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A priori choice of neuraxial labour analgesia and breastfeeding initiation success: a community-based cohort study in an Italian baby-friendly hospital

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ABSTRACT

Objective To investigate whether the nature of the decision about receiving neuraxial labour analgesia is associated with breastfeeding initiation success (BIS), defined as exclusive breastfeeding until discharge associated with postnatal weight loss <7% at 60 hours from birth.

Design Single-centre community-based cohort study.

Setting An Italian baby-friendly hospital, from 1 July 2011 to 22 September 2015.

Participants Inclusion criteria: women vaginally delivering singleton cephalic newborns and willing to breastfeed. Exclusion criteria: women who delivered in uterus-dead fetuses, were single or requested but did not receive neuraxial analgesia. Overall, 775 out of the 3628 enrolled women received neuraxial analgesia.

Results Compared with women who tried to cope with labour pain, those who decided a priori to receive neuraxial analgesia had less BIS (planned vaginal birth: 2121/3421 (62.0%), vs 102/207 (49.3%; p<0.001; risk difference (RD), 12.7%); actual vaginal birth: 1924/2994 (64.3%), vs 93/189 (49.2%; p<0.001; RD, 15.1%)). Multivariable analyses with antelabour-only confounders confirmed both associations (planned vaginal birth: relative risk (RR), 0.65; 95% CI, 0.48 to 0.87; actual vaginal birth: RR, 0.59; 95% CI, 0.43 to 0.80). Although women who requested analgesia as a last resort had less BIS than did those successfully coping with labour pain in the bivariable analyses (planned vaginal birth: 1804/2853 (63.2%), vs 317/568 (55.8%; p=0.001; RD, 7.4%); actual vaginal birth: 1665/2546 (65.4%), vs 259/448 (57.8%; p=0.002; RD, 7.6%)), multivariable analyses with either antelabour-only or peripartum confounders did not confirm these associations (planned vaginal birth: RR, 0.99; 95% CI, 0.80 to 1.23; actual vaginal birth: RR, 0.90; 95% CI, 0.69 to 1.16).

Conclusions Compared with trying to cope with labour pain, a priori choice of neuraxial analgesia is negatively associated with BIS. Conversely, compared with having successfully coped with pain, requesting neuraxial analgesia as a last resort is not negatively associated with BIS.

Strengths and limitations of this study

► The study enrolled a large and almost unselected population of mother–baby dyads due to the limited exclusion criteria.

► The comparison of groups is meaningful because physiologic birth was the true reference point.

► The outcome measure is robust because it included an index of the newborn's nutritional status at discharge.

► The generalisability of the findings may be limited due to the observational, single-centre design.

► The baby-friendly designation of the hospital may introduce a possible selection bias.

INTRODUCTION

A growing body of evidence now supports the consideration of breastfeeding as the normative standard for infant feeding.[1–11] In the past, the risk factors for breastfeeding failure have been investigated extensively to steer policies and interventions aimed at promoting breastfeeding success. Among the several medical interventions that could affect breastfeeding success, the role of neuraxial labour analgesia has been investigated thoroughly. Several studies have found that neuraxial labour analgesia can negatively impact either the initiation or duration of exclusive breastfeeding.[12–18] Although some reviewers have also quoted reassuring studies, to date, consistent results have not been reported.[19 20] The recent release of the 'Intrapartum Care for a Positive Childbirth Experience' guidelines by the WHO[21] pushes for an in-depth analysis of the relationship between neuraxial labour analgesia and breastfeeding. Indeed, these guidelines recommend pharmacological labour analgesia (either

neuraxial analgesia or parenteral opioid administration) 'for healthy pregnant women requesting pain relief during labour, depending on a woman's preferences'. Moreover, these guidelines underline that women who expressed an 'a priori desire for analgesia' to experience a pain-free labour may be different from those who only 'requested analgesia as a last resort' when the pain level was overwhelming.

To the best of our knowledge, the association between the nature of the decision about receiving neuraxial labour analgesia and breastfeeding success has not yet been investigated. Thus, we aimed to investigate whether the decision about receiving neuraxial labour analgesia, either a priori or as a last resort, was associated with breastfeeding initiation success (BIS) at discharge from a baby-friendly hospital. Specifically, we aimed to test two hypotheses. First, among women trying to deliver vaginally, we hypothesised that women who choose analgesia a priori have a lower BIS than do those who try to cope with labour pain. Second, among women who try to cope with labour pain, we hypothesised that those who request analgesia only as a last resort have similar BIS as those who successfully cope with labour pain.

METHODS

This manuscript adheres to the Strengthening the Reporting of Observational Studies in Epidemiology guidelines. The Aosta Valley community comprises 125 000 inhabitants, and the Parini Regional Hospital is the only available facility in the county. There are 1200 deliveries each year at this hospital, and since 2010, it has been repeatedly designated by Unicef as a baby-friendly hospital. All women who delivered at the facility between 1 July 2011 and 22 September 2015 were screened for eligibility. All women who planned to give birth vaginally to a singleton cephalic newborn and expressed the desire to breastfeed the baby were included in the study. Women who delivered an in uterus-dead fetus, who were currently single or who requested neuraxial analgesia but did not receive it due to technical difficulties were excluded. Single mothers were excluded because only a few of the potential participants were single and the analyses included several confounders that were relevant to both parents as a couple.

The study predictors were the a priori choice for analgesia and the request for analgesia as a last resort. Women were considered as choosing neuraxial labour analgesia a priori if they chose to receive the analgesia by themselves, and requested it on arrival at the delivery room without considering alternative means of pain relief offered by the facility's midwives. On the other hand, women were considered as requesting analgesia as a last resort if they requested it later during labour progression, or only after considering other techniques offered by the facility's midwives (postures, massage, water immersion, etc). In the latter case, the trigger for the request was an overwhelming level of pain or an unmanageable

sense of control over the labour or both, and the woman's decision was shared and supported by healthcare professionals. The decision about receiving neuraxial analgesia was first collected by the attending midwife when the women arrived at the delivery room (ie, when the active phase of labour was beginning or when labour would be induced with oxytocin). The need of labour induction was not considered a routine indication for neuraxial analgesia implementation or proactive epidural catheter placement. Accordingly, the woman's decision about receiving analgesia was collected by the duty gynaecologist when the woman signed the informed consent for the induction of labour and it was reported by the attending midwife in the delivery room. The women were then divided into two groups, those trying to cope with labour pain on their own (trying to cope group), and those who chose to receive analgesia a priori (a priori choice group). Thereafter, should women in the trying to cope group give up and demand analgesia, they were classified as requesting analgesia as a last resort (last resort group). In contrast, women who did not require neuraxial labour analgesia were categorised as having successfully coped with the pain (successful coping group).

Neuraxial labour analgesia was administered by the duty anaesthetist using the same technique in the a priori choice and last resort groups. The analgesia was either a combined spinal-epidural or a classic epidural, and in either case, a low-dose, high-volume mixture of ropivacaine and sufentanil was administered as intermittent on-demand boluses by the duty anaesthetist to pursue a verbal rating pain score from 4 to 6 out of 10 according to the woman's wishes.

The study endpoint was BIS, as collected by the attending paediatrician at hospital discharge. BIS was defined as exclusive breastfeeding during the entire hospital stay,[22 23] associated with a postnatal weight loss less than 7% at 60 hours from birth.[24 25] Mother–baby dyads' socio-demographic, anamnestic, peripartum and breastfeeding data were collected by study investigators, as retrieved from their computerised medical charts.

Sample size

Personal data (Wetzl RG, A baby-friendly hospital, 2011) showed a ratio of 0.07 between women in the a priori choice group and those in the trying to cope group. Therefore, it was hypothesised that 208 women in the a priori choice group and 2975 women in the trying to cope group would be necessary to detect a 10% difference in BIS at discharge (from 0.55 to 0.45).[26] At the end of the recruitment period, the power requirement for the planned endpoint of the study was wholly satisfied by the actual size of the enrolled population.

Statistical analysis

The descriptive data were presented as the number (n) and percentage for categorical variables, and as the mean, SD, median and the 10th and 90th percentiles for continuous variables. Bivariable associations between

predictors, confounders and the endpoint were evaluated through the χ^2 test using a two-tailed alpha of 0.05 and a power of 0.80 (1 – beta). Yates's correction for continuity was used when the expected value for at least one cell was less than 5 in a 2×2 contingency table.

The confounders that, according to the current literature, could be associated with BIS were entered into the analysis and grouped as antelabour-only and peripartum confounders. In addition to antelabour confounders, the peripartum confounders included the intrapartum and postpartum ones. To be considered an antelabour-only confounder, a factor was required to meet all the following criteria: (1) it must be present before labour initiation, that is, before exposure to analgesia; (2) there must be a theoretical basis for an association between the confounder and the endpoint; and (3) it should be impossible to reverse the temporal sequence.[27] Online supplementary table A1 and 2 indicate the antelabour-only and peripartum confounders, and their diagnostic and categorising criteria.

In the analyses, if a categorical variable had three or more possible values, dummy variables were created. In most cases, previously published and validated cut-offs were used. If the percentile cut-off was used, the 10th and 90th percentiles were calculated for the entire population of women who delivered in the facility (Wetzl RG, Aosta whole birth cohort, 2016). To adjust for the risk estimates in the main effects, considering the dichotomous endpoint, a log-linear multivariable regression analysis was used and the confounders were entered using a forward selection procedure. p<0.10 was considered acceptable to enter the variable into the log-linear regression model. Prior to multivariable analyses, multicollinearity was assessed at each step of the analyses. Values of condition index <15, tolerance >0.10 and variance inflation factor <10.0 were considered acceptable. The accuracy of the log-linear regression model was assessed using Nagelkerke's R^2 coefficient of determination. The results were reported as regression coefficient, relative risk (RR), 95% CI, p value and risk difference (RD), as a measure of the absolute risk. Records with missing data were excluded from the multivariable log-linear analyses.

Data were analysed first on the whole population of recruited women (first-step) and then excluding women who underwent an unplanned caesarean section (second-step). At each step, data analyses were conducted following a two-stages design. For the first study hypothesis, BIS was compared between women in the trying to cope group and the a priori choice group. For the second study hypothesis, within the trying to cope group, BIS was evaluated by comparing women in the successful coping group with those in the last resort group. At each stage, multivariable analyses were performed in sequence, first with the antelabour-only confounders and then with the antelabour and peripartum confounders together.

Data were collected and tabulated using the FileMaker 11 Pro Relational Database (FileMaker, FileMaker International, Santa Clara, California, USA). Statistical analyses were performed using SPSS V.22 (IBM SPSS Statistics).

Patient and public involvement

No parents were directly involved in setting the questions, selecting the outcome measure, designing and implementing the study. No parents were involved in the interpretation or writing up of study results.

RESULTS

The flow chart of the study steps has been presented in figure 1. From the set of eligible women (n=3685), the following were excluded: 11 women with intrauterine fetal death, 40 single mothers and 6 women who requested but did not receive analgesia due to technical difficulties. Finally, for the first-step anlyses 3628 women were recruited (attempted vaginal birth population). For the second-step analyses, 445 women who underwent an unplanned caesarean section were excluded. Therefore, the population of actual vaginal birth comprised 3183 women.

No differences in basal characteristics were found between the women who were excluded from the study and those who were included (data not shown). Missing data values regarding the 50 considered confounders represented 0.003% of all the collected data, and deletion of the involved records did not impact the power requirements for the study endpoint.

Descriptive analysis

Tables 1-2 show the characteristics of the study's groups in the planned vaginal birth (n=3628) and actual vaginal birth population (n=3183), respectively. Online supplementary tables A3–11 show the basal characteristics of the parents and newborns, the dyads' outcomes in caesarean and vaginal deliveries, and the basal and technical characteristics of administered neuraxial labour analgesia. The two groups of women who received neuraxial analgesia (whole cohort, n=775; a priori choice group, n=207; and last resort group, n=568) showed no differences regarding the following variables: cervical dilation at the time of analgesia request, percentage of combined spinal-epidurals versus classic epidurals administered, number of administered boluses, cumulative opioid or local analgesic administered doses, and mother's satisfaction registered at least 24 hours after the birth (online supplementary table A7).

Outcome data

A significant reduction in BIS at discharge was found in both women who chose analgesia a priori (planned vaginal birth: trying to cope group vs a priori choice group, 2121/3421 (62.0%; 95% CI, 60.4% to 63.6%), vs 102/207 (49.3%; 95% CI, 42.5% to 56.1%; p<0.001; RD=12.7%); actual vaginal birth: trying to cope group vs a priori choice group, 1924/2994 (64.3%; 95% CI, 62.5%
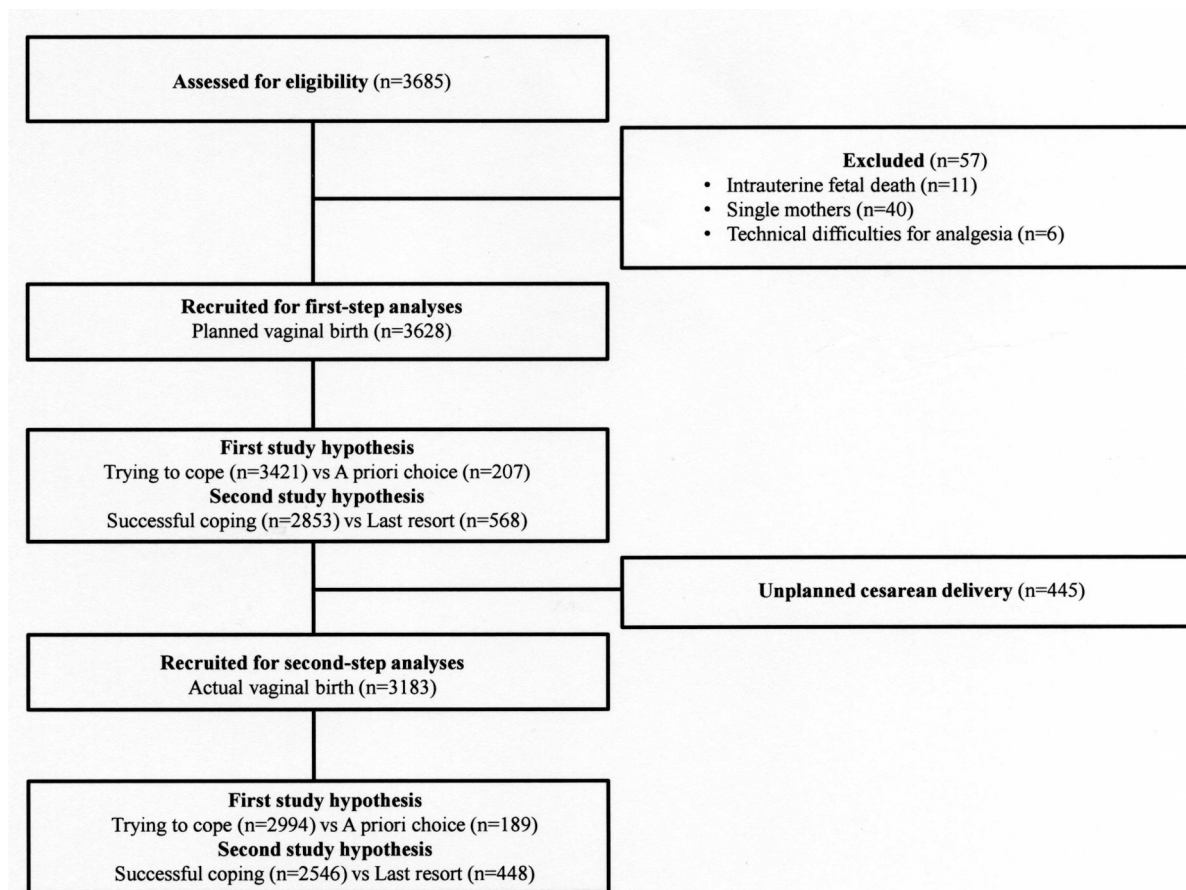
Figure 1 Flow chart of the study steps. For the first study hypothesis, among the women planning to give birth vaginally, breastfeeding initiation success (BIS) was compared between women who chose analgesia a priori and those trying to cope with labour pain. For the second study hypothesis, among the women who tried to cope with labour pain, BIS was compared between women who requested analgesia only as a last resort and those who coped with labour pain successfully.

to 66.0%), vs 93/189 (49.2%; 95% CI, 42.1% to 56.3%; p<0.001; RD=15.1%)), and women who requested analgesia as a last resort (planned vaginal birth: successful coping vs last resort group, 1804/2853 (63.2%; 95% CI, 61.5% to 65.0%), vs 317/568 (55.8%; 95% CI, 51.7% to 59.9%; p=0.001; RD=7.4%); actual vaginal birth: successful coping vs last resort group, 1665/2546 (65.4%; 95% CI, 63.5% to 67.2%), vs 259/448 (57.8%; 95% CI, 53.2% to 62.4%; p=0.002; RD=7.6%)).

In the group of women trying to deliver vaginally, multivariable log-linear analyses with antelabour-only confounders showed that women who chose analgesia a priori had significantly less BIS than those who tried to cope with labour pain (planned vaginal birth: RR=0.65; 95% CI, 0.48 to 0.87; p=0.004; actual vaginal birth: RR=0.59; 95% CI, 0.43 to 0.80; p=0.001) (table 3).

In contrast, in the group of women trying to cope with labour pain, compared with those who succeeded in coping with labour pain, the group of women who requested analgesia as a last resort did not show an independent association with BIS according to multivariable log-linear analyses with either antelabour-only or antelabour and peripartum confounders considered together (planned vaginal birth: RR=0.99; 95% CI, 0.80 to 1.23;

p=0.955; actual vaginal birth: RR=0.90; 95% CI, 0.69 to 1.16; p=0.405) (table 4). On the contrary, being nulliparous or older, presenting with a higher body mass index or a greater pregnancy weight gain, or having delivered a newborn at a younger gestational age were associated with a decreased BIS at discharge.

DISCUSSION

The findings of the present study conducted in a baby-friendly hospital setting demonstrate that a woman's a priori choice of receiving neuraxial labour analgesia was independently associated with reduced BIS at discharge compared with women trying to cope with labour pain. In contrast, a woman's request for neuraxial labour analgesia as a last resort led to similar BIS as that among women who succeeded in coping with labour pain.

The first results of the present study could be partially explained hypothesising a greater motivational vulnerability towards breastfeeding among women choosing a priori to receive neuraxial labour analgesia as compared with women trying to cope with labour pain on their own, comprising also the group of women requesting neuraxial analgesia as a last resort. If this is true, women who choose

Table 1 Planned vaginal births: characteristics of four study groups, caesarean deliveries included (n=3628)

| | Trying to cope versus a priori choice (n=3628) | | | | | Successful coping versus last resort (n=3421) | | | | |
| | Trying to cope with labour pain (n=3421) | | A priori choice of analgesia (n=207) | | P value (χ²) | Successful coping with labour pain (n=2853) | | Analgesia as a last resort (n=568) | | P value (χ²) |
	Number	%	Number	%		Number	%	Number	%	
Maternal age <10th percentile	296	8.7	11	5.3	0.094	220	7.7	76	13.4	**0.000**
Maternal age >90th percentile	205	6.0	18	8.7	0.116	173	6.1	32	5.6	0.693
Paternal age <10th percentile	376	11.0	18	8.7	0.303	271	9.5	105	18.5	**0.000**
Paternal age >90th percentile	246	7.2	16	7.7	0.771	210	7.4	36	6.3	0.389
Mixed couple	326	9.5	25	12.1	0.229	262	9.2	64	11.3	0.122
Foreign couple	542	15.8	25	12.1	0.147	466	16.3	76	13.4	0.078
Lower maternal education	826	24.1	49	23.7	0.877	685	24.0	141	24.8	0.679
Lower paternal education	1292	37.8	71	34.3	0.317	1070	37.5	222	39.1	0.478
In-country couple residence	3041	88.9	172	83.1	**0.011**	2558	89.7	483	85.0	**0.001**
Independent mother's income	2499	73.0	156	75.4	0.466	2076	72.8	423	74.5	0.403
Mother herself breastfed	2450*	71.7	143	69.1	0.421	2043*	71.7	407	71.7	0.989
Breast problems	25	0.7	6	2.9	0.004†	199	0.7	6	1.1	0.467†
BMI <10th percentile	347	10.1	25	12.1	0.373	299	10.5	48	8.5	0.143
BMI >90th percentile	291	8.5	21	10.1	0.414	239	8.4	52	9.2	0.544
Smoking during pregnancy	259	7.6	27	13.0	**0.005**	207	7.3	52	9.2	0.118
Pregestational dysthyroidism	211	6.2	20	9.7	**0.046**	177	5.2	34	6.0	0.844
Severe pre-eclampsia	83	2.4	2	1.0	0.266†	70	2.5	13	2.3	0.816
Diabetes	310	9.1	22	10.6	0.448	268	9.4	42	7.4	0.130
Arterial hypertension	146	4.3	7	3.4	0.538	119	4.2	27	4.8	0.531
Other maternal diseases	216	6.3	14	6.8	0.797	179	6.3	37	6.5	0.830
Assisted reproductive procedures	47	1.4	5	2.4	0.356†	38	1.3	7	1.6	0.637
Nulliparous	1846	54.0	135	65.2	**0.002**	1331	46.7	515	90.7	**0.000**
Gestational hypothyroidism	107	3.1	7	3.4	0.839	86	3.0	21	3.7	0.393

Continued

Table 1 Continued

| | Trying to cope versus a priori choice (n=3628) | | | | | | Successful coping versus last resort (n=3421) | | | | | |
| | Trying to cope with labour pain (n=3421) | | A priori choice of analgesia (n=207) | | P value (χ²) | | Successful coping with labour pain (n=2853) | | Analgesia as a last resort (n=568) | | P value (χ²) |
	Number	%	Number	%			Number	%	Number	%	
Weight gain <10th percentile	234	6.8	18	8.7	0.308		206	7.2	28	4.9	**0.048**
Weight gain >90th percentile	328	9.6	29	14.0	**0.038**		264	9.3	64	11.3	0.137
Preterm newborn	150	4.4	7	3.4	0.491		138	4.8	12	2.1	**0.004**
Post-term newborn	95	2.8	9	4.3	0.188		71	2.5	24	4.2	**0.021**
Neonatal weight >4000 g	149	4.4	5	2.4	0.179		129	4.5	20	3.5	0.286
Neonatal weight <2500 g	158	4.6	6	2.9	0.247		130	4.6	28	4.9	0.699
Male newborn sex	1731	50.6	104	50.2	0.920		1425	49.9	306	53.9	0.087
Maternal fever (T≥38°C)	24	0.7	1	0.5	1.000†		16	0.6	8	1.4	0.053†
Haemorrhage >1000 mL	162	4.7	18	8.7	**0.011**		118	4.1	44	7.7	**0.000**
Peripartum interventions	252	7.4	13	6.3	0.560		193	6.8	59	10.4	**0.003**
Labour induction	834	24.4	56	27.1	0.385		607	21.3	227	40.0	**0.000**
Unplanned caesarean delivery	427	12.5	18	8.7	0.107		307	10.8	120	21.1	**0.000**
Meconium	1197	35.0	78	37.7	0.431		939	32.9	258	45.4	**0.000**
Apgar score at 5 min <7	19*	0.6	1	0.5	1.000		15*	0.5	4	0.7	0.832†
Neonatal septic risk	348	10.2	14	6.8	0.112		324	11.4	24	4.2	**0.000**
Neonatal hypoglycaemia	128	3.7	2	1.0	**0.040**		111	3.9	15	2.6	0.149
Phototherapy	172	5.0	15	7.2	0.161		140	4.9	32	5.6	0.469
NICU admission	103	3.0	7	3.4	0.763		89	3.1	14	2.5	0.404
Skin-to-skin contact	2578	75.4	163	78.7	0.271		2199	77.1	379	66.7	**0.000**
Rooming-in	2780	81.3	159	76.8	0.113		2349	82.3	431	75.9	**0.000**

Bold indicates statistically significant difference at p<0.05.
*Three missing data points.
†Yates corrected χ².
BMI, body mass index; NICU , neonatal intensive care unit; T, temperature.

Table 2 Actual vaginal births: characteristics of four study groups, caesarean deliveries excluded (n=3183)

| | Trying to cope versus a priori choice (n=3183) | | | | | Successful coping versus last resort (n=2994) | | | | |
| | Trying to cope with labour pain (n=2994) | | A priori choice of analgesia (n=189) | | P value (χ²) | Successful coping with labour pain (n=2546) | | Analgesia as a last resort (n=448) | | P value (χ²) |
	Number	%	Number	%		Number	%	Number	%	
Maternal age <10th percentile	257	8.6	11	5.8	0.184	196	7.7	61	13.6	**0.000**
Maternal age >90th percentile	174	5.8	16	8.5	0.135	153	6.0	21	4.7	0.270
Paternal age <10th percentile	323	10.8	17	9.0	0.439	239	9.4	84	18.8	**0.000**
Paternal age >90th percentile	211	7.0	16	8.5	0.462	182	7.1	29	6.5	0.607
Mixed couple	273	9.1	24	12.7	0.101	229	9.0	44	9.8	0.575
Foreign couple	469	15.7	23	12.2	0.197	412	16.2	57	12.7	0.063
Lower maternal education	703	23.5	46	24.3	0.787	599	23.5	104	23.2	0.885
Lower paternal education	1117	37.3	65	34.4	0.421	947	37.2	170	37.9	0.762
In-country couple residence	2655	88.7	158	83.6	0.035	2277	89.4	378	84.4	**0.002**
Independent mother's income	2187	73.0	143	75.7	0.431	1852	72.7	335	74.8	0.371
Mother herself breastfed	2140*	71.5	129	68.3	0.331	1815*	71.4	325	72.5	0.612
Breast problems	21	0.7	5	2.6	0.004†	18	0.7	3	0.7	1000†
BMI <10th percentile	316	10.6	23	12.2	0.485	275	10.8	41	9.2	0.295
BMI >90th percentile	239	8.0	16	8.5	0.812	198	7.8	41	9.2	0.322
Smoking during pregnancy	213	7.1	26	13.8	0.001	173	6.8	40	8.9	0.105
Pregestational dysthyroidism	181	6.0	20	10.6	0.013	153	6.0	28	6.3	0.844
Severe pre-eclampsia	62	2.1	2	1.1	0.487	51	2.0	11	2.5	0.535
Diabetes	254	8.5	19	10.1	0.455	225	8.8	29	6.5	0.098
Arterial hypertension	106	3.5	6	3.2	0.791	86	3.4	20	4.5	0.251
Other maternal diseases	188	6.3	13	6.9	0.743	157	6.2	31	6.9	0.545
Assisted reproductive procedures	37	1.2	5	2.6	0.187†	30	1.2	7	1.6	0.497
Nulliparous	1519	50.7	119	63.0	**0.001**	1119	44.0	400	89.3	**0.000**
Gestational hypothyroidism	89	3.0	5	2.6	0.797	73	2.9	16	3.6	0.418
Weight gain <10th percentile	209	7.0	16	8.5	0.440	185	7.3	24	5.4	0.144
Weight gain >90th percentile	272	9.1	25	13.2	0.058	224	8.8	48	10.7	0.193
Preterm newborn	127	4.2	7	3.7	0.721	117	4.6	10	2.2	**0.022**
Post-term newborn	65	2.2	8	4.2	0.113†	49	1.9	16	3.6	**0.027**
Neonatal weight ≥4000 g	118	3.9	5	2.6	0.370	103	4.0	15	3.3	0.484
Neonatal weight <2500 g	127	4.2	6	3.2	0.477	110	4.3	17	3.8	0.611
Male newborn sex	1493	49.9	94	49.7	0.972	1250	49.1	243	54.2	**0.045**
Maternal fever (T≥38°C)	19	0.6	1	0.5	1.000†	13	0.5	6	1.3	0.086†
Haemorrhage >1000 mL	139	4.6	12	6.3	0.284	103	4.0	36	8.0	**0.000**
Peripartum interventions	226	7.5	12	6.3	0.543	175	6.9	51	11.4	**0.001**

Continued

Table 2 Continued

| | Trying to cope versus a priori choice (n=3183) | | | | | Successful coping versus last resort (n=2994) | | | | |
| | Trying to cope with labour pain (n=2994) | | A priori choice of analgesia (n=189) | | P value (χ^2) | Successful coping with labour pain (n=2546) | | Analgesia as a last resort (n=448) | | P value (χ^2) |
	Number	%	Number	%		Number	%	Number	%	
Labour induction	585	19.5	46	24.3	0.108	424	16.7	161	35.9	**0.000**
First-stage length >90th percentile	289	9.7	25	13.2	0.110	176	6.9	113	25.2	**0.000**
Second-stage length >90th percentile	295	9.9	22	11.6	0.426	215	8.4	80	17.9	**0.000**
Third-stage length >90th percentile	329	11.0	27	14.3	0.163	212	8.3	117	26.1	**0.000**
Oxytocin augmentation of labour	734	24.5	129	68.3	**0.000**	468	18.4	266	59.4	**0.000**
Operative delivery	168	5.6	19	10.1	**0.012**	111	4.4	57	12.7	**0.000**
Occiput posterior fetal position	109	3.6	3	1.6	0.137	90	3.5	19	4.2	0.462
Episiotomy	300	10.0	29	15.3	**0.020**	232	9.1	68	15.2	**0.000**
Meconium	1046	34.9	75	39.7	0.185	836	32.8	210	46.9	**0.000**
Apgar score at 5min <7	13*	0.4	1	0.5	1.000†	11*	0.4	2	0.4	1.000†
Neonatal septic risk	317	10.6	13	6.9	0.105	299	11.7	18	4.0	**0.000**
Neonatal hypoglycaemia	80	2.7	6	3.2	0.679	71	2.8	9	2.0	0.345
Phototherapy	91	3.0	1	5.3	**0.046**	81	3.2	10	2.2	0.280
NICU admission	158	5.3	13	6.9	0.344	131	5.1	27	6.0	0.442
Skin-to-skin contact	2527	84.4	159	84.1	0.919	2167	85.1	360	80.4	**0.011**
Rooming-in	2487	83.1	148	78.3	0.093	2139	84.0	348	77.7	**0.001**

Bold indicates statistically significant difference at p<0.05
*Three missing data points.
†Yates corrected χ^2.
BMI, body mass index; NICU, neonatal intensive care unit; T, temperature .

Table 3 Multivariable log-linear analyses: BIS in trying to cope with labour pain group versus a priori choice of labour analgesia group

Statistical parameter	Planned vaginal birth, n=3628 (including caesarean deliveries)				Actual vaginal birth, n=3183 (excluding caesarean deliveries)			
	Antelabour-only confounders (30)		Antelabour plus intrapartum and postpartum confounders (43)		Antelabour-only confounders (30)		Antelabour plus intrapartum and postpartum confounders (49)	
	RR (95% CI)	P value	RR (95% CI)	P value	RR (95% CI)	P value	RR (95% CI)	P value
A priori choice of analgesia	0.65 (0.48 to 0.87)	0.004	0.61 (0.45 to 0.83)	0.002	0.59 (0.43 to 0.80)	0.001	0.55 (0.38 to 0.75)	<0.001
Nulliparous	0.48 (0.41 to 0.56)	<0.001	0.52 (0.44 to 0.62)	<0.001	0.50 (0.43 to 0.59)	<0.001	0.53 (0.44 to 0.64)	<0.001
Maternal age >90th percentile	0.45 (0.33 to 0.61)	<0.001	0.50 (0.36 to 0.68)	<0.001	0.49 (0.35 to 0.67)	<0.001	0.51 (0.36 to 0.72)	<0.001
Weight gain >90th percentile	0.67 (0.53 to 0.85)	0.001	0.68 (0.53 to 0.87)	0.002	0.65 (0.50 to 0.84)	0.01	0.64 (0.49 to 0.84)	0.001
Preterm newborn	0.25 (0.17 to 0.37)	<0.001	0.57 (0.36 to 0.91)	0.017	0.24 (0.15 to 0.36)	<0.001	0.60 (0.36 to 0.99)	0.046
BMI >90th percentile	0.56 (0.43 to 0.73)	<0.001	0.63 (0.48 to 0.83)	0.001	0.64 (0.48 to 0.85)	0.002	0.72 (0.53 to 0.97)	0.033
Pregestational dysthyroidism	0.72 (0.54 to 0.96)	0.025	0.77 (0.55 to 0.99)	0.046	0.70 (0.52 to 0.95)	0.023		
Severe pre-eclampsia	0.52 (0.32 to 0.86)	0.011			0.55 (0.32 to 0.97)	0.05		
Neonatal weight <2500 g	0.50 (0.33 to 0.75)	0.001			0.48 (0.31 to 0.76)	0.001		
Neonatal weight ≥4000 g	0.60 (0.43 to 0.83)	0.002						
Lower maternal education	0.82 (0.69 to 0.99)	0.041						
Diabetes	0.71 (0.56 to 0.91)	0.007						
Smoking during pregnancy			1.34 (1.00 to 1.79)	0.048				
NICU admission			0.24 (0.13 to 0.45)	<0.001			0.23 (0.12 to 0.47)	<0.001
Neonatal hypoglycaemia			0.08 (0.04 to 0.16)	<0.001			0.07 (0.03 to 0.16)	<0.001
Phototherapy			0.25 (0.16 to 0.38)	<0.001			0.23 (0.15 to 0.36)	<0.001
Haemorrhage >1000 mL			0.64 (0.46 to 0.90)	0.009			0.60 (0.42 to 0.86)	0.006
Peripartum interventions			0.51 (0.38 to 0.68)	<0.001			0.48 (0.36 to 0.66)	<0.001
Rooming-in			1.95 (1.46 to 2.61)	<0.001			1.63 (1.11 to 2.38)	0.012
Unplanned caesarean delivery			0.62 (0.45 to 0.83)	0.002				

BIS, breastfeeding initiation success; BMI, body mass index; NICU, neonatal intensive care unit; RR, relative risk.
Nagelkerke's coefficient of determination for the four analyses is 0.12, 0.224, 0.108, and 0.209 respectively.

Table 4 Multivariable log-linear analyses: BIS in successful coping with pain group versus analgesia requested as a last resort group

Statistical parameter	Planned vaginal birth, n=3421 (including caesarean deliveries)				Actual vaginal birth, n=2994 (excluding caesarean deliveries)			
	Antelabour-only confounders (30)		Antelabour plus intrapartum and postpartum confounders (43)		Antelabour-only confounders (30)		Antelabour plus intrapartum and postpartum confounders (49)	
	RR (95% CI)	P value	RR (95% CI)	P value	RR (95% CI)	P value	RR (95% CI)	P value
Last resort analgesia	0.94 (0.77 to 1.16)	0.578	0.99 (0.80 to 1.23)	0.955	0.90 (0.72 to 1.13)	0.372	0.90 (0.69 to 1.16)	0.405
Nulliparous	0.48 (0.41 to 0.57)	<0.001	0.52 (0.44 to 0.62)	<0.001	0.51 (0.43 to 0.61)	<0.001	0.53 (0.43 to 0.64)	<0.001
Maternal age >90th percentile	0.47 (0.35 to 0.65)	<0.001	0.53 (0.38 to 0.73)	<0.001	0.52 (0.37 to 0.72)	<0.001	0.54 (0.38 to 0.78)	0.001
Weight gain >90th percentile	0.66 (0.52 to 0.84)	0.001	0.66 (0.51 to 0.85)	0.001	0.65 (0.50 to 0.85)	0.002	0.63 (0.48 to 0.83)	0.001
Preterm newborn	0.23 (0.15 to 0.34)	<0.001	0.50 (0.31 to 0.81)	0.006	0.21 (0.13 to 0.33)	<0.001	0.52 (0.31 to 0.87)	0.013
BMI >90th percentile	0.55 (0.42 to 0.72)	0.001	0.62 (0.46 to 0.82)	0.001	0.61 (0.45 to 0.82)	0.001	0.68 (0.50 to 0.94)	0.018
Neonatal weight ≥4000 g	0.56 (0.40 to 0.78)	0.001	0.66 (0.46 to 0.95)	0.025	0.65 (0.44 to 0.95)	0.025		
Pregestational dysthyroidism	0.72 (0.53 to 0.96)	0.028	0.72 (0.53 to 0.99)	0.04	0.69 (0.50 to 0.96)	0.025		
Neonatal weight <2500 g	0.52 (0.34 to 0.77)	0.002			0.51 (033 to 0.81)	0.004		
Severe pre-eclampsia	0.51 (0.31 to 0.85)	0.01			0.54 (0.30 to 0.95)	0.032		
Diabetes	0.71 (0.55 to 0.92)	0.008						
NICU admission			0.24 (0.13 to 0.46)	<0.001			0.23 (0.12 to 0.47)	<0.001
Neonatal hypoglycaemia			0.08 (0.04 to 0.16)	<0.001			0.07 (0.03 to 0.17)	<0.001
Phototherapy			0.23 (0.15 to 0.36)	<0.001			0.23 (0.14 to 0.36)	<0.001
Haemorrhage >1000 mL			0.62 (0.44 to 0.88)	0.007			0.63 (0.43 to 0.92)	0.016
Peripartum interventions			0.51 (0.38 to 0.64)	<0.001			0.49 (0.36 to 0.67)	<0.001
Rooming-in			1.89 (1.31 to 2.52)	<0.001			1.53 (1.03 to 2.28)	0.036
Unplanned caesarean delivery			0.58 (0.42 to 0.79)	0.001				

BIS, breastfeeding initiation success; BMI, body mass index; NICU, neonatal intensive care unit; RR, relative risk.
Nagelkerke's coefficient of determination for the four analyses is 0.12, 0.224, 0.106, and 0.205 respectively.

a priori to receive neuraxial labour analgesia would probably need increased peripartum breastfeeding support if they expressed the desire to breastfeed the baby. Although it cannot be ruled out that a mother's open externalisation of having chosen neuraxial labour analgesia a priori could simply represent a personal communicative style, we did not find studies addressing this topic. The second result of the present study could probably be explained hypothesising that, among the women trying to cope with labour pain, those requesting neuraxial analgesia as a last resort intrapartum received a medical intervention which at least seemed to not interfere with labour progression, probably because it was necessitated by actual or perceived difficulties of their own birth process. However, to the best of our knowledge, no previous study in literature has addressed this topic.

The findings of this study on the association of the well-known peripartum confounders with the breastfeeding initiation process were consistent with those already emerging from the current literature, except those related to older maternal age.[28–42] Regarding the association between older maternal age and breastfeeding, data in the current literature are conflicting.[17 43] Indeed, in the present study, the association between advanced maternal age and reduced breastfeeding success was confirmed by multivariable analyses because the sample included an almost unselected population of both nulliparous and multiparous women.

The effect of choosing to receive neuraxial labour analgesia on breastfeeding success remains a controversial issue. Previous studies reported breastfeeding initiation difficulties at hospital discharge in women who chose to receive neuraxial labour analgesia,[12–16] with some studies even inferring a dose–response relationship between the dose of a particular opioid (usually fentanyl) and the proportion of mothers who showed breastfeeding initiation difficulties.[17 18] However, other studies did not report any association between the choice to receive neuraxial labour analgesia and breastfeeding initiation difficulties.[43–55] The inconsistency of these findings is partially due to widespread deficiencies in study design.[56] To the best of our knowledge, no study has considered breastfeeding success in women who chose to receive neuraxial analgesia, taking into account the nature of the request.

In addition to providing interesting clinical remarks, the present study has several limitations. First, we did not assess the coping styles of all the labouring women, including those who did not request analgesia at all, using the type of coping scale recently proposed by the American College of Obstetricians and Gynecologists.[57] Second, the baby-friendly designation of the hospital where the study was conducted could have impacted the women's choice of the delivery setting, leading to a selection bias in the enrolled population. Some women could have chosen not to deliver in a baby-friendly hospital because they were afraid of feeling pressured into breastfeeding their newborn. On the other hand, some foreign women could have chosen to deliver their child in a baby-friendly

hospital, which also offers free access to neuraxial labour analgesia at all times. To control for the latter selection bias, we included residence as a confounder in the multivariable analyses. Regarding the first bias, the percentage of women who resided in the valley and did not deliver at the study hospital was less than 3.9% of the whole obstetric population, including women who underwent a planned caesarean section (data retrieved from the regional health data register). Third, even though a randomised controlled trial is preferable when assessing the impact of a new treatment, the present study employed an observational design. Actually, should potential side-effects or adverse reactions of the administered drugs be investigated, a well-conducted observational study will not be irrelevant due to the particularly delicate ethical issues arising in obstetric or neonatology research.[58] Fourth, the limitation stemming from the asynchrony in the time of collecting the choice of analgesia between the woman presenting in the active phase of labour and women undergoing labour induction needs to be acknowledged. Lastly, although a large number of peripartum variables were included in the multivariable analyses, the risk of residual confounding factors cannot be excluded.

In the statistical analyses we have not taken into account the technique used for administering neuraxial analgesia (spinal-epidural or classical epidural), since both techniques are major neuraxial blocks and are considered substantially equivalent, either in terms of analgesic efficacy, or of side effects,[59] as underlined by the Cochrane Collaboration in a recent meta-analysis on the effects of neuraxial analgesia on the delivery's and newborn's outcomes.[60]

The generalisability of the present findings could be limited by its single-centre design. First, because the study was conducted in a baby-friendly hospital setting, we could have selected women with high motivation to breastfeed. Indeed, the any-breastfeeding proportion at discharge was 98.2%, and the exclusive breastfeeding proportion was 82.9%. Moreover, in the present study, the cumulative doses of the administered drugs were very low compared with those reported in the literature.[61 62] These low cumulative drug doses were due not only to technical choices adopted regarding the administered neuraxial analgesia but also to the intermittent on-demand pattern of drug administration by the duty anaesthetist and to the moderate level of pain control pursued according to women's wishes. However, these technical choices were consistent with the emerging tendency of offering a less aggressive neuraxial analgesia, as reported by the Cochrane Collaboration.[60] Finally, regarding the drugs which were chosen for neuraxial analgesia, ropivacaine and sufentanil were administered as the local anaesthetic and opioid, respectively, while bupivacaine and fentanyl are used most frequently during delivery worldwide. Notwithstanding, the choice of sufentanil seems to be more appropriate in terms of fetal exposure.[63]

The present study also has a few strengths. First, the very limited number of exclusion criteria allowed us to recruit

a population of mother–baby dyads that was not only large but also almost unselected. Only 57 women (1.5%) were excluded from the whole cohort of 3685 women planning to give birth vaginally and willing to breastfed. Therefore, the present results seemed to be deeply contextualised in the actual complexity of a real birth setting in a baby-friendly hospital. Second, the two-stages design of the data analyses allowed us to use a large number of physiological deliveries as the true comparator. Indeed, 40.7% of the enrolled women delivered without any medical intervention. Lastly, in contrast to previous studies, the BIS definition included newborn weight loss at 60 hours from birth as an index of the newborn's nutritional status at discharge.

CONCLUSIONS

Based on the findings of the present study conducted in a baby-friendly hospital setting, the a priori choice of neuraxial labour analgesia is negatively associated with BIS as compared with women trying to cope with labour pain on their own. On the contrary, the decision to receive neuraxial labour analgesia as a last resort was not negatively associated with BIS as compared with women who coped with their pain successfully. Therefore, women who a priori choose to receive neuraxial labour analgesia and express the desire to breast feed the baby are to be considered at risk of breastfeeding initiation failure. Further studies are desirable to fully elucidate if these women can benefit from increased breastfeeding support and customised strategies implemented by health providers.

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