Appendix 2 (as supplied by the authors): Propensity score

Appendix 2A: **Propensity score construction**

To control for confounding factors that might influence both the choice of the mode of delivery and the occurrence of intra or postpartum severe acute maternal morbidity, we used a propensity score approach. A woman's propensity score was defined as her probability of a cesarean delivery based on her individual covariates measured before delivery. A propensity score was estimated for all women, by a logistic regression model with cesarean delivery as the dependent variable in relation to the following baseline maternal and obstetrical characteristics: country of birth, living without a partner, maternal age, body mass index, smoker, pre-existing medical condition, parity and previous cesarean, prior obstetric hemorrhage, gestational hypertensive disorder in a previous pregnancy, multiple pregnancy, in vitro fertilization, hypertensive disorder, third-trimester anemia, breech presentation, large for gestational age at birth as a proxy of prenatal suspicion of large for gestational age, gestational age at delivery, and maternity unit status. The choice of variables that were included in the propensity score model was made after reflection and analysis of the literature.

The proportion of women with missing confounders ranged from 0% to 9.3% including 3761 (72%) women with full data, of close characteristics to those of the women with missing data (data not shown). We used multiple imputation-chained equations to impute missing data. For each woman, we calculated first a propensity score in each of the 30 imputed datasets and then an average propensity score.

Exposed (with cesarean delivery) and unexposed (with vaginal delivery) women were matched with a one-to-one nearest neighbour matching algorithm without replacement

on the average propensity score, [1] within a calliper of 0.10. [2] Different caliper values were tested. A caliper at 0.10 including more women with an equivalent distribution of propensity score after matching, and with standardized differences for each variable of the propensity score were < 10%. Imbalances after matching were checked by propensity score distribution and calculation of standardised mean differences. [3]

We tested for clinically relevant interactions by using interaction terms between modes of delivery and the covariates considered. Because a significant positive interaction was found with maternal age ($p < 0.001$), the analysis was rerun (i.e., averaging the propensity score and matching) after stratifying by maternal age: < 25 years, [25-29] years, [30-34] years, ≥35 years.

In each maternal age stratum, matched groups were well balanced (standardised mean differences less than 10% for all variables, except among women aged less than 25 years where standardised differences were less than 20% for all variables) (Appendix 2B).

Paired conditional statistical methods were used to assess the effect of exposure on the matched sample. In the matched set, odds ratios (OR) and their 95% confidence intervals (95% CI) were estimated to quantify the association between the mode of delivery and intra or postpartum severe acute maternal morbidity by Generalized Estimating Equation logistic regression, with a further adjustment for absence of prophylactic oxytocin administration during third stage of labor, which was not included in the propensity score because it occurred after delivery, but which is a recognized risk factor for severe postpartum hemorrhage and which should be administered regardless of the mode of delivery.

References

1. Mitra R, Reiter JP. A comparison of two methods of estimating propensity scores after multiple imputation. Stat Methods Med Res. 2016 Feb;25(1):188–204.

2. Lunt M. Selecting an appropriate caliper can be essential for achieving good balance with propensity score matching. Am J Epidemiol. 2014 Jan 15;179(2):226–35.

3. Austin PC. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. Stat Med. 2009 Nov 10;28(25):3083–107.

Appendix 2B: Standardised differences between women with cesarean and vaginal deliveries, for the variables included in the propensity score, before (total population) and after matching (propensity score-matched population), for each stratum of maternal age after multiple imputations

Maternal age

Propensity score variables — < 25 years — [25-29] years — [30-34] years — ≥ 35 years

French
Other European country
North Africa
Other african country
Other nationality
Living without partner
Maternal age
Body Mass Index
Smoking
Pre-existing maternal condition
Nulliparous
Parous without previous cesarean
Multiparous with previous cesarean
Previous obstetrical hemorrhage
In vitro fertilisation
Multiple birth
Anaemia in 3rd trimester
Obstetrical hypertensive disorders
Breech presentation
Gestational age at birth
Birth weight<10th percentile for GA
Birth weight>10th and <90th percentile for GA
Birth weight> 90th percentile for GA
Public university maternity unit
Other public maternity unit
Private maternity unit

• Before.matching
▲ After.matching

Standardized differences (%)