

## Effect of Early Skin-to-Skin Mother–Infant Contact During the First 3 Hours Following Birth on Exclusive Breastfeeding During the Maternity Hospital Stay

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### Abstract

This was a nurse-driven, hospital-based, prospective cohort study of data collected in 19 hospitals in San Bernardino and Riverside counties by California Perinatal Services Network on all mothers (n = 21 842) who delivered a singleton infant (37–40 weeks gestation) between July 2005 through June 2006. Multivariate ordinal logistic regression showed that maternal infant-feeding method intention (measured prior to birth), sociodemographic characteristics, intrapartum variables, and early skin-to-skin mother–infant contact during the first 3 hours following birth (controlling for delivery hospital) were correlated with exclusive breastfeeding during the maternity hospitalization. Compared with mothers with no early skin-to-skin contact, exclusive breastfeeding was higher in mothers who experienced skin-to-skin contact for 1 to 15 minutes (odds ratio [OR] 1.376; 95% confidence interval [CI], 1.189–1.593), 16 to 30 minutes (OR 1.665; 95% CI, 1.468–1.888), 31 to 59 minutes (OR 2.357; 95% CI, 2.061–2.695), and more than 1 hour (OR 3.145; 95% CI, 2.905–3.405). The results demonstrate a dose–response relationship between early skin-to-skin contact and breastfeeding exclusivity.

**Keywords:** exclusive breastfeeding, early skin-to-skin contact, sociodemographic characteristics, intrapartum variables

There is ample evidence of the numerous benefits of breastfeeding.<sup>1</sup> Human milk is uniquely matched for the

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needs of the human infant, and breastfeeding benefits the health of the infant.<sup>2–4</sup> Breastfeeding rates in the United States have reached the goal of *Healthy People 2010* “to increase to 75% the proportion of mothers who breastfeed their babies in the early postpartum period.”<sup>5</sup> In contrast, in San Bernardino County 34.6% of mothers are exclusively breastfeeding at the time of their maternity hospitalization discharge, whereas in Riverside County 47.7 % of mothers are exclusively breastfeeding at the time of their maternity hospital discharge.<sup>6</sup> One factor influencing whether a mother breastfeeds during the immediate postpartum period is standard hospital practices that separate the mother and infant during a time when the infant is most receptive to self-attachment to the breast and breastfeeding.<sup>7</sup> The Academy of Pediatrics (AAP) recommends that healthy newborns be placed and remain in direct skin-to-skin mother–infant contact until after the first breastfeeding.<sup>1</sup> Common hospital-based practices prevent the mother and infant from the attachment experience that early skin-to-skin contact provides.<sup>7,8</sup> Newborns are routinely alert and are capable of latching to the mother’s nipple without assistance within the first hour following

birth.<sup>7,8</sup> Mothers and infants who experience early skin-to-skin contact are more likely to have breastfeeding success during the early postpartum period.<sup>9,10</sup> The benefits of early skin-to-skin contact immediately following birth are numerous; skin-to-skin contact eases the infant's transition to extra-uterine life.<sup>11</sup> The close body contact of the mother helps to regulate the infant's body temperature, energy conservation, respirations, crying, and nursing behaviors.<sup>11</sup>

Langercrantz<sup>12</sup> found that newborns experience a surge of catecholamine that enables them to stay awake and alert immediately after their birth. However, this stress response following birth can become maladaptive if allowed to continue. Early skin-to-skin contact alleviates the "stress of being born"<sup>13</sup> by decreasing the infant's sympathetic tone through the mother's touch, body warmth, and odor. The odor of the mother's breast helps guide the infant toward the mother's nipple.

We have not identified current literature that addresses in 1 study the impact of maternal infant-feeding intention, early skin-to-skin mother-infant contact, the mother's sociodemographic characteristics, maternal intrapartum variables, hospital of birth, and exclusive breastfeeding during the maternity hospital stay. It is important to include these variables in 1 study because any 1 of the variables could be confounded with early skin-to-skin contact. It is possible that 1 apparent connection between early skin-to-skin contact and exclusive breastfeeding during the maternity hospitalization could be the result of the implementation of specific hospital policies supporting this intervention. Therefore, such variables must be controlled if we are to determine the true relationship between early skin-to-skin contact and exclusive breastfeeding during the maternity hospital stay.

The Perinatal Services Network (PSN) of Loma Linda University Medical Center/Children's Hospital identified a number of standard hospital birthing practices that are not conducive to maternal-infant bonding and attachment or breastfeeding. These practices include infant physical exam, suctioning, vitamin K injection, application of erythromycin ophthalmic ointment, swaddling, and maternal-infant separation immediately following birth and during the recovery period.

From July 2005 through June 2006, PSN enacted a prospective cohort, nurse-driven, hospital-based quality assurance intervention ( $n = 21\,842$  mother-infant dyads) to promote, support, and improve the development of newborns through bonding and attachment and early mother-infant skin-to-skin contact during the first 3 hours following birth. Analysis of the PSN data pro-

vided the opportunity to fill a gap in the early skin-to-skin literature. It was our intention to include in one study maternal infant-feeding intention, sociodemographic characteristics, intrapartum variables, and the length of time spent in early skin-to-skin mother-infant contact during the first 3 hours following birth (controlling for the hospital of birth) to determine their association with exclusive breastfeeding during the maternity hospital stay. In addition, this program allowed us to examine a possible dose-response relationship between early skin-to-skin contact within the first 3 hours post birth and the likelihood of exclusive breastfeeding during the maternity hospital stay.

## Methods

### Study Design

This study involved analysis of data from a prospective cohort quality assurance intervention. We analyzed data collected on 21 842 mother-infant dyads who delivered in the 19 PSN-contracted hospitals during the study period of July 2005 through June 2006. These births represented 95% of the births in the 19 hospitals for that time period.

The hospitals that contracted with PSN were eager to partner with PSN. Each hospital agreed to implement 2 of 3 hospital practices (24-hour rooming-in, staff breastfeeding management classes, and early skin-to-skin contact) in order to be funded by PSN. Prior to the PSN quality assurance program initiation, nurses from each of the 19 PSN-contracted hospitals attended training at the PSN headquarters. This training included the practices that were to be implemented in the hospital. Those trained in bonding and attachment, breastfeeding management, and rooming-in had the option to incorporate early skin-to-skin contact into their standard hospital routines. At the onset of the intervention, each institution used the same PSN data measurement collection form and corresponding data dictionary to track specific variables of interest to PSN pertaining to the mother-infant dyads.

### Participants

The cohort consisted of all mothers who delivered in 1 of the 19 PSN-contracted hospitals during the study period and were included in the PSN data collection ( $n = 21\,842$ ). Mothers included in the study came from a variety of racial and ethnic backgrounds. They were English- and Spanish-speaking and representative of the existing patient population in Riverside and San

Table 1. Maternal Variables of the Sample

Age, y, mean $\pm$ standard deviation	26.7 $\pm$ 6.1
Education, n (%)	
Less than high school	6068 (32.7)
High school	6920 (37.3)
College	4473 (24.1)
Graduate	1113 (6.0)
Ethnicity, n (%)	
African American	1319 (5.8)
Caucasian	7254 (31.7)
Hispanic	13 017 (57.0)
Other	1261 (5.5)
Smoking, n (%)	
Yes	1053 (4.7)
No	21 449 (95.3)
Intention at entry, n (%)	
Undecided	208 (0.9)
Exclusive breastfeeding	13 334 (58.5)
Formula only	2752 (12.1)
Breast and formula	6516 (28.6)
Anesthesia, n (%)	
Central nervous system	516 (3.0)
Non-central nervous system	16 423 (95.8)
Both	208 (1.2)
Type of delivery, n (%)	
Vaginal	15 876 (69.8)
Cesarean section	6866 (30.2)
Exclusive breastfeeding during hospital stay, n (%)	
Yes	10 915 (49.9)
No	10 927 (50.1)
Skin to skin, n (%)	
None	4872 (22.4)
1-15 min	1068 (4.9)
16-30 min	1469 (6.8)
31-59 min	1212 (5.6)
1-3 h	13 126 (60.4)

Bernardino counties. Mothers were included in the study if they (a) delivered a healthy singleton infant (gestational age 37-40 weeks) and (b) were not separated from their infant for more than 1 hour during the mother's maternity hospital stay. Each participant signed an informed consent at the time of her maternity admission; these informed consents were specific to each maternity institution.

#### Data Collection

Mothers were interviewed in their language of choice (English or Spanish) by the peripartum staff who admitted them to the labor and delivery unit. This baseline data collection included maternal sociodemographic characteristics and desired infant-feeding method. During the intrapartum and postpartum period, additional data were collected including the type of delivery (vaginal or cesarean), maternal intrapartum analgesia and anesthesia usage, amount of time spent in early skin-to-skin

contact, and the type of feeding the infant received during the hospital stay.

To maintain confidentiality, PSN deidentified data collected in the individual hospitals. If data were missing or if discrepancies were present in the data, PSN contacted the individual responsible for the data collection at the specific institution and clarified the situation. Data were cleaned at PSN prior to our receiving it. Initially, data were collected on 23 074 mother-infant dyads; PSN identified missing data on 1232 dyads, which left us with a sample size of 21 842 dyads.

#### Instrument

The 1-page PSN data collection measurement form was developed in house by PSN. The variables to be included in the data collection instrument were decided upon by PSN staff according to their interest, research knowledge, and expertise. The peripartum staff who trained at PSN were experienced with the PNS collection form and data dictionary. The same data collection measurement instrument was used to gather data in each of the 19 maternity hospitals and became part of each mother's medical record.

The PSN quality assurance program was not a research-based project; therefore, prior to the beginning of the program the PSN did not test the data collection measurement form for reliability. After the program was underway, PSN attempted to validate the infant feeding method data that had been collected by comparing it with the data collected in the 2006 California Newborn Screening Program. PSN confirmed the validity of the assessment of breastfeeding rates in its preliminary analysis, which demonstrated a Spearman's  $\rho$  correlation of 0.90 with the newborn screening data.<sup>14</sup> This study received institutional review board approval from Loma Linda University.

#### Independent Variables

The key independent variables examined and reported were (1) maternal infant-feeding method intention; (2) maternal sociodemographic characteristics, which included mother's primary language, race and ethnicity, age, smoking status, educational level, and the maternal intrapartum variables of analgesia and anesthesia usage and mode of infant delivery (vaginal or cesarean); (3) and the duration spent in early skin-to-skin contact during the first 3 hours after delivery, subdivided as shown in Table 1.

Each of the variables included in our analysis have been examined individually in previous research stud-

ies and have shown their independent association with breastfeeding. Maternal sociodemographic characteristics are predictive of a mother's intention to breastfeed.<sup>15</sup> Maternal intrapartum analgesia/anesthesia readily transfers to the fetus via the placenta and has the potential to disturb the neonatal neurobehavioral transition to extra-uterine life.<sup>16</sup> These medications cause disorganized behavior in the newborn infant that can result in a delay in effective breastfeeding.<sup>17</sup> Cesarean section delivery is a significant barrier to a mother's initiation of breastfeeding within 30 to 60 minutes following birth.<sup>18</sup> Early skin-to-skin contact is not a common practice after cesarean births.<sup>17</sup>

#### Outcome Variable

The outcome variable was the actual type and method of feeding the infant received during the maternity hospital stay as entered by peripartum staff on the PSN data collection form. The various types of infant feeding were exclusive breastfeeding, breast and formula feeding, and formula feeding. However, for analysis purposes these were divided into 2 categories: exclusive breastfeeding or other.

#### Statistical Methods

Statistical analysis was performed using the Statistical Package for Social Sciences version 15 (SPSS, Chicago, Illinois). Univariate logistic regression assessed confounding by adding each potential confounder to the model that included early skin-to-skin contact alone. Confounding variables were considered to be significant if they produced more than a 10% change in the odds ratio of exclusive breastfeeding when added to the model. The initial model only included early skin-to-skin contact as the independent variable. The confounding variables that produced more than a 10% change in the odds ratio were then included in a multivariate regression model to determine the effect of early skin-to-skin contact after adjusting for these confounding variables.<sup>19</sup> In addition, the multivariate model included interaction terms between early skin-to-skin contact and other covariates. Interaction was tested by assessing the difference in the log likelihood ratio with and without the interaction terms.<sup>19</sup>

The 19 hospitals were controlled for in this study to explore whether the variation in the implementation of early skin-to-skin contact contributed to the difference in exclusive breastfeeding. A dummy variable was entered into the analysis to represent each hospital except the hospital with the most births which served as the reference group.

Table 2. Maternal Sociodemographic Characteristics, Maternal Intrapartum Variables, and Exclusive Breastfeeding Rates During the Maternity Hospitalization

Variables	Exclusive Breastfeeding During Hospital Stay		P Value
	Yes	No	
Age, y, mean $\pm$ SD	26.85 $\pm$ 5.91	26.5 $\pm$ 6.25	< .001 <sup>a</sup>
Education ( $\chi^2 = 452.8$ , df = 3), n (%)			< .001 <sup>a</sup>
Less than high school	2328 (26.5)	3448 (38.6)	
High school	3243 (36.9)	3370 (37.7)	
College	2526 (28.7)	1740 (19.5)	
Graduate	693 (7.9)	382 (4.3)	
Ethnicity ( $\chi^2 = 559.2$ , df = 3), n (%)			< .001 <sup>a</sup>
African American	462 (4.3)	760 (7.0)	
Caucasian	4197 (38.7)	2614 (24.1)	
Hispanic	5626 (51.8)	6824 (63.0)	
Other	572 (5.3)	389 (5.8)	
Smoking ( $\chi^2 = 162.8$ , df = 1), n (%)			< .001 <sup>a</sup>
Yes	290 (2.7)	682 (6.4)	
No	10 377 (97.3)	10 029 (93.6)	
Intention at entry ( $\chi^2 = 5040.5$ , df = 3), n (%)			< .001 <sup>a</sup>
Undecided	80 (0.7)	89 (0.8)	
Exclusive breastfeeding	8770 (81.0)	3879 (35.8)	
Formula only	129 (1.2)	2490 (23.0)	
Breast and formula	1854 (7.1)	4374 (40.4)	
Anesthesia ( $\chi^2 = 80.3$ , df = 2), n (%)			< .001 <sup>a</sup>
Central nervous system	135 (1.2)	315 (2.9)	
Non-central nervous system	7895 (72.3)	7713 (70.6)	
Both	82 (0.8)	117 (1.1)	
Type of delivery ( $\chi^2 = 614.1$ , df = 1), n (%)			< .001 <sup>a</sup>
Vaginal	8482 (78.6)	6830 (63.3)	
Cesarean section	2311 (21.4)	3966 (36.7)	
Skin to skin ( $\chi^2 = 1144.5$ , df = 4), n (%)			< .001 <sup>a</sup>
None	1162 (11.2)	2947 (28.6)	
1-15 min	429 (4.2)	594 (5.8)	
16-30 min	664 (6.4)	776 (7.5)	
31-59 min	650 (6.2)	544 (5.3)	
1-3 h	7512 (72.1)	5447 (52.8)	

<sup>a</sup>Significant at  $\alpha = .05$ .

#### Results

Table 1 shows the demographic characteristics of the sample as well as a breakdown of the demographic variables that were collected by PSN. Our participant population represented the ethnically diverse culture of this area in southern California. Study participants were mostly nonsmoking Hispanics with an educational background of high school or less. The mean age ( $\pm$  standard deviation) was 26.7  $\pm$  6.1 years. The majority of the women intended to exclusively breastfeed at entry, experienced a vaginal delivery, and had more



than 1 hour of early skin-to-skin mother infant contact during the first 3 hours post birth. Table 2 shows the differences between mothers who did and did not breastfeed exclusively during their maternity hospitalization. Mothers who breastfed exclusively were more likely to be Hispanic, to have a high school education, to intend to breastfeed exclusively at baseline, to have delivered vaginally, to have used non-central nervous system analgesia or anesthesia, and to experience more than 1 hour of early skin-to-skin mother-infant contact during the first 3 hours following birth, and they were less likely to smoke.

Table 3 indicates that maternal infant-feeding method intention, measured at entry to the maternity hospital stay, and the type of delivery (vaginal or cesarean) were significant confounders associated with early skin-to-skin contact during the first 3 hours following birth. Maternal infant-feeding intention and type of delivery produced more than a 10% change in the odds ratio when added to the model that only included early skin-to-skin contact as the independent variable.

These confounders were added to a multivariable analysis to create a logistic regression model to assess the effect of early skin-to-skin contact after adjusting for maternal infant-feeding intention and type of delivery. The resulting model is shown in Figure 1. Figure 2 shows the model after adjusting for all potential confounders found in Table 3, including hospital of birth. In both multivariate logistic regression analyses, we found that the ORs of the likelihood of exclusive breastfeeding continued to increase as the period of early skin-to-skin contact increased. The *P* value for trend test was statistically significant in both analyses (*P* < .001 and *P* < .001 respectively). Interaction terms between early skin-to-skin contact and other covariates were not significant in either of the multivariable analyses in Figures 1 and 2.

The analysis, which controlled for the 19 hospitals, explored whether the variation of the hospital implementation of early skin-to-skin contact contributed to the rates of exclusive breastfeeding during the maternity hospital stay. We found that even when the differences among the hospitals were controlled, early skin-to-skin contact was still strongly associated with exclusive breastfeeding in a dose-response manner as Figure 2 illustrates.

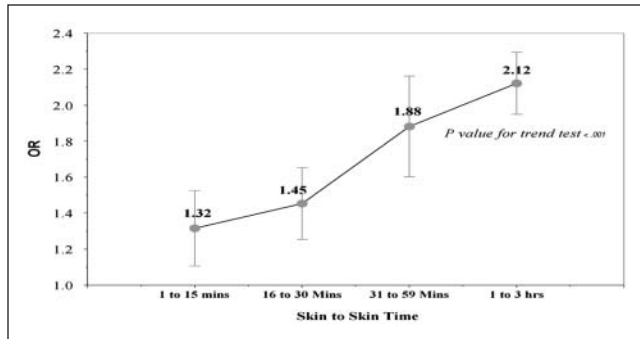
To summarize, we determined that the longer a mother experiences early skin-to-skin contact during the first 3 hours following birth, the more likely that she will breastfeed exclusively during her maternity hospitalization.

Table 3 Univariate Logistic Regression Analysis for Confounder Assessment Dependent Variable—Exclusive Breastfeeding Yes/No

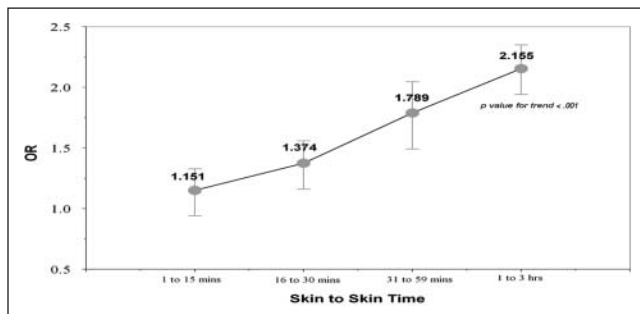
Variables	OR (95% CI)	% Change in OR After Adjustment
Early skin to skin (unadjusted)		
None (reference)	—	—
1-15 min	1.548 (1.350, 1.776)	NA
16-30 min	1.835 (1.629, 2.066)	NA
31-59 min	2.562 (2.254, 2.911)	NA
1-3 h	2.957 (2.763, 3.165)	NA
Early skin to skin + education		
None (reference)	—	—
1-15 min	1.519 (1.323, 1.744)	1.91
16-30 min	1.772 (1.571, 1.997)	3.56
31-59 min	2.515 (2.210, 2.851)	1.87
1-3 h	2.996 (2.769, 3.176)	-1.30
Early skin to skin + type of delivery <sup>a</sup>		
None (reference)	—	—
1-15 min	1.379 (1.200, 1.585)	12.26
16-30 min	1.627 (1.441, 1.836)	12.78
31-59 min	2.213 (1.942, 2.521)	15.77
1-3 h	2.493 (2.320, 2.678)	18.76
Early skin to skin + intention at entry <sup>a</sup>		
None (reference)	—	—
1-15 min	1.559 (1.335, 1.821)	0.71
16-30 min	1.711 (1.496, 1.957)	7.35
31-59 min	2.303 (1.992, 2.663)	11.25
1-3 h	2.687 (2.490, 2.899)	10.05
Early skin to skin + smoking		
None (reference)	—	—
1-15 min	1.526 (1.330, 1.751)	1.44
16-30 min	1.816 (1.612, 2.046)	1.05
31-59 min	2.514 (2.212, 2.859)	1.91
1-3 h	2.923 (2.731, 3.129)	1.16
Early skin to skin + ethnicity		
None (reference)	—	—
1-15 min	1.532 (1.333, 1.760)	1.04
16-30 min	1.777 (1.576, 2.005)	3.26
31-59 min	2.511 (2.206, 2.859)	2.03
1-3 h	2.913 (2.720, 3.121)	1.51
Early skin to skin + anesthesia		
None (reference)	—	—
1-15 min	1.543 (1.345, 1.770)	0.32
16-30 min	1.821 (1.617, 2.051)	0.77
31-59 min	2.531 (2.227, 2.877)	1.22
1-3 h	2.935 (2.741, 3.142)	0.75
Early skin to skin + age		
None (reference)	—	—
1-15 min	1.557 (1.357, 1.785)	-0.58
16-30 min	1.850 (1.642, 2.083)	-0.81
31-59 min	2.584 (2.274, 2.938)	-0.70
1-3 h	2.980 (1.779, 3.184)	-0.77
Early skin to skin + hospital		
None (reference)	—	—
1-15 min	1.376 (1.189, 1.593)	-11.1
16-30 min	1.665 (1.468, 1.888)	9.26
31-59 min	2.357 (2.061, 2.695)	8.00
1-3 h	3.145 (2.905, 3.405)	6.35

CI, confidence interval; NA, not applicable; OR, odds ratio.

<sup>a</sup>Significant at an  $\alpha = .05$



**Figure 1.** Multivariable analysis showing the odds ratio for exclusive breastfeeding adjusted for maternal infant-feeding method intention at entry to maternity hospital stay and type of delivery (vaginal or cesarean). Mothers experiencing no skin-to-skin mother–infant contact were the reference group.



**Figure 2.** Multivariable analysis showing the odds ratio for exclusive breastfeeding adjusted for maternal infant-feeding intention at entry to maternity stay, mode of delivery (vaginal or cesarean), age, race/ethnicity, primary language, education, smoking status, maternal intrapartum analgesia/anesthesia, and hospital of birth. Mothers experiencing no skin-to-skin mother–infant contact were the reference group.

## Discussion

Our hypothesis that longer periods of early skin-to-skin mother–infant contact would lead to an increased likelihood of exclusive breastfeeding during the maternity hospital stay was confirmed. Additionally, we were interested in which maternal sociodemographic and intrapartum variables were significantly correlated with early skin-to-skin contact and exclusive breastfeeding during the maternity hospital stay. To our knowledge this is the first analysis that included maternal infant-feeding intention, sociodemographic variables, intrapartum variables, early skin-to-skin contact, hospital of birth, and exclusive breastfeeding during the mater-

nity hospital stay. Previous studies have included 1 or more of these variables in their research but not all. We do not know of any other study that examined the dose–response relationship between increasing time duration of early skin-to-skin contact and exclusive breastfeeding during the maternity hospital stay.

Moore and colleagues<sup>20</sup> evaluated 30 early skin-to-skin contact studies in a Cochrane review in 2007. Two of these studies measured breastfeeding at hospital discharge as their outcome variable.<sup>21,22</sup> Neither study included all the variables that were analyzed in our research. Our results are consistent with previous studies that document the relationship between maternal infant-feeding intention,<sup>23</sup> education,<sup>24</sup> age,<sup>25</sup> race/ethnicity,<sup>26,27</sup> smoking,<sup>28</sup> maternal intrapartum analgesia and anesthesia,<sup>29</sup> type of delivery,<sup>18</sup> and breastfeeding. Moore and colleagues<sup>20</sup> concluded that no adverse effects are found with early skin-to-skin contact.

Previous authors have suggested that the length of early skin-to-skin contact positively affects the duration of breastfeeding.<sup>30,31</sup> Mikiel-Kostyra and colleagues<sup>30</sup> concluded that mother–infant skin-to-skin contact lasting longer than 20 minutes increases the duration of exclusive breastfeeding. Their study grouped early skin-to-skin contact into short contact (1–19 minutes) and extended contact ( $\geq 20$  minutes). Results demonstrated that there was a significant positive dose-related effect on exclusive breastfeeding duration. Mothers in the extended contact group ( $\geq 20$  minutes) breastfed 3 months longer than those with no skin-to-skin contact. However, this study did not control for intention to breastfeed prior to birth. Without this control it is possible that mothers who intended to breastfeed deliberately made an effort to spend more time in skin-to-skin contact with their infants and it was the intent to breastfeed that was presumably responsible for the apparent advantage of skin-to-skin contact.

## Interpretation

The maternal variables of education, type of delivery (vaginal or cesarean), maternal infant-feeding intention measured prior to birth, smoking, race and ethnicity, primary language, hospital, and intrapartum analgesia and anesthesia only slightly attenuated the overall odds ratio of the positive effect that early skin-to-skin contact had on the outcome variable of exclusive breastfeeding during the maternity hospital stay (Figure 2). We conclude that extended early skin-to-skin contact has a profound positive dose–response effect on exclusive breastfeeding during the maternity hospital stay.

Mothers who initially intend to exclusively breast-feed may read about early skin-to-skin contact and its benefits and look forward to this intervention as part of their birth experience. Mothers who do not initially intend to exclusively breastfeed may not be exposed to early skin-to-skin contact by the hospital staff. Consequently, intent to breastfeed is an important potential confounder in studies of the effects of skin-to-skin contact.

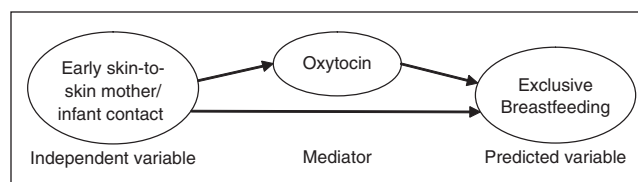
Additionally, we controlled for the 19 PSN contracted hospitals to explore whether the variation of early skin-to-skin mother–infant contact implementation contributed to the difference in exclusive breastfeeding. The association of early skin-to-skin contact with exclusive breastfeeding was not merely a function of the differences among the hospitals; the association still existed when we controlled for the hospitals. We can see from our analysis that early skin-to-skin mother–infant contact was not uniformly implemented in the 19 hospitals. Yet, even when the differences in early skin-to-skin implementation were controlled statistically by including a dummy variable for the hospital in the analysis, early skin-to-skin contact had a considerable, positive dose–response influence on exclusive breastfeeding rates.

#### Strengths and Limitations

The current study has several strengths. It collected information on 21 842 mother–infant dyads for 1 fiscal year. Maternal sociodemographic data collected from the existing patient census were representative of the racial and ethnic makeup of the population base in southern California.

We had the opportunity to analyze data on the variables that PSN was interested in collecting; we were not able to structure the study to collect data on other variables we wished to evaluate. Longer follow-up studies are needed to determine the impact of extended uninterrupted early skin-to-skin care on breastfeeding duration after the hospital discharge, because the interval between early skin-to-skin contact and the final assessment of exclusive breastfeeding was short. A longer interval would have been preferable. This was not a randomized controlled trial; the original data was collected as part of a quality assurance program instituted by PSN.

The hormone oxytocin (mediator) was not measured in this study; we relied on findings from previous research studies. Oxytocin plays an important role in maternal–infant behavior in the first hours following birth in molding maternal behaviors. Oxytocin has been found to play a major role in the maternal behaviors that



**Figure 3.** Conceptual model of the mediator effect.

are triggered by the newborn’s mouth and hands on the mother’s breast. These infant behaviors cause the release of oxytocin from the mother’s posterior pituitary gland and are significant for milk ejection, mother–infant bonding and attachment, and uterine contractions.<sup>32,33</sup>

#### Implications

The clinical implications for this study are numerous. The current study has provided data demonstrating that early skin-to-skin contact is clinically effective with respect to increasing exclusive breastfeeding during the maternity hospital stay. Results from our study imply that there is a need to increase the length of exposure to early skin-to-skin contact during the early postpartum period. These results provide important information that peripartum staff can include in their postpartum program planning, policies, and intervention. Maternity caregivers can specifically allocate resources to woman who may be less likely to breastfeed by encouraging skin-to-skin contact during the early postpartum period. Walters and colleagues<sup>11</sup> surveyed their hospital peripartum nursing staff after their early skin-to-skin contact (birth kangaroo care) pilot study. The peripartum personnel surveyed after the study stated that implementing early skin-to-skin contact did not take them longer nor did its implementation add to their workload.<sup>11</sup>

Numerous interfering events during the maternity hospital stay can cause problems for mothers who intend to breastfeed.<sup>34</sup> Events that interfere with breastfeeding may be decreased by allowing the mother and infant uninterrupted early skin-to-skin contact. Programs such as PSN’s pave the way to reestablish breastfeeding as the gold standard. One way to accomplish this seems to be facilitating uninterrupted, extended, early skin-to-skin mother–infant contact. We agree with the suggestion by Moore and Anderson<sup>10(p122)</sup> that “the ideal intervention would include the mother–infant dyad experiencing skin-to-skin contact not only as early as possible, but also as often as possible, and for as long as possible each time, at least during the entire postpartum stay.” Our findings, if incorporated into hospital-based practices

and protocols, can strengthen maternal–infant bonding and attachment and early exclusive breastfeeding behaviors. This is the ultimate goal, but in the interim we recommend the continuation and expansion of programs such as PSN’s early skin-to-skin mother–infant contact, nurse-driven, hospital-based intervention for a minimum of 2 hours during the first 3 hours following birth.

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