Factors influencing the success of vaginal birth after a caesarean section

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1. INTRODUCTION

This report analyses factors influencing the success of a successful vaginal delivery after a previous caesarean section. The data used in this analysis was obtained by Dr Peta Skillbeck from the databases at John Hunter Hospital. Specific factors assessed include:

- Maternal characteristics: age and body mass index (BMI),
- Pregnancy characteristics: gestation time
- Use of labour inducing techniques: syntocinon, artificial rupture of membranes (ARM) and cervical ripening balloon (CRB).
- Birth Weight

2. THE DATA

The data obtained from the databases of John Hunter Hospital consisted of 1618 cases, 1021 (63.1%) of whom had successfully given birth naturally (SVB) and 597 (36.9%) of whom had given birth through Caesarean section (see Table 1 below).

Caesarean or Vaginal

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Caesarean	597	36.9	36.9	36.9
	Successful Vaginal Birth	1021	63.1	63.1	100.0
	Total	1618	100.0	100.0	

Table 1: Proportion of pregnancies (in the data) resulting in successful vaginal birth and in caesarean section

The data required substantial cleaning before the analysis could be performed. Specifically, each of the nominal variables “previous vaginal delivery”, “successful vaginal delivery”, “use of syntocinon”, “artificial rupture of membranes” and “cervical ripening balloon” consisted of a large number categories; several of these categories included very few cases. In the case of “previous vaginal delivery” and “Syntocinon”, the categories consisted of different ways of indicating “yes” or “no”, while in the case of “successful vaginal delivery”, the categories consisted of a number of reasons why a vaginal birth was not successful. On the other hand, the categories in CRB consisted of different methods of cervical ripening, while ARM consisited of a combination of different ways of indicating “yes” or “no” and different ARM methods. The large number of categories with very

few cases in these variables was expected to reduce statistical power and hinder analysis. These variables were therefore dichotomised, in consultation with Dr Peta Skillbeck. Details of the dichotomisation, showing the original categories and the new binary variables are given in Appendix A.

In addition, the variable "Gestation Time" included entries that consisted of the number of full weeks plus the number of days in the gestation period. These were entered in several different ways. For example, a gestation time of 279 days may have been entered either as "39+6" or "39.6", both of which were meant to indicate 39 full weeks plus 6 days. In addition, strings of the type "T+3" were used to indicate 283 days, which was meant to be interpreted as a full term of 40 weeks plus 3 days. Once again, this variable was cleaned in consultation with Dr Peta Skillbeck. In the cleaned data, the gestation period was recorded in two ways: "gestation days", which showed the total number of days in the gestation period, and "gestation weeks decimal", which consisted of the "gestation days" divided by 7; "gestation weeks decimal" was used in the analysis.

As a result of the clean up the number of cases was reduced marginally due to missing or uninterpretable data on some of the variables. Specifically, each of "Previous Vaginal Delivery" and "Syntocinon" included 1616 correctly recorded entries, ARM included 1614 correctly recorded entries and CRB included 1613 correctly recorded entries. This small reduction in case numbers (<1%) was not expected to have an effect on the analyses.

3. DATA ANALYSIS

All data was analysed using IBM SPSS Statistics version 20. The analysis was performed in two stages:

1. Exploratory analysis consisting of:
    a. Chi-square analyses to assess the effect of each of the categorical variables (previous vaginal delivery, syntocinon, ARM and CRB) on successful vaginal delivery
    b. Logistic regression to assess the effect of individual continuous variables on successful vaginal delivery
2. A logistic regression model was developed to assess the combined effects of variables that showed a trend towards significance ($p < 0.1$) in their effect on successful vaginal delivery in the exploratory analysis.

Chi square analyses are used to assess whether two categorical variables are independent of each other. Specifically, chi-square analyses test the null hypothesis "Variable A and variable B are independent" against the alternative hypothesis "Variable A and variable B are not independent". A significant finding ($p < 0.05$) is interpreted to mean that variable A and variable B are not independent. If one of the variables (say variable A) can be considered a predictor and the other

one (Variable B) is a response, a significant finding ($p < 0.05$) is interpreted to mean that variable A has a significant effect on variable B. In the chi-square analysies performed for this report, "successful vaginal delivery" was treated as a response variable.

Logistic regression is used to assess the effect of one or more continuous or categorical predictor variables on a binary response variable. In the logistic regression models developed for this report, "successful vaginal delivery" was used as the response variable. The output of the logistic regression models includes an indication of the effect of the predictor variable on the odds of successful vaginal delivery. (In the literature, this may be referred to as the odds ratio.) The predictor is considered to have a significant effect on the odds of success, if the p-value associated with the predictor is less than 5% ($p < 0.05$). In models that include more than one predictor, a predictor with associated $p < 0.05$, is said to have a significant effect on the odds of success, after controlling for the effects of the other predictor variables in the model.

4. RESULTS AND INTERPRETATION

4.1. Exploratory Analysis

Chi-square analyses performed to assess the effects of previous vaginal delivery, syntocinon, ARM and CRB on successful vaginal delivery showed that:

1. Previous vaginal delivery had a significant effect on successful vaginal birth in current delivery ($p < 0.001$); 89.4% (n=338) of women who had previously delivered through vaginal delivery had a successful vaginal birth in the current delivery, as compared to 55.1% (n=682) of those who had not had a previous vaginal delivery.

2. Syntocinon had a significant (lowering) effect on successful vaginal delivery ($p = 0.026$); 59% (n=282) of women who had syntocinon had a successful vaginal delivery, as compared to 64.9% (n=738) of those who did not have syntocinon.

3. ARM had a significant effect on successful vaginal delivery ($p = 0.032$); 65.9% (n=478) of women who had ARM had a successful vaginal delivery, as compared to 60.7% (n=540) of those who did not have ARM.

4. CRB had a significant (lowering) effect on successful vaginal delivery ($p < 0.001$); 50.8% (99) of women who had CRB had a successful vaginal delivery, as compared to 65% (n=921) of those who did not have CRB.

Logistic regression models developed to assess the effects of maternal age, maternal BMI, birth weight and gestation time on the odds of success of a vaginal delivery showed that:

1. Maternal age did not have significant effect on odds of a successful vaginal delivery ($p = 0.493$). The associated odds ratio was 0.993 [95% confidence interval: (0.974, 1.013)], which is not significantly different from 1.

2. Maternal BMI had a significant effect on odds of a successful vaginal delivery ($p < 0.001$). The associated odds ratio was 0.970 [95% confidence interval: (0.955, 0.985)]. The odds ratio of 0.970 is interpreted to mean that a 1% increase in BMI is associated with a decrease in odds of success in vaginal delivery by 3% [calculated as 1 – 0.970].

3. Birth weight did not have significant effect on odds of a successful vaginal delivery ($p = 0.898$). The associated odds ratio was 1.000 [95% confidence interval: (1.000, 1.000)], which is not significantly different from 1.

4. Gestation time did not have a significant effect on odds of a successful vaginal delivery ($p = 0.051$). The associated odds ratio was 1.032 [95% confidence interval: (1.000, 1.065)]. The p-value of 0.051, however, was very close to the significance criterion of $p < 0.05$. Therefore, this relationship was considered worthy of further investigation in a model which controlled for the effect of previous vaginal delivery. The associated odds ratio of 1.032 could be interpreted to mean that a 1% increase in BMI is associated with an increase in odds of success in vaginal delivery by 3.2% (calculated as 1.032- 1).

Tables showing the statistical output of all exploratory analyses are presented in Appendix B.

4.2. Final Logistic Regression Model

A logistic regression model was developed to assess the effects of various predictors on the odds of a successful vaginal delivery, while controlling for the effect of other variables in the model. The predictors included in the model were the ones which were significant (or close to significant) in the exploratory analysis outlined in section 4.1, above. Specifically, the predictors included in the model were:

- Previous vaginal delivery
- Use of labour inducing techniques: syntocinon, ARM, CRB
- Maternal BMI
- Gestation Time

As in the analysis presented in section 4.1, the response was the odds of successful vaginal delivery.

1405 cases were included in the final model, and 213 cases were excluded due to missing data; 205 of these 213 had BMI data missing, while the remaining 8 had data missing on one or more of "previous vaginal delivery", syntocinon, ARM or CRB.

The omnibus test for model effects was highly significant ($p < 0.001$). This test assesses the usefulness of the model by testing the null hypothesis that none of the model predictors have a significant effect on the response variable against the alternative hypothesis that at least one of the model predictors has a significant effect on the response variable. The significant result indicates that the model is useful in assessing the odds of successful delivery.

The Hosmer-Lemeshow test was used to analyse the goodness-of-fit of the model. A non-significant result on the Hosmer-Lemeshow test indicates an adequate fit. The test returned a p-value of $p = 0.100 > 0.05$, indicating that the model was an adequate fit to the data. In addition, a classification

table was produced to assess the number of births that were correctly predicted by the model. The classification table showed that:

- 88.5% of successful vaginal births were correctly predicted by the model
- 31.9% of caesarean births were correctly predicted by the model
- Overall, 67.7% of delivery types were correctly predicted by the model.

The poor performance of the model on prediction of caesarean section could be due to complications or other confounding factors that are not captured in the data. However, the high percent of successful vaginal births that are correctly predicted by the model is an indication that the predictors in the model are useful in assessing the odds of success in a vaginal delivery.

The case processing summary, the results of the omnibus test for model effects, the Hosmer-Lemeshow test and the classification table are presented in Tables C1, C3, C5 and C6 (respectively) in Appendix C.

Table 2 (below) shows the effects of individual predictors in the model on the odds of successful vaginal delivery, after controlling for the effects of other predictors in the model.

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
PrevVagDel	2.075	.203	104.668	1	.000	7.968	5.354	11.858
BMI	-.030	.008	12.714	1	.000	.971	.955	.987
GestationWeeksDecimal	.057	.023	6.266	1	.012	1.059	1.012	1.107
CRB_Binary	-.585	.196	8.881	1	.003	.557	.379	.818
Synto_Binary	-.242	.148	2.681	1	.102	.785	.588	1.049
ARM_Bin	.349	.136	6.622	1	.010	1.417	1.087	1.849
Constant	-1.231	.910	1.830	1	.176	.292		

Predictors: PrevVagDel, BMI, GestationWeeksDecimal, CRB_Binary, Synto_Binary, ARM_Bin.

Table 2: Main Logistic Regression Table

As see from Table 2, above:

- Previous vaginal delivery has a significant effect on odds of successful vaginal birth in current delivery ($p < 0.001$), after controlling for the effects of BMI, gestation time, CRB, syntocinon, and ARM. The odds ratio is 7.968 [95% CI: (5.354, 11.858)]. In practical terms, this means that if BMI, gestation time, syntocinon status (yes/no), CRB status (yes/no) and ARM status (yes/no) remain the same, the odds of a successful vaginal delivery are 696.8% higher [calculated as (7.968 – 1)*100] if the woman had a previous vaginal delivery rather than a previous caesarean delivery.

- Maternal BMI has a significant effect on odds of successful vaginal birth in current delivery ($p < 0.001$), after controlling for the effects of previous vaginal delivery, gestation time,

CRB, syntocinon, and ARM. The odds ratio is 0.971 [95% CI: (0.955, 0.987)]. In practical terms, this means that if previous vaginal delivery status (vaginal/caesarean), gestation time, syntocinon status (yes/no), CRB status (yes/no) and ARM status (yes/no) are the same, a 1% increase in BMI is associated with 2.9% lower odds of a success in a vaginal delivery [calculated as (0.971 – 1)*100].

- Gestation time has a significant effect on odds of successful vaginal birth in current delivery (p = 0.012), after controlling for the effects of previous vaginal delivery, BMI, CRB, syntocinon, and ARM. The odds ratio is 1.059 [95% CI: (1.012, 1.107)]. In practical terms, if the previous vaginal delivery status (vaginal/caesarean), maternal BMI, syntocinon status (yes/no), CRB status (yes/no) and ARM status (yes/no) are the same, a 1 week increase in gestation time is associated with a 5.9% increase in the odds of success in a vaginal delivery [calculated as (1.059 – 1)*100].

- CRB has a significant effect on odds of successful vaginal birth in current delivery (p = 0.003), after controlling for the effects of previous vaginal delivery, BMI, gestation time, syntocinon, and ARM. The odds ratio is 0.557 [95% CI: (0.379, 0.818)]. In practical terms, if the previous vaginal delivery status (vaginal/caesarean), maternal BMI, gestation time, syntocinon status (yes/no), and ARM status (yes/no) are the same, the use of CRB decreases the odds of a successful vaginal delivery by 44.3% [calculated as (0.557 – 1)*100].

- Syntocinon does not have a statistically significant effect on odds of successful vaginal birth in current delivery (p = 0.102), after controlling for the effects of previous vaginal delivery, BMI, gestation time, CRB, and ARM. The odds ratio is 0.785. In clinical terms, this could mean that if the previous vaginal delivery status (vaginal/caesarean), maternal BMI, gestation time, CRB status (yes/no), and ARM status (yes/no) are the same, the use of syntocinon decreases the odds of a successful vaginal delivery by 21.5% [calculated as (0.785 – 1)*100]. However, the effect of syntocinon is not statistically significant in this model, and due caution should be exercised in interpreting its effect. The lack of statistical significance despite appearing to have a relatively large effect (21.5% decrease) is due to substantial variability in the odds of success of vaginal delivery when syntocinon is used. This could potentially be caused by some observed or unobserved confounding factor. Specifically, the effect of syntocinon may be confounded by the large number of cases (75.1%) in which the mother received syntocinon as well as ARM (see Table 3 below). This is worthy of further investigation.

			Artificial Rupture of Membranes		Total
			No	Yes	
Syntocinon	No	Count	770	366	1136
		% within Syntocinon	67.8%	32.2%	100.0%
	Yes	Count	119	359	478
		% within Syntocinon	24.9%	75.1%	100.0%
Total		Count	889	725	1614
		% within Syntocinon	55.1%	44.9%	100.0%

Table 3: Relationship between syntocinon and ARM

- ARM has a significant effect on odds of successful vaginal birth in current delivery (p = 0.010), after controlling for the effects of previous vaginal delivery, BMI, gestation time, syntocinon, and CRB. The odds ratio is 1.417 [95% CI: (1.087, 1.849)]. In practical terms, if the previous vaginal delivery status (vaginal/caesarean), maternal BMI, gestation time, syntocinon status (yes/no), and CRB status (yes/no) are the same, the use of ARM increases the odds of a successful vaginal delivery by 41.7% [calculated as (1.417 – 1)*100].

5. LIMITATIONS

As with all statistical models, the results of the final regression model need to be interpreted with caution. Specifically:

- The effect of gestation time on odds of successful vaginal delivery may be non-linear in the sense that increase in gestation time beyond a certain number of weeks may lead to a sudden drop in odds of successful vaginal delivery, either due to loss of patience on the expectant mother's part or due to a decision by the expectant mother's medical team. This situation needs to be considered from a clinical/theoretical perspective. The interpretation of the effect of gestation time on odds of successful vaginal delivery must therefore be interpreted in this context.

- Similar considerations may be required in interpreting the effects of other predictors in the final regression model. These considerations are beyond the scope of this report.

- As outlined in section 4.2, the effect of syntocinon on odds of successful vaginal delivery needs to be interpreted with caution.

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6. APPENDIX A – DATA CLEAN UP TABLES

Delivery * Caesarean or Vaginal Crosstabulation

Count

		Caesarean or Vaginal		Total
		Caesarean	Successful Vaginal Birth	
Delivery	cat 2 CS	1	0	1
	cs	80	0	80
	cs (ftp	1	0	1
	cs (sro	1	0	1
	cs ((non	1	0	1
	cs (2 pr	1	0	1
	cs (abru	9	0	9
	CS (APH,	1	0	1
	cs (aph)	1	0	1
	CS (APH)	1	0	1
	cs (aph/	2	0	2
	cs (arm)	2	0	2
	cs (cat	1	0	1
	cs (cord	3	0	3
	cs (ctg	12	0	12
	cs (CTG	2	0	2
	cs (ctg,	1	0	1
	cs (ctg)	48	0	48
	cs (CTG)	1	0	1
	cs (ctg/	2	0	2
	cs (dela	20	0	20
	CS (dela	6	0	6
	cs (derm	1	0	1
	cs (ecla	1	0	1
	cs (face	1	0	1
	cs (fail	34	0	34
	CS (fail	11	0	11
	CS (feta	5	0	5
	cs (ft e	1	0	1
	cs (fte	3	0	3

	cs (fte)	9	0	9
	cs (fte/	1	0	1
	cs (ftp	34	0	34
	cs (FTP	2	0	2
	cs (ftp)	68	0	68
	cs (ftP)	1	0	1
	cs (FTP)	2	0	2
	CS (FTP)	1	0	1
	cs (ftp/	2	0	2
	cs (high	19	0	19
	CS (high	8	0	8
	CS (HIGH	1	0	1
	cs (ht a	1	0	1
	cs (ht)	14	0	14
	cs (ht/0	1	0	1
	cs (HT/I	1	0	1
	cs (ht/m	1	0	1
	cs (hype	2	0	2
	CS (hype	9	0	9
	cs (hyst	1	0	1
	cs (iol	1	0	1
	cs (iugr	3	0	3
	cs (IUGR	1	0	1
	cs (labo	1	0	1
	cs (macr	1	0	1
	CS (macr	1	0	1
	cs (no-r	1	0	1
	cs (non	1	0	1
	cs (non-	3	0	3
	cs (nonn	1	0	1
	cs (nonr	28	0	28
	CS (nonr	22	0	22
	cs (poor	2	0	2
	CS (poor	25	0	25
	cs (ppro	2	0	2
	cs (PPRO	2	0	2

	CS (PPRO	5	0	5
	cs (PROM	2	0	2
	cs (ROM)	1	0	1
	cs (rupt	8	0	8
	cs (srom	17	0	17
	cs (SROM	3	0	3
	cs (stil	2	0	2
	CS (uter	1	0	1
	CS Cat 1	2	0	2
	CS Cat 2	3	0	3
	cs cat 3	1	0	1
	CS Cat 3	23	0	23
	cs faile	1	0	1
	cs high	1	0	1
	inst	0	120	120
	INST	0	1	1
	instr	0	22	22
	instrume	0	41	41
	Instrume	0	28	28
	svb	0	687	687
	SVB	0	103	103
	svb (iol	0	1	1
	svb (sti	0	12	12
	SVB (sti	0	4	4
	svb stil	0	1	1
	svb(APH)	0	1	1
Total		597	1021	1618

Table A1: Dichotomisation of the outcome variable: Delivery mode

PrevVaginalDel * Previous Vaginal Delivery Crosstabulation

Count

		Previous Vaginal Delivery		Total
		No	Yes	
PrevVaginalDel	n	788	0	788
	N	214	0	214
	N (2 pre	4	0	4
	no	232	0	232
	y	0	11	11
	Y	0	41	41
	yes	0	326	326
Total		1238	378	1616

Table A2: Dichotomisation of "Previous Vaginal Delivery"

Synto * Syntocinon Crosstabulation

Count

		Syntocinon		Total
		No	Yes	
Synto	n	952	0	952
	N	186	0	186
	synto	0	1	1
	Synto	0	73	73
	y	0	398	398
	Y	0	6	6
Total		1138	478	1616

Table A3: Dichotomisation of "Syntocinon"

ARM * Artificial Rupture of Membranes Crosstabulation

Count

		Artificial Rupture of Membranes		Total
		No	Yes	
	arm	0	3	3
	ARM	0	79	79
	FB	0	23	23
	FSE	0	7	7
ARM	n	738	0	738
	N	149	0	149
	nn	2	0	2
	y	0	608	608
	Y	0	5	5
Total		889	725	1614

Table A4: Dichotomisation of ARM

CRB * Cervical Ripening Group Crosstabulation

Count

		Cervical Ripening Group		Total
		No	Yes	
	Atad cat	0	20	20
	Cervadil	0	1	1
	Cervidil	0	1	1
	Double b	0	4	4
	Foley ca	0	9	9
	mife	0	1	1
CRB	Misopros	0	2	2
	n	1200	0	1200
	N	217	0	217
	no	1	0	1
	Single b	0	2	2
	y	0	151	151
	Y	0	4	4
Total		1418	195	1613

Table A5: Dichotomisation of CRB

7. APPENDIX B – EXPLORATORY STATISTICAL ANALYSIS

Crosstab

			Previous Vaginal Delivery		Total
			No	Yes	
Caesarean or Vaginal	Caesarean	Count	556	40	596
		% within Previous Vaginal Delivery	44.9%	10.6%	36.9%
	Successful Vaginal Birth	Count	682	338	1020
		% within Previous Vaginal Delivery	55.1%	89.4%	63.1%
Total		Count	1238	378	1616
		% within Previous Vaginal Delivery	100.0%	100.0%	100.0%

Table B1: Effect of Previous Vaginal Delivery on Successful Vaginal Birth

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	146.600[a]	1	.000		
Continuity Correction[b]	145.129	1	.000		
Likelihood Ratio	169.014	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	146.509	1	.000		
N of Valid Cases	1616				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 139.41.

b. Computed only for a 2x2 table

Table B2: Significance of effect of Previous Vaginal Delivery on Successful Vaginal Birth

Crosstab

			Syntocinon		Total
			No	Yes	
Caesarean or Vaginal	Caesarean	Count	400	196	596
		% within Syntocinon	35.1%	41.0%	36.9%
	Successful Vaginal Birth	Count	738	282	1020
		% within Syntocinon	64.9%	59.0%	63.1%
Total		Count	1138	478	1616
		% within Syntocinon	100.0%	100.0%	100.0%

Table B3: Effect of Syntocinon on Successful Vaginal Birth

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.957[a]	1	.026		
Continuity Correction[b]	4.708	1	.030		
Likelihood Ratio	4.918	1	.027		
Fisher's Exact Test				.028	.015
Linear-by-Linear Association	4.954	1	.026		
N of Valid Cases	1616				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 176.29.

b. Computed only for a 2x2 table

Table B4: Significance of effect of Syntocinon on Successful Vaginal Birth

Crosstab

			Artificial Rupture of Membranes		Total
			No	Yes	
Caesarean or Vaginal	Caesarean	Count	349	247	596
		% within Artificial Rupture of Membranes	39.3%	34.1%	36.9%
	Successful Vaginal Birth	Count	540	478	1018
		% within Artificial Rupture of Membranes	60.7%	65.9%	63.1%
Total		Count	889	725	1614
		% within Artificial Rupture of Membranes	100.0%	100.0%	100.0%

Table B5: Effect of ARM on Successful Vaginal Birth

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.616[a]	1	.032		
Continuity Correction[b]	4.396	1	.036		
Likelihood Ratio	4.628	1	.031		
Fisher's Exact Test				.034	.018
Linear-by-Linear Association	4.613	1	.032		
N of Valid Cases	1614				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 267.72.

b. Computed only for a 2x2 table

Table B6: Significance of effect of ARM on Successful Vaginal Birth

Crosstab

			Cervical Ripening Group		Total
			No	Yes	
Caesarean or Vaginal	Caesarean	Count	497	96	593
		% within Cervical Ripening Group	35.0%	49.2%	36.8%
	Successful Vaginal Birth	Count	921	99	1020
		% within Cervical Ripening Group	65.0%	50.8%	63.2%
Total		Count	1418	195	1613
		% within Cervical Ripening Group	100.0%	100.0%	100.0%

Table B7: Effect of CRB on Successful Vaginal Birth

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	14.830[a]	1	.000		
Continuity Correction[b]	14.226	1	.000		
Likelihood Ratio	14.392	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	14.820	1	.000		
N of Valid Cases	1613				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 71.69.

b. Computed only for a 2x2 table

Table B8: Significance of effect of CRB on Successful Vaginal Birth

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Age	-.007	.010	.471	1	.493	.993	.974	1.013
	Constant	.745	.309	5.823	1	.016	2.107		

a. Variable(s) entered on step 1: Age.

Table B9: Effect of Maternal Age on Odds of Success of a Vaginal Birth

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	BMI	-.030	.008	15.562	1	.000	.970	.955	.985
	Constant	1.365	.218	39.221	1	.000	3.916		

a. Variable(s) entered on step 1: BMI.

Table B10: Effect of Maternal BMI on Odds of Success of a Vaginal Birth

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	Wt	.000	.000	.016	1	.898	1.000	1.000	1.000
	Constant	.508	.226	5.053	1	.025	1.663		

a. Variable(s) entered on step 1: Wt.

Table B11: Effect of Birth Weight on Odds of Success of a Vaginal Birth

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	GestationWeeksDecimal	.031	.016	3.817	1	.051	1.032	1.000	1.065
	Constant	-.674	.622	1.177	1	.278	.509		

a. Variable(s) entered on step 1: GestationWeeksDecimal.

Table B12: Effect of Gestation Time on Odds of Success of a Vaginal Birth

8. APPENDIX C – FINAL LOGISTIC REGRESSION MODEL

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	1405	86.8
	Missing Cases	213	13.2
	Total	1618	100.0
Unselected Cases		0	.0
Total		1618	100.0

a. If weight is in effect, see classification table for the total number of cases.

Table C1: Summary of cases included in the final logistic regression model

Dependent Variable Encoding

Original Value	Internal Value
Caesarean	0
Successful Vaginal Birth	1

Table C2: Internal coding of the response variable

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	200.511	6	.000
	Block	200.511	6	.000
	Model	200.511	6	.000

Table C3: Omnibus Test for usefulness of the model ($p < 0.05$) indicates a useful model

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	1648.096[a]	.133	.182

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than .001.

Table C4: More information on sufficiency of the model; Cox & Snell R Square and Nagelkerke R Square are indicators of proportion of variation in the response variable that is explained by the predictors in the model. Neither is accepted as being fully accurate.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	13.366	8	.100

Table C5: Information on adequacy of the model fit; a non-significant result ($p \geq 0.05$) is an indication of an adequate fit.

Classification Table[a]

Observed			Predicted		
			Caesarean or Vaginal		Percentage Correct
			Caesarean	Successful Vaginal Birth	
Step 1	Caesarean or Vaginal	Caesarean	165	352	31.9
		Successful Vaginal Birth	102	786	88.5
	Overall Percentage				67.7

a. The cut value is .500

Table C6: More information on adequacy of the model fit; 67.7% of births were correctly predicted by the model; 88.5% of successful vaginal births were correctly predicted, while only 31.9% of Caesarean births were correctly predicted

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1[a]	PrevVagDel	2.075	.203	104.668	1	.000	7.968	5.354	11.858
	BMI	-.030	.008	12.714	1	.000	.971	.955	.987
	GestationWeeksDecimal	.057	.023	6.266	1	.012	1.059	1.012	1.107
	CRB_Binary	-.585	.196	8.881	1	.003	.557	.379	.818
	Synto_Binary	-.242	.148	2.681	1	.102	.785	.588	1.049
	ARM_Bin	.349	.136	6.622	1	.010	1.417	1.087	1.849
	Constant	-1.231	.910	1.830	1	.176	.292		

a. Variable(s) entered on step 1: PrevVagDel, BMI, GestationWeeksDecimal, CRB_Binary, Synto_Binary, ARM_Bin.

Table C7: Main Logistic Regression Table showing the effect of individual predictors on the odds of success in a vaginal birth, after controlling for the effects of the other predictors in the model