

Chapter 1

Introduction

1.1 Background and rationale

Multiple births are unusual in humans. Normally, a woman has only a single pregnancy. The prevalence of twins is approximately 1% but varies substantially by geographical location and the trend appears to be increasing, possibly due to assisted reproduction (Bortolus et al, 1999).

Twins are of two kinds, depending on whether they are conceived from two separate eggs (*fraternal* twins) or from a single egg that has subsequently split into two (*identical* twins). Fraternal twins, like normal siblings, can be of the same or opposite sex, but identical twins must be of the same sex.

Various studies have investigated the prevalence of identical twins in populations. It has been claimed that this prevalence is constant, even though the prevalence of fraternal twins may vary substantially. For example, Pison (2000) claimed that among all births the prevalence of fraternal twins varies from 3 per 1000 in Asia and Oceania to 8 per 1000 in America and Europe and 16 per 1000 in Africa, whereas the prevalence of identical twins is constant at 3.5-4 per 1000. This claim is supported by Terence (2006), who states that the prevalence of identical twins is “approximately 4 per 1000 births”. Based on MEDLINE and manual searches of the literature, Bortolus et al (1999) cited estimates of the prevalence of identical twins per 1000 total births as follows: India: 2.4 (sample size n=96); Italy 4.1 (n=23,236); Nigeria 4.45 (n=290); Israel 5.25 (n=238). Disputing an earlier claim by Arey (1940) that “statistically about

one fourth of all twins are identifiable as of the single egg type”, Strandskov and Edelen (1946) found that close to one third of 680,000 twins born in the United States from 1922 to 1936 were identical, and that this proportion was the same in both African-Americans and others.

Such claims by continental European and American authors ignore the situation in the largest, oldest and most populous continent in the world. In their study among 12,392 pairs of twins born in Japan in 1974, Asaka et al (1980) obtained the very narrow 95% confidence interval (0.66-0.69) for the proportion of identical twins among all twins. This finding confirms, at least for the Japanese, an earlier hypothesis by Bulmer (1970) stating that the prevalence of identical twins among twins in Caucasian population is one-third whereas the prevalence among Asian populations is two-thirds. Moreover, in a study of the health status of twin babies born from May 1993 to April 1994 in Kerala, Jaya et al (1995) found the proportion of same-sex pairs to be 79.6%, giving an estimated prevalence of 0.6 for identical twins among all twins. (The abstract for this paper does not report the sample size.)

Note that even though most studies of twins do not directly measure their status as identical or fraternal, because identical twins must be of the same sex it is possible to estimate the proportion of identical twins among twins if the proportion of same-sex twins is known. Suppose that p_s and p_z are the respective proportions of same-sex and identical twins among twins in a population. Assuming that half of the fraternal twins are same-sex (true at least approximately in any population) it follows that

$$p_s = p_z + \frac{1}{2}(1 - p_z). \quad (1)$$

Inverting this equation, we obtain the proportion of identical twins to be

$$p_z = 2p_s - 1. \quad (2)$$

If the sample size (n) is known, a 95% confidence interval can be obtained. Since the standard error of a proportion p based on a sample of size n is $\sqrt{p(1-p)/n}$, and the standard deviation of a linear function $a + bX$ of a random variable X is b times the standard deviation of X , it follows that the standard error of p_z is

$$SE[p_z] = 2\sqrt{p_s(1-p_s)/n} \quad (3)$$

There is more recent evidence suggesting that the prevalence of identical twins is not constant in Asia. Based on the gender distribution of 11,870 twin pairs born in Singapore between 1 January 1986 and 31 December 2001, Chia et al (2004) estimated the proportion of identical twins among twins to be 0.55 for those born to Malay mothers, 0.63 for those born to Malay fathers, 0.65 and 0.66 for those born to Chinese mothers and fathers respectively, and 0.87 and 0.99 for those born to Indian fathers and mothers respectively. Note that these estimates for Indians in Singapore appear to be inconsistent with that obtained from the study by Jaya et al (1995), suggesting that there could be regional difference among Indians.

In Thailand, we have only been able to find two studies reporting the gender composition of twins among hospital births. Based on 276 twin pairs born in Rayong Hospital between 1 October 1987 and 30 September 1991, Sangpethsong (1992) found only 22 to be of opposite sex, from which we can estimate the prevalence of identical twins to be 0.84 with 95% confidence interval (0.75-0.90). A similar study of 67 twins born in Lerdsin Hospital from 1989 to 1993 found 9 opposite sex twins, giving an estimated prevalence of identical twins of 0.73 with 95% confidence interval (0.45-0.88) (Lertkungwarnkai and Ramkiattisak, 1994).

As a matter of scientific interest it would be useful to know the prevalence of identical twins in Thailand, both among all twins and among all births, and whether it is constant or subject to regional variation among the different ethnic groups in the kingdom.

1.2 Study objectives

1. To measure the prevalence of twins and proportion of identical twins among all conceptions in Pattani hospital.
2. To identify the demographic for twinning in Pattani hospital.
3. To identify the factors associated with the sex distribution of twins in Pattani hospital.

1.3 Research hypothesis

1. The sex distribution of twins in Pattani differs from that in other regions of the world.
2. Demographic factors are associated with the twinning.
3. Demographic factors are associated with sex distribution of twins in Pattani.

1.4 Literature Review

1.4.1 Prevalence of twin

The prevalence rates of twins from other countries around the world are shown as following tables.

Year	Country	Number of twins	Twinning rates per 1000
1984	India 6 Villages (Talsania and Purohit, 1990)	-	10.1
1968-1983	Bangladesh (Razzaque et al, 1990)	-	7.8-11.2
1979-1990	Taiwan (Hsieh et al, 1992)	-	11.7
1951-1969	Japan (Imaizumi, 1987)	-	6.1-6.5
1974-1990	Japan (Imaizumi, 1987)	-	5.8-7.0
1955-1990	Taiwan (Chen et al, 1992)	-	3.8-11.4
1955-1984	Taiwan (Chen et al, 1992)	-	3.6-9.5
1980-1988	West Bengal (Chaudhuri et al, 1993)		
	- Hindu	-	10.7
	- Muslim	-	29.5
1960-1981	India 11 Villages (Goswami, 1987)	-	10.9-15.9
1982-1992	India 11 Villages (Goswami, 1993)	-	9.8-14.5
1978-1985	India 13 Villages (Goswami, 1993)	-	7.5-17.4
1930-1964	India (Goswami, 1987)	-	9.4
2002	South Korea (Hur and Kwon, 2004)	9,618	19.5
1993-1994	India (Jaya et al, 1995)	-	17.3
1961-1964	Israel (Modan et al., 1968)	1,769	9.7
1987-1991	Rayong Hospital (Sengpetsong, 1992)	276	7.7
1989-1993	Lerdsin Hospital (Lertkungwarnkai and Ramkiattisak, 1994)	67	6.3

Table 1.1: prevalence of twins in Asia

From Table 1.1, South Korea had the highest twinning rate follow by India and Israel, respectively. The lowest twinning rate was in Taiwan and the twinning rates in Bangladesh were higher among Muslim (29.5/1000) than Hindu (10.7/1000).

Country	Number of twins	Rates per 1000
Pakistan	51	8.2
India	163	9.7
Laos	12	6.5
Thailand	7	5.3
Cambodia	16	15.0
Vietnam	26	6.0
Philippines	158	9.6
China	42	8.0
Taiwan	34	13.1
Korea	68	7.7
Japan	36	9.5

Table 1.2: prevalence of twins among Asians woman in Illinois (Patel et al., 1997)

Table 1.2 shows twinning rates by country of origin among Asian woman in Illinois, United States from 1989-1995. The twinning rates varied between 5.3 per 1000 live births (Thailand) and 15 per 1000 live births (Cambodian).

Year	Country (Ref.)	Number of twins	Twinning rates per 1000
1967-1991	Norway (Kristensen and Irgens, 1999)	2,131	11.2
1950-1965	Scotland (Nylender, 1970)	440	12.5
1979-1998	Brazil (Colletto, 2003)	935	10.5
1974-1978	Nigeria (Rehan and Tafida, 1980)	228	39.7

Table 1.3: prevalence of twins in other part of the world

Nigeria had the highest twinning rates, followed by Scotland, Norway and Brazil respectively (Table 1.3).

1.4.2 Proportion of Identical Twins

The proportion rates of identical twin from other countries around the world are shown as following table.

Year	Country	Number of twins	Same sex	Opposite sex	Proportion of identical twin (95% CI)
1974	Japan (Imaizumi et al, 1980)	12,082	10,067	1,969	0.67 (0.65-0.68)
2001	Nepal (Katz et al, 2001)	116	84	32	0.45 (0.29-0.61)
1989-1993	Lerdsin Hospital (Lertkungwarnkai and Ramkiattisak, 1994)	67	58	9	0.73 (0.57-0.89)
1987-1991	Rayong Hospital (Sengpetsong, 1992)	276	254	22	0.84 (0.78-0.90)
1986-2001	Singapore (Chia et al, 2004)	5,935	4,724	1,211	0.59 (0.57-0.61)

Table 1.4: proportion of identical twins in Asia

Estimated overall identical twinning rates in Asia were between 0.45-0.84. The studies in Thailand show high proportion rates of identical twin while a study from Nepal shows lower proportion rates (Table 1.4).

Year	Country	Number of twins	Same sex	Opposite sex	Proportion of identical twin (95%CI)
1995-1998	Brazil (Colletto, 2001)	192	114	78	0.19 (0.05-0.23)
1922-1936	The United Stated (Stranskav and Edelen, 1946)	365,680	244,086	121,594	0.33 (0.33-0.34)
1995-1997	The United Stated (Tan et al, 2004)	148,234	99,281	48,953	0.34 (0.33-0.34)
1983-1985	The United Stated (Scher et al, 2002)	2,990	2,105	885	0.41 (0.38-0.44)
1981-1989	The United Stated (Scher et al, 2002)	6,226	4,383	1,843	0.41 (0.39-0.43)
1979-1998	Brazil (Colletto, 2003)	935	696	239	0.49 (0.43-0.55)

Table 1.5: proportion of identical twins in America

Estimated overall identical twinning rates in America were between 0.19-0.49. The proportion rates of identical twins from Brazil range from 0.19 to 0.49 while the studies from the United Stated show similar proportions.

Year	Country	Number of twins	Same sex	Opposite sex	Proportion of identical twin (95%CI)
1973-1991	Sweden (Liechtenstein et al,1996)	358	246	112	0.37 (0.28-0.47)
1982-1999	England (West et al, 2006)	70,772	49,610	21,162	0.40 (0.39-0.41)
1801-1900	Spain (Hernandez et al, 2004)	346	226	120	0.31 (0.21-0.39)

Table 1.6: proportion of identical twins in Europe

Estimated overall identical twinning rates in Europe were between 0.31-0.40. All above studies show similar proportion rates of identical twins.

Year	Country	Number of twins	Same sex	Opposite sex	Proportion of identical twin (95% CI)
1980-1989	West Australia (Scher et al, 2002)	5,343	3,767	1,576	0.41 (0.39-0.44)
1983-1989	Victoria (Scher et al, 2002)	9,895	7,006	2,889	0.42 (0.40-0.43)
1986-1988	South Australia (Scher et al, 2002)	1,465	1,043	422	0.42 (0.38-0.47)
1974-1978	Nigeria (Rehan and Tafida, 1980)	228	144	84	0.26 (0.14-0.39)

Table 1.7: proportion of identical twins in Australia and Africa

Estimated overall identical twinning rates in Australia and Africa were between 0.26-0.42. A study from Nigeria shows the lowest identical twinning rates while studies from Australia show similar rates.

1.4.3 Mother and child health care in Pattani province

Number of cases							
Year	Mother delivered	Delivered in hospital (%)	Delivered with TBA (%)	Infant	Live birth	Infant death	Mother death (%)
1998	11,594	44.0	56.0	12,040	11,953	87	4 (33.5)
1999	11,545	59.0	41.0	11,605	11,524	81	10 (86.8)
2000	11,502	62.1	37.9	11,683	11,590	93	9 (77.7)
2001	11,880	63.6	36.4	11,936	11,842	94	7 (59.1)
2002	12,315	71.4	28.6	12,407	12,296	111	7 (56.9)
2003	12,578	76.1	23.9	12,660	12,558	102	3 (23.9)
2004	10,937	83.0	17.0	11,010	10,921	89	3 (27.5)
2005	10,937	83.0	17.1	11,233	11,127	106	6 (54.5)

Table 1.8: Distribution of mother and child health care in Pattani province

(Pattani public health provincial office, 2005)

1.4.5 Risk factor of twinning

Maternal age

Twinning rates differ according to maternal age as reported in many studies. A study conducted by Nylander (1981) revealed that the highest twinning rate in Nigerian and Caucasian women were found in the 30-34 age groups whereas the highest twinning rates of Scottish women were found in the 35-39 age groups, a result similar to studies by Colletto (2003) and Rehan and Tafida (1980).

Parity

Parity is one of the main risk factors for twinning. Katz et al (2001) conducted a study of twinning rates in a rural area of Nepal and found that twinning rates increased with number of pregnancies. The result of this study was supported by a study in Nigeria.

Religion

Based on literature review, there are few studies comparing twinning rates between different religion. A comparison study of twinning rates between Bengali Muslim women and Bengali Hindu Caste women reported that the proportion of twinning rates in Bengali Muslim women were significantly higher than those in Bengali Hindu Caste women (Chaudhuri et al, 1993).

Education level

A study of factors associated with twinning rates in Taiwan was conducted between 1990 and 1995. The results showed that educational level of mother was not associated with twinning rates (Chen et al, 1992).

Heredity

Lichtenstein et al (1996) conducted a study of factors associated with twin infants of mothers who were also twins themselves. They found that mothers who were twins were more likely to give birth to twins than non-twin mothers.

1.4.6 Risk factor for sex distribution of twins

Sex distribution of twins

Studies of risk factors for sex distribution of twins are very rare. From our literature review we found only one study conducted in Hong Kong which revealed that older mothers were more likely to have opposite-sex twins (Tong et al, 1997)