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ORIGINAL ARTICLE

An analysis of the effects of intrapartum factors, neonatal characteristics, and skin-to-skin contact on early breastfeeding initiation

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Abstract

This study aims to determine relationships between intrapartum factors, neonatal characteristics, skin-to-skin contact (SSC), and early breastfeeding initiation after spontaneous vaginal and Caesarean section or operative vaginal birth. A total of 915 mother–newborn dyads were considered in a hypothetical model based on integrated concepts of breastfeeding initiation model, infant learning framework, and attachment theory. Multiple-group path analysis was used to determine whether differences exist between effects of immediate SSC (≤30 min) on early breastfeeding initiation in different modes of birth. SSC, mode of birth, labour duration, and neonatal intensive care unit admission were significantly associated with early breastfeeding initiation, as indicated by the path analysis model, which included all samples. Women with immediate SSC were more likely to initiate early breastfeeding in different modes of birth. In the spontaneous vaginal birth group, women showed a lower likelihood of initiating early breastfeeding when their neonates were admitted to the neonatal intensive care unit and presented an Apgar score of <7 at 1 min. Multiple-group analysis showed no significant difference between effects of immediate SSC on early breastfeeding initiation in different modes of birth (critical ratio = −0.309). Results showed that models satisfactorily fitted the data (minimum discrepancy divided by degrees of freedom = 1.466–1.943, goodness of fit index = 0.981–0.986, comparative fit index = 0.947–0.955, and root mean square error of approximation = 0.023–0.032). Our findings emphasize the crucial importance of prioritizing promotion of immediate SSC under different modes of birth.

KEYWORDS

a multiple-group path analytic model, early breastfeeding initiation, immediate skin-to-skin contact

1 | INTRODUCTION

The World Health Organization (WHO, 2016) considers early breastfeeding initiation within the first hour of birth as the best recommended practice. Despite strong evidence for nutritional and immunological benefits of early initiation in reducing neonatal mortality and morbidity (Khan, Vesel, Bahl, & Martines, 2015; NEOVITA Study Group, 2016), only 50% of newborns in the world are breastfed during their first hour (Victora et al., 2016). The importance of early breastfeeding initiation lies in colostrum, which contains bioactive immune factors to protect newborn against a wide variety of infectious (Chae, Aitchisonb, Daya, & Keenan, 2017) and allergic diseases (Hua et al., 2016). Neonates secrete catecholamine during their first hour of adaptation in extrauterine life (Riviere, McKinlay, & Bloomfield, 2017). Neonates coordinate autonomic, sensory, motor, and behavioural state systems to progress smoothly through nine progressive stages within the first hour after birth (Wiklund, Norman, Uvnas-Moberg, Ransjo-Arvidson, & Andolf, 2009). Hence, the first hour after birth is ideal for priming mothers and newborns to engage in synchronous relationship of reciprocal behaviours (Cantrill, Creedy, Cooke, & Dykes, 2014; Moore, Bergman, Anderson, & Medley, 2016). Newborns are alert, responsive, and fully active to follow their natural instincts to find and attach to the breasts of their mothers (World Health Organization & United Nations Children's Fund, 2009). During early nipple stimulation, rapid release of prolactin and oxytocin aids in initiating milk production and contraction of uterus (Buckley, 2014; Power &

Schulkin, 2016). Early initiation helps babies imprint on their mother's milk, whereby other babies can remember the taste, smell, and feel associated with breastfeeding (Kim, 2017). Understanding factors that possibly influence early breastfeeding initiation is significant for design and delivers more effective strategies, because early breastfeeding initiation is a consistently significant predictor of longer exclusive breastfeeding duration (NEOVITA Study Group, 2016; Patel et al., 2015).

Existing literature predominantly focused on factors of early breastfeeding initiation in geographic, socio-economic, individual, and health-related perspectives (Sharma & Byrne, 2016), and insufficient attention is afforded to intrapartum and neonatal characteristics. Literature also offers contradictory findings regarding intrapartum and neonatal characteristics (French, Cong, & Chung, 2016). Controversial factors include epidural analgesia (Mauri et al., 2015; Wiklund et al., 2009), pethidine analgesia (Wilson et al., 2010; Yousefshahi et al., 2013), labour duration (Matias, Nommsen-Rivers, Creed-Kanashiro, & Dewey, 2010; Oakley, Henderson, Redshaw, & Quigley, 2014), intrapartum complications (Lau, Htun, Im, Ho-Lim, & Klainin-Yobas, 2015; Patel, Banerjee, & Kaletwad, 2013), gestational age (Patel et al., 2015; Tang et al., 2013), infant gender (Haghighi & Taheri, 2015; Patel et al., 2015), infant weight (Khanal, Scott, Lee, Karkee, & Binns, 2015; Tang et al., 2013), Apgar scores (Ayrim, Gunduz, Akcal, & Kafali, 2014; Isik, Dag, Tulmac, & Pek, 2016), and neonatal intensive care unit (NICU) admission (Colaizy & Morriss, 2008; Cordero, Gabbe, Landon, & Nankervis, 2013). Varying outcomes across different studies highlight the importance of further exploration among intrapartum and neonatal factors and initiation of early breastfeeding.

After any mode of birth, skin-to-skin contact (SSC) between infants and their mothers is recommended by the 10 steps for successful breastfeeding according to the principles of the Baby Friendly Health Initiative (BFHI, 2017). SSC is a significant factor associated with initiation of early breastfeeding (Kim, 2017; Patel et al., 2015). SSC describes placement of naked infants on mothers' bare skin; the exposed side or back of infants is covered by dry towels or blankets (American Academy of Pediatrics, 2012). SSC benefits both mothers and newborns; such benefits include maintenance of neonatal thermoregulation, blood sugar levels, and cardiorespiratory stability; reduction in stress caused by birth; promotion of mother–infant attachment; and initiation of early breastfeeding (Moore et al., 2016; Stevens, Schmied, Burns, & Dahlen, 2014). Although UNICEF suggested that early SSC promotes early breastfeeding initiation, they did not recommend any exact timing of early contact. A recent systematic review (Moore et al., 2016) provided inadequate evidence with respect to details of SSC timing; future investigations are noteworthy for differential effects of SSC timing. During breastfeeding initiation, different timings of SSC must be primarily understood to develop evidence-based practice for effective breastfeeding promotion. Further studies should determine whether SSC is also effective following Caesarean section and operative vaginal birth.

Delayed breastfeeding initiation is related to Caesarean section (Haghighi & Taheri, 2015; Patel et al., 2015) or operative vaginal birth (vacuum extraction and forceps delivery; Chien & Tai, 2007). Conversely, some studies showed that no significant association exists between birth method and breastfeeding initiation (Ahluwalia, Li, & Morrow, 2012; Tang et al., 2013). Breastfeeding notably comprises multifaceted interactions among mothers, infants, their environment, and other important things (Tully & Ball, 2014). A systematic review showed that mode of birth poses no effect on breastfeeding duration for 6 months after initiation of breastfeeding (Prior et al., 2012). Hence, breastfeeding initiation bears importance in sustainability of breastfeeding in different modes of birth. However, after Caesarean section or operative vaginal birth, immediate SCC can be achieved, because mothers and neonates remain alert and responsive under spinal or epidural anaesthesia (World Health Organization & United Nations Children's Fund, 2009). Another systematic review showed beneficial effects of immediate SSC after Caesarean section; these beneficial effects include mother–infant physiological stability and emotional well-being, enhancement of communication capabilities, potential reduction of maternal pain, and promotion of early breastfeeding initiation (Stevens et al., 2014). More evidence must be gathered on how to effectively provide SSC after Caesarean section or operative vaginal birth (Stevens et al., 2014). Better knowledge of SSC influence may instigate more practical and effective support for this population. Although SSC constantly related to early breastfeeding initiation (Kim, 2017; Patel et al., 2015), few studies directly compared effects of SSC on early breastfeeding initiation under different modes of birth (Stevens et al., 2014). Hence, existing knowledge has not clearly compared the effects of immediate SSC on early breastfeeding initiation in different modes of births; such a comparison should be further explored for differences through stratifying different modes of births.

Over the last 10 years, government and nongovernment bodies in Singapore exerted much effort to promote breastfeeding. The first BFHI-certified hospital was accredited in 2013 (National University Hospital, 2013). Although five BFHI-certified hospitals exist in Singapore, evidence is insufficient for examining factors associated with breastfeeding initiation. Hence, our research team investigated this area. Recently, we observed that breastfeeding techniques and infant jaundice are significantly related to exclusive breastfeeding within 48 to 72 hr after birth in post-natal wards (Lau et al., 2015).

Key messages

- Skin-to-skin contact (SSC), mode of birth, duration of labour, and neonatal intensive care unit admission show significant effects on early breastfeeding initiation during path analysis.
- Immediate SSC was consistently and more likely to initiate early breastfeeding in different modes of birth.
- In spontaneous vaginal birth group, women showed a lower likelihood of initiating early breastfeeding when their neonates were admitted to the neonatal intensive care unit and an Apgar score of <7 at 1 min.
- Multiple-group analysis showed no significant difference between spontaneous vaginal birth and Caesarean section or operative vaginal birth concerning effects of immediate SSC on early breastfeeding initiation.

Given the well-known benefits of early breastfeeding initiation (Sharma & Byrne, 2016), our team investigated factors associated with exclusive breastfeeding initiation within 1 hr in intrapartum women. Considering our lack of existing knowledge on intrapartum factors, infant characteristics, SSC, and early breastfeeding initiation, this study attempts to fill research gaps in literature.

1.1 | Conceptual framework and hypothetical model

A hypothetical model (Figure 1) was formulated by integrating concepts of a breastfeeding decision-making model (Martens & Young, 1997), conceptual framework of infant learning (Alberts, 1994), and psychobiological theory of attachment (Kraemer, 1992). This model postulates that early initiation of breastfeeding is a dynamic multifactorial determined by intrapartum and neonatal factors and SSC. Obstetric procedure and physical condition of intrapartum women are directly associated with breastfeeding action (Martens & Young, 1997). After birth, infants learn survival behaviours, including searching, recognizing, apprehending, and suckling in a systematic manner (Alberts, 1994). SSC is an early mother–infant interaction shown to pose positive effects on mother–infant attachment to initiate early breastfeeding (Kraemer, 1992).

On the basis of theoretical (Alberts, 1994; Kraemer, 1992; Martens & Young, 1997) and empirical evidence (Moore et al., 2016; Patel et al., 2015), the following hypothetically influence early breastfeeding initiation: (a) intrapartum factors, including mode of birth, analgesia, duration of labour, and intrapartum complications; (b) neonatal factors, including infant's gestational age, gender, Apgar score, birthweight, and admission in NICU; and (c) SSC. To understand these hypothesized relationships, a path analytic model and multiple-group analysis were used to examine the following research questions:

1. What are the relationships between intrapartum factors, infant characteristics, immediate SSC, and early breastfeeding initiation with the entire group and subgroups of spontaneous vaginal birth and Caesarean section or operative vaginal birth?
2. Are the effects of immediate SSC on early breastfeeding initiation different between spontaneous vaginal birth and Caesarean section or operative vaginal birth?

2 | METHODS

2.1 | Setting and sample

This study is an exploratory cross-sectional design among intrapartum women at a BFHI-certified hospital in Singapore. The institution is a 1,160-bed university-affiliated hospital serving more than 670,000 outpatients and 49,000 inpatients, practising the 10 steps to successful breastfeeding. This hospital provides comprehensive obstetric care for different demographic and socio-economic groups in Singapore with a birth rate of 3,233 deliveries per year. Owing to resource constraint, we used convenience sampling in the present study. As routine practice, nurse midwives help intrapartum women to initiate SSC with their term asymptomatic neonates within the first hour of birth. Sample size was calculated using 10 times the number of parameters in path analysis (Kline, 2016). A minimum of 110–120 samples were required using 11–12 parameters in path analytic and multiple-group path analytic models. Inclusion criteria are as follows: (a) intrapartum women ≥21 years of age and (b) initiation of SSC within 60 min. Our study excluded intrapartum women (a) who did not perform SSC, (b) who initiated SSC after 60 min, or (3) who gave birth to fetuses or neonates with severe congenital anomalies.

2.2 | Data collection

Data collection was conducted from September 2013 to August 2014 after obtaining approval from the Domain Specific Review Board (Reference No.: 2013/00513). Experienced research team members recruited intrapartum women in delivery wards. Participants were informed about the research purpose, and consents were obtained.

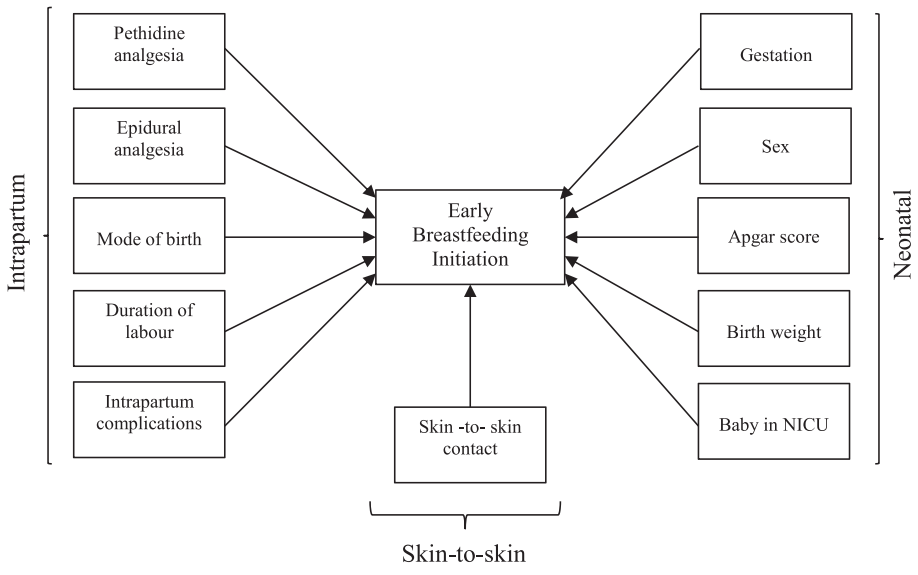

FIGURE 1 Hypothetical path model. NICU = neonatal intensive care unit

Participation was voluntary, and no personal information was recorded to ensure anonymity. The research team screened eligibility of women according to labour records and collected related information using structured questionnaires.

2.3 | Measures

On the basis of previous literature review (Moore et al., 2016; Patel et al., 2015), our study used a structured questionnaire, which was designed to assess intrapartum factors, neonatal characteristics, and SSC timing in relation to early breastfeeding initiation (Moore et al., 2016; Patel et al., 2015). Early breastfeeding initiation was defined as provision of mother's breast milk to babies within 1 hr after birth (WHO, 2016). Collected intrapartum characteristics include use of pethidine, epidural analgesia, mode of birth, duration of labour (hours of regular uterine contractions during the first stage of labour), and intrapartum complications (such as post-natal haemorrhage and fourth-degree tear), whereas neonatal characteristics include gestational age, gender, Apgar scores (Apgar score ≥ 7 is classified as normal, and Apgar < 7 is classified as low to intermediate; American Academy of Pediatrics, 2006), birth weight, and NICU admission. SSC was defined as the procedure after birth when newborn infants are placed in direct body contact with mothers for at least 1 hr. No standardized subcategories of early SSC exist in literature (Moore, Anderson, Bergman, & Dowswell, 2012; Moore et al., 2016); on the basis of different timings of SSC after birth, we employed two subcategories, including "immediate" (<30 min) and "early" (30–60 min), in this study.

2.4 | Data analysis

Analyses were performed using IBM statistics 24.0 (IBM Corporation, Armonk, New York). Missing data were less than 3% and were treated with mean substitution. Descriptive statistics were calculated for all intrapartum and neonatal characteristics, SSC, and early breastfeeding initiation. Chi-square test and independent-sample *t* test were used to compare two modes of birth (spontaneous vaginal birth vs. Caesarean section or operative vaginal birth). A path analytic model was used with Analysis of Moment Structures software (AMOS, Version 23.0) to test a hypothetical path model (Kline, 2016). The AMOS software facilitated testing of whether the hypothesized model fits among the constructs (variables) with path diagrams (Kline, 2016). The AMOS software included path analysis and group comparison; those programs were used to determine the degree of effects (structural relationships) in the entire sample and to compare parameters in subgroups (Kline, 2016). Path analysis examined observed data relations for degree of fit with expected relations among initial hypotheses using a multivariate technique, which allows simultaneous determination of parameter estimates (Kline, 2016). Multiple-group path analysis was employed to determine whether differences exist in structural parameters across groups (Molina, Alegría, & Mahalingam, 2013). In the entire sample, the path analysis model was the preferred analytical strategy for analysing the effects of intrapartum and neonatal characteristics and SSC on early breastfeeding initiation, and multiple-group path analysis was used to compare differences between effects (parameter estimates) of immediate SSC on initiation of early breastfeeding under different modes of birth.

A two-step approach was used to test the proposed hypothetical path model based on our theoretical assumption (Alberts, 1994; Kraemer, 1992; Martens & Young, 1997). First, the hypothesized path analysis model was tested to examine relationships among observed variables. Second, a multiple-group analysis was used to test critical ratio (CR) of differences between estimates of immediate SSC on early breastfeeding initiation for spontaneous vaginal birth and Caesarean section or operative vaginal birth groups. After a pairwise parameter comparison is used, the null hypothesis (H_0) is accepted when the CR for differences between two groups lies between −1.96 and +1.96 (Arbuckle, 2011; Byrne, 2013). When the CR is beyond −1.96 to +1.96, H_0 is rejected (Arbuckle, 2011; Byrne, 2013). Estimates of the path coefficient represent the path strength between two variables and were calculated using standardized regression coefficients (i.e., beta value). The full-information maximum-likelihood estimation method was used to estimate parameters that most possibly represent population values (Kline, 2016). Criteria for goodness of fit are as follows: minimum discrepancy divided by degrees of freedom (CMIN/DF) < 2, goodness-of-fit index (GFI) > 0.90, comparative fit index (CFI) > 0.90, and root mean square error of approximation (RMSEA) < 0.06 (Byrne, 2013; Hu & Bentler, 1999; Schermelleh-Engel, Moosbrugger, & Müller, 2003).

3 | RESULTS

A total of 1,012 mother–newborn dyads were invited in the antenatal ward. Among these women, 915 mother–newborn dyads were eligible to participate in this study (response rate = 90.4%). Table 1 summarizes intrapartum factors, neonatal characteristics, SSC, and early breastfeeding initiation. The prevalence of different modes of birth is 80.5% spontaneous vaginal birth, 4.7% vacuum extraction or forceps, 6.6% planned caesarean, and 8.2% emergency Caesarean. The proportion of pethidine use, labour duration, immediate SSC, and early breastfeeding initiation were significantly different between the spontaneous vaginal birth group and the Caesarean or operative vaginal birth group ($p < .05$) using chi-square test or Fisher's exact test (when expected frequency was less than 5).

In the first step, the hypothesized path analysis model was tested to examine relationships among constructs. Figures 2–4 show evaluated path analysis models with standardized regression beta coefficient for the entire and multiple-group samples, and Table 2 summarizes results of the regression models. In the entire sample, all pathway estimates (beta value) were reported in standardized format. Immediate SSC (β = .32; $p < .001$), Caesarean or operative vaginal birth (β = −.13; $p < .001$), labour duration (β = −.08; $p = .17$), and NICU admission (β = −.07; $p = .014$) were significantly associated with early breastfeeding initiation. However, use of pethidine and epidural analgesia, intrapartum complications, gestational age, gender, Apgar score, and birthweight demonstrated no significant effects ($p > .05$) on early breastfeeding initiation in the entire population. The confirmatory factor analysis model showed satisfactory fit indices (CMIN/DF = 1.943,

TABLE 1 Comparison of intrapartum and neonatal characteristics among spontaneous vaginal delivery and Caesarean or assisted delivery (*N* = 915)

Characteristics	Entire sample (*N* = 915)	Spontaneous vaginal birth (*n* = 737)	Caesarean or assisted birth (*n* = 178)	*p* value
Mode of delivery				
Spontaneous vaginal birth	737 (80.5%)	737 (100.0%)	—	—
Assisted birth (vacuum or forceps)	43 (4.7%)	—	43 (24.2%)	—
Planned Caesarean birth	60 (6.6%)	—	60 (33.7%)	—
Emergency Caesarean birth	75 (8.2%)	—	75 (42.1%)	—
Intrapartum characteristics				
Pethidine analgesia				
Yes	67 (7.3%)	62 (8.4%)	5 (2.8%)	.01[b*]
No	848 (92.7%)	675 (91.6%)	173 (97.2%)	
Epidural analgesia				
Yes	399 (43.6%)	317 (43.0%)	82 (46.1%)	.461[b]
No	516 (56.4%)	420 (57.0%)	96 (53.9%)	
Duration of labour (hr), *M* (*SD*)	6.42 (3.91)	6.16 (3.93)	7.48 (3.64)	<.001[a***]
Intrapartum complications				
Yes	34 (3.7%)	23 (3.1%)	11 (6.2%)	.053[b]
No	881 (96.3%)	714 (96.9%)	167 (93.8%)	
Neonatal characteristics				
Gestation (days), *M* (*SD*)	273.08 (8.96)	273.04 (9.05)	273.26 (8.64)	.768[a]
Sex				
Male	464 (50.7%)	373 (50.6%)	91 (51.1%)	.902[b]
Female	451 (49.3%)	364 (49.4%)	87 (48.9%)	
Apgar score at 1 min				
≥7	904 (98.8%)	731 (99.2%)	173 (97.2%)	.028[b*]
<7	11 (1.2%)	6 (0.8%)	5 (2.8%)	
Apgar score at 5 min				
≥7	915 (100%)	737 (80.5%)	178 (19.4%)	—
<7	0	0	0	
Birthweight (g), *M* (*SD*)	3,128.65 (408.88)	3,118.31 (402.13)	3,171.44 (434.29)	.139[a]
Baby in NICU				
Yes	387 (42.3%)	302 (41.0%)	85 (47.8%)	.101[b]
No	528 (57.7%)	435 (59.0%)	93 (52.2%)	
Skin-to-skin contacts				
Immediate skin-to-skin contacts				
Yes	769 (84.0%)	677 (91.9%)	92 (51.7%)	<.001[b***]
No	146 (16.0%)	60 (8.1%)	86 (48.3%)	
Breastfeeding characteristics				
Early breastfeeding initiation				
Yes	821 (89.7%)	692 (93.9%)	129 (72.5%)	<.001[b***]
No	94 (10.3%)	45 (6.1%)	49 (27.5%)	

Note. NICU = neonatal intensive care unit; — = cannot perform chi-square test.

[a]Independent *t* test.

[b]Chi-square test.

*$p < .05$.

**$p < .01$.

***$p < .001$.

GFI = 0.986, CFI = 0.955, and RMSEA = 0.032) for the entire population model (Table 2).

In the second step, multiple-group analysis was used to test the CR of differences between estimates of immediate SSC on early breastfeeding initiation in two birth mode groups. Figures 3 and 4 show the results of multiple-group analyses. In this study, a −0.309 CR was calculated for differences between spontaneous vaginal birth and Caesarean section or operative vaginal birth groups. Thus, no difference exists between effects of immediate SSC on early breastfeeding initiation in the two birth groups. Immediate SSC was

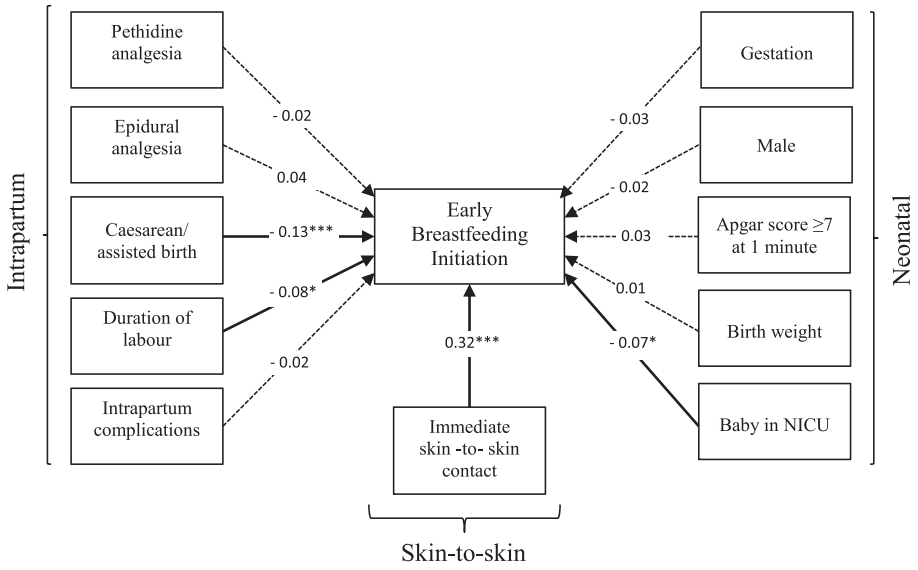

FIGURE 2 Path analysis model among entire population (N = 915). NICU = neonatal intensive care unit

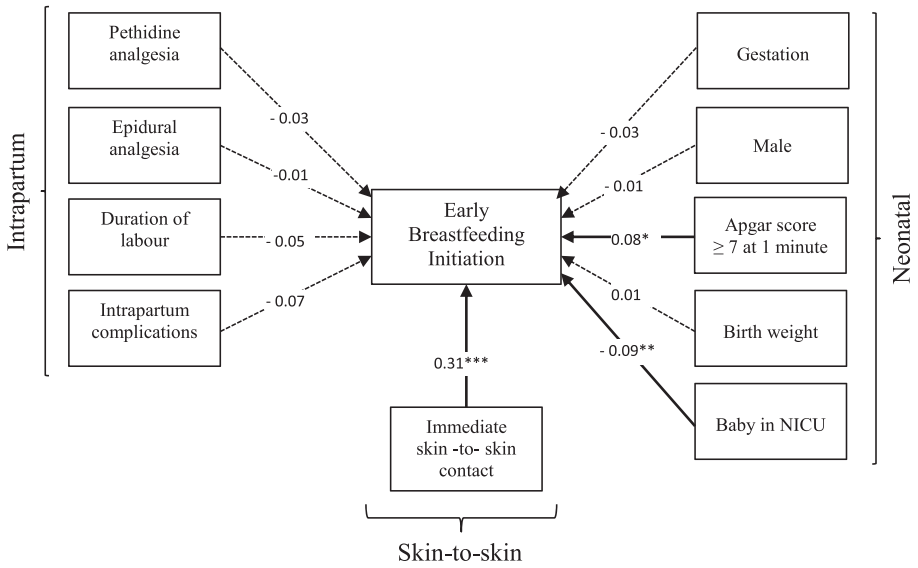

FIGURE 3 Multiple-group path analysis model among the spontaneous vaginal birth group (n = 737). NICU = neonatal intensive care unit

significantly consistently and positively associated with early breastfeeding initiation in both spontaneous vaginal birth (β = .31; p < .001) and Caesarean section or operative vaginal birth groups (β = .27; p < .001). Labour duration (β = −.08; p = .017) was significantly negatively associated with early breastfeeding initiation in the entire group. Neonates with Apgar scores of ≥7 at 1 min (β = .08; p = .024) were significantly associated with early breastfeeding initiation in the spontaneous vaginal birth group. NICU admission was significantly and negatively associated with early breastfeeding initiation in the entire group (β = −.07; p = .014) and spontaneous vaginal birth group (β = −.09; p = .008). However, use of pethidine or epidural analgesia, intrapartum complications, gestational age, gender, and birthweight showed no significant effects (p > .05) on early breastfeeding initiation in the entire group and two subgroups. Model statistics for the multiple-group model indicated better fitting of model with data (CMIN/DF = 1.466, GFI = 0.981, CFI = 0.947, and RMSEA = 0.023) compared with the entire population model (Table 2).

4 | DISCUSSION

To our knowledge, this study is the first to examine relationships between intrapartum factors, infant characteristics, and immediate SSC in early breastfeeding initiation among 915 mother–newborn dyads in Singapore. We used a path analytic approach to evaluate interrelated study variables according to theoretical (Alberts, 1994; Kraemer, 1992; Martens & Young, 1997) and empirical evidence (Moore et al., 2016; Patel et al., 2015). This study showed that immediate SCC, mode of birth, duration of labour, and NICU admission were significantly associated with early breastfeeding initiation in the entire population, depicting that our results partially support the

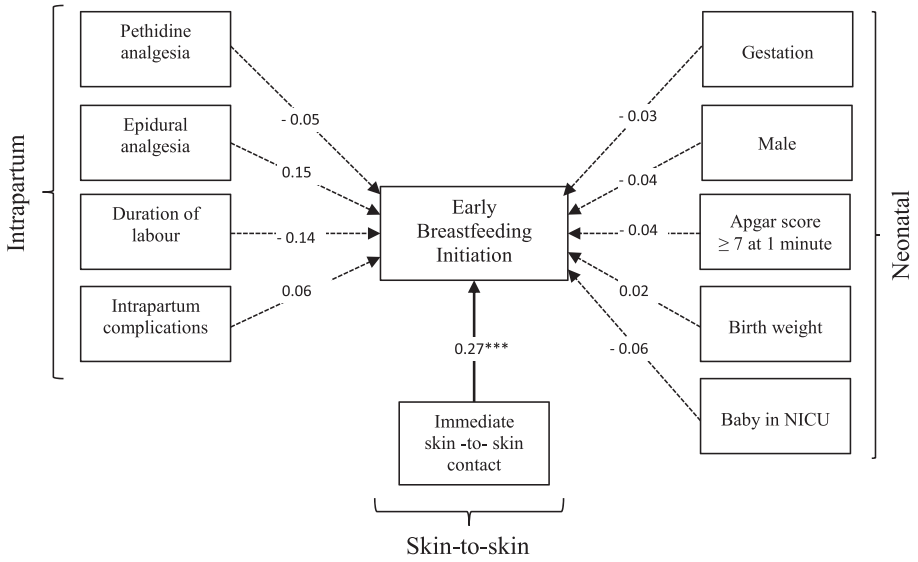

FIGURE 4 Multiple-group path analysis model among the Caesarean or assisted birth group (n = 178). NICU = neonatal intensive care unit

TABLE 2 Results of multiple regression models predicting early breastfeeding initiation

	Entire sample (N = 915)			Spontaneous vaginal birth (n = 737)			Caesarean or assisted birth (n = 178)		
Characteristics	**Estimate**	***SE***	***p* value**	**Estimate**	***SE***	***p* value**	**Estimate**	***SE***	***p* value**
Intrapartum characteristics									
Pethidine analgesia	−0.02	0.04	.46	−0.03	0.03	.39	−0.06	0.19	.43
Epidural analgesia	0.04	0.02	.20	−0.01	0.02	.79	0.15	0.07	.05
Caesarean/assisted birth	−0.13	0.03	<.001***	—	—	—	—	—	—
Duration of labour (hr)	−0.08	<0.01	.02*	−0.05	<0.01	.21	−0.14	0.01	.08
Intrapartum complications	−0.02	0.05	.60	−0.07	0.05	.06	0.06	0.13	.37
Neonatal characteristics									
Gestation (days)	−0.04	<0.01	.31	−0.03	<0.01	.44	−0.04	<0.01	.67
Gender of infant	−0.02	0.02	.59	−0.01	0.02	.77	−0.04	0.06	.57
Apgar score ≥ 7 at 1 min	0.03	0.08	.39	0.08	0.09	.02*	−0.04	0.19	.53
Birthweight (g)	0.01	<0.01	.70	.01	<0.01	.82	0.02	<0.01	.84
Baby in NICU	−0.07	0.02	.01*	−0.09	0.02	<.01**	−0.06	0.06	.42
Immediate skin-to-skin contacts (<30 min)	0.32	0.03	<.001***	0.31	0.03	<.001***	0.27	0.06	<.001***
Model fit summary									
CMIN/DF		1.943				1.466			
GFI		0.986				0.981			
CFI		0.955				0.947			
RMSEA		0.032				0.023			

Note. CFI = comparative fit index; CMIN/DF = minimum discrepancy, divided by degrees of freedom; GFI = goodness of fit index; NICU = neonatal intensive care unit; RMSEA = root mean square error of approximation.

*p < .05.

**p < .01.

***p < .001.

hypothetical model. Multiple-group analysis showed no significant difference between effects of immediate SSC on early breastfeeding initiation in different birth groups. In the spontaneous vaginal birth group, women were less prone to initiating early breastfeeding when their neonates were admitted to the NICU and their Apgar scores were <7 at 1 min. Immediate SSC was significantly related to early breastfeeding initiation in the Caesarean section or operative vaginal birth group.

4.1 | Mode of birth and early breastfeeding initiation

In this study, the prevalence rate of Caesarean section was 14.75%, which was considered an acceptable rate of Caesarean sections (10–15%) by the WHO (2015). This finding demonstrated that BFHI-accredited hospitals support breastfeeding per specific breastfeeding protocols and recommended guidelines for Caesarean section. One study observed that women who had planned Caesarean sections

were less expected to initiate breastfeeding compared with those who underwent emergency Caesarean section (Hobbs, Mannion, McDonald, Brockway, & Tough, 2016). Our study considered a relatively small sample size for subgroups of planned Caesarean section, emergency Caesarean section, and operative vaginal birth groups (n = 43–75). Comparisons among subgroups showed reduced probability of detecting actual effects because of low statistical power. Thus, further investigations are necessary. In Singapore, the prevalence rate of operative vaginal deliveries is 4.7%, which is similar to the 5% rate in the United States (Ali & Norwitz, 2009) and lower than the 15.3% rate in Ireland (Daly et al., 2014). For operative vaginal birth, the optimum rate is unknown, and almost all operative vaginal deliveries occur under emergency situations (Daly et al., 2014). An operative vaginal birth should only be performed when appropriate indications exist, because it can be technically challenging; studies showed that forceps delivery is associated with more maternal morbidity, whereas vacuum extraction causes more neonatal injuries (Ekéus, Högberg, & Norman, 2014; Le Ray, Theau, & Goffinet, 2013).

As portions of early breastfeeding initiation in the Caesarean or operative vaginal birth group were significantly lower than that in the spontaneous vaginal birth group, additional lactation support for the Caesarean or operative vaginal birth group are necessary to provide appropriate anticipatory guidance to improve early breastfeeding initiation (Stevens et al., 2014). Women who underwent Caesarean section or operative vaginal birth were significantly negatively related to early breastfeeding initiation. The present finding is consistent with previous findings (Chien & Tai, 2007; Haghighi & Taheri, 2015; Patel et al., 2015). Recent results can be explained by the fact that caesarean or operative vaginal birth may be related to limitations in maternal mobility, wound pain, and positioning difficulties (Tully & Ball, 2014); such limitations may interrupt early breastfeeding initiation. In addition, neonates born by Caesarean section or operative vaginal birth experience more problems with latching (Lau et al., 2015), reduced suckling ability, and decreased receptivity (Hobbs et al., 2016), all of which consequently influence effective breastfeed latching to initiate breastfeeding.

4.2 | Immediate SSC and early breastfeeding initiation

Immediate SSC within 30 min postbirth was consistently positively and significantly related to early breastfeeding initiation compared with SSC at >30–60 min in the entire population and the spontaneous vaginal and caesarean or operative vaginal birth groups. In this study, result patterns echo those of previous literature (Kim, 2017; Patel et al., 2015). The exact time of SCC must be understood for designing targeted strategies to improve breastfeeding initiation (Moore et al., 2016). SSC between mother and neonate is ideal, because it is biologically normal and promotes maternal and neonatal well-being (Bergman, 2014). Immediate SSC allows infants' demands for care; these demands may trigger neuropsychobiological paths that increase maternal behaviours and immediate response to infant needs and increased lactogenesis (Conde-Agudelo & Diaz-Rossello, 2016). SSC also facilitates neonatal breast crawl behaviour (Debes, Kohli, Walker, Edmond, & Mullany, 2013) and effective suckling (Cantrill et al., 2014).

A significantly lower rate of immediate SSC was noted in the Caesarean or operative vaginal birth group than in the spontaneous vaginal birth group. One possible interpretation of this result was shortage of staff in implementation of immediate SSC because of extra breastfeeding assistance and lack of support to help them in the operating theatre (Crenshaw et al., 2012). This condition can be explained by interruptions in some routine care practices (such as taking vital sign or neonatal physical examination) that delay immediate SSC (Robiquet et al., 2016). Another possibility is that operating staff fear changes in practice and that something would go wrong after initiating immediate SSC in the operating theatre (Hung & Berg, 2011). One systematic review highlighted that there were no disadvantages of immediate SSC after a Caesarean section (Stevens et al., 2014). Considering the benefits of immediate SSC, health care professionals should implement SSC as first priority in the first 30 min for asymptomatic neonates in the Caesarean section or operative vaginal birth group. There is a need for providing more manpower of operating staff to implement immediate SCC (Stevens et al., 2014). In addition, operating staff should be continuously educated for improving their active initiatives (Stevens et al., 2014).

We used multiple-group analysis and showed nonsignificant differences between effects of immediate SSC on early breastfeeding initiation under different modes of birth. With the comparison of different modes of birth, findings extend knowledge on association between immediate SSC and early breastfeeding initiation. This case may be linked to the determination of mothers despite difficulties that they may experience after Caesarean section or operative vaginal birth (Ahluwalia et al., 2012). Women's prebirth breastfeeding intention and attitudes towards breastfeeding initiation can explain the determination of mothers, because they know and are prepared for breastfeeding difficulties (Lau et al., 2015). Findings suggest the importance of immediate SSC for all women following birth regardless of delivery mode. Consistent with findings from a systematic review (Prior et al., 2012), the mode of birth showed no apparent influence on breastfeeding after initiation, but timing of first feeding was a key determinant. As one of the recommendations from the BFHI (2017), prompt initiation of breastfeeding is encouraged after different modes of birth to ensure its success.

4.3 | Longer first stage of labour and early breastfeeding initiation

Our study showed a decreased likelihood of initiating early breastfeeding in women in the entire group when they laboured for a longer duration in the first stage; this result echoes findings of a previous study in England (Oakley et al., 2014). Slow progress of labour is one of the leading causes of prolonged first stage (Bugg, Siddiqui, & Thornton, 2013), and women under prolonged labour are subjected to augmentation with synthetic oxytocin to accelerate the birthing process (Bell, Erickson, & Carter, 2014). However, administration of synthetic oxytocin increases disturbed neonatal suckling (Olza Fernandez et al., 2012), leading to a delay in breastfeeding initiation (Bell et al., 2014; Wiklund et al., 2009). Longer duration of labour may also be associated with worse labour pain (Nystedt, Hogberg, & Lundman, 2006), negative birth experience (Nystedt & Hildingsson,

2014), fatigue, and anxiety (Tzeng, Yang, Kuo, Lin, & Chen, 2017); thus, mothers may choose to rest and delay breastfeeding initiation.

4.4 | Apgar score at first minute and early breastfeeding initiation

Our results concur with findings reported in a previous study (Isik et al., 2016), which showed that Apgar scores of infants at 1 min influence early breastfeeding initiation in the spontaneous vaginal birth group. The Apgar score is an aggregate score of five readily identifiable neonatal characteristics, namely, skin colour, heart rate, respiratory effort, muscle tone, and reflexes (Apgar & James, 1962). The Apgar score was developed to assess neonatal condition and stratify effective care (Iliodromiti, Mackay, Smith, Pell, & Nelson, 2014). A neonatal Apgar score <7 is related to delayed onset of maternal lactogenesis, posing a greater risk of failure in initiating early breastfeeding in neonates (Matias et al., 2010). Another possibility is that neonates with an Apgar score <7 feature a decreased likelihood of effective suckling (Brimdyr et al., 2015); ineffective suckling may adversely affect initiation of early breastfeeding (Lau et al., 2015). Hence, neonates with an Apgar score <7 are less likely to initiate early breastfeeding compared with those with an Apgar score ≥7. However, further investigation should determine why Apgar scores did not influence early breastfeeding in the Caesarean section or operational birth group or the entire population.

4.5 | Babies in the NICU

Consistent with a previous study in America (Cordero et al., 2013), neonates who were admitted to the NICU were less prone to initiated early breastfeeding in the entire group and spontaneous vaginal group. NICU admission caused significant stress in mothers (Lefkowitz, Baxt, & Evans, 2010); stress is considered a barrier of early breastfeeding initiation. Owing to concern for health of neonates, mothers may skip early breastfeeding initiation to prevent delayed transfer of neonates from the birth room to NICU admission (Cordero et al., 2013). This result may be because of maternal and infant separation (Ray, Urquia, Berger, & Vermeulen, 2012), which may negatively affect early maternal–infant interactions along with known sensory physiologic and behavioural mechanisms, all of which contribute to early breastfeeding initiation. Future studies should focus on why such a significant finding was difficult to observe in the Caesarean section or operational birth group.

In this study, use of analgesia and epidural analgesia, intrapartum complications, gestation, gender of baby, and birthweight showed no significant effects on breastfeeding initiation. As this study is the first to explore the relationship between intrapartum factors, neonatal characteristics, SSC, and early breastfeeding in Singapore, difficulty arises in providing more than conjecture regarding results of preliminary investigation. Future research is needed to replicate this research using different populations to obtain a holistic understanding of observed associations.

4.6 | Implications

This study provides evidence that the exact time of SSC is within 30 min after any mode of birth. Immediate SSC in the operating room and in recovery should be recommended (Stevens et al., 2014) to achieve desired imprint effects for programming future physiology and behaviour (Kim, 2017). Knowing that breastfeeding poses lifelong effects on mother, infant, family, and society (Victora et al., 2016), initiation of early breastfeeding can be considered a universal practice; thus, promotion of this practice should be critically prioritized. Hospital policies and routines significantly influence breastfeeding success. Therefore, workflow priorities are important as they influence SSC timing and consequent breastfeeding initiation. Our result highlights the need to provide appropriate lactation support to women who underwent Caesarean section or operative vaginal birth to attain comfortable and correct positioning for initiating early breastfeeding. Efforts must be focused on preventing early lactation difficulties to ensure successful early initiation of breastfeeding. Antenatal women and health care professionals must be educated regarding beneficial effects of early breastfeeding initiation and immediate SSC (Stevens et al., 2014). Active management with early amniotomy and oxytocin is recommended to prevent long duration of labour in the first stage (Wei et al., 2013).

4.7 | Limitations

Despite contributions provided by this study, drawn conclusions should be considered in the context of their limitations. First, our research used a cross-sectional study design using convenience sampling methods in one hospital; this design may restrict causal relationship and generalizability of results. Second, data were retrospectively collected based on labour records, which may show recording bias because of the inability to properly decipher information on standardized questionnaires. Third, we lacked comparative data on Apgar scores at 5 min because all neonates in our sample were given scores of ≥7 though evidence shows that Apgar scores at 5 min present greater predictive performance than Apgar scores at 1 min (Drage, Jennedy, & Scwarz, 1964). Fourth, this research addressed some intrapartum and neonatal characteristics but failed to address other important factors, such as fatigue, emotional well-being, and social support, and thus warrants future research. Fifth, this study did not distinguish between types of operative vaginal birth (vacuum extraction and forceps birth); findings may overestimate or underestimate effects on early breastfeeding initiation. Lastly, we used early breastfeeding initiation as outcome. We must follow up breastfeeding duration in further longitudinal studies.

5 | CONCLUSION

Multiple-group analysis was uniquely performed among different modes of birth, and results signify the importance of immediate SSC on early breastfeeding initiation. This study provides valuable information for health care professionals to promote SSC within 30 min post childbirth after spontaneous vaginal birth, operative vaginal birth, and Caesarean section. An individualized approach for addressing factors may help improve early breastfeeding initiation to ensure long-term breastfeeding success and sustainability. We encourage further studies to strengthen recommendation for promotion of early breastfeeding initiation and establishment of immediate SSC.

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

CONTRIBUTIONS

LY contributed to the study design, coordinated data collection, developed research questions, conducted the statistical analysis of the data, and drafted, edited, and revised the manuscript. SS contributed to the drafting and revising of the manuscript. PHT participated in assisting data collection and conducting the statistical analysis. All authors read and approved the final submitted manuscript.

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