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A Quality Improvement Project to Increase Frequency of Skin-to-Skin Contact for Extreme Low-Birth-Weight Infants in the Neonatal Intensive Care Unit

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ABSTRACT

Benefits of skin-to-skin contact (SSC) are documented but often delayed in the extremely preterm population due to medical complexity and staff misconceptions about safety. This quality improvement initiative was designed to increase SSC utilization among infants born before 29 weeks' gestation regardless of respiratory support by addressing nursing barriers inhibiting SSC. A pre-/postsurvey evaluated comfort level performing and perceived barriers to SSC utilization. Implementation consisted of an updated unit-specific SSC protocol and tailored education specific to identified barriers. Evaluation included SSC rates and maternal human milk usage in the first 30 days of life. In total,

81 patients (22–28 weeks, 370–1410 g) were included. SSC rates ranged from 3.3% to 17.7% at baseline and increased to 33.2% to 39.1% postintervention. Maternal human milk utilization increased above target ($\geq 75\%$) postintervention for days 7 and 14, but declined towards baseline on days 21 and 30. A statistically significant increase was observed in nursing comfort level when performing SSC for intubated infants as well as infants with a peripherally inserted central catheter or umbilical venous catheter. SSC rates increased with infants younger than 29 weeks requiring intubation and central line management, possibly as a result of greater nursing comfort surrounding with SSC.

Key Words: extreme low-birth-weight infant, family-centered care (FCC), kangaroo care, neonatal intensive care unit (NICU), skin-to-skin contact (SSC)

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For many families, the anticipated arrival of an infant is a joyous occasion. Unfortunately, unexpected pregnancy outcomes can leave parents with the birth of a preterm infant and admission to a neonatal intensive care unit (NICU). As a result, many typical parenting behaviors are delayed. Medical staff in the NICU can enable family participation through a family-centered approach. Family-centered care (FCC) focuses on the entire family unit and aims to reduce separation and stress while increasing parent involvement in the care of their infants in the NICU.¹ The main focus of FCC is to promote the growth and development of the premature and medically complex infants while supporting family involvement. Kangaroo care, also known as skin-to-skin contact (SSC), is one method to support both the infant and their parents.

Extensive research demonstrates benefit to both mothers and neonates with the use of SSC. Maternal

benefits are directly correlated with increased frequency and duration of SSC. These benefits include decreased rates of depression and physiological stress,²⁻⁴ increased parental autonomy with infant care,⁵ and improved parent-infant bonding interactions^{1,4-7} that extend well past the initial NICU hospitalization. Neonatal benefits include increased weight gain,⁸ improved thermoregulation,⁸⁻¹⁰ increased breastfeeding success,¹¹⁻¹⁴ increased oxygenation,^{10,15,16} cardiorespiratory stability,^{4,7,15-19} and improved neurologic developmental outcomes.^{3,20,21}

SSC research among low-birth-weight (birth weight <2000 g) and very low-birth-weight infants (birth weight <1500 g) demonstrates a reduction in mortality,^{11,22} decreased length of stay,^{22,23} reduced risk of sepsis,^{11,22} hypothermia,^{8,9,11,24,25} hypoglycemia,^{11,24} and hospital readmissions,¹¹ increased exclusive breastfeeding,^{6,11,14,22,23,26} higher oxygen saturations,^{11,15,16} and decreases pain response.^{7,11} Near-infrared spectroscopy in ventilated infants with a median of 26 to 28.9 weeks' postmenstrual age showed that cerebral oxygenation as well as oxygen requirements did not differ during parent skin-to-skin care, countering the nursing misconception that this population is more vulnerable to physiologic instability during SSC.¹⁵ With prematurity accounting for an estimated 12% of live births, the resuscitation and survivability of premature infants at lower gestational ages has increased.^{27,28} Benefits surrounding SSC are therefore most important for infants born at less than 29 weeks' gestation, as they are one of the highest risk groups of neonates requiring prolonged intensive care following birth and the potential for lifelong complex co-morbidities.²⁹

SSC is now standard practice following late preterm and term deliveries in the NICU, but use of SSC is often limited to medically stable infants. Barriers limiting the consistent implementation of SSC in infants before 29 weeks' gestational age are numerous. Barriers inhibiting the routine use of SSC often stem from nursing misconceptions of infant intolerance while receiving complex care and perceived complications as a result of SSC.^{1,30-32} Yet, research found no difference between ventilated and nonventilated infants who received SSC or those receiving SSC with umbilical venous line access.^{15,16,19,30,32} Other barriers include concerns regarding the time to physically carry out SSC, nursing skill and comfort level with the provision of SSC, and variations in practice protocols with restrictions requiring provider order to implement SSC.^{1,6,15,16,19,30} Implementation of a structured educational program and SSC protocol has improved nurses' comfort, attitudes, and competency on the importance of SSC.^{1,16,24,30,31,33,34} Ultimately, the benefits of safe and effective use of SSC in infants

at less than 29 weeks' gestational age outweigh the risks.

SSC care is performed under the guidance of a unit-specific interdisciplinary approved guideline, although typically performed at the discretion of the nurse. SSC protocols typically specify that preterm infants born at less than 29 weeks, who require mechanical ventilation, need 2 health caregivers to conduct a safe transfer to parents. The need for 2 caregivers is a perceived barrier to the delivery of SSC. Ultimately, the "design and routines" of the NICU workflow usually consists of rigid, scheduled hands-on infant care times that dictate parental interaction.¹ Therefore, the purpose of this quality improvement initiative is to increase SSC rates among infants born before 29 weeks' gestational age regardless of respiratory support within the first 30 days of age with the use of an educational intervention to address perceived nursing barriers that inhibit SSC implementation.

METHODS

Design, setting, and sample

This pre-/postquality improvement project evaluated the implementation of an SSC clinical practice guideline for infants born before 29 weeks' gestation and examined the change in nurse perceptions of barriers to and comfort with implementation. The primary aim was to increase SSC rates over the first 30 days of age, with secondary aims to increase the frequency of SSC in the first 7 days of life and maternal milk utilization over the first 30 days of age. The project nursery that served as the setting is part of the larger Vanderbilt nursery structure. Monroe Carell Jr Children's Hospital at Vanderbilt comprises a 96-bed, level IV NICU of which a 20-bed unit is located in the Vanderbilt University Hospital (VUH) receiving inborn preterm NICU admissions from labor and delivery. This smaller VUH NICU site served as the primary setting for this project. The preproject SSC practice was performed at the discretion of the nursing staff under a standing nursing order placed at time of admission.

For inclusion in the project infants needed to be born at less than 29 weeks. Exclusion criteria for SSC sessions included any procedures performed that day (intubation, central line placement, chest tube placement, and lumbar puncture), the presence of a chest tube, sepsis with hemodynamic instability or increased cardiopulmonary events (eg, bradycardia and/or desaturation), congenital anomalies, other medical diagnosis limiting movement of the infant, provider discretion, and escalation in respiratory support requiring ventilator changes or nitric oxide administration. Infants who required

limited stimulation and were enrolled in other unit-specific protocols were excluded and for this reason infants younger than 26 weeks were excluded for the first 72 hours of life. During the project period this unit protocol changed to include any infant younger than 26 weeks for first 14 days of age and those infants 26 weeks to 27⁶/₇ weeks for the first 7 days of age. Hospital policy already excluded any infant with cardiovascular instability requiring inotropic administration and umbilical arterial catheters.

Planning

To be fully successful and widely adopted throughout the NICU for everyday use, the intervention must be perceived by the potential adopters (nursing staff) as having a benefit to patient outcomes. The literature has shown that nursing training sessions decrease barriers to SSC and increase utilization in the NICU.³¹ Specifically, educational sessions with simulation improved nurse perception of the value of SSC and improved comfort level in performing SSC, ultimately increasing utilization of SSC in the NICU setting.³¹ At the start of the project, the SSC nursing protocol lacked clarity on qualifications for SSC, was limited in transfer technique options, and guidance for use in conjunction with other protocols.

At our institution, prior QI projects showed increased SSC after focusing specifically on barriers with SSC and the use of bubble continuous positive airway pressure (bCPAP) administration in the preterm population. These prior efforts to increase use of SSC focused on late preterm infants or those infants no longer requiring acute respiratory support such as intubation. Previous quality improvement efforts within the VUH NICU occurred from November 8, 2017, to November 26, 2017. This project looked at parent visitation and SSC rates for infants requiring CPAP mostly in infants younger than 34 weeks. After implementation of a parental education bundle detailing the use of SSC in the NICU and a modified rounding tool to increase provider awareness, the SSC rate increased from 16% to 30%. The overall percentage of parental visitation was determined to be 54%. In a second project examining maternal human milk usage across the entire institution, assessment occurred from July 2, 2017, to March 9, 2018, on among all admitted very low-birth-weight infants with a birth weight less than 1500 g on days of life 7, 14, 21, and 28. Baseline maternal human milk usage was 75% on day of life 7, 72% on day of life 14, 71% on day 21, and down to 60% by day of life 28. Implementation efforts included early pumping initiation with time to first pump documentation, standardization of pump script to ensure pumping supplies prior to hospital discharge, antenatal education, lactation discussion with NICU consults, and

kangaroo-a-thon showed maternal human milk usage increased to 89% on day of life 7, 92% on day of life 14, 76% on day of life 21, and 77% on day of life 28.

These prior efforts addressed increasing SSC with infants receiving CPAP, parental education, and lactation support for maternal human milk usage. Given the prior efforts and data to date, continued improvement efforts were necessary to focus on the barriers associated with implementation in the nursing routine. This project was designed to implement interventions to address and overcome the barriers surrounding SSC within the highest risk patient population (those <29 completed weeks) regardless of respiratory support type through focused nursing education. All infants admitted to the NICU meeting criteria under current protocols for SSC qualified for inclusion. Review of the current SSC protocol was updated and modified to provide clarity on inclusion and exclusion criteria for SSC sessions, detailed performance description of seated patient transfer and inclusion of standing transition for removal and replacement to and from the isolette, and documentation information. Additionally, specific changes to the protocol centered around clinical practice changes requiring a 2-person transfer utilizing a respiratory therapist and either the bedside nurse or a resource nurse for all infant transitions either in or out of the isolette when an endotracheal tube in place. For infants requiring noninvasive positive pressure ventilation (bCPAP or high-flow nasal cannula), only a nurse was needed to be available for completion of the session. The electronic medical record was modified to include a place for bedside nursing to document the length of each SSC session and if any adverse events occurred.

Method of evaluation

Baseline and intervention group patient data were collected and analyzed from May 1, 2019, through February 16, 2020. Patient data were collected through chart review. Information to describe the population included gestational age at birth and birth weight. To describe SSC practice data collected included the day of life at initial SSC session, number of sessions occurring within first 30 days of age, maternal or donor bank-acquired human milk usage on days of life 7, 14, 21, and 30, respiratory support at first SSC session, and any adverse event associated with SSC defined as unplanned extubation or cardiopulmonary instability (eg, bradycardia and/or desaturation).

SSC utilization rates were calculated using protocol qualifications where the number of SSC sessions out of the number days the infant was qualified to receive SSC. Breakdown of SSC rates by month was calculated by taking the number of SSC sessions occurring by month within the first 30 days of age for

qualified infants compared with the total number of eligible days based on exclusion criteria with graphically represented in a run chart. Additionally, baseline SSC rates of infants qualified for SSC on day of life 7 were tracked with comparison to postinterventional data. Maternal human milk utilization was defined as any maternal human milk regardless of volume given on days of life 7, 14, 21, and 30. Nonparametric correlations for pre-/postintervention maternal human milk use and SSC occurrence were performed using Spearman's ρ on day of life 7, 14, 21, and 30.

A nursing provider survey was designed to evaluate baseline knowledge, comfort level with performing SSC broken down by respiratory support and central line access, and perceived barriers to SSC utilization. Review of the presurvey results allowed for the educational sessions to be developed to fill identified knowledge gaps and perceived barriers to SSC. Following the educational intervention, a nursing postintervention survey with branching logic was used for direct assessment of those receiving the educational session with an independent-samples *t*-test calculation comparison to preinterventional survey results. For both the pre- and postsurveys, more than one barrier was allowed to be selected if determined by the user to be a significant barrier to SSC utilization. Comparison of pre- and posttest perceived barriers was analyzed using Fisher's exact test. The pre- and posttest data were collected and managed using REDCap electronic data capture tools hosted at Vanderbilt University Medical Center.^{12,35} All data analysis statistical calculations were performed using IBM SPSS version 26.

Implementation

Baseline data collection started in May 2019 and occurred over a 4-month period prior to distribution of the nursing presurvey and educational sessions. After protocol revision and documentation creation, the project was presented to the nursing staff with detailed information on the educational sessions posted in the NICU. At that time, a baseline preintervention survey was conducted to identify staff perception and need for SSC, comfort level, and any potential barriers seen toward completion of SSC.

The main intervention focused on an educational series that was provided directly to the nursing staff assigned to this population in the VUH NICU and was tailored to overcome identified barriers in the initial provider survey. Each education session provided attendees with the purpose of the quality improvement project, clinical practice update of the revised SSC protocol, review of literature for identified barriers to implementation, benefits and risks, qualifications for SSC, and documentation. The instructional portion of

the educational session was followed by simulation allowing for hands-on practice with transfer techniques for infants requiring intubation and CPAP respiratory equipment as well as IV access (both umbilical venous catheter [UVC] and peripherally inserted central catheter [PICC] lines). As a part of the educational session, the purpose of the simulation was to help promote comfort with isolette to parent transition, which allows understanding from both the standpoint of the receiving parent and nurse provider. The educational sessions were offered over a 1-month period on 6 individual days and divided into 8 total sessions to equally distribute opportunity for both day and night shift staff attendance (see Supplemental Digital Content Table 1, available at: <http://links.lww.com/JPNN/A17>).

Two months after completion of the education sessions, the nursing postsurvey was distributed to all nursing staff to reassess understanding of importance and comfort level in performing SSC for those who received the educational intervention. Comparison assessment was performed on pre- and postsurvey responses. Additionally, all staff completing the survey were allowed to answer perceived barriers toward SSC implementation. Postinterventional infant data collection continued until February 16, 2020, to follow stability of the intervention.

RESULTS

Infant characteristics

In total, 81 patients were identified and qualified for inclusion during the period from May 2019 through February 2020. Infants had a mean birth gestational age of 25⁶/₇ weeks with a mean birth weight of 837 g of which the majority were female (58%) (see Table 1). Of the 81 infants, 73 had completed charts through the first 30 days of age, 8 charts were incomplete and therefore were excluded without data.

SSC rates

Baseline SSC rates within the first 30 days of age for qualified infants less than 29 weeks' gestation ranged from 3.3% to 17.7%, below the target of 25% or more. Of the 73 infants with complete data, the first SSC session occurred at a mean age of 10.7 days, with a mean of 5.7 SSC sessions within the first 30 days of life (see Table 1). Fourteen (19.1%) eligible infants did not receive any SSC within the first 30 days of age. Of the 59 infants who received SSC, the respiratory support required at the time of the first SSC session was most often bCPAP (72.9%). Of the remaining, 15% of the infants were intubated on conventional mechanical ventilation, 8.5% were receiving noninvasive positive pressure ventilation (NIPPV or

Table 1. Infant characteristics

Variable	Infants (N = 81)
Gestational age, mean (range)	
Weeks	25.84 (22-28)
Days	3.17 (0-6)
Birth weight, mean (range), g	837.07 (370-1410)
Gender	
Male	42% (34)
Female	58% (47)
Respiratory support ^a	
Bubble CPAP	72.9% (43)
Draeger CPAP/NIPPV	8.5% (5)
ETT/CMV	15.3% (9)
ETT/HFJV	3.4% (2)
None	14
Excluded due to incomplete chart	8
SSC session ^a	
First SSC session, mean (range), % (n)	10.7 d (1-30 d), 80.8% (59)
Number of SSC sessions within 30 d, mean (range)	5.7 sessions (1-28 times)
No SSC within 30 d	19.2% (14)
Excluded due to incomplete chart	8

Abbreviations: CMV, conventional mechanical ventilation; CPAP, continuous positive airway pressure; ETT, endotracheal tube; HFJV, high-frequency jet ventilation; NIPPV, noninvasive positive pressure ventilation; SSC, skin-to-skin contact.

^aOut of 81 qualified infants, 73 had completed charts for the entire 30 days of age, the information for respiratory support and SSC sessions represents only the completed information.

Draeger CPAP with a set back-up rate), and 3.4% were intubated on high-frequency ventilation (see Table 1).

Overall, the baseline SSC rates by month across the project ranged from 3.3% to 17.7% (mean 12.4%) and showed an increase to 33.2% to 39.1% (mean 35.9%) post-intervention (see Figure 1). Baseline or preinterventional SSC rates for SSC eligible infants occurring

within first 7 days of age were 52% and showed an increase to 62.5% in postinterventional SSC rates (see Table 2). Documentation review of all SSC sessions that occurred during the project period for qualified infants found no unplanned extubation events related to SSC or cardiopulmonary events (eg, bradycardia and/or desaturation) prompting cessation of any SSC session.

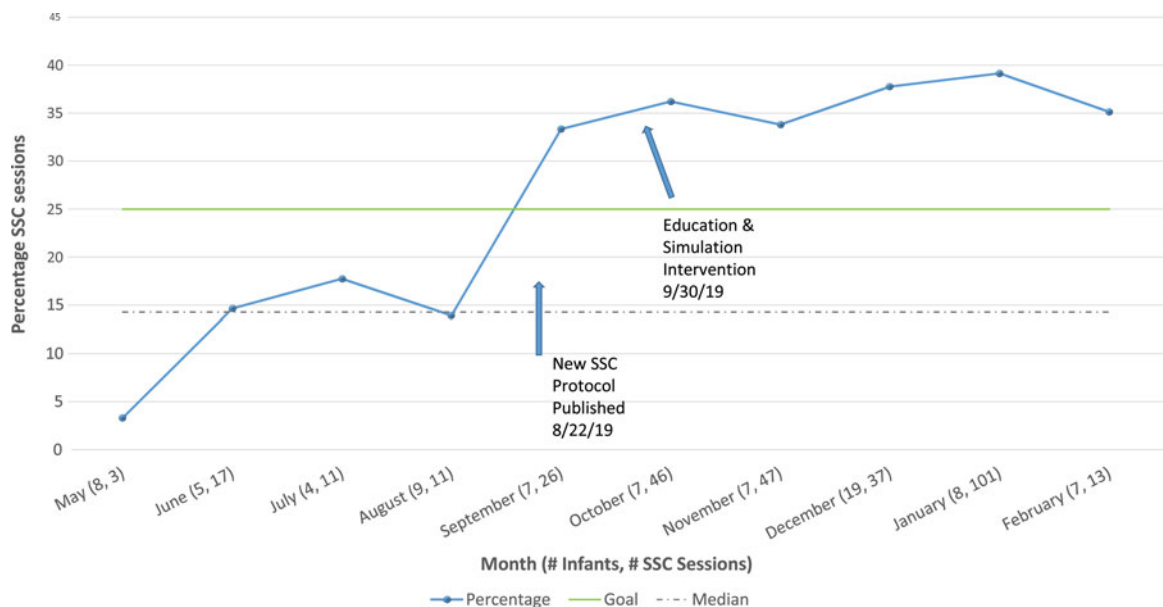


Figure 1. Skin-to-skin contact within the first 30 days of life. This figure is available in color online (www.jpnnjournal.com).

Table 2. Skin-to-skin care occurring within the first 7 days of life (*N* = 81)

	Baseline (May to September 2019), <i>n</i> = 33	Postintervention (October 2019 to February 2020), <i>n</i> = 48
Occurring within 7 d of birth	52% (13)	62.5% (15)
Ineligible for SSC (excluded)	8	24
Eligible for SSC and not occurring within 7 d	48% (12)	37.5% (9)

Abbreviation: SSC, skin-to-skin contact.

Human milk consumption

Maternal provision of human milk at time of admission for each qualified infant less than 29 weeks' gestation was 95% (*n* = 78). Collectively, over the entire project for the first 30 days of age, the use of any mothers' own milk was on average 78% on days of life 7 and 14, but dropped to about 70% on days 21 and 30 (see Figure 2). To determine whether mothers' own milk usage increased with the increasing SSC rates, breakdown of maternal milk usage comparison pre- and post-intervention revealed baseline mothers' own milk usage on days 7, 14, 21, and 30 was 71%, 67%, 70%, and 68%, respectively (see Figure 3). Baseline analysis showed mothers' own milk consumption below target goal use of 75% or more. Mothers' own milk was higher post-intervention and above target goal on days 7 at 80% and 14 at 84%, but was more similar to baseline on days 21 at 71% and 30 at 72% (see Figure 3). In an attempt to determine potential correlation between the increased occurrence of SSC with mothers' own human milk utilization, Spearman's ρ nonparametric correlation calculations were performed between SSC and use of mothers' own milk on days 7, 14, 21, and 30. However, there were no significant associations between early performance of SSC and use of mothers' own milk.

Nurse perceptions

The provider preintervention survey data included 70 respondents—most were registered nurses (94.3%) with an average of 13.54 years' experience. The breakdown by shift worked was evenly distributed between day and night shift (see Table 3). The majority of nursing discomfort in performing SSC identified from the presurvey centered on those infants requiring intubation and central line support. The educational sessions scaled to address perceived barriers from the preintervention survey had a total attendance of 58 individuals. Of which, registered nurses comprised 86.2% of attendees with advance practice provider making up 6.9%, nonregistered nurse or care partner 3.4%, and respiratory therapists and physicians each at 1.7% (see Table 3). The breakdown of shift attendance showed 72.4% day shift compared with 27.6% night shift. The provider postintervention survey resulted with 68 respondents, out of which 100% were registered nurses with an average of 3.59 years' experience. Out of the 68 postintervention survey respondents, only 22.1% participated in the educational sessions. Similarly to the shift breakdown for educational session attendance, the postintervention survey shift breakdown showed 72.1% of respondents identified with days shift and 27.9% night shift (see Table 3).

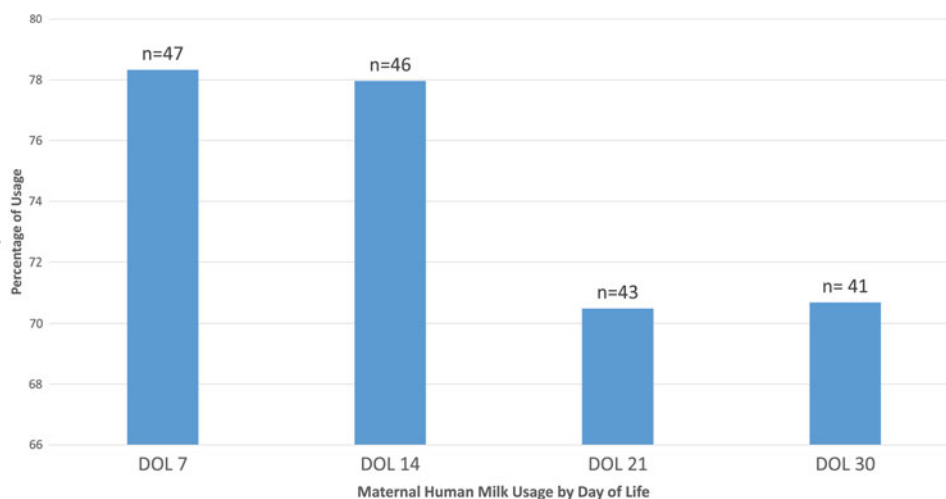


Figure 2. Maternal human milk usage across the first 30 days of life for infants younger than 29 weeks at birth. This figure is available in color online (www.jpnnjournal.com).

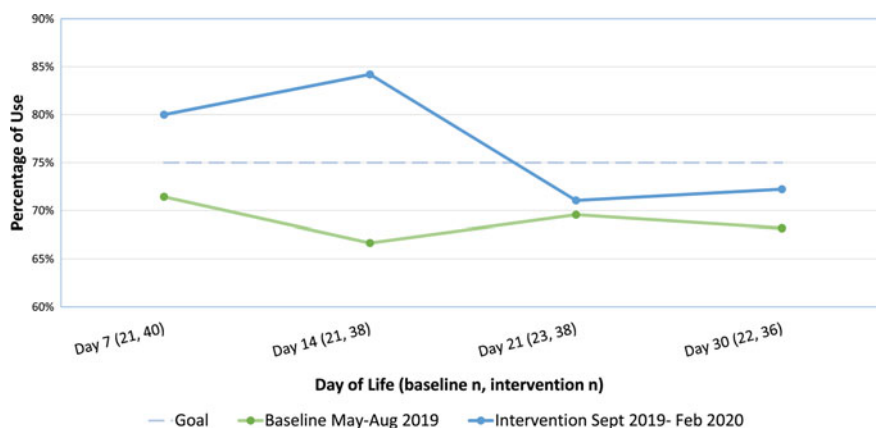


Figure 3. Percentage of any maternal human milk usage by day of life (baseline vs intervention group). This figure is available in color online (www.jpnnjournal.com).

Preinterventional nurse perceptions on the importance of SSC using a Likert scale of 0 to 10, with 0 as no importance and 10 as most importance, showed the role of SSC in the NICU daily routine was rated less than the role it plays in parental involvement, maternal human milk utilization, and respiratory stability (see Table 4). The majority of those surveyed identified initiation of SSC resulting from either nursing (55.7%) or parent (41.4%) driven. Additionally, assessment on nurse frequency to encouraging SSC on a Likert scale of 1 of 5, with 1 as rarely to 5 representing all of the time, showed a mean of 3.54, indicating most surveyed felt their encouragement to SSC occurred more than half of the time. Interestingly, 60% of respondents were not interested in participating in a multidisciplinary team with the goal of promoting SSC in the NICU.

Using the same Likert scale of 0 to 10, postinterventional survey respondents who received the educational intervention assessment of understanding for the role SSC plays in parental involvement, maternal human milk utilization, qualifications, and exclusions for SSC were rated highly at 8.4 to 8.87 (see Table 5). Assessment on nurse frequency to encouraging SSC using the same

Likert scale of 1 to 5, with 1 as rarely to 5 representing all of the time, showed a statistically significant increase toward encouraging parent intervention using SSC per shift ($P = .04$) for those who received the intervention. Initiation of SSC session remained unchanged between the 2 groups, showing majority remained nurse driven (60%) compared who parent driven (40%).

Perceived barriers to SSC were identified by all nursing survey participants independent of receiving the educational intervention, with the percentage reporting the barrier present in both the pre- and postimplementation surveys (see Table 6). In the preimplementation survey, the highest perceived barriers to SSC were lack of parental presence (68.6%), patient/nurse staffing assignment (65.7%), intubated patient (48.6%), nurse comfort level (40%), and lack of appropriate SSC equipment (35.7%). Postinterventional survey showed improvement in the perceived barriers to SSC related to an intubated patient from 48.6% down to 36.8% and nurse comfort level from 40% down to 30.9%. However, perceived barriers related to respiratory therapy available for assistance with transfers increased from 30% to 39.7%. The perceived barriers of patient/nurse staffing

Table 3. Survey and educational session participant demographics

Variable	Preintervention (<i>n</i> = 70)	Postintervention (<i>n</i> = 68)	Educational session (<i>n</i> = 58)
Position			
RN	94.3% (66)	100% (68)	86.2% (50)
Care partner (non-RN)	5.7% (4)	0% (0)	3.4% (2)
Respiratory therapist	0% (0)	0% (0)	1.7% (1)
Advance practice provider	0% (0)	0% (0)	6.9% (4)
Physician	0% (0)	0% (0)	1.7% (1)
Shift			
Day	51.4% (36)	72.1% (49)	72.4% (42)
Night	48.6% (34)	27.9% (19)	27.6% (16)
Experience, mean (SD), y	13.54 (13.13)	3.59 (1.42)	

Abbreviation: RN, registered nurse.

Table 4. Preeducation participant perceptions of the importance of SSC

Question	Preintervention Mean (SD)
Importance of SSC plays in daily care of nurse of NICU patient	7.60 (2.008)
Importance of SSC in parental involvement bonding	9.62 (0.692)
Importance of SSC in maternal human milk utilization	9.59 (0.670)
Importance of SSC in respiratory stabilization	8.43 (1.605)
Importance of SSC in sepsis reduction	7.79 (3.180)

Abbreviations: NICU, neonatal intensive care unit; SSC, Skin-to-Skin Contact.

assignment remained virtually unchanged. Additionally, the lack of parental presence as a perceived barrier increased slightly from 68.6% to 70.6%. Using Fisher's exact *P*-value calculation, there was not a statistically significant change in any perceived barrier category between the pre- and postinterventional survey results (see Table 6).

Preinterventional comfort assessment using a Likert scale of 0 to 10, with 1 being not comfortable and 10 as very comfortable, showed the comfort level rating for performing SSC was highest among nonventi-

lated infants whereas among intubated infants was the lowest for infants receiving high-frequency ventilation compared with those receiving conventional ventilator support (see Table 7). Likewise, the comfort level rating for performing SSC among infants with a central line showed less comfort in those with a UVC compared with the highly comfortable rating for infants with a PICC in both the nonventilated and intubated infant groups. Among intubated infants, there was decreased comfort specifically for an intubated infant with a UVC compared with intubated infants with a PICC. Among the postsurvey respondents who received the intervention, comfort level assessment using the same Likert scale revealed essentially unchanged comfort level rating for performance of SSC among nonventilated infants and those with a PICC line but all remaining categories saw an increase in reported comfort in performing SSC. Similarly, the comfort level rating for performing SSC among infants with a central line showed less comfort in those with a UVC compared with the highly comfortable rating for infants with a PICC in both the nonventilated and intubated infant groups. Among intubated infants, the comfort levels reported were lower for an intubated infant with a UVC compared with intubated infants with a PICC. Infants receiving high-frequency ventilation compared with those receiving conventional ventilator support remained the lowest (see Table 7).

Statistical comparison of pre- and postcomfort level in performing SSC using independent-samples *t*-test *P* value ($P \leq .05$) revealed significant results for a non-ventilated infant with a UVC ($P = .005$), an intubated infant on conventional ventilator support ($P < .001$), an intubated infant with a PICC line ($P < .001$), and an intubated infant with a UVC ($P = .004$) (see Table 7). After receiving the SSC education, 80% of nurses reported feeling more comfortable utilizing SSC with an intubated infant and 33% reported they were more likely to encourage parental interaction through SSC.

DISCUSSION

Overall, the primary aim of increasing SSC utilization in infants less than 29 weeks' gestation at birth was met with an increase in the overall frequency occurring within the first 30 days of age and an increase in initiation of SSC within the first 7 days of age. A consistent and stable SSC rate above 30% following implementation of the educational sessions shows the potential for continued sustainability in SSC occurrence. The safety and feasibility of SSC in infants born at less than 29 weeks' gestation independent of respiratory support was confirmed, and there were no adverse event reports

Table 5. Participant perceptions of the helpfulness of the education session to their understanding of SSC

Question	Postintervention Mean (SD)
Did you find the education session and simulation helpful in better understanding: Role SSC plays in NICU	8.53 (1.506)
Did you find the education session and simulation helpful in better understanding: Parental involvement and bonding	8.87 (1.552)
Did you find the education session and simulation helpful in better understanding: Maternal human milk utilization	8.80 (1.568)
Did you find the education session and simulation helpful in better understanding: Who qualifies for SSC	8.60 (1.682)
Did you find the education session and simulation helpful in better understanding: Who is excluded from SSC	8.40 (1.844)

Abbreviations: NICU, neonatal intensive care unit; SSC, skin-to-skin contact.

Table 6. Participant perceived barriers to SSC implementation

	Preintervention (<i>n</i> = 70)	Postintervention (<i>n</i> = 68)	
Barriers to frequent SSC or kangaroo care	Reporting the barrier is “present”		Fisher’s exact <i>P</i> value
RTs unavailable to help with transfer	30% (21)	39.7% (27)	.284
Too time consuming to perform	27.1% (19)	22.1% (15)	.556
Patient/nurse staffing assignment	65.7% (46)	63.2% (43)	.859
Intubated	48.6% (34)	36.8% (25)	.172
Central line access	24.3% (17)	36.8% (25)	.139
Lack of parental visitation	68.6% (48)	70.6% (48)	.854
Nurse comfort level	40% (28)	30.9% (21)	.290
Provider request	2.9% (2)	1.5% (1)	.999
Lack of appropriate equipment such as recliners	35.7% (25)	50% (34)	.121
Lack of privacy to perform kangaroo care	8.6% (6)	16.2% (11)	.203
Other	5.7% (4)	5.9% (4)	.999

Abbreviations: RT, respiratory therapist; SSC, skin-to-skin contact.

such as unplanned extubations or central line dislodgement occurring during SSC or surrounding transfers.

During the project, an intraventricular hemorrhage (IVH) prevention protocol was modified from the first 72 hours of age to reflect a longer totaling 14 days of minimal stimulation for infants born at less than 26 weeks' gestational age and extended to include infants from 26 to 28⁶/₇ weeks' gestational age for the first 7 days. The change in the IVH reduction policy likely impacts both the rate of SSC in the first 7 days of life and mothers' own milk usage. If parents are not able to interact in developmentally appropriate ways with their child, such as through SSC, the potential lack of bonding could increase rates of postpartum depression and parental withdrawal, resulting in reduction of maternal own human milk supply and availability.

Institutional management for enteral feeding in this population was through either maternal or donor human milk, with the amount of donor milk needed requested early in the day based on the amount of available maternal human milk at that time. Priority usage placed on already requested donor human milk for any given day. Therefore, it was difficult to assess whether maternal human milk was available but not being used because donor human milk had already been requested for the day. Interestingly, the interventional group usage of maternal own human milk utilization increased to above target goal ($\geq 75\%$). However, overall mothers' own milk usage drastically decreased from day 14 to day 21 in both the baseline and interventional groups. Further work is needed to understand the nature of the consistent drop in mothers' own milk utilization and

Table 7. Participants' comfort with the use of SSC pre- and posteducation session

Question	Preintervention Mean (SD)	Postintervention Mean (SD)	<i>t</i> test <i>P</i> value
Comfort level in performing SSC in nonventilated patients?	9.75 (0.708)	9.80 (0.414)	.809
Comfort level in performing SSC in infant intubated on conventional ventilator?	6.25 (2.762)	8.27 (1.486)	<.001
Comfort level in performing SSC in infant intubated on high-frequency ventilation?	3.26 (2.677)	4.67 (2.225)	.062
Comfort level in performing SSC in infant with a PICC line?	9.23 (1.656)	9.67 (0.617)	.321
Comfort level in performing SSC in infant with a UVC?	5.94 (2.906)	7.67 (1.839)	.006
Comfort level in performing SSC in nonventilated infant with a PICC line?	9.28 (1.402)	9.27 (1.580)	.975
Comfort level in performing SSC in nonventilated infant with a UVC?	6.01 (2.929)	7.80 (1.821)	.005
Comfort level in performing SSC in intubated infant with a PICC line?	5.91 (3.080)	8.47 (1.642)	<.001
Comfort level in performing SSC in intubated infant with a UVC?	4.43 (2.996)	6.87 (2.588)	.004

Abbreviations: PICC, peripherally inserted central catheter; SSC, skin-to-skin contact; UVC, umbilical venous line.

lack of sustainability occurring at 2 weeks of age. Efforts focused on continued lactation support throughout the NICU stay would likely influence mothers' on milk utilization rates through the first 30 days of age and potentially increase maternal breastfeeding or maternal own human milk rates at discharge.³⁶

The nursing pre- and postsurveys show an improvement in nursing comfort with performing SSC and specifically comfort level surrounding SSC with intubated infants for those respondents attending a focused educational session. The educational intervention was not only associated with greater comfort with the provision of SSC, but also may have directly impacted behavioral changes resulting in the increased performance of SSC. Yet when all respondents (those who attended and did not attend an educational session) were included in a pre-/postintervention analysis, there was no increase in discomfort with the use of SSC, further suggesting that the education may have impacted the level of comfort. Unfortunately, heavy patient assignments and higher acuity of patients may have also impacted feasibility to SSC performance. Variations in nursing documentation despite the addition of an SSC documentation section may still not capture all aspects of SSC performance. In addition, lack of clear data surrounding the exact number of days parents were present in the NICU limits knowledge of the number of opportunities available for SSC. Concern around parental presence for SSC was one of the highest perceived barriers to provision of SSC in both the pre- and postnursing surveys. Changes in the nursing perception of parent involvement need to continue. The cultural view of parents as visitors should shift to include the parent as part of the treatment team with an overall focus on FCC. Additionally, focused intervention on addressing the underlying causes related to lack of parental presence should be further evaluated.

In addition to lack of parental presence, appropriate equipment for SSC implementation was another barrier. Discussion with NICU administrators related to availability of appropriate equipment such as privacy screens and reclining chairs specific for SSC is underway, with plans for purchase in the near future. In addition, respiratory therapy staffing models should consider the need to support SSC as one of their key responsibilities and make provisions for availability for SSC transfer.

CONCLUSION

While length of study time and convenience sample are limitations, our project demonstrates direct improvement in SSC rates and highlights benefits rather than risks associated with consistent use of SSC. Given our findings, we recommend expanding the intervention

through the Vanderbilt University Medical Center NICU. The safety and feasibility shown through this project supports the use of early SSC initiation in infants less than 29 weeks' gestation. The educational sessions have been shown to be beneficial in the reduction of perceived barriers related to respiratory support and comfort and it is recommended that the education be provided to all NICU staff. There is a need for more studies related to the use of SSC in the extreme preterm population and its effect on maternal human milk utilization.

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