

Epidemiological trends in multiple births in the United States, 1971–1998

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The astounding rise in multiple births in the United States continues. We analyzed live birth files from the U.S. National Center for Health Statistics. Twin, triplet, quadruplet, and quintuplet+ rates were calculated for the period 1971–1977 and for each year between 1990 and 1998. Triplet rates were also computed within categories of mother's education and age. The twin rate increased from 1.8% in 1971–77 to 2.8% in 1998. The rate of triplets increased 5.9-fold, quadruplets 11.9-fold, and quintuplets+ 5.3-fold between 1971–77 and 1998. Increases in triplet rates were much more marked among births to university-educated women and women 30 years and older. Among women 45 years and older, the triplet rate was approximately fifty times higher in 1998 than in 1971–77. This group of older women (≥ 45 years) had the highest multiple birth rate in 1998.

Several investigators have reported an increase in multiple births between the 1970's and the early 1990's (Jewell & Yip, 1995; Kiely et al., 1992; Luke 1994; Martin et al. 1997; Taffel, 1992). In the U.S. and elsewhere, the triplet rate began to increase gradually in the 1970's. The rate of increase began to speed up in the late 1980's and this dramatic rise continued into the early 1990's. Most observers attributed the rise primarily to two factors: (1) therapies for infertility, including both medical treatments and Assisted Reproductive Technology (ART); and (2) an upward shift of the maternal age distribution (Centers for Disease Control and Prevention, 2000; Kiely et al., 1992; Martin & Park, 1999; Wilcox et al., 1996).

The purpose of the analyses reported here was to explore the extent of increases in multiple births in the middle to late 1990's. We hypothesized that the rise in rates of twins, triplets, quadruplets, and quintuplets would continue, but wished to explore more precisely the nature of the increase. In particular, there was the question of whether the increase might have slowed down slightly, due to more conservative use of eggs in IVF. Since in the U.S. more highly educated women have easiest access to infertility therapies, partly because of more financial resources and partly because of a better understanding of the medical care system, we hypothesized that university-educated women would show the greatest increases in rates. We also hypothesized that women in their late 30's and 40's would show a large increase, since infertility problems due to anovulation occur relatively commonly among women in this age range. Thus, these women more often seek infertility therapies than do younger women.

In this paper, we show time trends for twins, triplets, quadruplets, and quintuplets+ by individual year during the period 1990–1998 and we compare rates in the year 1998 to the period 1971–1977. The period 1971–1977 was chosen as the baseline comparison period, since these years coincided with the very beginning of the era of medical treatments for treatment of infertility (in particular, the use of clomiphene citrate.)

Materials and Methods

We used live birth certificate data from the National Center for Health Statistics annual natality files. These data include more than 99% of all live births delivered in the United States. During the period 1971–1977 there were a total of 22,749,922 live births in the U.S. During the years 1990–1998 there were about four million births each year, with a high point of 4,158,212 live births in 1990 and a low point of 3,880,894 in 1997. Each computerized birth record includes information on whether the infant was a singleton, twin, triplet, quadruplet, or quintuplet or higher. There are also data on parent's education and parent's age. Rates of twins were calculated as a percentage of live births and rates of high order multiple births were calculated per 1,000,000 live births. Analyses of fetal deaths (stillbirths) are not reported here since registration completeness of fetal deaths is questionable in many U.S. states.

The best measure of socioeconomic status on the U.S. birth certificate is maternal education. We analyzed time trends in triplet rates by maternal education, categorized into four categories:

- 11 years or less = less than high school education;
- 12 years = high school graduate;
- 13–15 years = some university education;
- 16 years or more = university graduate or higher.

We analyzed time trends in triplet rates by mother's age, categorized into six age groups: 20–24 years, 25–29, 30–34, 35–39, 40–44, and 45 years or older.

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It should be noted that one important limitation of the U.S. natality files is that an analyst can only count *individual* triplet, quadruplet, and quintuplet babies. It is not possible to calculate the number of multiple *pregnancies*. In other words, one cannot identify *sets* of triplets, quadruplets, or quintuplets.

Results

Overall rates of twins (per 100 live births), and of triplets, quadruplets, and quintuplets+ (per 1,000,000 live births) are shown in Figures 1 through 4. The twin rate increased from 1.8% in 1971–77 to 2.3% in 1990 and 2.8% in 1998. The triplet rate increased from 296 per million live births in 1971–77 to 681 per million in 1990; the rate continued to increase to 1755 per million in 1998. Thus, the triplet rate was 5.9 times higher in 1998 than in 1971–77. The quadruplet rate increased from 13 per million in 1971–77 to 45 per million in 1990; the rate continued to increase to 159 per million in 1998. Thus, the quadruplet rate was 11.9 times higher in 1998 than in 1971–77. The rate of quintuplet and higher multiple births increased from 3.8 per million in 1971–77 to 20.8 per million in 1996 and then dropped very slightly to 20.0 per million in 1998. Thus, the quintuplet+ rate was 5.3 times higher in 1998 than in 1971–77.

Time trends in triplet rates by maternal education between 1971–77 and 1998 by mother’s education are shown in Figure 5. The increase in mothers who had completed a university education was 8.2-fold. The magnitude of the change was smaller in mothers with some university education (5.4-fold increase) and still smaller in those with 12 years of education (3.7-fold increase). The change in rates was smallest in mothers who had not completed high school.

Trends in triplet rates within maternal age groups are shown in Table 1. In mothers less than 25 years of age the increase in the triplet rate between 1971–77 and 1997–98 was slightly less than 2-fold. In women in the 25–29 year old age group the increase was 3.5-fold. Marked rises occurred among mothers in the 30–34, 35–39, and 40–44 year old age groups, with increases of 618 percent, 887 percent, and 808 percent, respectively.

Perhaps the most striking phenomenon related to multiple births in the 1990’s was the sudden increase in triplets born to women 45 years of age and older. It is important to realize that, before 1990, triplet births almost never occurred in women 45 years and older. By 1997 and 1998, however, the triplet rate in this maternal age group had risen 50-fold and 2.3 percent (Table 1) of babies born to these women were triplets.

Discussion

It is clear that increase in the multiple birth rate continued at a marked pace in the middle and late 1990’s. In our attempt to examine social class variation in the triplet increase, we found that the greatest increase had occurred in university-educated women. These women are more likely to have the financial resources to afford treatments for infertility. Perhaps more important, they tend to have a better understanding of the health care system, which

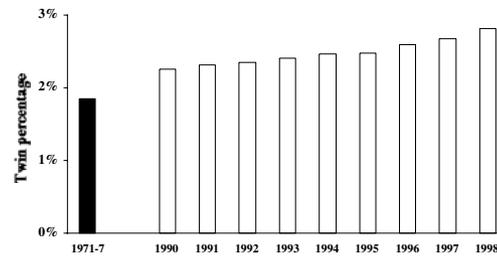


Figure 1
Twin rates, United States, 1971–1998.

Source: Centers for Disease Control and Prevention/National Center for Health Statistics, National live birth files, 1971–1977 and 1990–1998.

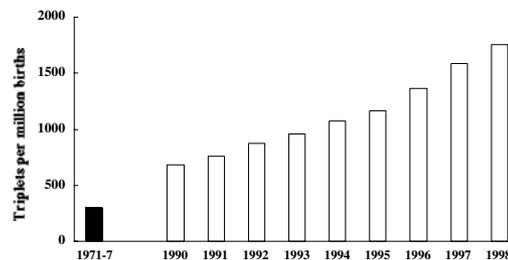


Figure 2
Triplet rates, United States, 1971–1998.

Source: Centers for Disease Control and Prevention/National Center for Health Statistics, National live birth files, 1971–1977 and 1990–1998.

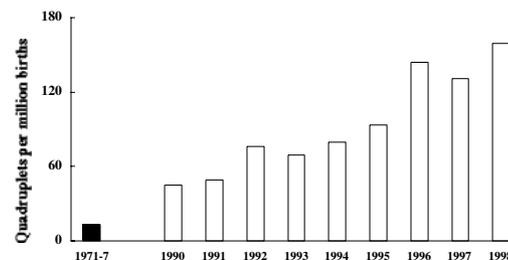


Figure 3
Quadruplet rates, United States, 1971–1998.

Source: Centers for Disease Control and Prevention/National Center for Health Statistics, National live birth files, 1971–1977 and 1990–1998.

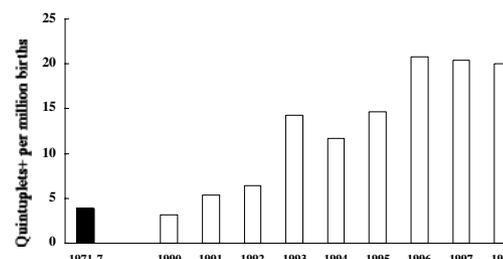


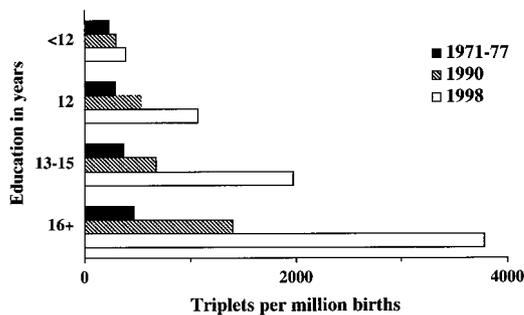
Figure 4
Rates of quintuplet and higher order multiple births, United States, 1971–1998.

Source: Centers for Disease Control and Prevention/National Center for Health Statistics, National live birth files, 1971–1977 and 1990–1998.

Table 1

Time Trends in Triplet Births Within Categories of Maternal Age.

Mother's age, years	Rate per 1,000,000 live births			Ratio of 1997–8 compared to 1971–7
	1971–1977	1990–1992	1997–1998	
20–24	261.8	335.3	432.1	1.7
25–29	394.0	767.9	1376.6	3.5
30–34	413.0	1328.5	2966.5	7.2
35–39	377.5	1690.5	3725.1	9.9
40–44	387.1	799.2	3513.4	9.1
45 or older	461.3	1680.7	23005.9	49.9

**Figure 5**

Time trends in triplet births within categories of maternal education.

Source: Centers for Disease Control and Prevention/National Center for Health Statistics, National live birth files, 1971–1977 and 1990–1998.

makes it easier for them to find the medical services that provide ART and other infertility therapies.

When we examined increases in the triplet rate by mother's age, we found that marked increases occurred in women 30–44 years of age. In addition, there was a virtual explosion of triplets among births to women who were 45 years old or older. Although the triplet increase in the 30–44 year old groups was probably due to both ovulation-inducing drugs and ART, the recent triplet increase among women over 44 years old was almost surely due solely to ART.

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