

Research Article

Incidence and Risk Factors of Severe Post-Partum Haemorrhage: A Nationwide Population-Based Study from a Hospital Database

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ABSTRACT

Objective: The aim of this study was to ascertain the risk factors of major postpartum haemorrhage (PPH), as substantiated from diagnoses and procedures recorded in the French hospital administrative database.

Materials and methods: This nationwide population-based study looked at 723 905 deliveries in mainland France in 2011, from the hospital database. The outcome of interest was major PPH identified by the International Classification of DiseasesICD-10 code for PPH in association with i) coding procedures for advanced measures for haemostasis or ii) need for intensive care or iii) death. Determinants studied included maternal and pregnancy characteristics, birth environmental factors and home-to-hospital distance. Adjusted odds ratios (aOR) for the outcome were calculated using a multilevel random-intercept model of logistic regression.

Results: Major PPH was associated with age ≥ 35 years (aOR 1.41; 95% confidence interval, 95% CI [1.25–1.59]), multiple pregnancy (aOR 3.40 [2.85–4.05], pre-eclampsia (aOR 2.80 [2.32–3.38]), chorioamnionitis (aOR 2.57 [1.64–4.03]), caesarean section (aOR 4.80, [4.27-5.39]) and delivery in a level III maternity unit. Home-to-hospital distance was not a significant risk factor for PPH. The AUC was 0.8 [0.83-0.85].

Conclusion: The model used gave accurate predictions of PPH occurrence according to risk factors identifiable from a French hospital database.

Keywords: Post-partum haemorrhage; Incidence; Risk factors; Hospital data; Accessibility

What do we know?

Post-Partum Haemorrhage is recognized as a major public health problem. Several epidemiological studies have focused on maternal, obstetric and therapeutic predictors. Only one of these studies, in Norway, considered home-to-hospital distances and reported increased maternal morbidity with increased distance to the healthcare establishment. In France, it is an important issue as 23% of deliveries occur >30 min from the woman's home.

What does this paper add?

Home-to-hospital distance was not a significant risk factor for PPH even though we found a positive odds ratio gradient for suburban and rural women.

The major strength of this nationwide population-based study lies in the fact that we analysed several important maternal variables for all deliveries in a whole country and drew the same conclusion as those from studies based on medical records.

Contrary to models in previous studies, our model has a very strong predictive ability and revealed important implications for the screening of women at risk of severe PPH.

How this fits in with quality in primary care?

The major finding of this paper was the need for the exhaustive collection of the maternal characteristics in order to predict PPH requiring advanced interventional procedures. We then highlight the role of all primary care professionals in the pregnancy follow-up as their contribution to the collection of this information is essential. Coordination between outpatient and inpatient care should be strongly promoted in order to provide hospital practitioners with indicators of severe PPH in time.

Introduction

Post-Partum Haemorrhage (PPH) is recognized as a major public health problem by both clinicians and researchers, because it is the leading cause of maternal mortality around the world [1] and also contributes to substantial maternal morbidity [2].

When looking at data sources on the incidence of PPH in high-resource countries, it appears that research in this area needs to be improved. One review recommended an improvement in data collection, in particular with regard to measurements of severity [3]. This work also reported that overall the incidence of PPH was increasing, especially because of severe PPH from uterine atony.

Atonic PPH is the leading cause of PPH, whatever the mode of delivery and the severity [4] and its severe forms are often unexpected and may occur in the absence of recognized risk factors [5]. Several epidemiological studies have focused on maternal, obstetric and therapeutic predictors [6]. None of these studies considered home-to-hospital distances. However, 23% of deliveries occur >30 min from the woman's home in France [7] and a Norwegian study reported increased maternal morbidity, including haemorrhage >1500 ml or blood transfusion, with increased distance to the healthcare establishment [8].

The French Health Authority (HAS) has stated that a decrease in mortality could be achieved by paying particular attention to severe forms, namely those requiring advanced interventional procedures. Recently, the HAS underlined that organizational aspects may contribute to maternal morbidity/mortality due to PPH and that they should be studied in order to make possible changes. As a result, all hospitals are now obliged to collect quality indicators for PPH, including those based on French hospital data.

Currently, each healthcare facility in France is legally obliged to produce a discharge abstract which codes all of the diagnoses made and procedures carried out. All of these abstracts are included in a French national administrative database, which provides a huge amount of epidemiological information concerning hospitalized patients in France [9-11]. The high proportion of in-hospital births in France makes this database particularly useful [10]. In the field of severe maternal morbidity, the validity of hospital data was assessed by comparing them with medical records in three teaching hospitals. Procedures for PPH reported in medical records showed a high degree of sensitivity and specificity in identifying severe PPH [12].

The aim of the present investigation was to ascertain the incidence and risk factors of severe atonic PPH in a nationwide, population-based study using diagnoses and procedures recorded in the hospital database.

Methods

Study design

The principle of this population-based retrospective cohort study was to examine hospital data for all deliveries in mainland France in 2011. This study was based on the hospital database, which gathers administrative and medical information from diagnoses coded according to the International Classification of Diseases (ICD-10) and from procedures coded according to the French Common Classification of Medical Procedures (CCMP), collected in a standardized fashion. To ensure the quality of data collection, quality control procedures are carried out *a posteriori* on sample data sets by medical inspectors and territorial medical advisors.

Setting

All deliveries in mainland France, recorded in the database with the codes Z37 of the ICD-10, noted in the women's abstract data, were examined. For the French agency responsible for collecting, hosting and analysing medical-economic data of French health establishments, Z37 codes are considered the most reliable and exhaustive to investigate deliveries. All deliveries were included, except for those that occurred in Paris, Lyon and Marseille: the "Assistance Publique-Hôpitaux de Paris (APHP)", "Hospices Civils de Lyon (HCL)" and "Assistance Publique-Marseille (APM)" all of which comprise many establishments scattered over several geographical sites. These three institutions each use a unique legal address identified by their specific legal number (FINESS). As we used this number to locate each individual birthplace, the above establishments were excluded from the analysis.

Parameters

The outcome of interest was cases of atonic severe PPH, which reflects major maternal morbidity, as substantiated by the need for advanced interventional procedures. In clinical practice, at the beginning of the haemorrhagic process, the "first-line" therapy includes manual removal of the placenta, uterine check, the infusion of crystalloid solutions and cardiopulmonary monitoring. If the haemorrhagic process continues and haemodynamic instability sets in, the second-line therapy is put in place. This consists of invasive techniques for haemostasis, blood transfusion or transfer to an intensive care unit.

In the present study, severe PPH was defined for one ICD-10 code (O72.0) linked to at least one of the following CCMP procedures, which correspond to second-line therapy and thus reflect the severity of the PPH: arterial embolization, uterine or hypogastric artery ligation, haemostasis hysterectomy and for the ICD-10 codes associated with transfer to an intensive care unit, or death [12]. Blood transfusion was not taken into account, as we showed in a recent report that the rate of transfusion is seriously underestimated in both pregnancy-related and birth-related abstracts in the French medico-administrative database [13].

As only atonic PPH was targeted in this study, we excluded all cases of severe PPH associated with one of the following major diagnoses: placenta praevia (codes O44), retroplacental haematoma (code O45), uterine rupture (codes O71.0 and O71.1).

Variables

The variables retained concerned the characteristics of the women and the healthcare establishments.

At the individual level, the following variables were considered: maternal age (<19, 20 to 34 and >35 years), parity, term, obesity, multiple pregnancy, preterm premature rupture of membranes, possible premature delivery, chronic or gestational high blood pressure, gestational diabetes, previous caesarean, prolonged labour, history of uterine scarring, pre-eclampsia, chorioamnionitis, mode of delivery, home-to-hospital distance.

The home-to-hospital distance was defined as 'the distance by road' in kilometres. For each delivery, the point of departure for the journey corresponded to the geographical coordinates (latitude, longitude) of the centroid of the district's main town derived from the geographic code recorded in the hospital data. The point of arrival corresponded to the geographical coordinates of the legal address of the establishment identified in hospital data by the legal number. The home-to-hospital distance was calculated using "Google Maps", which is able to calculate distance and journey time depending on the terrain, in standard traffic situations. In France, road network models are appropriate because almost all journeys take place by road. Some studies concluded that "Google Maps" is a useful tool for epidemiologists [14]: it proved to be an acceptable alternative to geocoded addresses [15] and to be reliable not only to calculate distances between postcode coordinates and care units [16], but also to predict with acceptable accuracy ambulance time of arrival at the emergency unit [17]. SAS software made it possible to automatically record requests to Google Maps.

For women domiciled in the same city as the maternity unit, we were unable to calculate home-to-hospital distance from hospital databases. For these, a distance of zero kilometres was attributed. Thus, the terms 'urban area' included all women who lived in an urban area according to the international standards and 'suburban area' included all women who lived in urban areas surrounding a town with an obstetric unit.-

Variables retained for the health establishment were those that may affect the management and have an impact on the severity of the PPH [5,18]. The type of maternity unit (I, II or III level of care), the annual number of deliveries, the number of beds and of delivery rooms, the number of staff (number of staff and full-time equivalents) were studied. To identify these elements, we used a compulsory exhaustive administrative survey that collected statements from public and private establishments.

Statistical analysis

Baseline characteristics of the participants are presented as means or proportions. The reference group included women without severe PPH reflecting major maternal morbidity. A mixed model, which took into account the hierarchical structure of the data, was used to assess associations with potential risk factors. As some women delivering in a given establishment had the same birth environment, the independence of the observations could not be confirmed. Hierarchical logistic regression was performed using the individual maternal variables as level 1 data and the establishment as level 2 data. Discrimination, which is the ability of the model to correctly predict severe PPH, was assessed by plotting the receiver operating characteristic (ROC) curve and calculating the area under the curve (AUC) [19]. An AUC value of 0.5 indicates no ability to discriminate, and larger values indicate increasing ability. A value of 0.8 is considered good.

Other than type of maternity unit, correlations between covariates of the birth environment were searched for. A French Decree established standard parameters based on the annual number of deliveries. As these parameters correlated with each other, the annual number of deliveries was retained for the analysis, because this information was more frequently available.

As distances in rural or urban areas could be very different, a sensitivity analysis was done. Descriptive analyses and multilevel analyses with the GLIMMIX procedure were performed using SAS 9.3. This study was approved by the National Committee for data protection (Commission Nationale de l'Informatique et des Libertés, registration number 1576793) and was conducted in accordance with French legislation. Written consent was not needed for this study. The PMSI database was transmitted by the national agency for the management of hospitalization data (ATIH number 2015-111111-47-33).

Results

The PMSI recorded 723,905 deliveries in 2011 in mainland France, without APHP, HCL, APM. Among these, 1,393 severe PPH which reflects major maternal morbidity were identified (Incidence 0.19%), and 1,219 of these women (87.51%) underwent an invasive technique for haemostasis. Nearly 38% of them had arterial embolization, 32.4% ligature of the uterine or hypogastric arteries and 17.2% haemostasis hysterectomy.

The characteristics of the study population are presented in Table 1. There were more women aged over 35 years in the severe PPH group. Women presented a similar term of pregnancy in both groups. Many factors were significantly different between the two groups (Table 1). Twin pregnancy (12.06% vs. 1.57%), high blood pressure (13.5% vs. 3.1%), pre-eclampsia (10.7% vs. 1.5%) and previous caesarean (15.3% vs. 5.7%) were more frequent in the severe PPH group. The proportion of caesarean sections was also significantly higher in women with severe PPH (60.1% vs. 20.0%).

Table 1 presents the comparison between women with severe PPH and those without severe PPH with regard to the health establishment's characteristics. The frequency of severe atonic PPH was significantly lower in type I maternity units (14.5% vs. 30.4%) and type II units (37.3% vs. 48.4%), and much higher in type III units (47.8% vs. 21.1%).

The results of the multilevel logistic regression analysis are shown in Table 2. Age, multiple pregnancy, pre-eclampsia, chorioamnionitis, caesarean section and type III maternity unit were significantly associated with a higher risk of severe PPH reflecting major maternal morbidity, after adjusting for the other variables. Although the home-to-hospital distances were significantly different between the two groups in the bivariate analysis ($p<0.001$), the risk of severe PPH was not significantly affected by distance after adjustment for maternal variables and birth environment.

The results of the sensitivity analysis of home-to-hospital distance for women who lived in an urban, suburban or rural area are presented in Table 3. For suburban and rural women, when the home-to-hospital distance increased, we found a positive odds ratio gradient which nonetheless did not reach significance.

The AUC of the model in predicting severe PPH was 0.84, 95% Confidence Interval (0.83-0.85) (Figure 1). In fact, among the 1,393

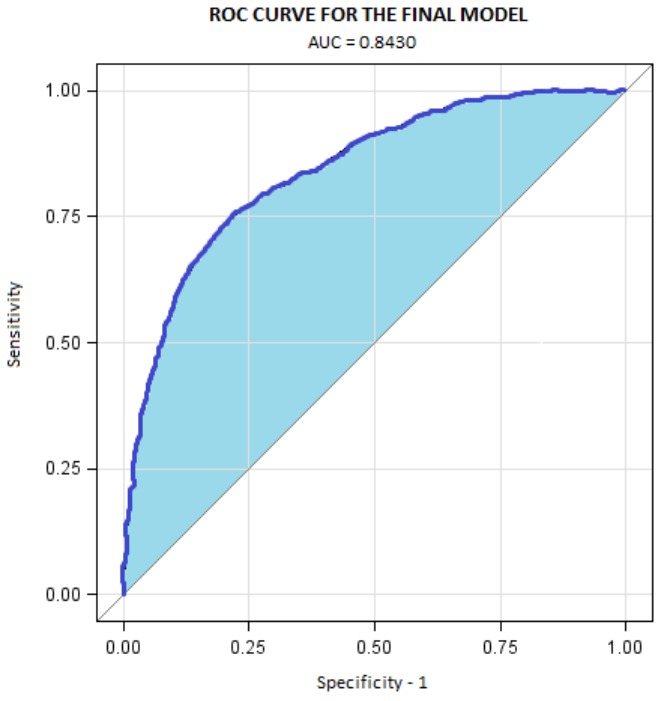

Figure 1: ROC curve for the hierarchical model, severe postpartum haemorrhage in France in 2011.

Table 1: Pregnancy characteristics, adverse outcomes and environment of birth in France in 2011.

	No severe PPH* (n=722,512)		Severe PPH* (n=1,393)	
Term (Gestational Age), mean SD	39		38	
	N	**%**	**N**	**%**
Age (years)				
≤ 19	16,941	2.34	28	2.01
20-34	571,851	79.15	964	69.20
≥ 35	133,72	18.51	401	28.79
Area of residence				
Urban	411,63	61.57¥	879	68.46
Rural	256,887	38.43¥	405	31.54
Not documented	53,995	7.47	109	7.82
Home to hospital distance¥				
<15 km	412,049	57.03	792	56.86
15-29 km	173,475	24.01	285	20.46
≥ 30 km	134,315	18.59	306	21.97
Obesity	20,063***	2.81¥	85****	6.22
Primiparous women	315,145	43.62	595	42.71
Pregnancy				
Singleton pregnancy	710,985	98.41¥	1,219	87.51
Multiple pregnancy	11,514	1.59¥	174	12.49
Possible premature delivery	24,709	3.42¥	97	6.96
Haemorrhage during pregnancy	3,865	0.53¥	113	8.11
High blood pressure	22,422	3.10¥	188	13.5
Gestational Diabetes	39,35	5.45¥	112	8.04
Pre-eclampsia	10,953***	1.53¥	147****	10.75
Previous caesarean**	23,060***	5.73¥	120****	15.36
Prolonged labour	80***	0.01	1****	0.07
Mode of delivery				
Not documented	837	0.12¥	3	0.22
Vaginal delivery	577,138	79.88¥	552	39.62
Caesarean	14,4537	20.00¥	838	60.16
Elective caesarean section	*24,066***	*3.37¥*	220****	16.09
Emergency caesarean section	*65,305***	*9.14¥*	371****	27.14
Chorioamnionitis	1,851***	0.26¥	21****	1.54
Type of establishment¥				
Type 1	217,247[a]	(30.36)	201[b]	(14.47)
Type 2	347,169[a]	(48.42)	524[b]	(37.32)
Type 3	151,121[a]	(21.12)	664[b]	(47.80)
Annual number of deliveries¥				
<500	40,664	(5.63)	40	(2.87)
501-1000	113,298	(15.68)	109	(7.82)
1001-2000	239,328	(33.12)	326	(23.40)
2001-3000	177,866	(24.62)	436	(31.30)
3001-4000	110,027	(15.23)	324	(23.26)
4001-5000	30,411	(4.21)	128	(9.19)
>5000	10,918	(1.51)	30	(2.15)

*** Post-Partum Haemorrhage** **** Only multiparous women**

***** N=714,278 **** N=1,367** **[a] N=715,537 [b] N=1,389**

¥ p<0.0001 versus comparative group with PPH

Table 2: Association between severe PPH and maternal characteristics, adverse outcomes and birth environment in France in 2011.

	Severe PPH* (n=1,310)		p-value
	aOR	(95% CI)	
Age			<0.0001
≤ 19	1.09	(0.74-1.62)	
20-34	1		
≥ 35	1.41	(1.25-1.59)	
Parity			0.41
Primiparous women	1		
Multiparous women	1.05	(0.94-1.17)	
Pregnancy			<0.0001
Singleton	1		
Multiple	3.40	(2.85-4.05)	
Obesity	1.21	(0.96-1.52)	0.11
Pre-eclampsia	2.80	(2.32-3.38)	<0.0001
Chorioamnionitis	2.57	(1.64-4.03)	<0.0001
Mode of delivery			<0.0001
Not documented	2.36	(0.58-9.54)	
Caesarean	4.80	(4.27-5.39)	
Vaginal delivery	1		
Home-to-hospital distance**			0.68
<15 km	0.96	(0,83-1.11)	
15-29 km	0.92	(0.78-1.10)	
>=30 km	1	(0.91-1.19)	
Annual number of deliveries			0.48
≤ 500	0.69	(0.36-1.31)	
501-1000	0.69	(0.48-0.99)	
1001-2000	0.83	(0.63-1.10)	
2001-3000	1		
3001-4000	0.84	(0.59-1.18)	
>4000	0.94	(0.54-1.62)	
Type of establishment			<0.0001
1	0.27	(0.19-0.40)	
2	0.36	(0.26-0.49)	
3	1		

*** Post-Partum Haemorrhage**

**** Distance up to 160 km and 120 min**

women with severe PPH, only 191 (13.7%) had no risk factors identified by the model.

Discussion

This study used the national French hospital database, which includes the whole French population. It estimated an overall incidence rate for severe PPH due to uterine atony of 0.19%. This study also indicated that maternal age, multiple pregnancy, pre-eclampsia, chorioamnionitis, caesarean section and a type III maternity unit were associated with an increased risk of severe atonic PPH. We had very complete information on these factors. For example, only 0.11% of data regarding the mode of delivery were not documented. We could have excluded these women as the corresponding bias could be considered negligible. However, we decided to retain these missing data as a specific category.

In the literature, data on the incidence of PPH due to uterine atony are heterogeneous, but the results of other studies that used procedures to define PPH are consistent with ours. In a nationwide inpatient sample in the USA, Kramer et al. reported an incidence rate of 0.3%, when severe haemorrhage was defined by PPH plus the receipt of a blood transfusion, hysterectomy and/or surgical repair of the uterus [20]. In 2008, using data from a computerized maternity database, Mousa et al. found an incidence closer to ours of 0.2%, for «major primary PPH» defined as «haemorrhage not responding to first-line treatment» [21].

Overall, the risk factors of severe PPH which reflects major maternal morbidity showed by our study correspond to the same risk factors found in previous studies carried out on medical records or hospital data.

Table 3: Association between severe PPH and maternal characteristics, adverse outcomes and birth environment based on housing environment in France in 2011.

Outcome	Severe PPH*					
	Rural areas (N=390)		Suburban areas (N=323)		Urban areas (N=827)	
	aOR	(95% CI)	aOR	(95% CI)	aOR	(95% CI)
Age (years)						
≤ 19	1.05	(0.49-2.24)	0.94	(0.30-2.95)	1.12	(0.69-1.79)
20-34	1		1		1	
≥ 35	1.51	(1.21-1.90)	1.31	(1.02-1.68)	1.33	(1.14-1.56)
Parity						
Primiparous women	1		1		1	
Multiparous women	0.89	(0.73-1.09)	1.23	(0,98-1.54)	1.14	(0.99-1.31)
Pregnancy						
Singleton	1		1		1	
Multiple	3.75	(2.78-5.04)	3.28	(2.32-4.64)	3.46	(2.77-4.33)
Obesity	1.09	(0.72-1.64)	1.48	(0.97-2.27)	1.27	(0.95-1.69)
Pre-eclampsia	2.68	(1.92-3.74)	3.30	(2.33-4.69)	2.77	(2.18-3.51)
Chorioamnionitis	1.69	(0.68-4.22)	2.34	(1.01-5.43)	2.89	(1.70-4.92)
Mode of delivery						
Vaginal delivery	1		1		1	
Caesarean	4.83	(3.90-5.99)	4.24	(3.35-5.37)	4.81	(4.15-5.56)
Not documented	4.82	(0.67-34.72)	3.89	(0.52-28.91)	1.74	(0.24-12.62)
Home-to-hospital distance						
<15 km	0.81	(0.60-1.08)	0.91	(0.67-1.23)	1.13	(0.77-1.26)
15-29 km	0.87	(0.69-1.09)	0.95	(0.71-1.28)	1.02	(0.76-1.37)
≥ 30 km	1		1		1	
Annual number of deliveries						
<500	0.96	(0.42-2.17)	0.92	(0.21-4.08)	1.19	(0.44-3.24)
500-1000	0.88	(0.53-1.45)	0.88	(0.48-1.63)	0.86	(0.55-1.35)
1001-2000	0.90	(0.61-1.33)	1.18	(0.80-1.75)	0.98	(0.72-1.34)
2001-3000	1		1		1	
3001-4000	0.67	(0.43-1.05)	0.97	(0.64-1.47)	0.87	(0.60-1.25)
>4000	0.86	(0.48-1.54)	1.04	(0.59-1.81)	0.92	(0.52-1.60)
Type of establishment						
1	0.17	(0.10-0.30)	0.33	(0.19-0.56)	0.27	(0.17-0.41)
2	0.24	(0.16-0.35)	0.42	(0.29-0.61)	0.38	(0.27-0.52)
3	1		1		1	

*** Post-Partum Haemorrhage**

**** Distance up to 160 km and 120 min**

Indeed, all of the papers retrieved from the literature showed an association between PPH or severe PPH and maternal age [6,20,22-24]. Kramer et al. reported an adjusted odds ratio (aOR) of 1.2 (1.2-1.3) before 19 years and of 1.5 (1.5-1.6) beyond 35 years [20].

Because multiple pregnancies are associated with an enlarged uterus, they are classically considered a risk factor for PPH. In our study, multiple pregnancies presented an aOR of 3.40 versus singleton pregnancies. This is consistent with all of the studies that investigated PPH or severe PPH, as they reported OR from 2.8 to 3.4 for multiple versus singleton pregnancies [20,23].

Both pre-eclampsia and high blood pressure have been strongly associated with PPH in several reports, with OR varying between 1.5 and 5 [20,23]. We found an OR of 2.80 for pre-eclampsia. The blood loss that defines PPH in the case of vaginal birth is different from that for caesarean birth, and previous studies have shown that caesarean section increases the risk of PPH. Davis et al. estimated an OR equal to 3.59 [24], while Al-Zirqi et al. separated elective caesarean (OR=2.2) from emergency caesarean (OR=3.4) [6]. Similarly, Bateman et al. analysed caesarean without labour (OR=1.3) and caesarean with labour (OR=1.7) [25]. Our results revealed an OR of 4.80 for caesarean sections (60.0%) versus vaginal deliveries (20.0%). It is important to point out that data from the medico-administrative database showed not only the same risk factors described by previous studies based on medical records, but also that the proportions were the same, as illustrated by comparing the OR values found in several other studies with ours.

Our results showed that severe atonic PPH occurred less frequently in type I and type II maternity units than in type III units. We speculate that this finding may be the proof of the efficacy of the national maternity network in France, since it suggests that type I and II maternity units transfer the most severe cases and at-risk women to an establishment with an appropriate level of care. However, other interpretations are possible. Davis et al. [24] reported that the planned place of birth did not influence the risk of blood loss greater than 1,000 ml when adjusted for active management of labour compared with physiological management. This suggests that higher rates of severe haemorrhage

could be explained by the active management of third stage of labor, usually more frequent in type III establishments.

The major result is the strong predictive ability of our model, which takes into account maternal characteristics and birth environment. This finding is new. Usually, the onset of PPH is considered unpredictable because of the lack of known predictors. However, our study showed that certain combinations of known risk factors accurately predicted the onset of PPH that required invasive procedures.

The major strength of this study lies in the fact that we analysed several important maternal variables for all deliveries in France. Z37 codes are able to identify deliveries in mainland France with a difference of 0.6% compared with INSEE data and of 0.3% compared with the civil registry, which records all births in our country [10].

Furthermore, French hospital data for the perinatal period are checked against various sources: medical records, national perinatal surveys or the civil registry. For the year 2010, hospital data, when compared with the national perinatal survey based on a representative sample of the French population, were able to properly recognize maternal age, multiple pregnancies, modes of delivery and birth weights [10]. Finally, since 2011, major changes to the data collection process have improved the quality of collection for other maternal morbidities, including high blood pressure and diabetes, especially in cases of delivery haemorrhage.

Even though the influence of medical practices was globally taken into account by level 2 of statistical model, our data did not allow us to adjust for each potential confounder as some of them were not recorded in our database – i.e., third-stage management of labour (active versus physiological), augmentation of labour (yes or no), place of birth (planned versus actual), duration of labour stages and oxytocin doses. As a result, we cannot draw any firm conclusions about the mechanisms underlying the association between severe PPH and obstetrical practices. This is one limitation. Other limitations concerned the absence from our database of data regarding socio-economic status.

Conclusion

The major strength of this nationwide population-based study lies in the fact that we analysed several important maternal variables for all deliveries in a whole country and drew the same conclusion as those from studies based on medical records. Contrary to models used in previous studies, our model has a very strong predictive ability and revealed important implications for the screening of women at risk of severe PPH.

In drawing the same conclusion as those from studies based on medical records, this study emphasizes the need for the exhaustive collection of the maternal characteristics in order to predict PPH requiring advanced interventional procedures. We then highlight the role of all primary care professionals in the pregnancy follow-up as their contribution to the collection of this information is essential. Coordination between outpatient and inpatient care should be strongly promoted in order to provide hospital practitioners with indicators of severe PPH in time.

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