

Research

Spontaneous preterm delivery in primiparous women at low risk in Denmark: population based study

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Abstract

Objectives To analyse trends in preterm delivery and the factors contributing to preterm delivery in Denmark. To construct a standard population at low risk (white European, 20-40 years of age, with a singleton spontaneous pregnancy) and describe the changes in this population so that time trends can be compared internationally.

Design Population based study.

Participants 99.8% of all deliveries in Denmark, 1995-2004.

Main outcome measures Proportion of babies born at less than 37 weeks' completed gestation for each year in the overall population and in a standard population at low risk.

Results Overall, the proportion of preterm deliveries increased by 22% from 1995 to 2004. During the same period, known risk factors for preterm delivery such as in vitro fertilisation, multiple pregnancies, and elective deliveries also increased, and logistic regression analyses showed that these factors were associated with an increased risk of preterm delivery.

Spontaneous preterm deliveries in primiparous women at low risk rose 51% (from 3.8% to 5.7%) during this time compared with 20% (2.7% to 3.2%) in multiparous women at low risk.

Conclusions The overall proportion of preterm deliveries increased significantly from 1995 to 2004 and primiparity and multiple birth were the most important contributing factors. The rise in spontaneous preterm deliveries in the standard population of primiparous women at low risk was greater than in the total population.

Introduction

Recent data show an increase in the proportion of preterm births (live infants born before 37 weeks' completed gestation out of all live born infants) in the United States (11.0% in 1995 v 12.1% in 2002) and Norway (7.5% in 1995 v 8.5% in 2002).^{1 2} The prevalence of several risk factors for preterm delivery, such as in vitro fertilisation (IVF) high maternal age, primiparity, and elective delivery before term, have changed in recent years and this may explain the increase in the proportion of preterm deliveries.

We used data from the Danish national registers to calculate the proportion of preterm deliveries in low risk pregnancies from 1995 to 2004.

Methods

Data comprised case based information from four national registries on 99.8% of live births in Denmark from 1995 to 2004 (646 144 deliveries and 659 154 infants). To study changes in the proportion of spontaneous preterm births over time in women

at low risk, we selected a standard population consisting of white European primiparous women aged 20-40 with a singleton spontaneous pregnancy. We calculated the proportion of spontaneous preterm deliveries by dividing the number of spontaneous preterm deliveries (excluding elective caesarean section and induction of labour) by the total number of deliveries in this population. We also studied the proportion of spontaneous preterm deliveries in multiparous women at low risk (20-40 year old white European multiparous women with a singleton spontaneous pregnancy) using the same methods as for primiparous women.

Results

The overall proportion of preterm deliveries (preterm births as a proportion of all live births) increased by 22% between 1995 and 2004 (from 5.2% to 6.3%). When we stratified preterm deliveries in the total population into extremely preterm (22-28 completed weeks of gestation), very preterm (28-32), and moderately preterm (32-36), we found increases of 41%, 22%, and 22% between 1995 and 2005 (table 1).

The proportion of spontaneous preterm deliveries in primiparous women at low risk increased by 51% (95% confidence interval 40% to 64%) between 1995 and 2004 (from 3.8% to 5.7%; figure). This rise was significantly higher than the 20% rise (2.7% to 3.2%) seen in the corresponding population of multiparous women at low risk.

Table 2 shows the multivariate logistic regression analysis comparing extremely preterm, very preterm, and moderately preterm births with term and post-term (≥ 37 weeks) births in the general population. Maternal age and smoking habits, parity, IVF, multiple pregnancy, elective delivery, ethnic origin, and the year of delivery had a significant effect on preterm delivery in all groups. Elective delivery was associated with a decrease in extremely preterm and very preterm delivery and with an increase in moderately preterm delivery, whereas a white European origin was associated with a reduced risk of moderately preterm delivery.

A comparison of extremely preterm, very preterm, and moderately preterm delivery showed that IVF increased the risk of extremely preterm delivery significantly more than it increased the risk of very preterm and moderately preterm delivery ($P < 0.001$).

We calculated the population attributable risks using the prevalence of the various risk factors in the population. They were 17.7% for primiparity, 14.3% for multiple births, 7.2% for smoking, 5.7% for elective delivery, and 5.1% for IVF (based on the unadjusted risk ratios).

Table 1 Deliveries in Denmark. Values are percentages of the total number of deliveries unless otherwise stated

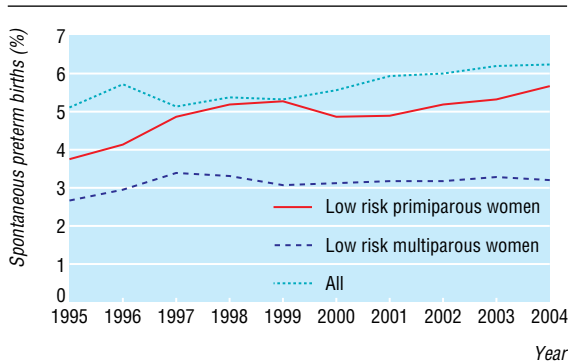
	Year										% Change 1995-2004
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	
No of deliveries	67 840	65 635	65 783	64 578	64 578	65 541	63 814	62 515	63 038	62 814	-7.41
Stage of delivery*:											
Extremely preterm	0.22	0.27	0.21	0.20	0.22	0.21	0.26	0.24	0.31	0.31	40.91
Very preterm	0.55	0.61	0.58	0.61	0.61	0.61	0.59	0.63	0.66	0.67	21.82
Moderately preterm	4.40	4.85	4.39	4.57	4.54	4.76	5.09	5.18	5.26	5.36	21.82
Term	94.83	94.27	94.82	94.63	94.63	94.42	94.06	93.94	93.77	93.67	-1.22
Characteristics of mother:											
White European	95.23	94.81	94.33	94.01	93.75	93.61	93.59	93.63	94.02	94.43	-0.84
In vitro fertilisation	1.17	1.55	1.89	2.03	2.43	2.82	2.99	2.95	3.37	2.47	111.11
Multiple births	1.70	1.89	1.88	1.98	1.97	1.99	2.23	2.22	2.24	2.26	32.9
Primiparity†	44.85	45.69	46.52	43.49	43.62	44.33	44.16	43.70	43.79	44.02	-1.85
Spontaneous delivery‡	87.63	87.17	93.28	92.82	88.67	85.70	84.68	82.11	80.52	79.18	-9.64
Smoker	26.8	25.5	22.0	21.2	20.0	19.7	18.6	17.7	16.3	15.5	-42.2
Standard population§	34.88	35.33	37.97	35.41	33.54	32.80	32.47	31.49	31.01	31.31	-10.24

*Extremely preterm: 22-27 completed weeks of gestation; very preterm: 28-31; moderately preterm: 32-36; term: ≥37.

†Women giving birth for the first time.

‡All deliveries except induced delivery and elective caesarian section.

§20-40 year old white European primiparous women with a singleton spontaneous pregnancy.



Time trends in spontaneous preterm birth in Denmark

Discussion

In Denmark, the proportion of spontaneous preterm births increased by 51%—from 3.8% to 5.7%—over 10 years in primiparous women with singleton spontaneous pregnancies. The increase in this low risk group was higher than the increase in the total population (22%).

Limitations

Increases could theoretically be due to changes in registration policies or dating pregnancies by ultrasound, but this form of dating was used throughout the period and national clinical guidelines have not been changed recently.^{3,4} Estimated gestational ages may vary owing to inconsistencies in “rounding”

Table 2 Multivariate logistic analysis of risk factors for preterm delivery in Denmark, 1995-2004

	All preterm			Extremely preterm*		Very preterm*		Moderately preterm*	
	No	Odds ratio (95% CI)		No	Odds ratio (95% CI)	No	Odds ratio (95% CI)	No	Odds ratio (95% CI)
Mode of conception:									
Spontaneous	63 0928	34 039	1.00	1379	1.00	3607	1.00	29 053	1.00
In vitro fertilisation	15 216	2 711	1.25 (1.19 to 1.32)	197	1.76 (1.47 to 2.12)	345	1.15 (1.01 to 1.31)	2 169	1.17 (1.10 to 1.24)
Initiation of delivery:									
Spontaneous	55 7267	29 870	1.00	1433	1.00	3344	1.00	25 093	1.00
Elective	88 877	6 880	1.09 (1.06 to 1.12)	143	0.39 (0.33 to 0.46)	608	0.77 (0.71 to 0.85)	6 129	1.19 (1.15 to 1.23)
Parity:									
Primiparous	28 7080	19 938	1.53 (1.49 to 1.57)	931	1.79 (1.60 to 1.99)	2240	1.63 (1.52 to 1.74)	16 767	1.48 (1.44 to 1.51)
Multiparous	35 9064	16 812	1.00	645	1.00	1712	1.00	14 455	1.00
Type of pregnancy:									
Singleton	633 012	30 859	1.00	1250	1.00	3171	1.00	26 438	1.00
Multiple	13 132	5 891	14.03 (13.75 to 14.90)	326	11.12 (9.6 to 12.87)	781	11.88 (10.83 to 13.02)	4 784	11.70 (11.22 to 12.20)
Maternal age†									
Year‡	646 144	36 750	1.01 (1.01 to 1.01)	1576	1.03 (1.02 to 1.04)	3952	1.02 (1.01 to 1.02)	31 222	1.01 (1.01 to 1.01)
Year‡	646 144	36 750	1.03 (1.02 to 1.03)	1576	1.06 (1.04 to 1.07)	3952	1.03 (1.01 to 1.04)	31 222	1.02 (1.02 to 1.03)
Smoking:									
Non-smoker	489 129	24 820	1.00	916	1.00	2479	1.00	21 425	1.00
Smoker	131 914	9 190	1.52 (1.49 to 1.55)	379	2.26 (2.11 to 2.42)	1041	1.76 (1.68 to 1.85)	7 770	1.41 (1.38 to 1.44)
Ethnic origin:									
White European	608 339	34 778	0.93 (0.88 to 0.97)	1493	0.86 (0.69 to 1.07)	3751	0.94 (0.81 to 1.09)	29 534	0.94 (0.89 to 0.98)
Other	37 797	1 972	1.00	83	1.00	201	1.00	1 688	1.00

CI, confidence interval.

All odds ratios were mutually adjusted for other variables in the table.

*Extremely preterm: 22-27 completed weeks of gestation; very preterm: 28-31; moderately preterm: 32-36; term: ≥37.

†Odds ratio for a one year change in age.

‡Odds ratio for a one year change in calendar time.

and “truncating” the weeks of gestation at delivery, so all analyses were repeated using gestational age truncated to completed weeks only.³ This did not affect the conclusions, indicating that the increase in preterm delivery among low risk primiparous women with a singleton pregnancy is real. Furthermore, changes in methods of calculating and registering gestational age do not explain why the increase in preterm delivery is greater in primiparous women at low risk than in multiparous women at low risk.

Only primiparity and multiple births contributed substantially as explanatory factors of preterm delivery (17.7% and 14.3%). Of the risk factors, only multiple births after IVF could be prevented by transferring just one embryo. Although IVF is a strong risk factor for preterm delivery and contributes to the increase in multiple births, IVF in itself contributed little to the overall risk of preterm delivery (5.1%). Thus the increase is mainly due to other factors.

Implications

Do the increases in preterm delivery reflect increased levels of stress in women who try to cope with the demands of both a job and a family? Many obstetricians report that an increasing number of primiparous women are reluctant to take time off work when they are not well. Although stress during pregnancy correlates with preterm delivery, the contribution of stress to the increase in preterm deliveries is unknown.⁵ Both psychosocial stress and neuroendocrine factors such as corticotrophin releasing hormone are associated with preterm delivery.⁶

Analysing the differences in proportions of preterm deliveries between countries might increase our understanding of preterm delivery. Populations from different countries cannot be compared owing to different proportions of high risk pregnancies and parity, but using standard populations of primiparous women at low risk identified by the criteria described here could enable valid international comparisons of spontaneous preterm delivery rates to be made.

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What is already known on this topic

The proportion of preterm births has increased in many countries over the past few decades. These increases have been attributed to increases in multiple births, greater use of in vitro fertilisation, and more obstetric intervention

Variations in dating pregnancies and calculating gestational age may result in misclassification of preterm delivery

What this study adds

In Denmark, the overall proportion of preterm delivery increased by 22% from 1995 to 2004

The proportion of spontaneous preterm births increased by 51% from 1995 to 2004 in primiparous women with singleton spontaneous pregnancies

The reasons for the higher increase in primiparous women at low risk are unknown