



Trends of Twinning Rates in Ten Countries, 1972-1996

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Abstract. Trends of twinning rates were analyzed using vital statistics in Austria, Finland, Norway, Sweden, Canada, Australia, Hong Kong, Israel, Japan, and Singapore during the period from 1972 to 1996. The twinning rates increased significantly year by year in each country. During these periods, the twinning rate increased by twenty percent in Austria and Canada, and by sixty percent in Norway and Sweden. The twinning rate was 1.6 times higher in Sweden than in Hong Kong in 1972 and by eighty percent in Israel in 1995. Twinning rates were higher in European countries, Canada, and Australia than in Asia. The variations of the twinning rates among countries were not only due to biological factors, but also to assisted reproductive techniques. In Australia, the overall twinning rate was 1.3 times higher in the nuptial births (14.1 per 1000 births) than in the ex-nuptial births (10.7) during the period 1994-1996. As for maternal age, twinning rates in Sweden increased year by year for maternal age groups except the youngest and the oldest age groups. In Sweden, the rising twinning rate has been attributed to the higher proportion of mothers (for the 25-39 year old age groups) treated with ovulation-inducing hormones and attributed to in-vitro fertilization.

Key words: Twinning rates, World-wide, Nuptiality, Maternal age

INTRODUCTION

Since 1972, rising twinning rates have been reported in Japan [3, 4], Taiwan [2], Denmark [9], the USA [8] and the UK [6, 10]. Rising twinning rates were only observed in the dizygotic twins in Japan [5], Denmark and England and Wales [6, 9, 10].

The present study focuses attention on trends in the overall twinning rate on a world-wide scale during the period from 1972 to 1996. It also deals with influencing factors on twinning rates.

MATERIALS AND METHODS

In this analysis, data on twin births was obtained by the courtesy of the staff of the Statistics Section in many countries: the Austrian Central Statistical Office, the Health and Welfare Statistics and Information Department in the National Board of Health and Welfare in Sweden, Division of Population Statistics in Finland, Division for Population Statistics in Norway, Division of Health Statistics in Canada, the Australian Bureau of Statistics, the Health and Welfare Statistics and Information Department in Japan, Demographic Statistics Section in Hong Kong, National Registration Department in Singapore, and the Ministry of Health in Israel.

RESULTS

Secular changes in the twinning rate

Table 1 shows the number of twin pairs in six countries and the number of twin births in four countries during the period from 1972 to 1996. Table 2 and Figure 1 show secular changes in the twinning rates in ten countries during that period. The twinning rate in Finland remained nearly constant from 1972 to 1989 (10.4-11.3), and rapidly increased to 14.1 by 1995. With a few exceptions, the twinning rate was the highest in Finland (10.4-14.4) during the examined period. Twinning rates were higher in European countries, Canada, and Australia than in Asian countries. Among western countries including Australia, the rate was lowest in Austria (8.5-11.8) and Canada (9.2- 11.2) during that period. In Australia, the twinning rate was 10.9 per 1000 nuptial live births in 1985 and increased to 14.1 by 1996. Among Asian countries, twinning rates indicated similar values except in Israel during the entire period. During these periods, the twinning rate increased by twenty percent in Canada, by sixty percent in Norway and Sweden, and by eighty percent in Israel. The twinning rate was 1.6 times higher in Sweden than in Hong Kong in 1972 and the corresponding value was 1.8 in 1995. The linear regression coefficients of the twinning rate on the year were statistically significant at 1% level in each country.

Twinning rate by nuptiality in Australia

Table 3 and Figure 2 show twinning rates by nuptiality in states and territories in Australia during the period from 1994 to 1996. Overall twinning rates were thirty percent higher in the nuptial population (14.1) than in the ex-nuptial population (10.7). The ratio of twinning rates in the nuptial births to the ex-nuptial births was the highest in the Northern Territory (1.7) and lowest in Victoria (1.2). Among states and territories, the twinning rate was the highest in South Australia for the nuptial population (15.4) and ex-nuptial (12.0) population.

Table 1 - Number of twin pairs and number of twin births in ten countries, 1972-1996

Year	Number of twin pairs										Number of twin births				
	Austria	Finland	Norway	Canada	Australia	Hong Kong	Japan	Sweden	Israel*	Singapore					
1972	966	-	-	3095	-	449	-	2048	1688	655					
1973	879	-	-	2995	-	508	-	1837	1811	773					
1974	879	-	534	3036	-	546	24784	1816	1916	608					
1975	884	735	538	3129	-	498	23610	1738	-	500					
1976	778	716	515	3209	-	529	22537	1640	-	512					
1977	742	681	468	3181	-	488	22953	1582	1860	502					
1978	744	705	551	3332	-	519	22188	1672	1753	511					
1979	740	664	465	3282	-	501	22007	1872	1798	521					
1980	796	684	473	3428	-	606	21165	1760	1791	483					
1981	813	673	468	3337	-	617	20852	1738	1918	515					
1982	852	701	507	3398	-	645	20796	1712	1928	544					
1983	821	711	468	3461	-	552	20597	1786	1928	518					
1984	784	683	472	3555	-	563	20421	1918	2488	532					
1985	826	696	559	3617	2276	585	19611	1948	2656	606					
1986	801	656	524	3509	2266	522	18798	2153	2752	492					
1987	780	640	586	3701	2206	578	18636	2042	2922	519					
1988	869	693	625	3781	2394	541	18472	2474	2968	702					
1989	897	667	690	4000	2595	506	18147	2444	3146	698					
1990	929	761	747	4108	2520	540	17865	2712	3170	703					
1991	925	770	748	4015	2638	544	18284	2928	3312	726					
1992	1004	858	790	4082	2616	547	18856	3078	-	742					
1993	967	880	808	3976	2712	560	19288	3272	3710	769					
1994	1083	929	847	4255	2701	536	21324	3025	3647	753					
1995	1048	879	910	4255	2651	597	21058	2952	4073	812					
1996	1019	-	886	-	2592	516	22188	-	4233	821					

* Numbers of live twins

Table 2 - Twinning rates per 1000 births in ten countries, 1972-1996

Year	Austria*	Finland	Norway	Canada	Australia	Hong Kong	Japan	Sweden	Israel	Singapore
1972	9.20	-	-	9.15	-	5.54	-	9.06	9.77	6.54
1973	8.89	-	-	8.94	-	6.13	-	8.32	10.13	7.94
1974	8.95	-	8.88	8.96	-	6.48	5.79	8.21	10.18	6.97
1975	9.35	11.25	9.47	8.91	-	6.20	5.89	8.34	-	6.21
1976	8.83	10.77	9.56	9.13	-	6.69	5.82	8.29	-	5.94
1977	8.60	10.43	9.13	8.97	-	6.06	6.20	8.19	9.67	6.49
1978	8.65	11.09	10.58	9.48	-	6.38	6.18	8.92	9.39	6.43
1979	8.51	10.54	8.95	9.15	-	6.08	6.38	9.68	9.54	6.35
1980	8.70	10.92	9.20	9.44	-	7.07	6.40	9.03	9.45	5.82
1981	8.61	10.68	9.18	9.17	-	7.07	6.48	9.20	10.21	6.05
1982	8.94	10.68	9.83	9.27	-	7.45	6.53	9.19	9.91	6.34
1983	9.06	10.70	9.32	9.42	-	6.60	6.52	9.69	9.71	6.35
1984	8.75	10.57	9.34	9.59	-	7.25	6.54	10.17	12.56	6.36
1985	9.40	11.17	10.87	9.79	10.89	7.65	6.53	9.85	13.29	7.09
1986	9.17	10.90	9.93	9.56	11.19	7.26	6.49	10.52	13.78	6.38
1987	8.99	10.76	10.80	10.16	11.02	8.23	6.61	9.71	14.67	5.92
1988	9.83	11.01	10.81	10.18	12.00	7.14	6.72	11.00	14.69	6.60
1989	10.07	10.60	11.58	10.33	12.97	7.23	6.97	10.49	15.53	7.29
1990	10.23	11.70	12.20	10.26	12.28	7.94	7.00	10.90	15.28	6.85
1991	9.74	11.87	12.24	9.92	13.32	7.94	7.18	11.79	15.59	7.36
1992	10.50	12.98	13.09	10.18	13.03	7.67	7.50	12.49	-	7.48
1993	10.12	13.71	13.48	10.18	13.88	7.91	7.82	13.82	16.45	7.63
1994	11.68	14.41	14.03	10.98	14.07	7.45	8.32	13.44	15.85	7.57
1995	11.77	14.08	15.03	11.19	14.09	8.66	8.58	14.22	17.35	8.32
1996	11.42	-	14.48	-	14.07	8.13	8.90	-	17.44	8.42

* per 1000 live births

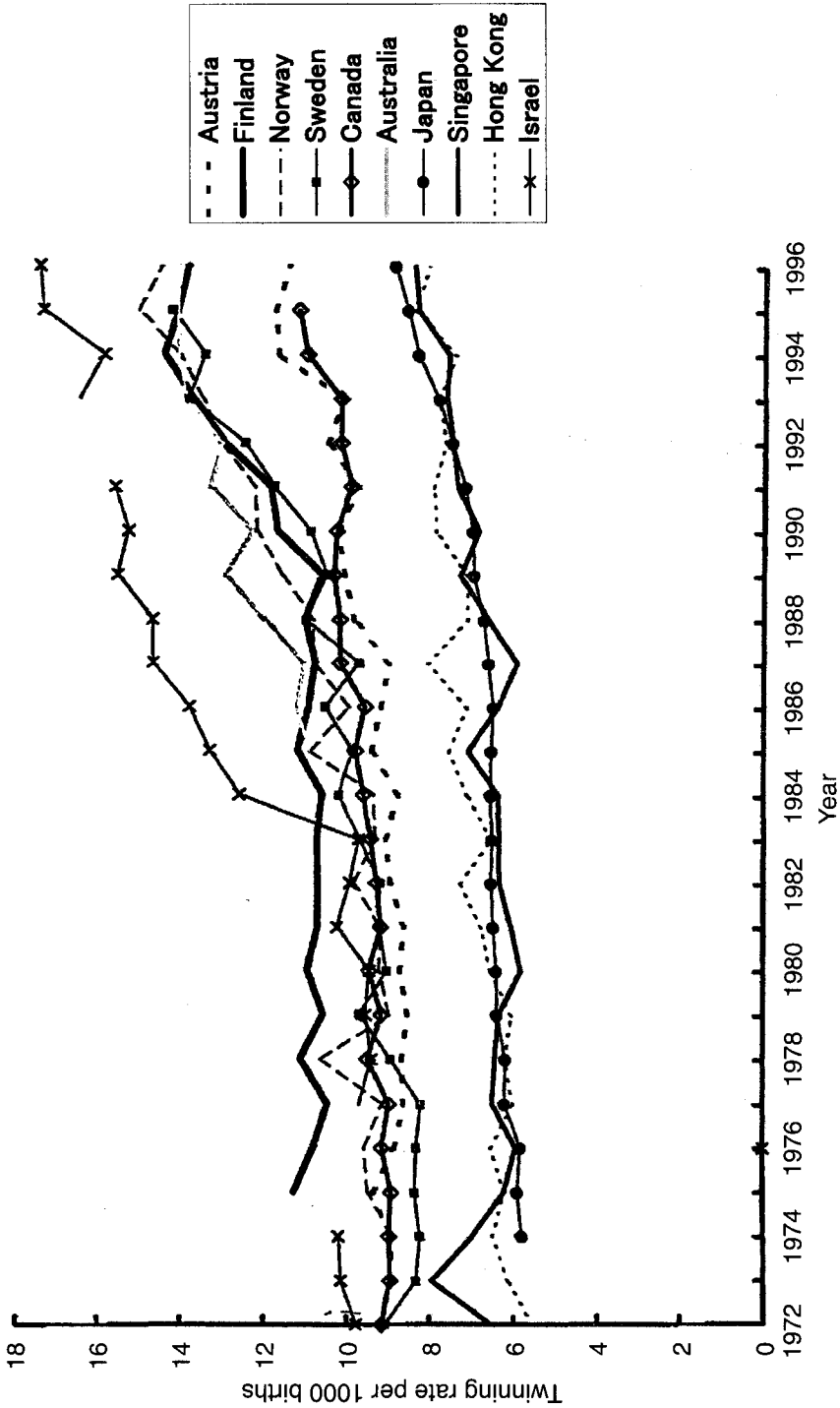


Fig. 1 - Secular changes in twinning rates in ten countries during the period from 1972 to 1996

Table 3 - Number of twin pairs and twinning rates by nuptiality in states and territories in Australia, 1994-1996

States and Territories	Nuptial					Ex-nuptial				
	1994	1995	1996	Total	Twinning Rate	1994	1995	1996	Total	Twinning Rate
New South Wales	917	890	879	2686	13.64	244	233	209	686	10.48
Victoria	735	715	658	2108	14.27	144	160	167	471	11.79
Queensland	452	437	447	1336	13.75	150	118	159	427	9.77
South Australia	210	222	207	639	15.35	54	58	82	194	11.99
Western Australia	265	257	259	781	14.82	69	76	79	224	10.02
Tasmania	64	57	73	194	14.53	12	27	21	60	9.20
Northen Territory	22	27	16	65	13.83	26	22	26	74	8.00
Australian Capital Territory	35	46	53	134	13.42	9	14	10	33	10.05
Total	2701 *	2651	2592	7944	14.08	708	708	753	2169	10.65

* Including a pair of twins in other territories

Effect of maternal age on twinning rates in Sweden

Table 4 shows secular changes in twinning rates by maternal age in Sweden during the period from 1972 to 1995. The rates for the youngest group (under 20 years old) and the oldest group (over 40 years old) remained constant during that period. Twinning rates for the 20 to 24 and 35 to 39 year old age groups remained nearly constant from 1972 to 1983 and gradually increased thereafter. The rates significantly increased year by year for these maternal age groups. The twinning rates increased by eighty percent for the 35-39 year old age group, by sixty percent for the 30-34 year old age group, and by forty percent for the 25-29 year old age group from the period from 1972-1983 to 1995.

DISCUSSION

Pollard [7] studied the twinning rates of 14 ethnic groups in California, the USA during the period from 1982 to 1988. Twinning rates were 13.2 for African Americans, 10.1 for whites, and 7.2 for Asians. Similarly, before the introduction of fertility drugs, the twinning rate was highest in blacks, intermediate in Caucasians, and lowest in Orientals [1]. In the present study, the overall twinning rate increased in ten countries during the period from 1972 to 1996, where the twinning rate was higher in Caucasians

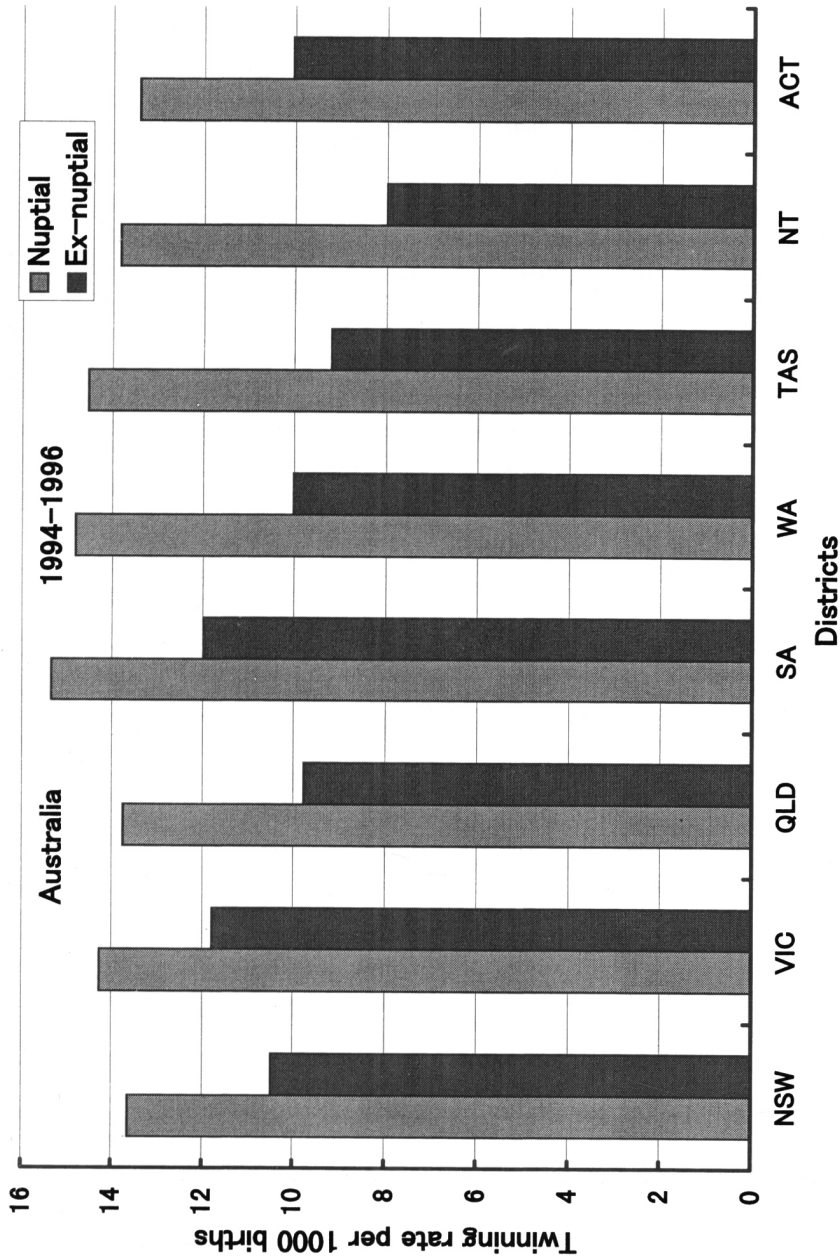


Fig. 2. Twinning rates by nuptiality in states and territories in Australia during the period from 1994 to 1996. NSW stands for New South Wales, VIC for Victoria, QLD for Queensland, SA for South Australia, WA for Western Australia, Tas for Tasmania, NT for Northern Territory, and ACT for Australian Capital Territory.

Table 4 - Number of twins and twinning rate by maternal age in Sweden, 1972-1995

Year	Maternal age						Total
	Under 20	20-24	25-29	30-34	35-39	Over 40	
	Number of twins						
1972-73	206	1007	1602	736	272	62	3885
1974-75	202	890	1436	776	222	28	3554
1976-77	140	796	1254	806	206	20	3222
1978-79	120	820	1334	940	294	36	3544
1980-81	86	728	1300	906	420	58	3498
1982-83	94	682	1228	1042	396	56	3498
1984-85	74	738	1412	1096	480	66	3866
1986-87	56	839	1502	1188	534	76	4195
1988-89	86	842	1690	1484	722	94	4918
1990-91	90	908	2009	1823	710	100	5640
1992-93	70	806	2218	2044	1080	132	6350
1994-95	56	674	2090	1975	1044	138	5977
	Twinning rate per 1000 births						
1972-73	5.97	6.82	9.41	10.74	12.78	13.29	8.69
1974-75	6.31	6.65	8.70	10.38	10.99	7.35	8.27
1976-77	5.68	6.85	8.49	10.23	10.22	5.97	8.24
1978-79	6.17	7.75	9.45	10.94	11.86	9.58	9.31
1980-81	5.02	7.20	9.33	9.86	13.98	13.73	9.11
1982-83	6.36	7.48	9.02	11.61	11.71	11.43	9.44
1984-85	5.87	8.14	9.91	11.45	12.55	10.20	10.01
1986-87	4.51	8.44	9.98	11.34	13.21	10.20	10.11
1988-89	6.49	7.58	10.21	12.90	16.23	11.10	10.74
1990-91	6.02	8.01	10.84	14.54	14.59	10.59	11.34
1992-93	5.81	8.15	11.89	16.22	21.43	14.00	13.14
1994-95	6.13	8.39	12.71	16.23	21.62	15.55	13.81

than in Asians in each year. Recently, HMG (or hMG: human menopausal gonadotropin) has been used for ovulation-inducing hormones and the *IVF*. The number of multiple births by the *IVF* method has increased yearly [4]. According to Imaizumi [5], the rising dizygotic twinning rate has been attributed to the higher proportion of mothers treated with the ovulation-inducing hormones and partially attributed to the *IVF* in Japan. On the other hand, the monozygotic twinning rate remained constant during the

examined period [2, 5]. After the introduction of the assisted reproductive techniques such as the *IVF*, the natural twinning rate has been changing depending on how popular these techniques have been in each country. Namely, variations of twinning rates among countries were not only due to biological factors, but also to assisted reproductive techniques.

In Victoria (Australia), the *IVF* method is allowed only in nuptial couples (Infertility Medical Procedure ACT, 1984). Then the twinning rate is higher in nuptial couples (14.3) than in ex-nuptial couples (11.8). The same tendency was obtained in other states and territories of Australia, where the twinning rate was higher in nuptial couples (1.3-1.7 fold) than ex-nuptial couples. On the other hand, in Austria, the *IVF* method is not only allowed in nuptial couples but also in ex-nuptial couples (Bundesgesetzblatt für die Republik Österreich, 1992, SS. 1299-1304). However, twinning rates in Austria were rather lower among western countries.

In Sweden, the overall twinning rate increased by sixty percent from 1972 to 1995, where the rates increased by seventy percent for the 35-39 year old age group and by fifty percent for the 30-34 year old age group (see Table 4). Similar tendency was seen in England and Wales [10], Denmark [9], and Japan [5]. Then, in the present studies, the rising twinning rate may be attributed to the higher proportion of mothers (for the 30 years old and over) treated with ovulation-inducing hormones and the *IVF* in the nine countries.

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