



Does young maternal age increase the risk of adverse obstetric, fetal and neonatal outcomes: A cohort study[☆]

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ABSTRACT

Objective: To determine whether young maternal age is associated with increased risks of adverse obstetric, fetal and perinatal outcomes.

Study design: Register-based study using the data from a computerized database of a University Hospital for the years 1994–2001. The study population included 8514 primiparous women aged less than 31 who delivered a singleton infant. Using maternal age as a continuous variable, crude and adjusted relative risks (RRs) were estimated for each maternal and perinatal outcome.

Results: Crude and adjusted RRs of anaemia during pregnancy and fetal death consistently increased with younger maternal age. After adjustment for confounding factors, RRs (95% confidence interval) of fetal death and anaemia were respectively 1.37 (1.09–1.70) and 1.27 (1.15–1.40) for a 16-year-old compared to a 20-year-old mother. Younger mothers had significantly decreased risks of obstetric complications (preeclampsia, caesarean section, operative vaginal delivery and post-partum haemorrhage). Higher prevalence of prematurity and low birth weight in infants born to teenagers were not attributable to young maternal age after adjustment for confounding factors.

Conclusion: In our population, younger maternal age was significantly and consistently associated to greater risks of fetal death and anaemia and to lower risks of adverse obstetric outcomes.

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1. Introduction

Pregnancy complications are responsible for the deaths of 70,000 adolescent mothers each year and an estimated one million infants born to these teenagers die before the age of 1 year. This public-health problem concerns mainly developing countries [1,2]. The highest teenage birth rate in the developed world is in the United States (41.1/1000) [3] and the lowest in Korea (2.9/1000). France is under the European average with 9.3/1000 [4]. In 2001, the estimated percentage of all 20-year olds who had a child in their teens was 4% in France, 13% in UK and 22% in USA [4].

Most studies from developed and developing countries have reported higher risks of inadequate prenatal care [5,6], low birth weight (LBW) [7,8] and premature birth [7,9,10]. However, results concerning other poor pregnancy outcomes are controversial. The relationship between teenage pregnancy and fetal death has been

reported by some studies [11,12] but not by others [7,13]. Some investigators have found increased risk of anaemia [5,7] whereas others did not [6,12].

The role of maternal youth in adverse maternal and neonatal outcomes is not well established. Mahfouz et al. [14] considered that teenage childbearers were not a high risk group if good prenatal care was provided. Lawlor et al. [15] held that there is no biological reason to suggest that having a baby before the age of 20 is associated with ill health. On the other hand, several investigators noticed increased risks of both maternal and neonatal complications in teenagers, even after adjustment for major confounding factors and suggested the implication of young maternal age [7,9,10].

In most of the previous studies, maternal age was categorized, sometimes dichotomized, for the analysis. This strategy leads to easy interpretation and presentation of results but is known to imply an inevitable loss of information, of precision and of power [16–19]. It ignores within-category variability by assuming that the frequency of the studied outcome is constant within categories with a sudden jump at the cutoff values (step function). Keeping age as a continuous variable allows for a more precise and realistic modelization of the relationship between age and the outcome.

The aim of this population-based retrospective cohort study was to determine whether young maternal age was associated

[☆] The study was conducted in Caen, France.

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with increased risk of adverse maternal and neonatal outcomes, using age as a continuous variable in the analysis, as recommended in the statistical and epidemiological literature.

2. Materials and methods

This retrospective cohort analysis was derived from data of the computerized medical records system of a French University Hospital for the years 1994–2001. These dates were chosen as the computerized database was implemented in 1994 and modified in 2001.

Inclusion in the study group was restricted to singleton births of primiparous women aged between 14 and 30 years. Women with a previous birth were not included since investigators reported higher risks of prematurity [20], fetal death [20] and neonatal mortality in multiparous adolescents.

Medical records data used in the analysis were collected either by interview at booking for the characteristics of the population (ethnic origin, marital status, education level, history of previous miscarriage or abortion, cigarette smoking and prepregnancy weight) or gradually added to the database by the medical team for obstetric, fetal and neonatal outcomes.

Gestational age was defined as the number of weeks' gestation between the first day of the last menstrual period and the delivery date. The ultrasound evaluation of the fetus before 20 weeks replaced the use of the last menstrual period when they differed. The mother's ethnic origin (European or extra-European) was asked at booking. Marital status at time of delivery divided mothers into those who had a partner and those who were single mothers. The mother's education level was categorized as either appropriate or inappropriate. As women in the sample were 14 years old or more, mothers who did not attend secondary school (usually attended from the age of 12 onwards) were considered to have an inappropriate educational level. History of previous miscarriage or abortion was asked at booking. Data on cigarette smoking, recorded at the first prenatal consultation, divided mothers into three groups: non-smokers, smokers of fewer than 10 cigarettes daily and smokers of 10 cigarettes or more a day. The prepregnancy body mass index (BMI) (weight [kg]/height² [m²]) was entered as a continuous variable in the regression models but was categorized (underweight, normal weight, overweight) for the descriptive part of the analysis (Table 2). Adults were considered as underweight when the BMI was below 18.5 and overweight when it was greater than 25, as recommended by the World Health Organization. A standardized percentile curve was used to identify underweight (<5th percentile), normal weight (5th–95th percentile) and overweight (>95th percentile) adolescents, according to their age and sex [21]. Prenatal care consisting of less than 50% of expected consultations according to gestational age was considered as inadequate.

Maternal outcomes investigated were anaemia during pregnancy (haemoglobin concentration <10 g/dl), preeclampsia (hypertension ≥140/90 mmHg and proteinuria ≥0.30 g/day in women who were normotensive at booking), caesarean section, operative vaginal delivery (delivery either by vacuum or forceps), and post-partum haemorrhage (>500 mL bleeding). The screening for anaemia was performed either in the first trimester if there were risk factors or at 6 months of gestation for every woman.

Perinatal outcomes evaluated were prematurity (live infant delivered before 37 weeks' gestation), LBW (<2500 g), birth weight ≥4000 g, admission to the neonatal intensive care unit and fetal death (delivery of a dead infant after 22 weeks' gestation).

The associations between maternal age and each maternal and neonatal complication were assessed with log-binomial regression

models to get a direct estimation of relative risks (RRs). Crude and adjusted RRs with 95% confidence intervals (CIs) were computed. For each outcome, adjustment was made simultaneously for the following factors, independently of their statistical significance: ethnic origin, marital status, educational level, history of previous miscarriage or previous abortion, tobacco use, prepregnancy BMI and prenatal care.

As specified at the end of the introduction, maternal age was kept as a continuous variable in the models. A fractional polynomial analysis was applied to test the assumption of linearity of the variable and to suggest an appropriate transformation in case of non-linearities [18]. Linearity of age was not rejected in every model except for the association with preeclampsia.

To limit the inflation of the α error due to the analysis of multiple outcomes, *p*-values were corrected using Hochberg adjustment for multiple comparisons, for maternal complications on the one hand, and neonatal complications on the other hand.

Statistical significance was defined as *p* < 0.05. Data were analyzed with SPSS software, version 15.0 (SPSS for Windows, Chicago, IL: SPSS Inc., 2006) and the mfp package of the R software (Multivariable Fractional Polynomials, R package version 1.4.0., by Gareth Ambler, modified by Axel Benner, 2007).

3. Results

During the study period, there were 8514 first-born singleton infants whose mothers were <31 years. The number of women at each age is shown in Table 1.

Table 2 presents the characteristics of the study population and the prevalence of adverse maternal and perinatal outcomes. Younger women were more likely to be single, to come from extra-European countries, to have an inappropriate education level for their age and to smoke (data not shown).

Predicted rates of outcome and crude RRs of anaemia consistently increased with younger maternal age (Table 3). RRs of anaemia at the age of 16 compared to 20 and 25 years were 1.46 and 2.35, respectively. Young maternal age was also associated with decreased risks of preeclampsia, caesarean section, instrumental vaginal delivery and post-partum haemorrhage (Table 3). Compared to mothers aged 20 and 25 years, the crude RRs of caesarean section for a 16-year-old mother were 0.82 and 0.64, respectively. After adjusting for confounding factors, RRs of caesarean section, instrumental delivery, post-partum haemorrhage and preeclampsia remained significantly lower in adolescent mothers. Adjusted RRs of anaemia remained consistent and increased significantly with lower maternal age (Table 3, Fig. 1).

Table 1
Number of women included in the study according to their age (*n* = 8514).

Maternal age (years)	Number of women
14	3
15	13
16	49
17	89
18	203
19	364
20	468
21	483
22	522
23	648
24	798
25	886
26	931
27	997
28	834
29	693
30	533

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