	157	165	322	46	37	25	108	430	90.68
1984	156	162	318	47	31	12	90	408	87.06
1985	133	174	318	47	31	12	90	408	87.06

Table 3 - Secular change of quadruplet rate, 1951-1968 and 1974-1985

Year	Live births			Fetal deaths				Total	Quadruplet rate per million births
	Males	Females	Total	Males	Females	Unknown	Total		
1951	—	—	0	—	—	—	0	0	0
1952	—	—	4	—	—	—	4	8	0.91
1953	—	—	0	—	—	—	0	0	0
1954	—	—	0	—	—	—	8	8	1.02
1955	2	0	2	7	11	0	18	20	2.61
1956	2	0	2	4	6	0	10	12	1.63
1957	0	0	0	4	8	0	12	12	1.72
1958	0	0	0	4	4	0	8	8	1.09
1959	0	0	0	0	0	0	0	0	0
1960	0	0	0	0	0	4	4	4	0.56
1961	4	0	4	4	0	0	4	8	1.13
1962	0	3	3	0	1	0	1	4	0.56
1963	0	0	0	0	0	0	0	0	0
1964	6	0	6	6	8	0	14	20	2.65
1965	0	0	0	4	0	0	4	4	0.50
1966	0	0	0	8	0	0	8	8	1.33
1967	0	4	4	4	0	0	4	8	0.96
1968	3	1	4	0	0	0	0	4	0.50
Subtotal	—	—	29	—	—	—	99	128	0.93
1974	7	4	11	9	4	4	17	28	3.27
1975	18	26	44	8	8	0	16	60	7.49
1976	9	9	18	11	5	4	20	38	4.91
1977	3	0	3	9	8	0	17	20	2.70
1978	9	13	22	4	4	0	8	30	4.18
1979	14	14	28	0	0	4	4	32	4.64
1980	4	4	8	4	4	0	8	16	2.42
1981	7	9	16	3	1	0	4	20	3.11
1982	11	15	26	0	5	0	5	31	4.86
1983	8	8	16	0	0	0	0	16	2.53
1984	8	3	11	0	1	4	5	16	2.56
1985	12	17	29	8	7	4	19	48	8.00

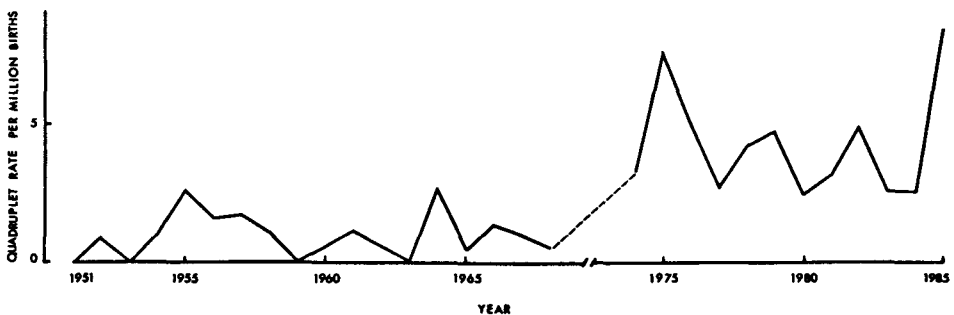


Fig. 2 - Secular change of birth rate in quadruplets during 1951-1968 and 1974-1985.

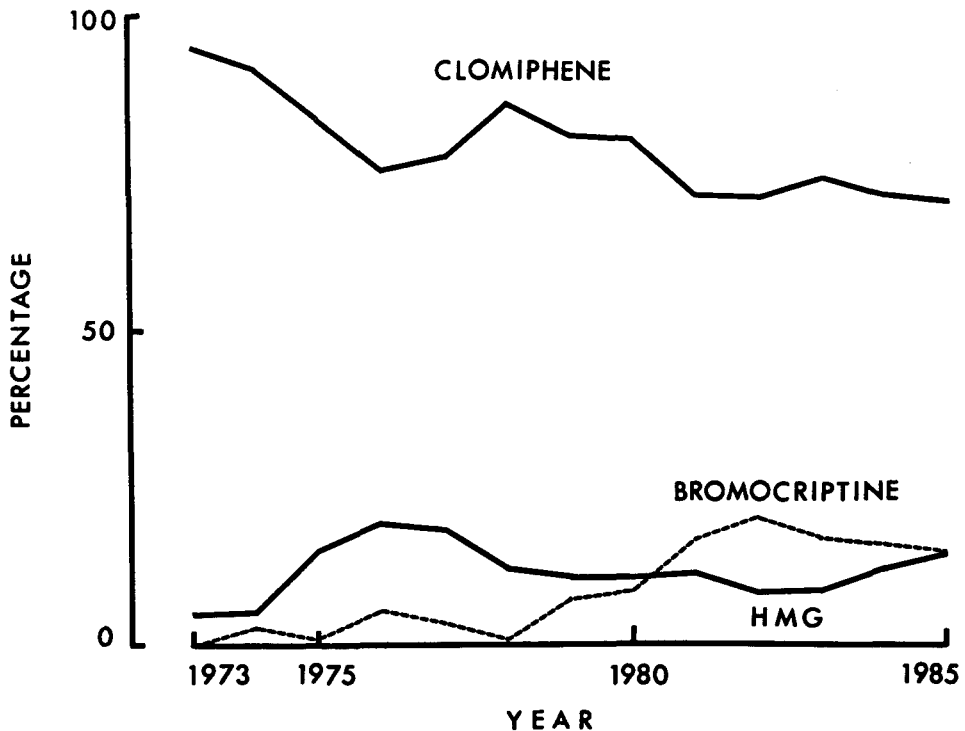


Fig. 3 - Secular change in proportions of mothers treated with three kind of ovulation-inducing hormones at the Osaka University Hospital during 1973-1985.

dually decreased from 1960 to 1967 and in 1974. The rate was higher in MZ than DZ twins, and higher in males than females. The secular trends of stillbirth rates in like-sexed triplets was similar to that in twins, whereas the rate in unlike-sexed triplets remained almost constant for the entire period [7]. The rate was higher in like-sexed than unlike-sexed triplets.

Table 4 shows the secular changes in the stillbirth rates in twin births from 1951 to 1968 and from 1974 to 1985. The rate increased significantly with the years up to 1961, and decreased thereafter. Table 4 and Fig. 4 show secular trends of the stillbirth rate of twins according to sex from 1960 to 1967 and from 1974 to 1985. The rates for male and female twins are 0.278 and 0.229 in 1960, 0.135 and 0.113 in 1974, and 0.110 and 0.066 in 1985, respectively. The stillbirth rates gradually decreased with the years in both sexes, and they decreased to $2/5$ for males and to $1/3$ for females during the 25-year period from 1960. The stillbirth rate is 1.18 to 1.66 times higher in male than in female twins in each year, which is statistically significant.

Table 4 also shows secular changes of the stillbirth rate in triplet births during the same period. The stillbirth rate in triplet births slightly increased from 1951 up to 1961, then gradually decreased up to 1978 and thereafter remained constant at a little higher level. Therefore, the stillbirth rates decreased to $2/5$ during the 34-year period from 1951. Table 4 and Fig. 4 show the stillbirth rate of triplets according to sex during the period from 1960 to 1967 and from 1974 to 1985. The rates for male and female triplets are

Table 4 - Secular change of stillbirth rates for twins and triplets, 1951-1968 and 1974-1985

Year	Twins				Triplets			
	Males	Females	Total ^a	χ^2	Males	Females	Total ^a	χ^2
1951	-	-	0.2377	-	-	-	0.5319	-
1952	-	-	0.2387	-	-	-	0.5600	-
1953	-	-	0.2521	-	-	-	0.4908	-
1954	-	-	0.2545	-	-	-	0.6084	-
1955	-	-	0.2572	-	-	-	0.5051	-
1956	-	-	0.2576	-	-	-	0.5915	-
1957	-	-	0.2612	-	-	-	0.5451	-
1958	-	-	0.2644	-	-	-	0.6055	-
1959	-	-	0.2619	-	-	-	0.6070	-
1960	0.2777	0.2291	0.2584	69.43	0.5923	0.5192	0.5530	1.14
1961	0.2755	0.2297	0.2589	63.61	0.6541	0.6190	0.6408	0.27
1962	0.2643	0.2173	0.2464	69.77	0.5461	0.5500	0.5512	0.002
1963	0.2609	0.2155	0.2444	65.13	0.4935	0.5223	0.5143	0.16
1964	0.2299	0.1951	0.2184	44.33	0.5000	0.4414	0.4695	0.74
1965	0.2137	0.1777	0.2020	49.81	0.4507	0.4602	0.4611	0.003
1966	0.2383	0.1874	0.2203	74.04	0.4701	0.4667	0.4799	0.005
1967	0.1859	0.1518	0.1746	54.35	0.4056	0.4641	0.4485	0.89
1968	-	-	0.1689	-	-	-	0.4330	-
1974	0.1349	0.1133	0.1232	25.34	0.3988	0.3144	0.3790	2.40
1975	0.1333	0.1131	0.1269	55.95	0.3736	0.2381	0.3081	7.88
1976	0.1349	0.0994	0.1218	109.53	0.2515	0.2967	0.2990	0.73
1977	0.1263	0.1037	0.1193	60.00	0.2917	0.2193	0.2806	2.24
1978	0.1160	0.0984	0.1133	41.01	0.1808	0.1443	0.1788	0.68
1979	0.1205	0.0900	0.1166	53.29	0.2802	0.2312	0.2642	0.96
1980	0.1119	0.0834	0.1074	47.80	0.2251	0.2123	0.2354	0.03
1981	0.1127	0.0778	0.1068	71.93	0.1827	0.2107	0.2203	0.39
1982	0.1123	0.0738	0.1053	89.49	0.2709	0.2241	0.2681	1.17
1983	0.1047	0.0765	0.1042	48.50	0.2266	0.1832	0.2512	0.92
1984	0.1119	0.0727	0.1053	91.69	0.2315	0.1606	0.2206	2.71
1985	0.1096	0.0662	0.1019	112.28	0.2176	0.1553	0.2208	2.02

^a Including unknown sexes

roughly the same during the period, with one exception in 1975 where the rate is significantly higher in male than in female triplets.

Table 5 and Fig. 5 show the stillbirth rate of quadruplets from 1951 to 1968 and from 1974 to 1985. The overall rates decreased to 1/5 during the 32-year period from 1951. The stillbirth rates for male and female quadruplet births are also computed. With two exceptions, they are higher in males than females. The difference between males and females is not statistically significant at the 5% level except for the early period of 1955 to 1961.

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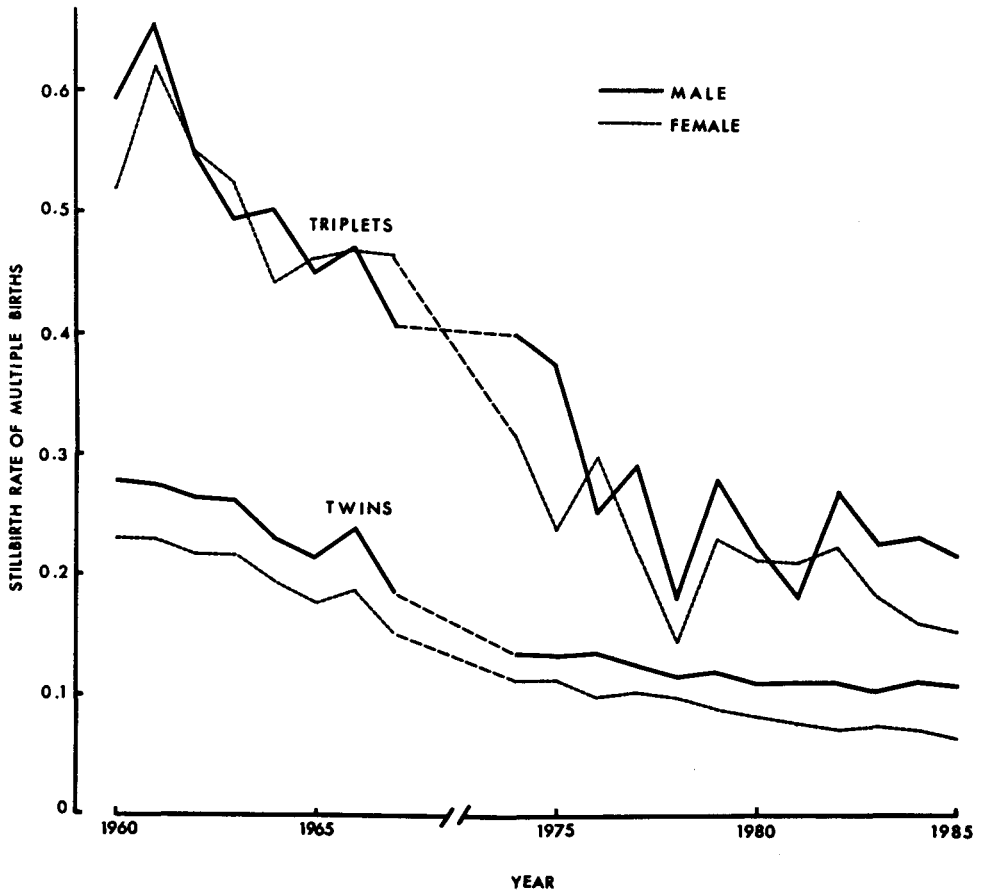


Fig. 4 - Secular changes of stillbirth rates in twins and triplets, for males and females, during 1960-1967 and 1974-1985.

Table 5 - Secular change of stillbirth rate of quadruplets, 1951-1968 and 1974-1985

Year	Males	Females	Total ^a
1951-54	—	—	0.7500
1955-61	0.7419	1.0000	0.8750
1962-68	0.7097	0.5294	0.6458
1974-76	0.4516	0.3036	0.4206
1977-79	0.3333	0.3037	0.3537
1980-82	0.2414	0.2632	0.2537
1983-85	0.2222	0.2222	0.3000

^a Including unknown sexes

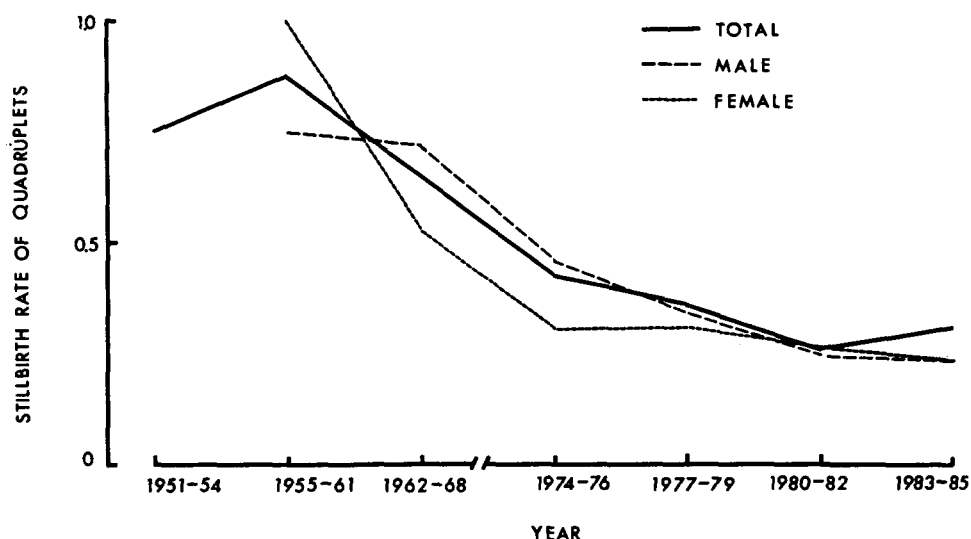


Fig. 5 - Secular change of stillbirth rate in quadruplets for overall, males and females, during 1951-1968 and 1974-1985.

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