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Title: Association between intrapartum interventions and breastfeeding duration

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The authors have no conflicts of interest to disclose.

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PRÉCIS

Individual intrapartum interventions had no impact on breastfeeding duration but experiencing multiple interventions increased the risk of early weaning.

ABSTRACT

Introduction: Few women who reside in Hong Kong exclusively breastfeed and one-half stop breastfeeding within the first few months. There is little research in this population on the association between intrapartum interventions and breastfeeding duration.

Methods: A sample of 1280 mother-infant pairs were recruited from the obstetric units of four public hospitals in Hong Kong and followed prospectively for 12 months or until the infant was weaned. The outcome variables for this analysis were the duration of any and exclusive breastfeeding. Predictor variables were four intrapartum interventions: receipt of opioid pain medication, induction vs spontaneous labor, epidural administration, and mode of delivery. We used Cox Proportional Hazards Modeling to assess the impact of intrapartum interventions on the duration of any and exclusive breastfeeding and we constructed Kaplan-Meier survival curves to evaluate the cumulative impact of multiple intrapartum interventions on breastfeeding outcomes.

Results: Bivariate analysis showed that induction of labour (HR=1.24; 95% CI 1.09 to 1.41), opioid pain medication (HR=1.21; 95% CI 1.06 to 1.37), and having an emergency cesarean section (HR=1.22; 95% CI 1.01 to 1.48) were associated with a shorter duration of any breastfeeding. Induction of labour (HR=1.23; 95% CI 1.08 to 1.39) and having an emergency cesarean section (HR=1.25; 95% CI 1.05 to 1.51) were associated with a shorter duration of exclusive breastfeeding. After controlling for known confounding variables, there was no longer any association between individual intrapartum interventions and the duration of any or exclusive breastfeeding. The median duration of breastfeeding for participants who experienced a natural birth with no intrapartum interventions was 9 weeks compared with 5 weeks for participants who experienced ≥ 3 intrapartum interventions.

Discussion: Clinicians working with new breastfeeding mothers should focus on providing additional support to mothers who experience a difficult labour and delivery with multiple interventions to improve their breastfeeding experiences.

Keywords

Breastfeeding, infant feeding, intrapartum practices, delivery interventions, epidural analgesia, cesarean section, natural delivery, Hong Kong

INTRODUCTION

The benefits of breastfeeding have been widely recognized, yet the duration of any and exclusive breastfeeding remains sub-optimal in many countries. In the United States, less than one-half of mothers breastfeed for 6 months and only 15% do so exclusively.¹ Similarly, while over 80% of mothers who reside in Hong Kong initiate breastfeeding,² only a small proportion exclusively breastfeed and more than one-half cease breastfeeding within the first two months.³ These outcomes remain far short of both the World Health Organization (WHO)⁴ and the United States American Academy of Pediatrics⁵ recommendations for exclusive breastfeeding for the first six months and continued breastfeeding for up to 24 months of age. Numerous variables such as sociodemographic factors, maternal confidence, spousal support, maternal employment, and hospital practices have been identified as strong predictors for early breastfeeding cessation.⁶⁻¹⁰

A number of intrapartum interventions have been studied in diverse settings in developed countries for their impact on breastfeeding. Four of the most common interventions experienced by women in the intrapartum period are induction of labour, administration of epidural analgesia, administration of opioid pain medications for labour pain relief, and assisted (instrumental or operative) deliveries. Rates of intrapartum interventions have increased substantially in most developed countries over the past several decades. Cesarean delivery rates in the United States¹¹ and many other developed countries¹² are above 30% and the use of epidural anesthesia continues to rise.¹³ Cesarean sections and various forms of labour analgesia facilitate separation of the mother and infant after birth, impede the infant's natural breastfeeding reflexes, and may contribute to difficulty with initiation of breastfeeding.¹⁴⁻¹⁶ Many studies have confirmed that all four of the identified intrapartum interventions impede early breastfeeding initiation and increase the amount of infant formula newborns receive while in hospital.¹⁷⁻²⁸ The impact on long-term breastfeeding outcomes, however, is more uncertain. Some studies have shown a negative impact of labour induction,^{18, 19, 26} opioid pain medication,^{25, 29} epidural administration,^{19, 30} assisted vaginal delivery³¹ and

cesarean birth³¹⁻³⁴ on breastfeeding. Other studies, however, have been unable to show any impact or have had mixed findings.^{20, 35-40}

The negative impact of intrapartum interventions on breastfeeding duration, however, has not been adequately investigated in Hong Kong. Studies from other countries show that the impact on breastfeeding duration and exclusivity remains controversial and there are many limitations in the evidence that currently exists. Many studies did not measure breastfeeding beyond the early postpartum period.^{17, 18, 20, 21, 24-28} As the benefits of breastfeeding are dose-dependent and a longer duration of breastfeeding produces greater health benefits to both the mother and child,⁵ it is important that studies examine the longer-term breastfeeding outcomes associated with intrapartum interventions. Furthermore, most studies have measured only one or two intrapartum interventions^{24, 35, 37, 38} and only a few have distinguished between planned and emergency cesarean sections.²³ In addition, few studies have examined the cumulative impact of intrapartum interventions and whether having a natural birth with no intrapartum interventions increases breastfeeding duration.^{41, 42} Therefore, the purposes of this study were to investigate the impact of intrapartum interventions on the duration of any or exclusive breastfeeding among women intending to breastfeed and to assess whether a birth without any interventions (natural birth) improves these breastfeeding outcomes.

METHODS

Study Participants

Participants were recruited into this study from four geographically distributed public hospitals in Hong Kong between 2006 and 2007. Participants were followed-up for one year or until they had completed breastfeeding, whichever came first. The study methods and data sources have been described in greater detail elsewhere.³ Briefly, 1417 breastfeeding mother-infant pairs were recruited in the immediate post-natal period. Inclusion criteria were: intention to breastfeed; singleton pregnancy; Hong Kong resident, Cantonese speaking, and no serious medical or obstetric complications. Additionally, selection criteria for their infants were: a gestational age ≥ 37 weeks; an

Apgar score of ≥ 8 at 5 minutes; a birth weight of $\geq 2,500$ gms; no severe congenital malformation; no placement in the special care baby nursery after delivery for ≥ 48 hours; and no admission to the neonatal intensive care unit.

Data Collection

Basic demographic data were collected by self-report during the postpartum hospitalization. Maternal and birth data were extracted from the medical records by trained research nurses. Follow-up breastfeeding data were collected after hospital discharge through telephone interviews at 1, 2, 3, 6, 9, and 12 months or until weaned. In Hong Kong, public hospital births account for more than one-half of all births.² After recruitment, we excluded participants who subsequently did not meet the study eligibility criteria (n=8), participants with whom we had no further contact after hospitalization (n=87) and participants with missing information relevant to this analysis (n=42), resulting in 1,280 (90.3%) of the initial 1417 mother-infant pairs in the final analysis.

Variable Descriptions

The two outcome variables were the duration of any breastfeeding and the duration of exclusive breastfeeding, defined as the total number of weeks the infant received "any" or "only" breast milk. Infants were considered exclusively breastfed if they received no other liquids or breast milk substitutes (other than vitamins or medications) and were considered non-exclusively breastfed if they were supplemented with infant-formula and/or other breast milk substitutes.⁴³ Independent variables measured were four intrapartum interventions: 1) the nature of the onset of labour, 2) the administration of opioid labour analgesia, 3) the administration of epidural analgesia, and 4) the mode of delivery. Onset of labour was recorded as three categories: spontaneous, induced, and none (i.e., planned cesarean section). The mode of delivery was recorded as four responses: spontaneous vaginal delivery, assisted vaginal delivery (normally with vacuum extraction), planned cesarean section, and emergency cesarean section. The other two independent variables were recorded as either yes or no. We did not collect data on the dose of medication given for labour analgesia but at the time of the study a low concentration local anaesthetic (i.e., either

Ropivacaine 0.15% or Bupivacaine 0.125%) plus Fentanyl 2-4mcg/ml was used for epidural analgesia. Intramuscular pethidine was used in all four study sites for opioid labour analgesia.

We also computed the total number of intrapartum interventions participants received. Participants who received no interventions were categorized as having a 'natural birth.' The remaining participants were grouped according to the number of intrapartum interventions: 1, 2 or ≥ 3 . In addition, we controlled for known confounding variables such as maternal age (in years) and education (compulsory secondary, upper secondary or university degree), monthly family income (<HKD 15,000, HKD15, 000-29,999 or \geq HKD 30,000), previous breastfeeding experience (yes or no), intention to exclusively breastfeed (yes or no) and returning to work postpartum (yes or no).³

Data Analysis

Descriptive statistics were used to describe the sample characteristics and the duration of any and exclusive breastfeeding. To explore the unadjusted association between intrapartum practices and the duration of any and exclusive breastfeeding we used bivariate Cox proportional hazards regression analysis.⁴⁴ Then, all variables with a significance of $P < .05$ for either the duration of any or exclusive breastfeeding in the bivariate Cox regression model were entered into the multiple Cox proportional hazards models along with the previously described confounding variables. To examine the duration of any and exclusive breastfeeding among participants with a natural birth (no interventions), 1, 2 and ≥ 3 intrapartum interventions, we constructed Kaplan-Meier survival curves and compared them using the log-rank test (trend).⁴⁵ Finally, we performed bivariate and multiple Cox proportional hazards regression to evaluate the cumulative impact of intrapartum interventions on breastfeeding duration. All data analysis was conducted using Stata version 11.2 statistical software (Stata Corp, College Station, Tx)⁴⁶ and the 0.05 level of significance was used throughout the statistical analysis.

Before data collection, ethical approval for the study was obtained from the following institutional review boards overseeing the four study hospitals: the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong

West Cluster, the Hong Kong East Cluster Research Ethics Committee, the Kowloon West Cluster Clinical Research Ethics Committee, and the Research Ethics Committee of the Kowloon Central/ Kowloon East Cluster. Informed written consent was obtained from all participants.

RESULTS

The median duration of any and exclusive breastfeeding were 8 weeks and 2 weeks respectively. Characteristics of the participants are presented in Table 1. Mean maternal age was 31.6 years (SD=4.36) and just over one-third of the sample had obtained at least a university degree. Almost two-thirds were primiparous and one-third had previous breastfeeding experience. The cesarean section rate was 20% (n=255) and 34% (n=435) experienced a natural birth.

Bivariate analysis showed that induction of labour (HR=1.24; 95% CI 1.09 to 1.41), receipt of opioid pain medication (HR=1.21; 95% CI 1.06 to 1.37), and having an emergency cesarean section (HR=1.22; 95% CI 1.01 to 1.48) shortened the duration of any breastfeeding while induction of labour (HR=1.23; 95% CI 1.08 to 1.39) and having an emergency cesarean section (HR=1.25; 95% CI 1.05 to 1.51) shortened the duration of exclusive breastfeeding (Table 2). Table 3 presents the adjusted results of the Cox Proportional Hazards Model of the impact of intrapartum interventions on breastfeeding outcomes. After controlling for known confounding variables, there was no longer any statistically significant impact of individual intrapartum interventions on breastfeeding outcomes.

Results of the Kaplan-Meier survival analysis show that multiple intrapartum interventions significantly increased the risk of cessation of any breastfeeding ($P < .001$) (Figure 1) and exclusive breastfeeding ($P < .001$) (Figure 2). The median duration of any breastfeeding among participants experiencing a natural birth was 9 weeks as compared with 8 weeks, 6 weeks and 5 weeks in those experiencing 1, 2, and ≥ 3 intrapartum interventions respectively. Similarly, the median duration of exclusive breastfeeding among participants experiencing a natural birth was 2.9 weeks as compared with 2 weeks, 1 week and 1 week in those experiencing 1, 2 and ≥ 3

intrapartum interventions respectively. Each intrapartum intervention increased the risk of cessation of any breastfeeding by approximately 15% (Figure 1) and exclusive breastfeeding by 13% (Figure 2). These associations were attenuated somewhat after adjustment for known confounding variables. Each additional intrapartum intervention increased the risk of cessation of any breastfeeding by 7% (HR=1.07; 95% CI 1.01-1.14; $P=.036$) and the association between intrapartum interventions and duration of exclusive breastfeeding became statistically insignificant (HR=1.03; 95% CI 0.97-1.10; $P=.35$).

DISCUSSION

Results from this study show that after controlling for multiple confounding variables such as sociodemographic characteristics and maternal breastfeeding intentions, individual intrapartum interventions did not significantly impact the duration of any or exclusive breastfeeding. Participants who experienced multiple intrapartum interventions, however, did have a shorter duration of breastfeeding, with each additional intervention significantly increasing the risk of breastfeeding cessation. These findings may help to explain why many previous studies that have only examined the impact of individual intrapartum interventions on breastfeeding have found no association between these variables. Breastfeeding is a complicated process with many influencing factors. Along with intrapartum interventions and delivery complications, factors such as maternal age, education, income, employment and social support have been previously demonstrated to substantially affect the duration of breastfeeding in this and other populations.^{7, 9, 10} Therefore, it is not altogether surprising to find that when all of these factors are considered, individual intrapartum interventions do not show statistical associations with breastfeeding outcomes.

Existing data on whether intrapartum interventions affect breastfeeding outcomes is conflicting and there has been no consensus on the overall impact. A previous study in the Hong Kong population³¹ reported that mothers who underwent cesarean section had lower rates of breastfeeding initiation and a shorter duration of breastfeeding. However, the previous study did not differentiate between scheduled

and emergency cesarean sections and mothers giving birth at both public and private institutions were recruited.³¹ The rate of surgical delivery in private hospitals at the time of that study was 48.3% compared with 18.2% in public hospitals.⁴⁷ Furthermore, private hospitals in Hong Kong permit cesarean sections on maternal request, something that is not done in public hospitals. Mothers who request a cesarean section for non-medical reasons have been found to be less likely to exclusively breastfeed⁴⁸ and to breastfeed for a shorter duration.⁴⁹

Surprisingly, few studies have examined the impact of simultaneous multiple intrapartum interventions or have specifically examined the impact of a natural birth on breastfeeding outcomes as we have done in this study. Daglas et al.⁴¹ reported that women who experienced a 'natural delivery' were significantly more likely to initiate breastfeeding earlier than mothers with difficult or surgical deliveries. However, in their study a 'natural delivery' was not clearly defined and appeared to be simply a non-cesarean delivery. In addition, long term breastfeeding outcomes were not examined.⁴¹ Only about one-third of participants in our study, who all had low-risk pregnancies and delivered full-term babies, experienced a natural birth. Mothers who experience multiple intrapartum interventions possibly experience more pain, fatigue, and stress during labour and delivery than those having a natural birth. Furthermore, numerous studies show that intrapartum interventions do reduce early mother-infant contact, delay the initiation of the first breastfeed, and increase the rate of infant formula supplementation during the hospitalization.^{18, 20, 21, 24} Early introduction of infant formula can impede future breastfeeding success^{3, 50, 51} and can have negative health consequences.⁵²⁻⁵⁴

Results from this study also show that a large proportion of mothers stop breastfeeding early in the postpartum period. This is at least partially attributable to such a high proportion of mothers returning to work early in the postpartum period. In Hong Kong, approximately 75% of women of childbearing age work full-time⁵⁵ and maternity leave is provided for only 10 weeks.⁵⁶ However, even after controlling for returning to work and other variables, the sub-group of breastfeeding mothers who experience multiple intrapartum interventions is at greater risk of early breastfeeding

cessation and should be provided with additional breastfeeding support in the early postnatal period.

These findings have implications beyond Hong Kong. Intrapartum interventions have biological and physiological consequences for both mothers and newborn infants,^{14, 57} which are unlikely to be only observed in Hong Kong or Chinese postpartum women. As the rates of intrapartum interventions continue to rise globally, more women will experience multiple interventions and the negative effects on both the duration and exclusivity of breastfeeding will undoubtedly increase.

Strengths and Limitations

This is one of only a few studies to report on the impact of multiple intrapartum interventions.^{19, 25, 58} The study sample is a cohort of low-risk mothers and babies delivered at term with normal birth weight and high Apgar scores. There were no serious medical or obstetric complications in either the mothers or the infants to interfere with breastfeeding. Data for this study were collected prospectively and there was a low rate of maternal drop-out and loss to follow-up (9.7%). Maternal and birth data was collected directly from the hospital record, thereby eliminating the impact of poor maternal recall. All mothers were intending to breastfeed and cesarean sections were performed for medical indications only and not on maternal request.

This study has some limitations. First, although we had a large cohort, the sample was not population based. In addition, we do not have data available on those participants who chose not to participate in this study. It is possible that mothers with more positive attitudes, experience and preparation for breastfeeding were more inclined to participate. However, the rates of both any and exclusive breastfeeding found in our sample are similar to the overall breastfeeding patterns in the Hong Kong population.⁵⁹ Second, although data were collected prospectively, both the duration of any and exclusive breastfeeding were self-reported. We cannot exclude the possibility that mothers reported their breastfeeding patterns inaccurately. Evidence suggested, however, that maternal reports of breastfeeding initiation and duration are accurate for up to three years after they stop breastfeeding.⁶⁰ Third, there were conservative rates of intrapartum interventions in this sample which may have limited the study power to

detect meaningful differences between participants with interventions and those without interventions. In particular, the group experiencing ≥ 3 intrapartum interventions was small ($n=120$). The cesarean section rate of 20% is similar to previously published rates among public hospital patients in Hong Kong⁴⁷ and is substantially lower than the rate in many developed countries. A recent review of global cesarean section rates found that 31.1% of high-income countries had rates above 20%.¹² In public hospitals in Hong Kong, maternal requests for cesarean sections are not accepted and all operational deliveries must be medically indicated. This has kept the cesarean section rate low and close to the acceptable rate of 15% recommended by the WHO.⁶¹ Furthermore, other studies have reported that 20 to 77% of deliveries in developed countries are done using epidural analgesia,^{13, 57} while only 11% of participants in this study received epidural analgesia for labour pain relief. Fourth, we did not collect data on the dosage and duration of medications that were administered to participants. This may limit our ability to identify specific drugs or duration of administration that may increase the risk of breastfeeding cessation.⁶² Beilin et al.⁶³ found that a higher dose of the epidural anesthetic fentanyl increased the risk of early weaning but another study was unable to demonstrate a dose-response effect.³⁸

Conclusion

The judicious and prudent use of individual intrapartum interventions does not appear to significantly reduce the duration of breastfeeding among mothers with uncomplicated pregnancies who deliver normal birth weight infants at term. Study results, however, support what many maternal and child health-care practitioners suspect. Mothers who experience multiple intrapartum interventions do have a substantially reduced duration of exclusive breastfeeding. In the immediate postpartum period it is important to identify these women so that they can receive early and additional breastfeeding support to improve their breastfeeding experiences. Future research into the impact of intrapartum interventions on breastfeeding should also focus on mothers who experience multiple interventions so these relationships can be further understood and strategies to improve their breastfeeding outcomes can be identified.

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Table 1. Characteristics of the participants

Characteristic	Total N=1,280 N (%)
Age of mother M(SD)	31.6 (4.36)
Maternal education	
Primary or compulsory secondary ^a	303 (23.7)
Upper secondary	479 (37.4)
University degree or above	498 (38.9)
Monthly household income (HKD) ^b	
<\$15,000	285 (22.3)
\$15,000–\$29,999	429 (33.5)
≥\$30,000	566 (44.2)
Number of previous children	
None	767 (59.9)
One	450 (35.2)
Two or more	63 (4.9)
Previous breastfeeding experience	
No	853 (66.6)
Yes	427 (33.4)
Mother planning to exclusively breastfeed	
No	467 (36.5)
Yes	813 (63.5)
Returning to work post-partum	
No	337 (26.3)
Yes	943 (73.7)
Onset of labour	
Spontaneous	715 (55.9)
Induced	454 (35.5)
None (planned cesarean section)	111 (8.7)
Opioid pain medication during labour	
No	903 (70.6)
Yes	377 (29.5)
Epidural analgesia for labour pain relief	
No	1,139 (89.0)
Yes	141 (11.0)
Delivery type	
Spontaneous vaginal delivery	925 (72.3)
Assisted vaginal delivery	100 (7.8)
Planned cesarean section	111 (8.7)
Emergency cesarean section	144 (11.3)
Intrapartum interventions	
None (natural birth)	435 (34.0)
One	501 (39.1)
Two	224 (17.5)
Three	102 (8.0)
Four	18 (1.4)

^a Compulsory secondary education is to Form 3 or Grade 9.

^b 1 USD = 7.78 HKD

Table 2. Unadjusted HRs for cessation of any and exclusive breastfeeding by intrapartum interventions

Intrapartum variables	Any breastfeeding			Exclusive breastfeeding		
	HR	(95% CI)	<i>P</i> value	HR	(95% CI)	<i>P</i> value
Onset of labour						
Spontaneous	1	--	--	1	--	--
Induced	1.24	(1.09, 1.41)	.001	1.23	(1.08, 1.39)	.002
None (planned c-section)	0.95	(0.76, 1.18)	.65	1.19	(0.97, 1.48)	.10
Opioid pain medication during labor						
No	1	--	--	1	--	--
Yes	1.21	(1.06, 1.37)	.004	1.10	(0.96, 1.25)	.17
Epidural analgesia for labour pain relief						
No	1	--	--	1	--	--
Yes	1.20	(1.00, 1.45)	.054	1.18	(0.98, 1.42)	.08
Delivery type						
SVD	1	--	--	1	--	--
Assisted vaginal delivery	1.11	(0.89, 1.38)	.35	1.21	(0.97, 1.50)	.09
Planned c-section	0.90	(0.73, 1.12)	.36	1.15	(0.94, 1.42)	.18
Emergency c-section	1.22	(1.01, 1.48)	.04	1.25	(1.05, 1.51)	.02

HR, hazard ratio; SVD, Spontaneous vaginal delivery; c-section, cesarean section

Table 3. Adjusted HRs for cessation of any and exclusive breastfeeding by intrapartum interventions

Intrapartum variables	Any breastfeeding			Exclusive breastfeeding		
	aHR ^a	(95% CI)	<i>P</i> value	aHR ^a	(95% CI)	<i>P</i> value
Induction of labor						
No	1	--	--	1	--	--
Yes	1.08	(0.95, 1.23)	.24	1.03	(0.91, 1.17)	.63
Opioid pain medication during labor						
No	1	--	--	1	--	--
Yes	1.10	(0.96, 1.25)	.17	0.98	(0.86, 1.12)	.81
Emergency cesarean section						
No	1	--	--	1	--	--
Yes	1.07	(0.89, 1.29)	.52	1.02	(0.84, 1.23)	.84

HR, hazard ratio

^aAdjusted for maternal age, maternal education, household income, previous breastfeeding experience, intention to exclusively breastfeed, and returning to work

Figure 1. Kaplan-Meier survival estimates of the duration of any breastfeeding by number of intrapartum interventions

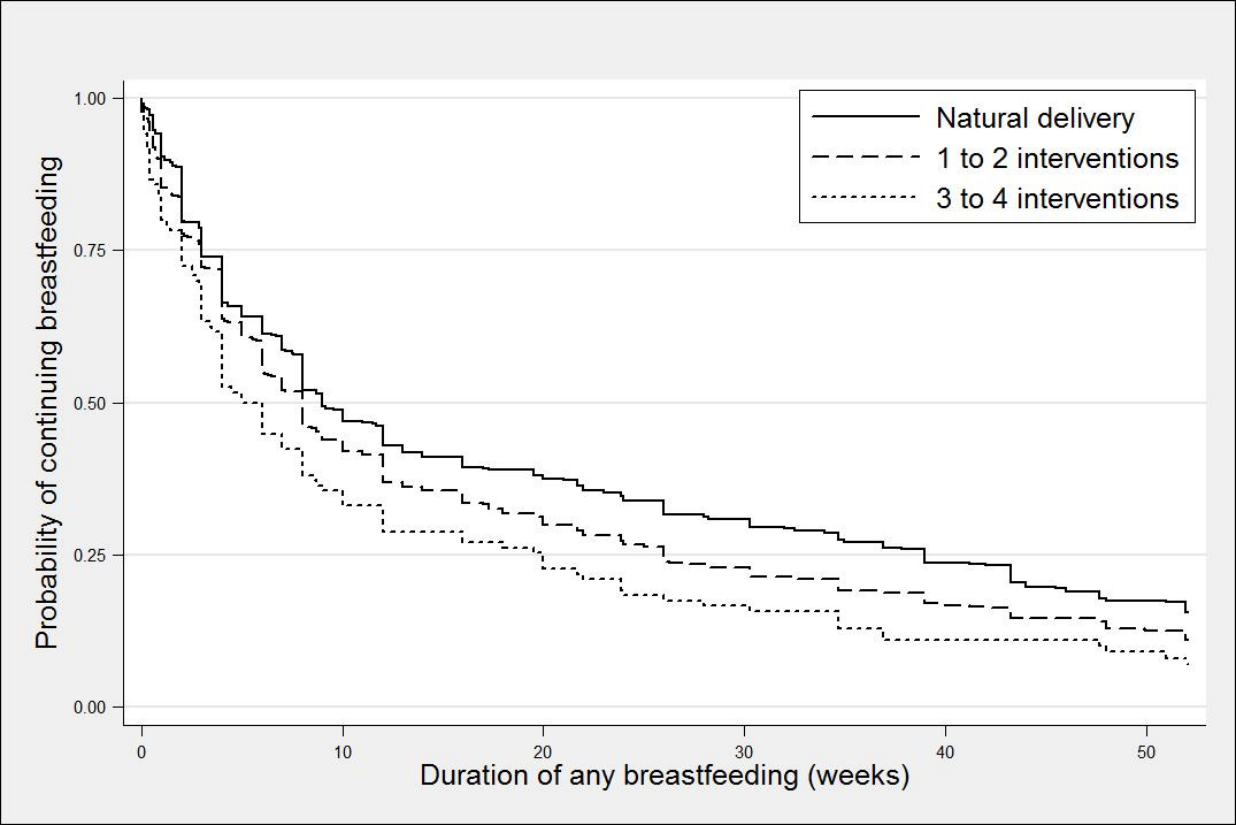


Figure 2. Kaplan-Meier survival estimates of the duration of exclusive breastfeeding by number of intrapartum interventions

