Skin Care Guidelines for the Neonate Aged 23-30 Weeks

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Abstract

Skin, the largest organ of the human body, has many important functions; among them are thermoregulation, acting as a barrier against toxins, and secreting water and electrolytes. Traditionally, skin care in the neonatal intensive care unit has been handed down from more experienced nurses to new nurses. Today's neonatal nurses realize the importance of utilizing evidence based guidelines to guide their care, which includes the area of skin care. The purpose of this education project is to provide scientific based education to the neonatal nurses working at a university based hospital. The specific education being proposed is on skin care for the premature infant age 23-30 weeks gestation. A premature infant's skin is underdeveloped and thinner than full term infants, placing them at risk for sepsis, dehydration, and hypotherma, among other physically detrimental side effects. In fact, infants are discharged from the neonatal intensive care unit with significant scars. The proposed education is an eight hour classroom based course that will be offered to newly graduated and experienced nurses alike. Topics included are: a discussion on skin functions, how skin develops, the effect of nutrition on skin, skin assessment, skincare guidelines for infants 23-30 weeks, evaluating and documenting skin conditions, and case study and discussion. Offering this course will provide a set of guidelines for neonatal nurses to follow in providing skincare to premature infants, therefore decreasing the incidence of iatrogenic injuries.

Keywords: neonatal, skincare, premature, intensive, care

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Chapter One: Introduction

During the newborn's adaptation from intrauterine to extrauterine life it is important that the skin remain intact (Lund, Kuller, Lane, Wright Lane, & Raines, 2001). However, maintaining this intact barrier is almost impossible when the infant requires intensive care, and is particularly challenging when the newborn is a premature infant 23-30 weeks gestation. Premature infants, particularly infants at 23-30 weeks gestation, are at high risk for many physiologic alterations due to their underdevelopment which is associated with prematurity. The skin is just one organ affected by prematurity. Skin serves many vital functions in people such as thermoregulation, a barrier against toxins, the sensation of touch, insulation and fat storage, and water and electrolyte secretion (Allwood, 2011). Due to their prematurity, the skin of the premature infant is thinner than the skin of a full-term infant. Since the premature infant's skin is not as effective in performing the vital functions mentioned (Afsar, 2009), the premature infant is at risk of hypothermia, sepsis, dehydration, electrolyte imbalance, and skin breakdown. Additionally, the premature infant is at greater risk of acquiring cosmetically or functionally significant scars due to invasive procedures necessary for resuscitation; in fact, about 4% of infants discharged from the neonatal intensive care unit (NICU) have either one of these (Sardesai, Kornacka, Walas, & Ramanathan, 2011). The protection of this fragile barrier is why it is imperative that NICU nurses have evidence based guidelines on which to base skin care. (Allwood, 2011).

Significance of Problem

Nurses working in the NICU are caring for some of the most fragile infants. Skin care in the NICU has been based on tradition (Allwood, 2011). Today's nurses, especially NICU nurses, are realizing the importance of having evidence based guidelines to direct them in their practice (Allwood, 2011). In the past, because there were no evidence based guidelines for NICU nurses, infants suffered from more iatrogenic injuries and skin breakdown. By providing NICU nurses with evidence based guidelines, premature infants will have less iatrogenic injuries and less skin breakdown in particular.

Statement of Problem

Allwood (2011, p. 22) states that "the epidermis, stratum corneum specifically, is the most important permeability barrier of the skin". In premature infants, especially infants 23-30 weeks gestation, the permeability barrier is underdeveloped, compromising the barrier function of the epidermis and stratum corneum (Allwood, 2011). At 23 weeks gestation, the premature infant has almost no stratum corneum; an infant born at 30 weeks gestation may have only a few layers of stratum corneum (Allwood, 2011). Due to the stratum corneum being underdeveloped, or non-existent, premature infants are at increased risk of dehydration, electrolyte loss and sepsis.

In addition, the dermal-epidermal junction is weaker because the anchoring fibrils are thinner and fewer in number (Fox, 2011). The weakened bond between the dermis and epidermis puts the premature infant at risk of injury from adhesive removal (Fox, 2011). Adhesives are often utilized in the NICU to secure life saving equipment, such as endotracheal tubes (Allwood, 2011). When this equipment is no longer needed, the adhesive is removed and along with the adhesive being removed, a layer of epidermis may also be removed; due to the bond between the

epidermis and the adhesive being stronger than the bond between the epidermis and dermis (Fox, 2011). As a result of the epidermal layer being injured, the premature infant's transepidermal water loss (TEWL) increases at the site of injury and the risk of systemic sepsis increases due to bacteria being able to penetrate the epidermal layer at the site of injury (Allwood, 2011).

Because the premature infant's skin is immature, making it more fragile, it is important that skin care in the NICU be evidence based (Allwood, 2011). Allwood (2011, p. 27) states that "adhesives, emollients, semi-permeable membranes, humidity and bathing are all environmental factors that can potentially cause harm to the premature infant's delicate skin". Therefore, it is imperative that NICU's have skin care guidelines in place for premature infants 23-30 weeks gestation to minimize the negative effects that the environmental factors can cause (Allwood, 2011).

Purpose Statement

The purpose of this education project is to provide evidence based education to the nursing staff of a NICU at a university based hospital for premature infants, age 23-30 weeks. Utilizing evidence based clinical guidelines this education project will educate the NICU nursing staff on: (a) bathing, (b) use of emollients and adhesives, (c) disinfecting the skin prior to procedures, and (d) the use of a skin assessment tool.

Chapter Two: Literature Review

The first step to achieving these aims was to perform a comprehensive review of current literature. A wide-ranging literature search covering the years between 1999 and 2011 was performed using the following reputable computerized databases; MEDLINE, CINAHL, and the National Guideline Clearinghouse. The keywords neonatal and skincare were entered into the search engine in various orders and combinations. Cited references from key studies of interest were found by hand searching for the title as appropriate.

Support from the literature for this project will be presented in the following areas: (a) skin, (b) nutrition, (c) iatrogenic injuries, (d) skin care guidelines, (e) clinical practice guidelines, (f) bathing, and (g) the use of skin assessment tools.

Skin

Skin, the largest organ in the body, is composed of the epidermis, dermis, and the subcutaneous layer. Among the functions of skin are thermoregulation, toxin and infection barrier, tactile sensation, insulation and fat storage, and water and electrolyte excretion. The outermost layer of the skin, the epidermis, is composed of keratinocytes, the basal cell layer, and the stratum corneum (Allwood, 2011). The basal layer, made up of keratinocytes, is located near the dermis-epidermis junction and is constantly replenishing the stratum corneum (Allwood, 2001). The stratum corneum, Allwood (2011, p. 22), reports, is "constructed like the bricks and mortar of a wall", with keratinocytes as the bricks and lipids in between the keratinocytes as mortar. The epidermis is connected to the dermis by proteins called fibrils (Allwood, 2011).

The dermis is composed of nerves and blood vessels that nourish the skin (Allwood, 2011). The function of the dermis is to act with great mechanical strength, elasticity, resilience,

and compressibility (Allwood, 2011). Finally, the subcutaneous layer is composed of fatty connective tissue, providing insulation and calorie storage (Allwood, 2011).

The full-term infant, like adults, has ten to twenty layers of stratum corneum which provides control over evaporative heat loss and transepidermal water loss (TEWL) (Hughes, 2011). Full-term infants are covered in a cheesy substance called vernix caseosa. The vernix begins to form before twenty weeks of gestation and starts to thin after thirty-six weeks of gestation (Allwood 2011). While in utero the vernix protects the fetus from amniotic fluid maceration (Allwood, 2011). In addition, the vernix prevents fluid and electrolyte loss from the fetus to the amniotic fluid, and after birth the vernix has been shown to have anti-infective properties (Allwood, 2011).

The epidermis and the stratum corneum are underdeveloped in premature infants; at twenty-three weeks gestation the premature infant has virtually no stratum corneum, at thirty weeks there may be only a few layers present (Allwood, 2011). Thus, the protective function of the stratum corneum, including protection from toxins and infectious agents, is deficient in premature infants (Allwood, 2011). However, the barrier function of the stratum corneum does mature at an accelerated rate during the first two weeks of the premature infants' life (Allwood, 2011).

Fibrils, which connect the epidermis and dermis, are widely spaced and fewer in number in premature infants but become stronger with advancing gestational and postnatal age (Allwood, 2011). This diminished cohesion is what puts premature infants at increased risk of injury from adhesive removal and for potential blistering from friction and thermal injury (Allwood, 2011).

Nutrition

Fat and zinc are both necessary for maintaining intact and healthy skin, and are important for growth and development. Fat and zinc stores develop in the fetus during the final trimester of pregnancy (Allwood, 2011). This is important because infants born prematurely, most notably 23-30 weeks gestation, have not been able to develop fat and zinc stores. Therefore, premature infants are deficient in both essential fatty acid (EFA) and zinc at birth. These EFA and zinc deficiencies put premature infants at risk for complications with their skin as well as with their growth and development.

The most severe cases of essential fatty acid (EFA) deficiency presents itself with superficial scaling of the skin and with desquamation and irritation in the neck, groin, or perianal areas (Allwood, 2011). In addition to being essential for maintaining healthy skin, EFAs are also needed to promote platelet function. Allwood (2011) reports that EFA deficiency can be prevented or reversed by adding lipids to the infant's total parental nutrition (TPN).

Zinc, in addition to being an essential trace mineral, is also a co-factor for a number of metabolic processes and is required for normal wound healing (Allwood, 2011). Lund et al (2001) reports that zinc deficiency occurs when zinc stores are low or absent, such as in the premature infant, or if zinc is being lost at an unusually fast rate via urine or stool, or during times of rapid growth, stress, and extensive tissue healing. Zinc deficiency is manifested by excoriated, scaly skin in the groin or perianal area, neck folds, circumoral area and areas of trauma (Allwood, 2011). Additional manifestations of zinc deficiency include lethargy, poor growth, alopecia, and diarrhea (Allwood, 2011). A deficiency in zinc is treated with and prevented by adding zinc supplementation to the infant's TPN (Allwood, 2011).

Iatrogenic Injuries

Infants admitted to the NICU require invasive procedures necessary for resuscitation; however, the margin of safety between effective treatment and iatrogenic injury is narrow (Sardesai et al., 2011). Due to these necessary life-saving procedures, Sardesai et al. (2011) found that about 4% of infants leave the NICU with either cosmetically or functionally significant scars. Research states that risk factors associated with iatrogenic injuries include: gestational age, low birth weight, use of central venous lines, mechanical ventilation, repeated blood sampling and parenteral nutrition (Hyndman, 2009; Sardesai et al., 2011). According to Sardesai et al. (2011), the incidence of severe skin injuries is decreasing but has not been completely eliminated. Their recent research reports the rates of iatrogenic injuries at 57% for infants born between twenty-four and twenty-seven weeks gestational age, compared to 3% in full-term newborns (Sardesai et al., 2011). There are many different injuries that can occur that are due to a number of different reasons.

The scalp and face are common sites for injuries at birth. On average, according to Sardesai et al. (2011), scalp and face injuries occur in 16% of vacuum assisted deliveries and 17% of forceps deliveries. Scalp and facial injuries usually seen at birth include lacerations, ecchymoses, and erosions (Sardesai et al., 2011).

Burn injuries have been reported following the use of transcutaneous oxygen monitoring (TCOM), pulse oximeters, infrared heat lamps, various electrodes, disinfecting chemical agents and warming bottles (Sardesai et al., 2011). Burns in neonates can result in hypothermia, excessive water loss, sepsis, renal failure, skin scarring and depigmentation (Sardesai et al., 2011).

While adhesives are used in the NICU to secure life-support devices, a single removal of an adhesive is capable of removing 70-90% of the epidermis. Repeated adhesive removal plus the use of bonding agents can result in deeper epidermal injuries (Sardesai et al., 2011).

Extravasation injuries are most often caused by calcium, lipids, and hyperalimentation infusions, resulting in partial or complete skin loss (Sardesai et al., 2011). In addition, svasopressors, such as dopamine and epinephrine, can cause intense local vasoconstriction and tissue ischemia (Sardesai et al., 2011). A United Kingdom survey of regional NICU's found the prevalence of extravasation injuries resulting in tissue necrosis to be 38%, with 70% of injuries occurring in infants 26 weeks gestational age or less (Sardesai et al., 2011).

One of the most common procedures done in the NICU is blood sampling via heel sticks. Complications that may result from repeated heel sticks include the implantation of epidermoid cysts and osteomyelitis which can cripple hind foot growth (Sardesai et al, 2011).

Nasal continuous positive airway pressure (NCPAP) causes nasal injuries in neonates at a rate between 20 and 60% (Hyndman, 2009; Sardesai et al., 2011). Among the factors contributing to nasal injury to neonates are incorrect application of the NCPAP device, inadequate monitoring of skin and surrounding tissue, using the wrong size of prongs or mask and inappropriate size and /or application of the head securing device (Hyndman, 2009; Sardesai et al., 2011). According to Sardesai et al. (2011) and Hyndman (2009), nasal injuries that occur in neonates can cause irreparable damage to nasal structures, and include skin excoriation, pressure necrosis of nasal tissue, or pain.

Skin Care Guidelines

Until recently, nurses have relied primarily on trial and error, traditions, and myths to guide them in appropriate skin care practices for the premature neonate. However, neonatal skin care should be based on recent and relevant scientific research. By utilizing evidence-based practice it is hoped that nurses will see better outcomes in the skin condition of infants, particularly those aged 23 to 30 weeks gestation (Allwood, 2011).

A major concern of premature infants is increased transepidermal water loss (TEWL). Premature infants less than 30 weeks gestation can lose 15 times as much water as compared to term infants (Allwood, 2011). Among the strategies recommended by Lund et al. (2001) to reduce TEWL in premature infants aged 30 weeks gestation or less, is to include the use of double-walled incubators, ambient humidity, transparent adhesive dressings, and emollients. Allwood (2011) reports that by placing premature infants in a double-walled incubator with increased ambient humidity, the infants exhibited lower fluid requirements, increased urine output, and better electrolyte balance. Transepidermal water loss can be reduced by as much as 50% by using a transparent dressing to create a semi-permeable membrane or a second skin (Allwood, 2011). She continues to report that applying a transparent adhesive dressing to the chest, abdomen, and extremities of extremely low birth weight infants has been proven to reduce fluid and electrolyte disturbances and increase survival.

The normal barrier function of the stratum corneum and an intact skin is dependent on hydration (Lund et al., 2001). Lund et al. (2001) states that use of petrolatum based emollients will hydrate the skin by conserving water in the stratum corneum. Some studies have shown that while use of emollients may improve skin condition, their use may also increase the incidence of

nosocomial bacterial and fungal infections (Allwood, 2011). A randomized trial researched the effects of lanolin and sunflower seed oil on 173 premature infants with a mean gestational age of 30 weeks (Allwood, 2011). The results showed no significant difference in sepsis rates between the treatment group and the control group (Allwood, 2011). .

NICUs use adhesives such as tape to secure endotracheal tubes, intravenous catheters and other lifesaving equipment. This is not ideal though since removal of adhesives can disrupt the skin of premature infants, possibly resulting in epidermal stripping (Allwood, 2011). Removal of adhesives can be facilitated by the use of solvents. Allwood (2011) states that solvents are not recommended for use on premature infants because of the increased risk of absorption due to the neonates underdeveloped stratum corneum.

Clinical Practice Guidelines

The Institute of Medicine (1990) defined Clinical Practice Guidelines as being systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances. The Neonatal Skin Care (2^{nd} ed), protocol is an evidence based practice guideline written by the Association of Women's Health, Obstetric, and Neonatal Nurses (AWHONN). The guidelines suggest nurses perform a head to toe skin assessment at least once per shift and in addition, consider using a valid and reliable assessment tool such as the Neonatal Skin Condition Score (NSCS), the Braden Q, or the Starkid Skin Scale. The first recommendation from the guidelines for Neonatal Skin Care is to identify which patients are at risk of skin injury based on individual patient assessment. These risk factors may include, but are not limited to, gestational age being less than 32 weeks, edema, use of paralytic agents, use of vasopressors, use of endotracheal tubes, continuous positive airway pressure

(CPAP), nasogastric/orogastric tubes, vascular access devices, numerous electrodes; monitor probes, surgical wounds, ostomies, high frequency ventilation, and extracorporeal membrane oxygenation (ECMO). The guidelines go on to state that the nurse should be aware of potential causes of skin injury, such as: adhesive removal, burn/thermal injury, abrasion/friction injury, diaper dermatitis, pressure ulcer, or infection. Finally, if the nurse should visualize a pustular or purulent skin lesion, the nurse should notify the health care provider and order a skin culture.

When an infant is in the NICU it is imperative that nurses and physicians are able to disinfect the skin prior to performing invasive procedures. Before being used on a neonate's fragile skin, the risks and benefits of skin disinfectants should be evaluated. Some of the important factors to keep in mind are efficacy, the potential for toxicity, and the probability of skin irritation. The National Neonatal Skin Care Guideline has three suggestions on how best to disinfect the skin of a neonate. The first (a) apply chlorhexidine gluconate (CHG) for thirty seconds or two consecutive applications. Note that aqueous CHG will not dry, but can be wiped off with sterile gauze. (b) Use 2% aqueous CHG or povidone-iodine on infants less than 34 weeks gestation. Remember to completely remove the disinfectant used at procedure completion. (c) Apply povidone-iodine with two consecutive applications and allow drying for thirty seconds. All skin disinfectants should be completely removed with sterile water or saline when the procedure is done (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007).

The clinical practice guidelines urge NICU's to use adhesives sparingly and only for securing life support, monitoring and other devices. The recommendation from the national guidelines is to use a product tailored to the infant's wound care needs. Choices may include pectin or hydrocolloid barriers, semi-permeable dressings to anchor silicone catheters, peripheral

intravascular devices, central venous catheters, nasal cannulas, and nasal or oral gastric tubes, hydrogel adhesives (like the ones used for electrocardiograms or limb electrodes), alcohol-free barrier films, and silicone-based adhesive products. When securing adhesives, electrodes, probes, and limbs to arm boards, the guidelines prefer using stretchy gauze. The Neonatal Skin Care Guidelines go on to recommend minimizing contact between adhesive tape and the neonate's skin by either "backing" the tape or applying cotton to the adhesive. For removing adhesives, the national guidelines recommend using water soaked cotton balls while pulling off the adhesive slowly and carefully. Tape should be pulled along a horizontal plane, folding tape onto itself while continuously wetting the adhesive-skin interface. Alternatively, mineral oil or petrolatum may be used to loosen tape, unless re-taping is necessary at the same site (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). Finally, health care professionals should avoid using solvents, enhancing bonding agents, and adhesive bandages after drawing labs on infants.

The Neonatal Skin Care Guidelines do agree with the use of emollients at the first sign of dry skin, fissures, or flaking. The emollient should be applied every twelve hours or as needed. Because of the neonate's fragile skin, emollients should be free of perfumes, dyes, and preservatives and be applied gently to avoid friction (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). The health care team should observe for the development of systemic infections, especially in neonates less than 750g (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). The Neonatal Skin Care Guideline goes on to recommend that emollients be dispensed from the hospital pharmacy in either unit-dose or patient-specific containers and that every effort be made to maintain sterility of the container. In addition, emollients may be used discreetly to treat infants on a radiant warmer or

undergoing phototherapy (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007).

To reduce TEWL, the Neonatal Skin Care Guidelines recommend choosing one or more of the following seven techniques. (a) Place the infant in an occlusive polyethylene bag from the shoulders down without drying the baby's body and while the infant is under a radiant warmer. The polyethylene bag is removed after the infant has been stabilized and admitted to the NICU. The purpose of the bag is to reduce postnatal temperature decreases caused by excessive evaporative heat loss (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (b) Provide humidity levels of 70% - 90% relative humidity for the first week of life (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (c) Use Servo-controlled humidification systems in incubators that actively heat and evaporate water separately from circulating heat (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (d) Gradually reduce the relative humidity to 50% after the first week until the infant is twenty-eight days old (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (e) Choose a thermoregulation device on the basis of individual facility protocol and availability. (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (f) Use supplemental conductive heat from water-filled pads or heated mattresses to reduce heater output from radiant warmers (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (g) Use polyethylene coverings to reduce TEWL (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007). (h) Apply semi-permeable transparent adhesive dressings to the back and abdomen to reduce TEWL (Association of Women's Health, Obstetrics, and Neonatal Nurses, 2007).

Bathing

The evidence agrees that the skin of a full term infant at birth has a neutral pH which drops to a pH of 5 within the first week (Allwood, 2011). Premature infants, 24-34 weeks gestation, however, according to Allwood (2011), have a skin pH greater than 6 at birth which does not drop to a pH of 5 for three weeks. As stated by Allwood (2011, p. 24), "neonatal skin is vulnerable to infections at this time." Therefore, it is important that guidelines be evidence based; one such guideline, based on evidence based practice, is bathing both term and premature infants. It is important to have guidelines in place for the infant's first bath, routine bathing, and immersion bathing.

There are many reasons to bathe an infant, including the removal of waste materials, general aesthetics, and potentially reducing microbial colonization (Lund et al., 2001). However, bathing premature or term newborns that are physiologically unstable can have detrimental effects including hypothermia, destabilization of vital signs, and absorption of harmful chemicals (Allwood, 2011). Lund et al. (2001) recommends giving a newborn his/her first bath two to four hours after the infant's temperature has stabilized. It is not hygienically necessary to remove all the vernix from an infant's skin, according to Lund et al. (2001), as it is thought to provide antibacterial protection and promote wound healing. She goes on to recommend that newborns only need to be bathed two to three times per week, using soaps with a neutral pH that contain minimal dyes and perfumes. Furthermore, she advocates that extremely premature infants less than 26 weeks gestational age be bathed with sterile water alone.

The National Neonatal Skin Care Guidelines recommends that the first bath should not occur until the infant has attained thermal, cardiac and respiratory stability and has remained

stable for at least two to four hours. Even once an infant has reached this stage, only mild pH cleaners should be used. However, if the infant is a premature neonate less than 32 weeks gestation, the guidelines recommend bathing with warm sterile water with a cotton cloth or cotton balls and no rubbing for the first seven days of life.

Skin Assessment Tools

Traditionally, the skin assessment is performed during the head-to-toe exam. This skin assessment consists of the neonatal nurse noting areas of breakdown (in the nursing progress notes) with a shift-to-shift comparison between nurses. Meanwhile, the general appearance (i.e. dryness, erythema, and integrity) is not usually addressed in the nurse's progress notes (Lund & Osborne, 2004). The Neonatal Skin Condition Score (NSCS), which addresses the general appearance of a newborn's skin, was developed for a neonatal skin care evidence based practice project sponsored by the Association of Women's Health, Obstetrics, and Neonatal Nurses (AWHONN, 2011) and the National Association of Neonatal Nurses (NANN, 2011).

Lund and Osborne (2004) conducted a validation study of the NSCS; which consists of examining the tool's content, concurrent or predictive validity, intra rater and inter rater reliability and how responsive the instrument is to change. This study utilized twenty-seven NICUs and well-baby nurseries located throughout the United States with 1,006 neonates being observed (Lund & Osborne, 2004). To assess for intra rater reliability, sixteen sites used one nurse for a total of 475 NSCS assessments; while for inter rater reliability eleven sites used multiple raters for a total of 531 NSCS assessments (Lund & Osborne, 2004). Lund and Osborne (2004) have determined that the NSCS demonstrated adequate reliability for each of the three subscales and the total score. For intra rater reliability, the percent of agreement between scores

ranged from 68.7% to 85.4%, and inter rater reliability ranged from 65.9% to 89%; all Kappas were significant at $p < .001$ and were in the moderate range for reliability (Lund & Osborne, 2004). Lund and Osborne (2004) determined validity of the NSCS was demonstrated by finding that smaller infants were six times more likely to have erythema ($X^2 = 109.55$, $p < .0001$) and approximately twice as likely to have the most severe breakdown ($X^2 = 108.01$, $p < .0001$). Infants with longer stays in the NICU had higher skin score (odds ratio =1.21, $p < .0001$) and an increased probability of infection (odds ratio =2.25, $p < .0001$) (Lund & Osborne, 2004).

Lund and Osborne (2004), determined that the Neonatal Skin Condition Score is reliable when used by a single or multiple users. The NSCS is also reliable when used across weight groups and racial groups (Lund & Osborne, 2004). Lund and Osborne (2004) determined the validity of the NSCS by confirming the relationship of skin condition scores with birth weight, number of observances, and prevalence of infection.

In addition to the NSCS, there are two other skin assessment tools that were considered for use in the NICU; the Starkid and the Braden Q. The only similarity between all three skin assessment tools is that they are all designed to predict the risk of pressure ulcers. The Braden Q has seven subscales that are measured (mobility, activity, sensory-perception, moisture, friction-shear, nutrition, tissue perfusion and oxygenation) (Noonan, Quigley, Curley, 2011); the Starkid has six subscales (mobility/activity, sensory-perception, moisture, friction-shear, nutrition, tissue perfusion and oxygenation) (Suddaby, Barnett, Facteau, 2005). Both the Starkid and the Braden Q were designed for pediatrics, pediatric intensive care (PICU) (Suddaby, Barnett, Facteau, 2005), specifically; while, as mentioned earlier, the NSCS was designed for use with neonates in the NICU.

The Braden Q was validated in a multisite study which utilized 322 PICU patients three weeks to eight years old on bed rest for at least 24 hours (Noonan et al., 2011). The study established the predictive validity of the Braden Q and identified the critical cutoff for classifying patient risk at a score of 16 (Noonan et al., 2011). Noonan et al. (2011) report that at a score of 16, the Braden Q's sensitivity is 88% and specificity of 58%.

Suddaby, Barnett, Facteau (2005) report testing the Starkid in one hospital on four different units using four staff nurses and three clinical nurse specialists. Inter rater reliability was determined by thirty patients being scored by a staff nurse and a clinical nurse specialist at separate times on the same day (Suddab et al., 2005). For the Starkid, Suddaby et al. (2005), found sensitivity to be 0% and specificity to be 99.6% for a minimal score of 9. Additionally, they found a maximum score of 24 to have a sensitivity of 100% and specificity of 0%. Due to the Starkid having a high level of specificity at a low score, Suddaby et al. (2005), have determined that the Starkid would be a useful tool in predicting which patients need preventive measures to prevent skin breakdown. Therefore, due to the Starkid and Braden Q not being tested in neonates in the NICU setting like the NSCS, neither tool is valid or reliable for their use in neonates or premature infants.

Summary

Skin, the body's largest organ, provides protection from the environment and toxins and aids in temperature regulation. When a baby is born prematurely or is admitted to the NICU, the skins function is compromised due to its immaturity. These infants have not developed fat and zinc stores yet both of which are necessary for healthy skin. This immaturity also places the

infant at an increased risk of injuries such as tears, burns, and breakdown. In an attempt to protect the premature infant's skin, some authors have published skin care guidelines and AWHONN with NANN developed an evidence based clinical practice guideline. Bathing can be detrimental to a physiologically unstable infant making it imperative that nurses have evidence based guidelines to follow. Finally, by having a reliable and valid skin assessment tool, such as the Neonatal Skin Condition Score, areas of potential breakdown will be identified sooner.

Conceptual Framework

The conceptual frameworks being used for this teaching project are the American Association of Critical Care Nurses (AACN) synergy model for patient care and Neuman's Systems Model. The synergy model for patient care was introduced in the 1990's by the AACN as a conceptual framework for certified practice (Kaplow, 2008). At its core this model is about optimizing patient outcomes (Kaplow, 2008).

The synergy model states that nursing care is based on eight patient characteristics and eight nursing competencies (Kaplow, 2008). The patient characteristics, which span the health-wellness continuum, include resiliency, vulnerability, stability, complexity, resource availability, participation in care, participation in decision making and predictability (Kaplow, 2008). The eight nurse competencies described in the synergy model are clinical judgment, advocacy and moral agency, caring practices, collaboration, systems thinking, response to diversity, facilitation of learning and clinical inquiry (Kaplow, 2008). Synergy occurs when these patient characteristics and nurse competencies match, thereby optimizing patient outcomes.

Neuman's Systems Model was originally developed by Betty Neuman in 1970 as a method for teaching an introductory nursing course for nursing students (Ume-Nwagbo, DeWan,

Lowry, 2006). Today, Neuman's Systems Model is wellness-based and holistic. This model is based on the patient's reaction to stress in the environment (Ume-Nwagbo et al, 2006).

In a diagram of Neuman's Systems Model, the patient system is illustrated as an open circle surrounded by several concentric circles. At the center of the diagram is the basic structure (Ume-Nwagbo et al, 2006). The basic structure represents factors common to all people such as temperature and blood pressure (Ume-Nwagbo et al, 2006). The basic structure is then surrounded by several more circles which represent lines of resistance (LOR) that serve the function of protecting the system from stressors and maintain a healthy state (Ume-Nwagbo et al, 2006). Surrounding the LOR is a flexible line of defense (FLD) and a normal line of defense (NLD)(Ume-Nwagbo et al, 2006). The FLD functions as a protective buffer preventing stressors from invading the system while the less flexible NLD represents a patient's normal wellness state (Ume-Nwagbo et al, 2006). When stressors are able to invade the NLD, the LOR are activate (Ume-Nwagbo et al, 2006). Once the LOR is activated, the nurse approaches the patient through prevention as intervention (Ume-Nwagbo et al, 2006).

Neuman's System Model utilizes primary, secondary, and tertiary prevention to maintain and promote wellness. Primary prevention focuses on maintaining wellness while secondary prevention is based on strategies that are initiated after stressors have already penetrated the NLD and the patient is becoming ill. Finally, tertiary prevention strategies help the patient to readapt and resume a healthy lifestyle through support and education (Ume-Nwagbo et al, 2006).

Chapter Three: Methods

Proposed Program Description and Outcomes

Skin care in the NICU that is based on trial and error, hospital tradition, and myths has been cited in the literature (Allwood, 2011; Lund et al., 2001). In today's environment of magnet designation, it is imperative that NICU's base their skin care practices on evidence based guidelines. By utilizing evidence based practice in neonatal skin care, Allwood (2011) reports it is hoped that more positive outcomes and better skin condition will be seen, especially in neonates aged 23-30 weeks. In an effort to bring this to a realization, an eight hour course on neonatal skin care is proposed. This course will provide enhanced post nursing education for newly graduated nurses in the NICU setting. In addition to educating the newly graduated nurse, experienced nurses interested in a career change to NICU will also be welcome to learn the basics of skin care for neonates aged 23-30 weeks. The proposed course is designed to be part of the didactic portion of the New Grad program at a free standing university based teaching hospital in San Diego. Additionally, the course will be made available as an educational course offered through the learning center at this teaching hospital for those more experienced nurses who may be inexperienced in NICU, for NICU nurses who would like a refresher course on the subject, or for any other interested healthcare or non-healthcare professional. The course will be limited to ten participants per class session. With approval from the Board of Registered Nursing, six continuing nursing education units (1CEU) will be earned after successful completion of the course.

Course objectives and curriculum will be proposed to assist the participant in the following: identifying the layers of skin, correlating skin maturation based on developmental age, identifying risk factors for skin breakdown, and understanding best practice and Joint Commission Standards for skincare (See Appendix A for proposed course objectives).

At the end of the course the facilitator and the participants will have the opportunity to discuss a case study following a neonate between the ages of 23 and 30 weeks gestation to ensure that the best skin care practices are being followed. Case studies require the participant to apply and utilize information presented into a real world situation. Sandstrom (2006) advocates for case studies, believing that their use encourages the development of critical thinking skills while discussion allows for multiple viewpoints to be shared and that as a result encourages professional development and an increase in the participants learning.

Proposed Curriculum Content

This course is being developed on the principle of building upon the nurse's knowledge to guide practice. The AACN's framework of synergy theory will serve as the foundation for understanding the importance of providing evidence based skincare to infants 23 – 30 weeks gestation. Therefore it is expected that the participant in this course will have a better understanding of skin development in the neonate, risk factors related to having immature skin, and best care practices for immature skin based on evidence based practices. (See Appendix B for course outline).

Unit One: Skin Functions. The reason for introducing the course with a discussion on skin functions is to gather information regarding the participant's understanding of skin functions. Thirty minutes of open discussion moderated by the lead instructor with the

participants is planned. The reasoning behind this discussion is so that later in the course, participants gain understanding of the risk factors immature skin poses to a neonate related to how the skin functions.

Unit Two: Pathophysiology: How skin develops: Unit two will begin with a one hour lecture on skin development. A wound ostomy continence nurse specializing in pediatrics would be an ideal instructor for this unit of the course. The wound ostomy continence nurse, as a certified nurse, has advanced knowledge in pathophysiology of skin and can speak about the development of skin and how wounds heal. It is important to understand how skin develops in the premature infant and equally important to understand why the skin of a premature infant age 23-30 weeks gestation is so fragile. First will be a discussion on the components that make-up mature skin, followed by a discussion on how premature skin differs and how that puts the premature infant's skin at risk of injury.

It is important to understand how and when the different layers of skin develop and each layers function and how they relate to the function of skin as a whole. The first layer that will be studied is the stratum corneum; including when during gestational development this layer forms and its individual function as a barrier and how this funciton relates to the overall function of the skin. This is quite relevant when considering the medical care of the premature infant age 23-30 weeks gestation, because the immature stratum corneum is partly responsible for the infant being at risk for injuries and sepsis.

Of equal importance is the development of fibrils which connect the dermis to the epidermis. In the premature infant age 23-30 weeks gestation, there are fewer fibrils and they are widely spaced (Fox, 2011). This causes diminished cohesion which is why premature infants are

at an increased risk for injury due to tape removal and possible blistering from friction or thermal injury (Fox, 2011).

Unit Three: The Effect of Nutrition on Skin. It is important to realize that skin development and maturation is not dependent on nursing interventions alone. Nutrition is of equal importance to skin development and maturation. Fat and zinc are particularly crucial in this respect. For this reason, nutrition is an important topic to be included in the curriculum for NICU nurses. One hour will be utilized to discuss nutritional status and its relationship to the skin. It would be appropriate to utilize a registered dietitian specializing in the NICU for this unit of the course. The registered dietitian is an expert in food and nutrition with specialized training in working with hospitalized patients and how to optimize their nutrition to aid in healing. The registered dietitian working in the NICU is specifically trained in how to optimize nutrition in premature and ill infants.

As mentioned earlier, fat and zinc are essential for maintaining intact, healthy skin. Unfortunately, fat and zinc do not accumulate in the fetus until the last trimester (Allwood, 2011). Because fat and zinc accumulate during the third trimester, premature infants are at risk of developing skin problems due to their deficiencies (Allwood, 2011). Zinc, an essential trace mineral, is required for normal wound healing (Allwood, 2011). According to Allwood (2011), zinc build-up accelerates between 28 and 36 weeks gestation. Zinc deficiency is corrected by adding zinc to the infant's total parenteral nutrition (TPN) (Allwood, 2011).

Premature infants are deficient in essential fatty acids (EFA) due to the fact that they have less fat stores. (Allwood, 2011). EFA deficiency can present as superficial scaling of the skin, in addition to desquamation and irritation in the neck, groin and perianal areas (Allwood,

2011). Since EFA's are essential for platelet function as well, an EFA deficiency can cause thrombocytopenia and impair platelet aggregation (Allwood, 2011). To treat this deficiency, in EFA's the premature infant receives intravenous lipids at a total dose of 0.5gm/kg/day (Allwood, 2011).

Unit Four: Skin Assessment Tools. This unit of the proposed course will discuss the use of a standardized skin assessment tool as an aid for nurses during their evaluation of the infant's skin. One hour will be dedicated to this unit, in which a neonatal clinical nurse specialist will be utilized to engage the participants in a lecture format. By employing a neonatal CNS the information given to the participants will be based on evidence and best practice gathered from research and available clinical guidelines. The neonatal skin condition score (NSCS), a standardized skin assessment tool utilized by the university-based facility, will be discussed. In addition, the Braden Q and Starkid skin assessment tools will be discussed including their reliability and validity and the pros and cons of using each tool.

The goal of assessing the skin with the NSCS is prevention of skin breakdown throughout the infant's ongoing continuum of care. Another goal is to assure that proper interventions are applied in regards to skin care. The skin assessment, therefore, is necessary to obtain desirable skin care outcomes. The NSCS is a valid and reliable standardized skin assessment tool used to assess the infant's skin on a nine point scale (Lund & Osborne, 2004). The NSCS has been designed to assess the infant's skin for dryness, erythema, and breakdown/excoriation (Lund & Osborne, 2004). Lund & Osborne (2004) discuss that an infant's chances of having skin breakdown are greatly reduced by early identification of these areas.

Unit Five: Skin Intervention for Infant's 23-30 weeks gestation. Skincare interventions are another important topic with one hour of the proposed eight hour course dedicated to this topic. A neonatal nurse practitioner (NNP), an advanced practice nurse, has advanced knowledge in how to care for the neonate, including the skin and would make an excellent instructor for this portion.

This unit of the course will introduce evidence based skin care guidelines for bathing and for using adhesives, emollients, and semi-permeable membranes on infants age 23-30 weeks gestation. This first portion will focus on interventions that are intended to minimize the negative effects of environmental factors such as bathing, using emollients, adhesives, the semi-permeable membrane, and humidity (Allwood, 2011).

The next section of this unit will focus on iatrogenic injuries. Sardesai et al (2011) reports that many infants are discharged home from the NICU with cosmetically or functionally significant scars caused by extravasations, chest tubes, tape, and vascular catheters. Most iatrogenic injuries result from sub-standard nursing care and are avoidable (Sardesai et al. (2011).

Unit Six: Evaluation and documentation of skin. It will be important for the participants in the proposed course to understand the basis for strict standards in the practice of good skincare. In 2007 the Joint Commission identified the prevention of hospital acquired pressure ulcers as a national patient safety goal (Schindler, Mikhailov, Kuhn, Christopher, Conway, Ridling, Scott, Simpson,2011). Also in 2007, according to Schindler et al. (2007), the Institute for Healthcare Improvement established the 5 Million Lives Campaign for reducing unintended iatrogenic injuries. Additionally, since October 2008 the Centers for Medicare and

Medicaid (CMS) will no longer reimburse hospitals for preventable medical conditions including pressure ulcers (Padula, Mishra, Makic, & Sullivan, 2011). Thirty minutes will be spent discussing the standards of care set forth by AWHONN and NANN which includes a thorough newborn assessment, measures to prevent and/or treat diaper dermatitis, measures to prevent and/or treat skin breakdown, and measures to prevent and/or treat intravenous infiltration (Association of Women's Health, Obstetrics, and Newborns, 2007). A thirty minute discussion on how to document skin quality using the NSCS will be included in this unit.

Unit Seven: Case Study Discussion: A day in the life of a 25 week old infant.

Sandstrom (2006) reports that case studies encourage the development of critical thinking skills used in nursing. One hour will be dedicated to discussing a case study on skincare of a 25 week gestation infant. Participants of the proposed course will discuss the case study as a group. The case study will give the participants the opportunity to apply the content learned earlier to a real-life situation. The case study will involve a 25 week old infant during its first week in the NICU and cover bathing, the use of adhesive, emollients, humidity and semi-permeable membranes. Discussing the case study encourages professional development and increases the participants learning by allowing multiple viewpoints to be shared (Sandstrom, 2006).

Proposed Teaching Strategies

When deciding on how best to teach this proposed course, a look at adult learning theory is called for. Malcolm Knowles, an adult learning theorist, coined the term andragogy which is defined as the art and science of helping adults learn (Candela, 2012). Candela (2012) reports that adult learners like opportunities to apply their experience and their newly acquired knowledge to real-life situations. The author goes on to note that adult learners want to learn

new information and skills if they believe that what they are being taught is personally and professionally relevant.

Keeping the above aspects of adult learning theory in mind, several teaching modalities will be employed in this proposed course on neonatal skincare. It is imperative that the students of this proposed course understand why this particular topic is important and how it can improve their skills (Candela, 2012). By incorporating a lecture format with Power Point presentations, which will be made available to the students prior to class after they have completed and submitted the pretest, the information will be delivered in a systematic manner with each successive unit building on the last (Candela, 2012).

Active participation will be invaluable to the participants learning the content. Unit one will employ group discussion to ascertain what participants may or may not know about the functions of the skin. At the end of each unit, ten minutes will be reserved for participants to ask questions for clarification and review of presented content. This course will conclude with a case study discussion (Unit seven) involving a premature infant and nursing care provided to promote optimal skin development.

Finally, this proposed eight hour course on skincare for the infant 23-30 weeks gestation will utilize different teaching modalities to appeal to different learning styles. By utilizing content experts in the areas of skin development, nutrition, and neonatal nursing, scientific, evidence based information will be provided to the proposed class. Sandstrom (2006) reports that by utilizing the case study method, the participants are able to use the nursing process, thinking processes, and course content to solve the stated problem.

Chapter Four: Program Evaluation

Proposed Evaluation Method

Assessment and evaluation of the course and participant feedback (See Appendix E) is needed to better the teaching process. The participants will evaluate the whole course, in addition to evaluating each content expert's presentations. Evaluation of the presentations will be based on delivery, instructional methods, and adherence to the learning objectives utilizing a Likert Scale Survey. Actually evaluating each of the participant's clinical performances would probably be too time consuming of a task for a project of this magnitude. Therefore, to evaluate clinical performance and quality skin care in this patient population, it is proposed that the NICU join the Collaborative Alliance for Nursing Outcomes (CALNOC, 2011-2012) skin breakdown survey. CALNOC is a non-profit, self-sustained corporation that provides a premier nursing sensitive benchmarking registry (CALNOC, 2011-2012). However, a limitation to participating in national and statewide benchmarking surveys is that individual nursing outcomes cannot be evaluated in regards to providing quality skincare. Despite this drawback, by collecting data on the quality of skincare, hospitals are showing families that they and the NICU are committed to providing best practices in patient care (CALNOC, 2011-2012).

A test can be utilized before instruction to determine the student's knowledge as well as post-tests being employed as a summative evaluation of learning (Twigg, 2012). To assess pre- and post-knowledge of the material presented during the proposed skincare guideline course, participants will be asked to complete the same test designed by the facilitator. The test presented will be ten multiple choice questions based on material presented in the skin care

guideline course. The pre-test will be used to determine the nurse's pre-knowledge on the subject matter. The facilitator will provide the test via email to the participants upon signing up for the course. The test will be a requirement, with participants emailing the completed quiz to the facilitator prior to beginning the course. At the end of the course the participants will be asked to complete the same test that they took prior to the beginning the course. The post-test will be worth a total of 100 points, with each question worth ten points. A score of 80-100 points will be a passing score. Learners who score below 80 will be required to re-take the post-test and will be given the opportunity to review the answers along with rationales for why the answer was right/wrong. Data from the pre-test will be compared to data from the post-test to determine if there is any correlation between increased scores and completing the eight hour skin care guideline course. Finally, the program will be developed into a Power Point presentation with the post-test for experienced nurses to review as a part of their yearly competencies.

Chapter Five: Discussion and Conclusion

Discussion

The literature supports educating nurses on evidence based care as it will increase nurse's knowledge and contribute to providing quality nursing care. As a specialized clinical practice, it is not possible for neonatal nursing to be covered in its entirety during undergraduate nursing school. Therefore, it is important for new graduate nurses and experienced nurses interested in working in a NICU to attend specialty courses like the course currently being discussed which focuses on skincare for infants 23-30 weeks gestation. Additionally, as this is a continuing education course, it also gives nurses already working in the NICU the opportunity to advance and improve their knowledge and provides them with up to date evidence based and best practice guidelines.

Implications for Nursing

A goal of healthcare organizations is to provide safe, high quality care to its patients. The quality of care provided to patients within a healthcare organization is directly correlated with the quality of its nurses. By providing educational support in the form of new grad classes and offering continuing education in services and classes, the nurse's knowledge base will improve and positively affect the quality of patient care. While skin care is a small part of the care provided to the neonate, it is an important part of their care that needs attention and improvement. Healthcare organizations and the nursing leaders need to support specialty programs like the skin care guideline course to encourage and support the nurses to engage in evidence based best practices.

Newly graduated nurses are entering the health care field with basic nursing knowledge acquired from their respective colleges and universities. Nursing curriculum prepares novice nurses with the basic clinical skills and knowledge to care for patients. Nursing education is inundated with a vast amount of information that must be delivered in a short amount of time. It is assumed that new graduate nurses are receiving little education, if any, about neonatal care, not to mention neonatal skin care. Due to this knowledge deficit, it is necessary that healthcare organizations provide specialized education to new graduate nurses, especially when new nurses are being employed in a NICU.

Limitations

One limitation of this proposed course would be the lack of a clinical component. Without a clinical element, participants do not have the opportunity to practice and apply the concepts being taught. The lack of a clinical practice component may limit a participant's full absorption of the learned material. Therefore, participants will need to be provided with plenty of opportunities in the NICU, to apply and practice their newly acquired knowledge.

For this course to be successful, the healthcare organization and its nursing leaders need to be supportive of the course prior to its implementation. Also, the participants, who are employees of the organization, and the proposed content experts, should be financially compensated for their time. If the organization does not have the fiscal or human resources available to take on a project like the proposed Skin Care Guideline Course, that would also be a limitation.

Suggestions for Further Research

Research in the area of neonatal skin care is not the most abundant. In fact, the last time guidelines were published was 2007. A potential future research project could be establishing the validity and reliability of a skin care tool that can predict skin breakdown in premature infants. Additionally, a research study could be conducted to assess if skin condition of premature infants has improved after employing the guidelines proposed in this project.

Conclusion

Assessing and providing quality skin care is a core nursing responsibility, especially when it comes to premature infants. It is the responsibility of healthcare organizations and their nurse educators to ensure that new nurses and nurses with little or no NICU experience are prepared to provide quality care, including quality skin care. Additionally, in order for an organization to attain magnet status from the American Nurses Credentialing Center (ANCC) hospitals are required to have systems in place to address patient care and practice concerns, provide orientation for new nurses and provide professional development, and utilize evidence based practices (ANCC, n.d.).

Specialty courses, like the one proposed here, will prepare the new graduate NICU nurse and the experienced nurse interested in NICU with the background, management and assessment skills necessary for providing quality skin care to premature infants.

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Appendix A

Course Objectives

By the end of the course the participant will be able to:

1. Identify the layers of skin
2. Describe and discuss how skin maturation correlates to gestational age
3. Identify and discuss reasons the premature infant is at risk for skin breakdown
4. Identify and discuss the functions of mature skin
5. Explain the roles fat and zinc play in skin development and maturation
6. Identify and discuss AWHONN and NANN guidelines for skincare for premature infants 23-30 weeks gestation
7. Analyze and understand the Joint Commission's position on hospital acquired pressure ulcers

Appendix B

Proposed Course Curriculum

8am-8:30am Unit One: Skin Functions

Class discussion on skin function

8:30am-9:30am Unit Two: Pathophysiology: How skin develops

The development of the layers of skin and their specific functions

The role of fibrils

Premature skin vs. Mature skin

Risk factors for injury

Wound healing

9:30am-9:45am Break

9:45am-10:45am Unit Three: The affect of Nutrition on Skin

Development of fat and zinc stores.

Why fat and zinc are important to healthy skin and wound healing

10:45am-11:45am Unit Four: Skin Assessment

NSCS

Braden Q

Starkid

Validity/Reliability

Pros/Cons

11:45am-12:30pm Lunch

12:30pm-1:30pm Unit Five: Skin Care Guidelines for infants 23-30 Weeks

Bathing

Emollients

Semi permeable membrane

Adhesives

Humidity

Iatrogenic Injuries

1:30pm-2:30pm Unit Six: Evaluating and Documenting Skin Condition

Financial Impact

AWHONN

NANN

2:30pm-2:45pm Break

2:45pm-4pm Unit Seven: Case Study & Discussion, Post-Test & Course Evaluation

Case Study & Discussion

Post test

Evaluation of course

Appendix C

Case Study

A 24 week gestation girl weighing 900 grams is born to a 25 year old woman who received prenatal care. Apgars were 4 at 1 minute, 6 at 5 minutes, and 9 at 10 minutes. The infant received positive pressure ventilation in the delivery room. The infant was intubated and received 1 dose of Curosurf prior to being transported to the NICU.

At this point we can discuss what the functions of mature skin are including how the baby in the case study's skin is immature and what risks this immaturity exposes the baby to.

Upon arrival to the NICU the infant is placed in a pre-warmed giraffe Isolette. Once the NICU nurse is done obtaining an initial assessment, vital signs, labs, and a peripheral IV, the neonatologist wants to insert venous and arterial umbilical lines.

What does the nurse anticipate the neonatologist will use to disinfect the area? Explain answer.

That night, the infant's vital signs are stable including her temperature, so the nurse decides to bathe the baby in the giraffe during the infant's touch time.

What supplies will the nurse gather to bathe the infant? How often should the infant be bathed? How long should the infant be bathed using plain water?

The infant is being housed in a giraffe in humidity of 80%.

Explain why or why not the RN may or may not use an emollient or semi-permeable membrane to reduce TEWL?

The neonatologist has ordered parenteral nutrition including lipids.

Explain why zinc and fats are essential to skin development and maturation. Does anyone remember what the standard doses of zinc or fat?

Appendix D

Pre-/Post-Test

1. Which of the following is **NOT** a function of skin

    A. Barrier against toxins

    B. Insulation and fat storage

    C. Thermoregulation

    D. Water and electrolyte retention

2. The infant born at 29 weeks is at risk of sepsis due to a diminished barrier function because of an immature

    A. Dermis

    B. Epidermis

    C. Subcutaneous layer

    D. Stratum corneum

3. The fibrils connecting the dermis to the epidermis are widely spaced in premature infants putting them at increased of injury risk from what?

    A. Disinfectant

    B. Emollient

    C. Soap

    D. Tape

4. When does the fetus develop fat and zinc stores?

    A. 2nd Trimester

    B. 3rd Trimester

    C. 20th Week

    D. 36th Week

5. Which skin assessment tool does UCSD use in the NICU?

A. Braden Q

B. Neonatal Skin Condition Score (NSCS)

C. Neonatal Skin Risk Assessment Scale (NSRAS)

D. Starkid Skin Scale

6. Which of the following is NOT measured in the skin assessment tool used by the NICU at UCSD

A. Breakdown

B. Dryness

C. Erythema

D. Nutrition

7. A 24 week gestation infant has been admitted to the NICU. As the RN you understand the infant should be bathed

A. at 6 Hrs. old

B. at 12 Hrs. old

C. at 24 Hrs. old

D. when stable

8. The NICU RN has determined the 24 week gestation infant is stable enough to be bathed at the next hands on time. What should the nurse use to bathe the infant

A. Low Ph body wash

B. Cloths impregnated with body wash

C. Cloths impregnated with chlorhexadine

D. Plain, warm water

9. A NICU RN caring for a 30 week gestation infant notices dryness and cracking on the baby's skin and applies which emollient

A. Aquaphor

B. Eucerin

C. Johnson & Johnson lotion

D. Vaseline

10. A 28 week gestation infant needs to have lines placed. Which of the following would you, the NICU RN, expect the provider to use to disinfect the surrounding area.

A. Chlorhexidine Gluconate (CHG), any concentration

B. 0.5% CHG in 70% isopropyl alcohol

C. 2% CHG in 70% isopropyl alcohol

D. 2% aqueous CHG or povidone-iodine

Appendix E

Pre-/Post-Test Answers

1. Which of the following is NOT a function of skin

   A. Barrier against toxins

   B. Insulation and fat storage

   C. Thermoregulation

   D. Water and electrolyte retention

2. The infant born at 29 weeks is at risk of sepsis due to a diminished barrier function because of an immature

   A. Dermis

   B. Epidermis

   C. Subcutaneous layer

   D. Stratum corneum

3. The fibrils connecting the dermis to the epidermis are widely spaced in premature infants putting them at increased of injury risk from what?

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   C. Soap

   D. Tape

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   C. 20th Week

   D. 36th Week

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D. Plain, warm water

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A. Chlorhexidine Gluconate (CHG), any concentration

B. 0.5% CHG in 70% isopropyl alcohol

C. 2% CHG in 70% isopropyl alcohol

D. 2% aqueous CHG or povidone-iodine

Appendix F

Course Evaluation Form

Course Evaluation Form

Date: TBA **Time:** 0800-1600

Program Title : Skincare guidelines for the infant 23-30 weeks gestation

Learning Objectives:

1. Identify the layers of skin
2. Describe and discuss how skin maturation correlates to gestational age
3. Identify and discuss reasons the premature infant is at risk for skin breakdown
4. Identify and discuss the functions of mature skin
5. Explain the roles of fat and zinc play in skin development and maturation
6. Identify and discuss AWHONN and NANN's guidelines for skincare for premature infants 23-30 Weeks
7. Analyze and understand the Joint Commission's position on hospital acquired pressure ulcers

Course Evaluation: Circle one answer per question1. Overall, I would rate today's course as:	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**
2. This presentation was useful to me in my current position:	**Daily**	**Weekly**	**Occasionally**	**Rarely**
3. My level of knowledge regarding this information has increased:	**Abundantly**	**Somewhat**	**A little**	**Not Much**
4. The learning objectives for this presentation were achieved:	**Completely**	**Somewhat**	**A little**	**Not Achieved**

I Would Rate The Instructors Teaching/Presentation Style As:

Lead Instructor (Units 1 and 7)	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**
Wound/Ostomy Nurse (Unit 2)	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**
Registered Dietitian (Unit 3)	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**
Clinical Nurse Specialist (Units 4 and 6)	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**
Neonatal Nurse Practitioner (Unit 5)	**Excellent**	**Good**	**Satisfactory**	**Needs Improvement**

What did you like most about the course?

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What did you like least about the course?

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Additional comments:

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