Effect of the Training Program on Nurses' Knowledge, Attitude and Practice regarding Neonatal Nursing Care in Obstetrics and Gynecology and Pediatric Teaching Hospitals at Wad Medani, Gezira State, Sudan (2010 - 2013)

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Date of Examination  11/9/2014
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قال تعالى:

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فول (28) صرا الله تعالى النظير

سورة طه
Dedication

To the Soul of my Father

To my Mother

To all my family members

To my Husband.

And my Children
Acknowledgments

First of all, I would like to convey my sincere gratitude to Almighty God for his grace in the completion of this work as I wish.

My sincere thanks and gratitude with respect to the main supervisor Dr. Imad Eldin Eljack and Co-supervisors Prof. Haydar Elhadi Babikir for their tireless efforts and valuable comments during the whole preparation and completion of this work.

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ABSTRACT

High risk newborns are neonates who have a greater chance of complications which lead to death. Neonatal Intensive Care is an nursing specialty and the nurses who work in Neonatal Intensive Care Unit should have additional training to prepare them for this role. This is an interventional hospital based study aimed at assessing the effect of training program on nurses’ knowledge, attitude and practice regarding neonatal nursing care in Pediatric and Obstetric and Gynecology Teaching Hospitals. The sample size consisted of (90) nurses that constituted the total coverage of study population during the period of the study from July 2010 – July 2013. The data was collected using assessment sheet to evaluate nurses’ knowledge, modified likert attitude scale to evaluate nurses’ attitude and an observation checklist to monitor nurses’ performance when caring of preterm infant, neonates with respiratory distress syndrome and neonatal jaundice. The data was analyzed using statistical package for social sciences (SPSS). The study results evident that the means of knowledge for all items of premature care, neonate with respiratory distress syndrome, neonatal jaundice and immunization of children were all significantly improved from 21% before the training program to 90% after intervention. P.value <0.05. The mean of the total percentages of nurses’ attitude regarding care of preterm infant, neonate with respiratory distress syndrome and neonatal jaundice were improved from 64.5% before the training program to 93.4% after intervention P. value 0.00. The mean of the total percentages of nurses’ performance was 32.6% before the training program and it was improved to 70% after the program P. value ≤0.05. The study concluded that there was a significant improvement in nurses’ knowledge attitude and practice regarding neonatal care after the training program. So the study recommended that continuing education program for nurses is very important, learning facilities (books, Journals) about neonatal care should be available at neonatal intensive care units. Supervision system should be developed by the hospital to monitor the nurses performance is necessary for quality assurance.
أثر البرنامج التدريبي على معرفة واتجاهات وممارسات الممرضات تجاه العناية التمريضية

ملخص الدراسة

المواقيض ذوى المخاطر الشديدة هم المولود الذين تزداد لديهم نسبة حدوث المضاعفات والتي تؤدي إلى الوفاة. العناية المكثفة للمولود هي تخصص تمريضي وممارسات اللائي يعمن بوحدة العناية المكثفة للمواقيض يجب أن يخضعن لتدريب اضافي ليوجهن لهذا الدور. أجريت هذه الدراسة التداخلية التي تهدف إلى تقييم أثر البرنامج التدريبي على معرفة واتجاهات وممارسات الممرضات تجاه العناية التمريضية لحديثي الولادة في مستشفى الأطفال ومستشفى التوليد وأمراض النساء التعليمي بودمدنى. شملت العينة (90) ممرضة وهن اللائي يمثلن العينة المتاحة للممرضات أثناء فترة الدراسة من يوليو 2010 – يوليو 2013م. تم جمع المعلومات باستخدام استمارة تقييم لمعرفة الممرضات وقياس لايكرت المعدل لقياس اتجاهات الممرضات وقياسات الملاحظة لمراقبة أداء الممرضات أثناء العناية بالطفل الخديج، المواقيض المصابون بمتلازمة الضائقة التنفسية، والبرقان الوليدى. تم تحليل البيانات باستخدام برنامج الحزمة الإحصائية للعلوم الاجتماعية (SPSS). أوضحت نتائج الدراسة أن متوسط معرفة الممرضات لكل مفردات العناية بالوليد، المواليد المصابون بمتلازمة الضائقة التنفسية، البرقان الوليدى وتطعيم الأطفال صورًا واضحة من (21%) قبل إجراء البرنامج التدريبي إلى (90%) بعد التدخل (P.value < 0.05). متوسط النسب لاتجاهات الممرضات حول العناية بالطفل الخديج، المواقيض المصابون بمتلازمة الضائقة التنفسية والبرقان الوليدى تحسن من (64.5%) قبل البرنامج التدريبي إلى (93.4%) بعد التدخل P. value 0.00. متوسط النسب للداء الكلى للممرضات قبل البرنامج التدريبي (70%) وتحسن إلى (32.6%) بعد البرنامج P. value < 0.05. خلصت الدراسة على أن هناك تحسناً ملحوظاً في معرفة واتجاهات وممارسات الممرضات حول العناية بالمواقيض بعد البرنامج التدريبي. أوصت الدراسة بأن البرامج التعليمية المتواصلة للممرضات مهمة جدًا، وسائل التعليمية مثل الكتب والمجلات عن العناية بالمواقيض يجب توفيرها بحدود حديثي الولادة. إنشاء نظام أشراف بواسطة المستشفى لمراقبة أداء الممرضات مهم جداً لضبط الجودة.
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<tr>
<td>AAP</td>
<td>American Academy of Pediatrics</td>
</tr>
<tr>
<td>ACOG</td>
<td>American college of obstetricians &amp; Gynecology</td>
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<tr>
<td>AIDS</td>
<td>Acquired immune deficiency syndrome</td>
</tr>
<tr>
<td>BCG</td>
<td>Bacillus of Calmette and Guein</td>
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<tr>
<td>CNS</td>
<td>Central nervous system</td>
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<tr>
<td>CPAP</td>
<td>Continuous positive airway pressure</td>
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<td>CPD</td>
<td>Citrate phosphate dextrose</td>
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<tr>
<td>CS</td>
<td>Cerebrospinal</td>
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<tr>
<td>DT</td>
<td>Diphtheria, Tetanus</td>
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<tr>
<td>DTP</td>
<td>Diphtheria, tetanus, pertussis</td>
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<tr>
<td>EBT</td>
<td>Exchange blood transfusion</td>
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<tr>
<td>ELBW</td>
<td>Extremely Low birth-weight</td>
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<td>ETT</td>
<td>Endotracheal tube</td>
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<tr>
<td>G6PD</td>
<td>Glucose 6-phosphate dehydrogenase</td>
</tr>
<tr>
<td>Hib</td>
<td>Hemophilus influenza type B</td>
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<tr>
<td>HIV</td>
<td>Human immune virus</td>
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<td>IgM</td>
<td>Immunoglobulin M</td>
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<td>IUGR</td>
<td>Intrauterine growth restriction</td>
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<td>IV</td>
<td>Intravenous</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>KMC</td>
<td>Kangaroo mother care</td>
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<td>LBW</td>
<td>Low birth-weight</td>
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<td>MDG4</td>
<td>Millennium development goal 4</td>
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<tr>
<td>MEFs</td>
<td>Minimal enteral feedings</td>
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<td>Nasogastric</td>
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<td>NICU</td>
<td>Neonatal intensive care unit</td>
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<td>O₂</td>
<td>Oxygen</td>
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<td>OPV</td>
<td>Oral polio vaccine</td>
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<td>PEEP</td>
<td>Positive end-expiratory pressure</td>
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<td>Premature infant pain profile</td>
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<td>Rhesus</td>
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<td>SIDS</td>
<td>Sudan infant death syndrome</td>
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<td>VLBW</td>
<td>Very low birth-weight</td>
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<td>WHO</td>
<td>World health organization</td>
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CHAPTER ONE

Introduction

1.1 Background:

Admissions of neonatal intensive care units (UICUs) were high risk newborns, have a greater chance of complications because of conditions that occur during fetal development, pregnancy conditions of the mother, or problems that might occur during labour and birth. The neonatal death rate on national level, like that of other developing countries is very high. The NICUs are critical to premature newborns and to the well-being of the infants with malformations and acute complications of the newborn period (Thilo & Resenerg; 2012).

Over the past 20 years, care of infants and children has become extremely technical. It is generally assumed that newborns with a term birth weight, more than 2500 g will thrive at birth. However, many infants are born each year with birth weights lower than 2500 g or who are ill at birth and do not thrive. Such infants are regularly transferred to a neonatal intensive care units or intensive care nursery (ICN) (Adele P; 2010).

The world health organization (WHO) estimates that birth weight below 2500g indirectly contributes to about 15% of the neonatal mortality, ranging from 6% in high income countries to 30% in low income countries, with preterm birth and related complications being the underlying cause. The world health organization (WHO) reported that out of 130 million live birth every year, 4 million die within the first four weeks of life. Of these deaths 99% occur in developing countries (Approximately half following difficult deliveries at home) against 1% in developed countries (WHO, 2005).

Rapid advances in our understanding of the pathophysiology of the neonate and increased capacity to apply this knowledge have emphasized the need for appropriate settings in which to care for the seriously ill infant. Intensive care of the ill and immature newborn requires specialized knowledge and skill in a number of areas. Much of the equipment long used in the care of the critically ill adult is unsuited to the singular needs of the very small infant; therefore common place apparatuses have been modified to meet these needs. Examples of modification include ventilators that deliver small volumes of oxygen in the proper concentration and pressure, infusion pumps that deliver very small amounts accurately, and radiant
Heat warmer that provide a constant source of warmth. Most important advances in intensive care have created a need for highly skilled personnel trained in the art of neonatal intensive care (Gerald & Sandra, 2010).

Nurses in the neonatal care units should be highly trained in the management of variety of sophisticated mechanical devices and educated in the infant's behavior, interpreting observations of others and timing interventions appropriately. Proficiency is developed through daily observation and practice under the guidance of skilled practitioner- in-service education is one of the prime objectives in the ongoing management of successful Neonatal Intensive Care Unit (NICU) (Marilyn J & David W., 2011).

The national association of neonatal nurses was created over the last ten years in Chicago to bring the world together. This forum provides an opportunity for neonatal nurses and midwives everywhere to network, exchange ideas and experiences about neonatal care throughout the world. The purposes of the Neonatal Nurses Association include the promotion of good standards of neonatal nursing for the benefit of babies, their families and the nurses involved in their care. The neonatal nurses Association has developed regular links with other national organizations representing neonatal nurses both in Europe and elsewhere in the world.

Http://www.bizjet.com/jnn/conference-html

1.2 Problem Statement:

Studies have repeatedly demonstrated the importance of prenatal and neonatal infant care in the development of healthy babies. In fact, neonatal care is so important that the nursing industry has responded with a specialized nursing focus that concerns itself with the medical care provided to newborns. Neonatal nursing professionals work with newborns that are born early or with serious illnesses, helping to stabilize the new infants and ensure that their lives get off to the healthiest start possible. Of the three principle roles played by neonatal nursing professionals, only two remain in high demand. The first, level one care, entails caring for healthy newborns. This type of nursing is rapidly declining across the United States as more and more healthy babies now stay in the room with their mother almost from the moment they are born. Levels two and three involve caring for babies born prematurely or with serious illnesses, and work within a neonatal intensive care unit that focuses on caring for the sickest of newborns. Of the three the intensive care work is the most complex, as
neonatal nurses working with these seriously ill children must not only continually monitor the various equipment used to stabilize these infants, but must help to instruct the parents on the best ways to care for their sick child. (Karen P, 2010).

Advances in technology have resulted in infant survival at much lower birth weights than ever. The incidence of early births is not decreasing, however, in 2006 12.8% of births were preterm and 8.3% of newborns weighed less than 2500 g.

In terms of medical expense, lost potential and suffering of infants and their parents, preterm birth is extremely costly. One study of moderately preterm infants (32 to 34 weeks of gestation) found the average cost of their 17.6 days in NICU was $31,000. Less mature preterm infants have a longer stay and need more complex care, adding to the cost of care. More than one third of all infant deaths are related to preterm birth. (Emily S. et al., 2009).

World wide, the most important causes of neonatal deaths are preterm birth, birth asphyxia, sepsis and pneumonia. This reflects the mortality pattern in low income countries where neonatal mortality is high, whereas in high income countries where mortality is low, preterm birth and congenital malformaitons are the leading causes of death. (National Bureau of Statistics, 2011)

The aim of the United Nations' Millennium development Goal 4 (MDG4) is to reduce under – five mortality world wide to 30 deaths per 1000 live births by 2015. Globally, an estimate of 10.6 million children under five years died in 2000, declining to 8.8 million in 2008, and further to 7.7 million in 2010. The slow decline in neonatal mortality as compared to post-neonatal mortality calls for attention and efforts to reserve this trend. Within the neonatal period and estimated 50% of all deaths are within the first 24 hours while 75% are within the first week of life, given that a large fraction of these deaths are preventable, focus on mortality in the first week of life is important in order to accelerate the millennium goal. (Rajaratnam JK. et al., 2010).

About 12 percent of babies born in the United States are preterm, which is higher than in other developed countries and 10 percent of premature babies in the united states develop RDS each year (Goldenberge et al. 2010).

Neonatal mortality and morbidity rates in the African region is currently estimated as 45 deaths per 1000 live births and thus it among the highest in the world, and contributes about 50% of infant mortality rate in the region according to WHO (WHO, 2005).
Tanzania is among countries with insufficient progress towards achieving the MDG4 showing slow decline in under-five mortality rate. Tanzania is estimated to account for 28 – 34% of deaths in children under 5 years with the most frequent single causes of death being prematurity, birth asphyxia, sepsis and pneumonia (Mumbaga BT et al., 2011).

Sudan is classified as having insufficient progress in achieving the Millennium Development Goal (MDG-4), where the levels of infant and child mortality are among the highest in the region and the world. The current infant mortality rate in Sudan is 60 per 1000 live births and the under-five mortality rate is also high ranging from 34 to 47 per 1000 births. (Amel et al., 2010).

In Wad Medani Obstetric and Gynecology Teaching Hospital, there is high level of neonatal mortality and morbidity (11.7%), most babies take more time from decision to seeking care to admission. The quality and availability of the equipment in the nursery is not adequate because it is either not existent or not operating. (Amel M. et al., 2003).

In Wad Medani Pediatric Teaching Hospital the majority of deaths were due to prematurity 33.3% neonatal sepsis 24.3% and birth asphyxia 20%. Neonatal death in Wad Medani Pediatric teaching hospital was found to be significantly high and necessary equipments are not available in NICU. (Mey M., 2006).

Another hospital based study conducted at Wad Medani Obstetric and Gynecology Teaching Hospital during the period Jan – June, 2009. The study concluded that neonatal infection, preterm birth and low birth weight (LBW) were the common causes of neonatal morbidity and mortality. Few or no published data are available concerning neonatal morbidity and mortality in Sudan, which is the largest African country with 40 Million inhabitants (Elhassan M, et al., 2009).

1.3 Justification and Rationale:

Neonatal intensive care is an nursing specialty requiring further study. Nurses who work in (NICU) should have additional education and experience to prepare them for this role. Nursing personnel primarily provide the care of new born world wide. The role of neonatologist is only secondary and supervisory to provide the direction for overall organization and services for the newborn care unit. Any amount of excellence in the capability of neonatologist and availability of high tech equipments can not improve the quality of newborn care until we have quality input.
from neonatal nursing personnel. Nurses form the backbone of neonatal care service, they are the ones constantly monitoring and caring for sick neonate, they are the ones most often available to anxious mothers and they are the ones most suitable to report the course of the baby and problem to the doctors. Therefore, they have a very responsible role in the care of the newborns. Therefore, nurses working in neonatal unit have to be highly motivated and should be committed to the care of the sick neonate and should have adequate knowledge and nursing skills of the problems in neonate (Rashmi G., 2010).

All the previous studies that conducted in Wad Medani town regarding the neonates done by doctors and regarding neonatal morbidity and mortality rate only, but there is no study done regarding assessment of neonatal care in NICUs in Wad Medani Town, thus, the current study was conducted to provide care givers and health planners with basic data necessary for interventions for improving and sustaining quality neonatal care in Wad Medani Town.

1.4 Objective

1.4.1 General objective:
To assess the effect of the Training Program on nurses' knowledge, Attitude and Practice regarding neonatal nursing care in neonatal care units in Wad Medani Pediatric and Obstetrics and Gynecology hospitals, Gezira State, Sudan (2012).

1.4.2 Specific objectives:

1. To assess nurses' knowledge and Attitude regarding various aspects of nursing care of premature infant, neonates with jaundice, respiratory distress syndrome and immunization of children in NICU of pediatric teaching hospital and obstetric and gynecological Teaching hospital in Wad Medani town.

2. To monitor nurses' performance when caring of premature infant, neonates with jaundice and respiratory distress syndrome in NICU of Wad Medani Pediatric teaching hospital and Wad Medani obstetric and gynecological teaching hospital.

3. To evaluate the effect of implemented training program on nurses' knowledge, Attitude and practice when caring of premature infant, neonates with jaundice, respiratory distress syndrome and immunization of children in selected areas.
CHAPTER TWO
2- Literature Review

2.1 Preterm infant

Prematurity accounts for the largest number of admissions to an NICU. The immaturity not only places infants at risk for neonatal complications (e.g., Hyperbilirubinemia and RDS), which highest in the preterm infant, but may also predispose the infant to problems that persist into adulthood (Learning disabilities growth deficiencies, asthma). Preterm infants are born before the beginning of the 38th week of gestation. The word preterm is sometimes confused with the term low birth weight (LBW), which refers to infants weighing 2500 gram or less at birth. Very-low-birth-weight (VLBW) infants weigh 1500 g or less at birth- extremely low-birth – weight (ELBW) infants weigh 1000 g or less at birth. Although most of these infants are preterm, other are full term and have failed to grow normally while in the uterus, a condition called intrauterine growth restriction (IUGR) (Emily S. et al.; 2009).

2.1.1. Characteristics of preterm infants:

Preterm infants vary by gestational age. For example, the appearance and problems of infants born at 34 weeks of gestation are different from those of infant born at 26 weeks of gestation. Some characteristics, however, are common to all preterm infants.

2.1.1.1 Physical characteristics:

- Preterm baby is small in size with relatively large head – crown – heal length is less than 47cm and head circumference is less than 33cm but exceed the chest circumference by more than 3cm.
- General activity of the baby is poor with sluggish or incomplete neonatal reflexes such as moro, sucking and swallowing reflex. Limbs are extended due to hypotonia.
- Head is larger than body, skull bones are soft, sutures are widely separated and fontanelles are large. Face is small with small chin and less or abscent buccal fat. Scalp hairs are scanty with separate individual hair fibers.
- Eyes remain closed and protruding, ears are soft, flat and cartilage is not fully developed.
- Skin is shiny, thin, delicate and pink with little venix caseosa and plenty lanugo hair. There is less subcutaneous fat. Edema may present.
- Breast nodules are absent or less than 5mm. Nipples and areola are flat. Abdomen is full, soft and round with prominent veins.
- Nails are short and not grown up to finger tips. Deep creases over soles and palms are absent or less.
- Genitalia – in male baby, testes are undescended and scrotum is poorly pigmented. In female baby, labia minora is exposed due to poorly developed and widely separated labia majora. Clitoris is hypertrophied and prominent (Debra L, Julie F, 2012).

2.1.2 Assessment and care of common problems:

Preterm infants are prone to problems that affect all systems and body processes. The assessment includes the assignment of an Apgar score and an evaluation for any obvious congenital anomalies or evidence of neonatal distress.

2.1.3 Daily Routine Care of Neonates:

The major goal of nursing care of the newborn infant is to establish and maintain homeostasis, i.e. stability in the normal physiological status. The daily routine care of the neonates are as follows:-

- **Warmth:** warmth is provided by keeping the baby dry and wrapping the baby with adequate clothing in two layers, ensuring head and extremities are well-covered. Bathing is avoided to prevent hypothermia and infections.
- **Breastfeeding:** The baby should be put to the mother’s breast as soon as possible the mother has recovered from the exertion of labor. No prelacteal feeds to be given and colostrum feeding must be offered. All babies should invariably receive the colostrum during first three days of life.
- **Skin care and bath:** No bath, especial dip baths, should be given till the umbilical cord has fallen off. In summer months, the baby can be sponged using un-medicated soap and clean lukewarm water. Use of olive oil or coconut oil can be allowed after 3 to 4 weeks of age. Oil massage improves circulation and muscle tone.
- **Care of the umbilical cord:** The cord must be inspected afterwards for bleeding which commonly occurs due to shrinkage of cord and loosening of ligature. No dressing should be applied and the cord should be kept open and dry.
- **Care of the eyes:** Eyes should be cleaned at birth and once every day using sterile cotton swabs soaked in sterile water or normal saline. Each eye should
be cleaned using a separate swab. Application of ‘kajal’ in the eyes must be avoided to prevent infection or lead poisoning.

- **General care:** The newborn baby should be kept with the mother for continuous mothering in hospital (Bedding-in) or in home (Rooming-in) in a well-ventilated room. Baby should be handle with gentle approach after proper hand washing. No infected person should take care or touch the baby. General cleanliness to be maintained and surroundings to be kept clean.

**2.1.4 Monitoring physiologic data:**

Most neonates under intensive observation are placed in a controlled thermal environment and monitored for heart rate, respiratory activity, and temperature. The monitoring devices are equipped with an alarm system that indicates when the vital signs are above or below preset limits. However, it is essential to check the apical heart rate and compare it with the monitoring reading. It's important to follow the manufacturer's directions for care and handling of electrodes to avoid malfunction or burns to sensitive skin.

Blood pressure is monitored routinely in the sick neonate by either internal or external means. The umbilical venous catheter may also be used to monitor the neonate's central venous pressure. (Gerald B, Sandra L, 2010).

**2.1.5 Problems with respirations:**

Respiration of preterm neonates are rapid, shallow irregular with periods of apnea and cyanosis. Breathing is mostly diaphragmatic, periodic and associated with intercostals recessions due to soft ribs. Problems of the respiratory system are a major concern because preterm newborns have immature lungs. The presence of surfactant inadequate amount. Surfactant reduces surface tension in the alveoli and prevents their collapse with expiration. It allows the lungs to be inflated with lower negative pressure, decreasing the work of breathing infants born before surfactant production is adequate develop respiratory distress syndrome (RDS). In addition, preterm infants have a poorly developed cough reflex and narrow respiratory passages, which increase the risk of respiratory problems (Parul D, 2009).

**2.1.5.1 Assessment:**

The infant's respiratory status must be observed constantly. The lungs are assessed for breath sound or areas of absent breath sounds. The Silverman - Andersen index (Appendix 5) is a useful tool for evaluating the degree of respiratory distress and used to score the infant's degree of respiratory difficulty. The score for individual criteria
matches the grade, with a total possible score of 10 indicating severe distress. Gynosis also occurs with apenic episodes. They are common in preterm infants increasing in incidence with lower gestational age. Apnea without an identified cause in a preterm infant is called apnea of prematurity and generally improves as the infant matures. The infant may require gentle stimulation, bag – and – mask ventilation, or medications. The nurse observes the effort required for breathing and the location and severity of retraction which is noticeable in a preterm infant, whose weak chest wall is drawn in with each inspiration. Grunting may be an early sign of RDS. It closes the glottis and increase the pressure within the alveoli, keeping the alveoli partially open between breaths and increasing the amount of oxygen absorbed. (Emly S. et al., 2009).

2.1.5.2 Nursing intervention:

An oxygen hood is often used for infants who can breath alone, but need extra-oxygen. The infant breathes the higher levels of oxygen within the hood. Oxygen also may be given by nasal cannula to the infant who breathes well alone. After discharge many preterm infants continue to receive oxygen via nasal cannula at home. Oxygen must be humidified to prevent in sensible water loss and drying of the delicate mucous membranes. It is warmed to maintain body temperature. Continuous positive airway pressure (CPAP), the application of 3 to 8 cm H₂O (positive) pressure to the airway, uses the infant's spontaneous respiration to improve oxygenation by helping prevent alveolar collapse and increasing diffusion time. It can be delivered via nasal prongs or an endotracheal tube. The infant may need conventional mechanical ventilation, or high – frequency ventilation may be used to provide very fast, frequent respiration with less pressure and volume. This helps decrease injury to the tissue from pressure (barao trauma) and volume (volutrauma) (Hockenbury, 2007). When oxygen is administered, the level of oxygen in the infant's blood must be monitored. Arterial blood may be drawn for testing oxygen levels. Pulse oximetry or transcutaneous monitoring may also be used, they are less invasive and provide continuous information about oxygen partial pressure (Po₂) level through sensors attached to the skin.(Marilyn J & David W, 2011).

2.1.5.3 Positioning the infant:

The side-lying and prone positions facilitate drainage of respiratory secretions and regurgitated feedings. The prone position is not recommended for normal newborn infants because it is associated with an increased incidence of sudden infant death syndrome (SIDS). In preterm infant, however, the prone position increases
oxygenation and enhances respiratory control, improve lung mechanics and volume and reduces energy expenditure. Supine positioning for sleep is begun when the infant can tolerate it and before discharge so the infant can become accustomed to sleeping on the back before going home. Frequent position changes help air passages drain and prevent stasis of secretions. Infants should be repositioned every 2 to 3 hours when other care is given to help dependent areas of the lungs drain into the main bronchi.(Adele P, 2010).

2.1.5.4 Suctioning secretions:

The nurse checks equipment at the beginning of each shift to ensure that it available and functioning properly at all times. Suction should be gentle to avoid traumatizing the delicate mucous membranes. Suctioning also provides an entry for organisms and decreases oxygenation during procedure. The procedure may cause changes in heart rate, blood pressure, and cerebral blood flow. Suction should be applied for only 5 - 10 seconds at a time and increased oxygen should be provided before and after each suction attempt. The mouth is suctioned before the nose because stimulation of the nares causes reflex inspiration that could cause aspiration of fluids in the infants mouth. Rest period should be provided after suctioning (Adele P, 2010).

2.1.6 Problems with thermoregulation:

Although heat loss can be a problem for full-term infants, it is even more significant for preterm infants. They have thin skin with blood vessels near the surface and little subcutaneous (white) fat for insulation. Preterm infants' body surface area in proportion to their body mass is five times that of adults. Their extended extremities increase exposure to the air for heat loss. The temperature control center of the brain is less mature and may be further impaired by asphyxia. These conditions all contribute to heat loss. Complications of heat loss are more likely in the preterm infant than in the full-term infant. They include hypoglycemia, metabolic acidosis, pulmonary vasoconstriction, and impaired surfactant production.(Wong D, et al., 2009).

2.1.6.1 Assessment:

The infant's temperature is monitored continuously by skin probe, which is attached to the heat control mechanism of the radiant warmer or incubator. The abdominal skin temperature is usually maintained at 36° to 36.5°C. The infant's temperature as shown on the monitor should be recorded every 30 – 60 minutes in unstable infant and every 1-3 hours when the infant is stale. The nurse should assess the axillary temperature every 4 to 8 hours and compare it with the heat control reading to ensure that the
machinery is functioning properly. The axillary temperature for a preterm infant should remain between 36.3 & 36.9°C.

Indications of inadequate thermoregulation include:

- Poor feeding or intolerance to feedings.
- Lethargy.
- Irritability
- Poor muscle tone.
- Cool skin temperature.
- Skin pale, mottled or acrocyanotic
- Signs of hypoglycemia.
- Signs of respiratory difficulty
- Poor weight gain. (Knobel, R & Holditch D, 2011)

2.1.6.2 Nursing interventions:

- To avoid conduction of heat away from the body, warm objects that come into contact with the infant.
- Pad cool surfaces such as weighing scales before placing infants on them.
- Warm stethoscopes and clothing before using them.
- Before touching the infant run warm water over your hand if they are cold.
- To prevent heat loss by radiation in cold weather, position the newborn's crib or incubator away from walls or windows that are part of the outside of the building.
- Avoid areas with drafts such as near hall doors or air conditioners.
- Keep traffic low around radiant warmers, because movement increases air currents.
- When assessing or caring for newborns avoid exposing more of their bodies than necessary.
- Keep the upper part of the infant covered when changing diapers.
- Warp infants in blankets, and use insulated hat to prevent heat loss from the large surface area of the head.
- The infant should receive only warmed oxygen, because thermal receptors in the face are very sensitive to cold. (Knobel, R & Holditch D, 2011)

2.1.7. Problems with fluid and electrolyte balance.

Preterm infants lose fluid very easily. The rapid respiratory rate and the use of oxygen increase fluid loss from the lungs. Their thin skin has little protective
subcutaneous white fat and is more permeable than the skin of term infants keratin, which helps maintain water in the skin, is not developed until 2 to 3 weeks after birth for infants born before 30 weeks of gestation. The large surface area, in proportion to body weight, and lack of flexion further increase insensible water losses. Radiant warmers heighten insensible water losses by 40% to 50% compared with water loss in an incubator. Heat from phototherapy lights causes more fluid loss through the skin. Development of kidney is not complete until approximately 35 weeks of gestation.

The fluid needs of preterm infants range from 60 – 80 mL/kg/day on first day of life and 90 to 140 mL/kg/day on the second and third days of life with more needed by extremely low – birth – weight infants Normal urinary output is 2 to 5 mL/kg/hr. The kidney regulation of electrolytes also is a problem - preterm infants need higher intakes of sodium because the kidneys do not reabsorb it well. (Emily S. et al., 2009)

2.1.7.1 Assessment:
Monitoring intake and output of fluids is important in determining fluid balance. Parenteral, feeding tube, and oral fluids are included when measuring intake. Output from regurgitation, stools, drainage tubes, and urine should be measured. The nurse must also keep track of the amount of blood taken for laboratory tests because the loss can be substantial. (Blake and Murriay, 2010)

2.1.7.2 Urinary output:
There are several methods of measuring urinary output. Plastic bags that adhere to the perineum are not suitable for the preterm infant because they may damage the fragile skin. Weighing diapers is less invasive to the infant. The weight of dry diapers is subtracted from the weight of wet diapers to determine the amount of urine excreted: 1g is equivalent to 1ml of urine. Specific gravity should be checked to determine if the urine is more concentrated or dilute than expected. Urine is collected by placing cotton balls at the perineum. The specific gravity should range between 1.001 & 1.020. (Swinford R, et al; 2006).

2.1.7.3 Weight:
Changes in infant's weight can give an indication of fluid gain or loss, especially if the changes are sudden and greater than would be expected. The undressed infant should be weighed at the same time each day with the same scale. They may be weighed twice a day to monitor their fluid status more closely. (Swinford R, et al; 2006).
2.1.7.4 Signs of dehydration or overhydration:
The nurse should observe for signs that indicate that the infant has received too little or too much fluid. Early signs of dehydration include:
- Decreased urine output (less than 2ml/kg/hr)
- Increased specific gravity
- Weight losses may exceed that expected for the infant’s age and general condition.
- Dry skin or mucous membranes
- Sunken anterior fontanel
- Poor tissue turgor are late signs.
- Elevated blood sodium, protein, and hematocrit levels.

Signs of overhydration include:
- Increased output of urine (more than 5ml/kg/hr)
- Below normal specific gravity.
- Edema and weight gain.
- Bulging fontanels
- Moist breath sound.
- Decreased blood sodium, protein & hematocrit levels. (Emily S, et al.; 2009).

2.1.7.5 Nursing interventions:
The nurse must gratefully regulate intravenous (IV) fluids using infusion control devices to help prevent fluid volume overload.
IV medications should be diluted in as little fluids as is consistent and should be included when measuring intake.
IV sites should be assessed at least every hour for signs of infiltration.
Central venous catheter and umbilical lines must be assessed for infection or position changes. (Emily S, et al., 2009).

2.1.8 Problems with the skin:
Preterm infants have fragile, permeable, easily damaged skin. Increased skin permeability is a major concern that allows the infant to absorb topical medication, chemical preparations and lotions through their skin, thus placing the infant at risk for toxicity and infections. This increase in skin permeability places the infant at risk for insensible water loss and temperature instability. The premature infant skin does not mature for 2 – 3 weeks. The nurse should frequently assess the condition of the
infant's skin and record any changes. The infant's response to products used for cleansing and disinfection should be noted. (Rashmi G, 2010).

2.1.8.1 Nursing interventions:
Guidelines for evidence – based practice in caring for the newborn's skin have been developed and endorsed by AWHONN (2007).
- Standard adhesive tape can be very damaging to the skin, especially during removal so, it should be used as little as possible.
- Backing tape with cotton, waiting more than 24 hours to remove it, and using gauze warps instead of tape decrease skin damage.
- Pectin or hydrocolloid barriers, semipermeable dressing, hydrogel or silicone – based adhesive products may be used to attach devices yet be less disruptive to skin surface (AWHONN, 2007).

Hydrogel and hydrocolloid sheet dressings help healing if skin breakdown or wounds occur. These substances prevent further tissue damage, reduce epidermal water loss, and help healing. All disinfectants have potential risks when used on neonates. Chlorhexidine gluconate solutions are commonly used at this time. Povidone – iodine may injure the skin and may have toxic effects on the thyroid in premature infants. All disinfectants should be removed with sterile water or saline after procedures are completed. Alcohol should not be used (AWHONN, 2007).
- Use transparent adhesive dressings to secure IVs, catheters and central lines.
- Do not use adhesive remover, solvents, and bonding agents.
- Remove adhesives or skin barriers slowly, supporting the skin underneath with one hand and gently peeling away the product from the skin with the other hand.
- Infants and their equipments should be positioned to avoid undue pressure on the skin.
- Frequent position changes are important but should be based on the infant's ability to tolerate changes (Emily S. et al., 2009).

2.1.8.2 Bathing:
- Assess for stable temperature a minimum of 2 – 4 hours before first bath.
- Use cleansing agents with neutral PH or minimum dyes or perfume, in water
- Do not completely remove vernix caseosa.
- Warm water without soap should be used for infants less than 32 weeks of gestational age for the 1st week after birth. Sterile water is not necessary unless
there are concerns about the safety of tap water or there is a break in skin integrity.

- Decrease frequency of baths to every second or third day by daily cleansing of eye, oral and diaper areas, and pressure points.
- Use cleanser or soaps no more than two or three times a week.
- Avoid rubbing skin during bathing or drying. (Marilyn J & David W, 2011).
- Stable preterm infants without umbilical IV lines may be immersed in water that covers the shoulders for bathing if there is no contraindications.
- Emollients can help reduce fissure in dry skin and transepidermal water loss. They are safe to use under radiant warmers and during phototherapy (AWHONN, 2007).

2.1.9 Problems with infection:

The incidence of infection in preterm infants is 3 – 10 times greater than in full – term newborns. Factors contributing to the high rate of infection include exposure to maternal infection, lack of transfer of immunoglobulin G (IgG) from the mother during the third trimester, and immature immune response to infection (Stoll, 2007).

- It is the policy of the Neonatal Care Units that appropriate infection control measures are utilized to reduce the risk of infection in patients, staff and visitors. There should be a hospital program for control of infections. Prior to employment all nursing personnel hired for the Neonatal Care Units will complete a pre-placement physical by hospital health service. Any staff member with a known contagious illness is not permitted into the Neonatal Care Unit. Appropriate personnel protective equipments, gown, gloves, masks, protective eye wear (goggles) is available in all patient care areas. (Rashmy G, 2010).

2.1.9.1 Hand washing:

1- Before first entry into the nursery in any 24 – hour period, a full surgical scrub up to the elbows for a minimum of 2 – 3 minutes must be performed with appropriate antimicrobial scrub.

2- Hands must be washed between each infant contact (15 – 20 seconds).

3- All jewellery must be removed prior to hand washing (Rashmy G, 2010).
2.1.9.2 Visitors:
The same absolute criteria for exclusion from the nursery for illness apply to family and visitors as to staff. The medical staff will be responsible for determining those to be excluded. Periodic epidemiologic studies (at least quarterly or monthly) are carried out in the NICU to evaluate the incidence and types of nosocomial infections and the number and types of bacteria colonized from indwelling lines (Catheters) and blood, endotracheal (ET) tube secretions, and cerebrospinal fluid cultures. (Marilyn J, David W, 2011).

2.1.9.3 Nursing intervention:
- Scrupulous cleanliness and maintaining the infant's skin integrity.
- Even the normal flora on the hands of caretakers may cause sepsis, therefore parents and staff members should thoroughly wash their hands and arms before handling infants.
- Exposure to family or staff member who have contagious diseases should be prevented.
- Early signs of infections should be identified and reported.
- The nurse carefully notes the infant's response to treatment because some organisms become resistant to antibiotics. (Emily S. et al., 2009).

2.1.10 Problems with pain:
Infants in the NICU undergo many painful procedures each day. It's now recognized preterm infants do feel pain and pain stimuli cause physiologic and behavioral changes in infants. Pain can have numerous untoward effects. For example, increases in intracranial pressure resulting from pain may elevate the risk for intraventricular hemorrhage. Other risks include hypoxia, changes in metabolic rate, and adverse effects on growth and wound healing (Blackburn, 2007). Infants repeatedly exposed to pain may respond to touch or other non-painful stimuli as if they were in pain. The long term effects of pain in the neonate are not yet fully understood (Gardner, Hagedon & Dickey, 2007).

The American Academy of Pediatrics and the American College of Obstetricians (AAP & ACOG, 2007) recommended that pain be routinely assessed, painful procedures be minimized, and non pharmacologic and pharmacologic interventions be used to prevent, reduce, or eliminate pain in neonate (Emily S. et al., 2009).
Several studies have documented the effectiveness of non pharmacologic analgesia such as containment, positioning, during painful procedures (Marilyn J & David W, 2011).

2-1-10-1 Assessment:

Pain assessment is the fifth vital sign - assessment for pain should be included in every vital sign assessment. In addition, the nurse must assess the infant's response to painful stimuli and to pharmacologic and non pharmacologic interventions. The premature infant pain profile (PIPP) is designed for use with term or preterm infants. The tool assesses gestational age and behavior states, heart, oxygen saturation, brow bulge, eye squeeze, and nasolabial furrow (Lines from the edge of the nose to beyond the corner of the mouth), to assign a pain score. Physiologic responses to pain include changes in heart rate and respirations, increased blood pressure, and decreased oxygen saturation. However, physiologic changes may be unpredictable and cannot be used alone to assess pain. Behavioral changes include high-pitched, intense, harsh crying. Infants who are intubated or too weak to cry have "cry face," a facial expression of crying without the sound of a cry. Less than half of preterm infants experiencing painful stimuli respond with crying (Gardner et al., 2006).

2-1-10-2 Nursing interventions:

Nurses should prepare infants for potentially painful procedures by waking them slowly and gently and using containment. It involves keeping the extremities in a flexed position near the body by swaddling, nesting or positioning devices, or the nurse's hand. Kangaroo care also is used to reduce pain. The infant should be allowed to rest before and after procedures. Comfort measures help the infant cope with short – term, mild pain and reduce agitation. They include using a pacifier (Non nutritive sucking) attenuates behavioral, physiologic, and hormonal responses to pain from procedures, such as heel puncture, venipuncture, and immunization injections. The administration of concentrated sucrose with and without non nutritive sucking has been demonstrated to have calming and pain relieving effects for invasive procedures in neonates. Infants who spent 1 to 3 hours in Kangaroo care should increased frequency in quiet sleep, longer duration of quiet sleep, and decreased crying in NICU, and they cried less at the age of 6 months when compared with neonates who did not receive skin – to – skin contact. Significant differences were found in pain responses during heel lancing between infants who were kangaroo held and those who were not.
In another study, infant responses to pain during heel lance procedures were compared using kangaroo holding, with the neonate held upright at 60-degree angle between the mother's breast for maximal skin- to skin contact. A blanket was placed over the neonate's back, and the mother's clothes were warped around the neonate for 30 minutes before the lancing procedure, during, and at least 30 minutes after the heel stick. Another group remained in the isobette in a prone position, swaddled with a blanket and the heel accessible, for 30 minutes before the heel lancing procedure. Pain scores were significantly lower in kangaroo-held infant (Marilyn J., David W., 2007). The nurse should discuss the infant's pain with the primary care provider to ensure that medications are available for long - term and more severe pain. Opioids are needed for moderate to severe pain, such as fentanyl which can be tolerated by preterm infants (Emily S. et al., 2009).

Sedatives are effective for agitation but do not treat pain. Regional or general anesthesia is used during surgery. Topical anesthetics maybe effective for some procedures. The nurse gives ordered medication before painful procedures and when the infant demonstrates signs of pain. The family is involved in identifying pain, developing a pain management plan and determining its effectiveness. Documentation of pain assessment, management plan and response occurs in the medical record. (Rashmi G, 2006).

2.1.11 Nutrition:
Preterm infants are born before they are able to accumulate stores of nutrients and their digestive system is immature. Full term newborns have reservoirs of calcium, iron, and other nutrients but these are lacking in preterm infants. Fat stores are minimal or absent, and glucose reserves are used up soon after birth. Nutrition problems can arise with a preterm infant because the infant's body is attempting to continue to maintain the rapid rate of intrauterine growth. Because of this, a preterm newborn requires a larger amount of nutrients than the mature infant. If these nutrients are not supplied, an infant can develop hypocalcemia (decreased serum calcium) or a zotemia (low protein level in blood). Delayed feeding and a resultant decrease in intestinal motility may also add to hyperbilirubinemia, a problem an infant already is at high risk of developing when fetal red blood cells begin to be destroyed.

Digestion and absorption of nutrients in a preterm infant's stomach and intestine may be immature. Nutrition problems are further compounded by a preterm infant's immature reflexes, which make swallowing and sucking difficult. Increased activity
that occurs from ineffective sucking may increase the metabolic rate and oxygen requirements. In addition the preterm infant's stomach capacity is small, possibly limiting adequate intake. If a small stomach is distended from a full feeding, this puts pressure on the diaphragm and can lead to respiratory distress. An immature cardiac sphincter (between the stomach and esophagus) allows regurgitation to occur readily. The lack of cough reflex may lead an infant to aspirate regurgitated formula (Adele P, 2010).

2.1.11.1 Nutritional needs:
The American Academy of Pediatrics, Committee on Nutrition (2007), recommends an energy intake of 105 to 130 kcal/kg/day (taken enterally) for most preterm infants to achieve a satisfactory growth rate. It is estimated that for a daily weight gain of 15g/kg, acaloric expenditure of 45 to 67 kcal/kg above the maintenance expenditure of 50 kcal/kg would be require (American Academy of Pediatrics, 2007). The amount and method of feeding are determined by the infant's size and condition. Nutrition can be provided by either the parenteral or enteral route or by a combination of the two. Infants who are ELBW, VLBW, or critically ill have historically been fed exclusively by the parenteral route because of their inability to digest and absorb enteral nutrition (Marilyn J & David W, 2011).

2.1.11.2 Feeding tolerance:
Assess how well the infant tolerates feedings, whether by gavage or nipple. Aspirate the stomach contents to measure the residual of feeding in the stomach before intermittent gavage feedings or every 2 to 4 hours for continuous feedings. If the residual measures more than half the previous feeding or more than 2 to 4 ml/kg or a 1 – hour volume for continuous feedings, report it to the physician. Excessive residuals may indicate that the amount, the type, or formula flow rate needs changing or that complications such as necrotizing enteroocolitis (NEC) are occurring. Unless they are bloody, have large amounts of mucous, or are other wise abnormal, gastric residuals are often replaced to prevent loss of electrolytes. The next feeding may be reduced by the amount of the residual. If residuals are not replaced, observe for signs of electrolyte imbalance. Vomiting or frequent regurgitation may indicate that the feedings are too large. Vomitus or residuals containing bile may be a sign of intestinal obstruction. Obtain objective data about abdominal distension by using a tape to measure abdominal girth at the level of the umbilicus every 4 – 8 hours. Report signs of feeding intolerance to the physician or nurse practitioner because may be early
indications of complications such as sepsis, obstruction of gastrointestinal tract or NEC (Raab, 2011)

2.11.3 Readiness for nipple feeding:
During gavage feedings, watch for signs that nipple feeding may soon be possible. These include rooting, respiratory rate below 60, and increasing ability to tolerate holding and handling. Although sucking on the gavage tube, a finger, or a pacifier may be a sign of readiness, it is not enough. Infants must also have an intact gag reflex or they are more likely to aspirate feedings. Note whether the infant gags on the tube or a gloved finger inserted into the mouth. When the infant begins to feed by nipple, assess coordination of suck, swallow, and breathing and observe for aspiration. Assess the respiratory rate before and during feedings. When the respiratory rate is more than 60 breaths per minute before feedings, gavage feed to prevent aspiration. Observe for signs that the effort of nipple feeding requires too much energy and oxygen for the infant (Conti, 2012).

2.11.4 Administering parenteral feedings:
The nurse manages the administration of parenteral nutrition, which may be necessary for very immature infants because of respiratory problems, limited gastric capacity, surgery, or reduced preistalsis. Paranteral nutrition is the IV infusion of solutions containing the major nutrients needed for metabolism and growth. It provides carlories, amino acids, fatty acids, vitamins and minerals. It is continued, in decreasing amounts, until the infant is able to tolerate full enteral feedings (Emily S. et al., 2009).

2.11.5 Administering enteral feeding:
Enteral feedings (feeding into the gastrointestinal tract, orally or by feeding tube) are usually begun with the first few days with minimal enteral feedings (MEFs) (also called trophic feedings) in which a few milliliters of feeding are given at a time. It promote maturation of the intestinal tract and gastric hormone and enzyme production. Human milk is preferred if it is available. Feedings are gradually increased according to the infant's tolerance. Pre term infants may need 24 Kcal/OZ (instead of 20 Kcal/OZ used for the full – term infant) to meet their requirements. (Anderson et al., 2010).
2.1.11.6 Administering Gavage Feedings

Gavage feedings is a safe means of meeting the nutritional requirements of infants who are not yet ready to feed orally. These infants are usually too weak to suck effectively, are unable to coordinate swallowing, or lack a gag reflex. A gag reflex is not intact until 32 weeks' gestation. Although a sucking reflex is present earlier, the ability to coordinate sucking and swallowing is inconsistent until approximately 34 weeks' gestation (Adele P, 2010).

A small, soft catheter is inserted through the mouth or nose (A size 3, 5, 6 or 8 French feeding tube is usually used to instill the feeding) each feeding for intermittent (bolus) feeding every 2 to 3 hours. For some infants, indwelling catheter is used to provide intermittent or continuous feedings. Pediatric Nursing staff (2007). Intermittent bolus feedings provide a more normal feeding pattern with periodic stimulation of gastric hormones and enzymes. Continuous feedings may be better for infants with severe respiratory problems, gastroesophageal reflux, short bowel syndrome, congenital heart disease, or intolerance to bolus feeding or those recovering from (NEC) however, continuous feedings have a higher risk of aspiration because the infant is not attended at all times during the feeding. In addition, bacteria counts in the milk or formula may become too high, and fats tend to adhere to the tubing during continuous feeding. If fortifiers are added to the milk, it should be shaken regularly to ensure delivery of sedimented minerals. Offering a pacifier during gavage feeding can help strengthen the sucking reflex, better prepare an infant for bottle feeding or breast feeding and provide oral satisfaction (King, 2009).

2.1.11.7 Administering oral feeding

The ability to feed orally and gaining weight are important milestones. Most infants are ready for oral feedings when the infant reaches what would be 34 to 35 weeks of gestation and some are ready by 30 to 34 weeks (Anderson et al., 2006). Infants must have a functional gag reflex and the ability to coordinate sucking and swallowing with breathing. (Emily S., 2009). Vigorous infants can be fed orally with little difficulty, whereas compromised preterm infants will require alternative methods. The amount to be fed is determined largely by the infant's weight gain and tolerance of previous feeding and increased by small increments until a satisfactory caloric intake is ensured (Marilyn J & David W, 2011).

The first nipple feedings may be only a few milliliters once a day, completed by gavage. Placing the gavage tube before beginning oral feeding helps prevent
regurgitation stimulated by passing the catheter. Gradually increase the amount and frequency of oral feeding until the infant feeds by breasts or bottle once every 8 hours, then every second or third feeding, and eventually every feeding (Greer, 2011).

2.1.11.8 Preparing for feeding:
Provide for heat maintenance during feedings. When infants have stable temperature maintenance wrap them in warm blankets and hold for feedings. Nipple feedings involve a greater expenditure of energy by the infant than gavage feedings. Provide a period of rest before and after feeding. Use a pacifier before feedings to help bring the infant to an alert state to improve feeding success. Infants maybe fed on a schedule or when they begin to show hunger cues such as rooting and sucking on fingers. They should not be allowed to cry excessively or they will be too tired to eat (MC, Grath, 2011).

Nursing interventions for bottle feeding the preterm infant:
1- Use a feeding container (eg, a volutrol) an which each milliliter is marked. Place container in warm water to heat milk to room temperature or slightly warmer. Do not use a microwave oven to warm.
2- Determine the type of nipple that work best for the infant, choose a nipple with a flow that prevents him from receiving too much or too little milk at a time.
3- Feed him in the incubator or under the warmer if needed. Use a quiet area and avoid distractions or interruptions during feeding.
4- Position him at a 45 to 60 degree angle, support the head and neck in a neutral position. Swaddle the infant with the body flexed and the hands towards the midline.
5- If necessary place a finger on each check and one under the jaw at the base of the tongue midway between the chin and the neck.
6- Feed slowly, and allow the infant to rest when he stops sucking, remove the nipple from the mouth if he has long sucking bursts with out pausing to breath.
7- Do not move the nipple around in his mouth to force the infant to resume feeding.
8- Observe for coughing, gagging, cyanosis, apnea and changes in heart rate, respirations, or oxygen saturation. Stop feeding, and allow the infant to recover. Evaluate the infant's ability to continue. Provide or increase oxygen if needed.
9- Assess for signs of over fatigue: falling a sleep during feedings, feeding lasting more than 20 to 30 minutes, increased respiration, decreased oxygen saturation.
10- Finish feeding by gavage if necessary
11- After feeding, position the infant on the right side or prone with his head elevated approximately 30 degrees.
12- Involve parents as soon as possible in giving feedings. Teach them to assess feeding cues and the infant's response to feedings. (Emily S, et al., 2009).

2.1.11.9 Facilitating Breastfeeding:
Studies indicate that even small preterm infants are able to breastfeed if they have adequate sucking and swallowing reflexes and no other contraindication, such as respiratory complications or concurrent illness. Mothers who wish to breast-feed their preterm infants are encouraged to pump their breasts until their infants are sufficiently stable to tolerate breast feeding (Marilyn J & David W. 2011).
Explain that the immunologic benefits of breast milk are particularly important to preterm infant who did not receive passive immunity during fetal life. Nutrients in breast milk are more easily digested and it provide antimicrobial components, enzymes, hormones, and growth factors important for the preterm infant. Breast milk may stimulate immune system and gastrointestinal maturation. It is well tolerated and nutrients are more available than those in cow's-milk formulas. Infants fed human milk have fewer infections and a decreased incidence of NEC. In addition breast feeding may be less stressful than bottle feeding for preterm infants (King and Jones, 2009).
Oxygenation levels are often higher during breastfeeding because the infant can regulate breathing and sucking better than with bottle feeding. Mothers who plan to breast feed need help in maintaining lactation until the infant is mature enough to nurse. Help her begin to use a breast pump within the first 12 hours after birth if possible and instruct her to pump about eight times daily. Give her sterile containers to store her milk. Show her how to label her milk and where to take it when she brings it to the NICU (Emily S., et al., 2009).
Expressed milk can be frozen for six months for safe transport and storage. The sodium content of breast milk in a mother whose infant has been born preterm is higher than that of milk in a mother whose infant has been born at term. Therefore, it is better for infants to receive their own mother's breast milk rather than banked (Adele P, 2010).
When the mother goes home, tell her to place the milk in a refrigerator if the infant will receive it within 24 hours or in a freezer if it will be more than 24 hours before it
is fed to the infant. If fortifiers will be added to the milk, explain the higher needs of the preterm infant so the mother does not think something is wrong with her milk (Emily S. et al., 2009).

Ongoing support for breast feeding mothers is important. Encourage her efforts to breastfeed, which may be difficult at first. Provide as much privacy as possible, using a separate room or screens. Help the mother feed comfortable holding the tiny infant and any attached equipment, such as monitor leads. The presence of a lactation consultant during initial breastfeeding sessions is very helpful. A supplemental nursing system, a device that holds expressed breast milk in a bag with a small tube attached to the mother's nipple, may be used to help infants receive more milk with less effort during early feedings. Make the same observations of the infant during breast feeding as during bottle feeding. Signs of fatigue, bradycardia, tachypnea, or apnea may show lack of readiness for breast feeding. Be sure that the infant stays warm. The mother's body heat will help maintain the infant's temperature during feeding. Kangaroo care can often be combined with breast feeding (King, 2009).

2.1.12 Making Ongoing Assessments
continually assess the infant's responses to all feeding methods. Watch for signs of distress, especially when feedings are first initiated. Record the amount of breast milk or formula the infant takes by gavage or bottle and compare it with the amount needed to meet nutrient needs for the infant's age and weight. Infants may be weighed on an electronic scale before and after breastfeeding to determine intake. Weigh the infant daily at the same time with the same scale. Record the length and head circumference each week. Observe changes in the infant's ability to take feedings. As the infant becomes more mature, less energy should be expended during the feeding sessions. The infant will take the feedings more quickly and show fewer signs of fatigue, such as falling asleep during feedings. (Emily S, 2009).

2.1.13 Supporting Parents During Early Visits to the NICU:
Take the mother to the NICU as soon as she is able. If she is too sick to be with her infant, give her photographs. Prepare parents before the first visit. Describe the equipment and its purposes, the various attachments to the infant and the sounds of alarms. Explain how the infant will look and behave. At first, stay with the parents during visits. When they are comfortable, allow them time alone with the infant so that they can interact in private. Answer questions and explain changes in the infant's
condition and treatment. Help parents perform thorough hand washing while explaining the importance. Introduce them to the infant's nurse. Give parents written information about the NICU so that they can take it home to read later. Provide an opportunity for the parents to express their concerns and feelings and to ask questions. Parents should touch the infant as soon as possible because touching helps promote attachment. Show them how to touch in a ways appropriate for the infant, such as holding the infant's hand through the portholes of the incubator. Explain that handling is kept to a minimum because it is stressful to physiologically unstable infants. Help the parents to hold the baby as soon as possible, is particularly important to parents who may interpret it as a very positive sign of the infant's condition. (Melnyk, Feinsten, Alpert-Gillis, et al., 2006).

2.1.14 Instituting Kangaroo Care:

2.1.14.1 Definition:

Kangaroo mother care (KMC) is special way of caring low birth weight (LBW) infants by Skin – to – skin contact. It promotes their health and welling by effective thermal control, breast feeding and bonding. KMC is initiated in hospital and continued at home (Parul D, 2009).

2.1.14.2 Component of KMC:

The two components of KMC are:-

1- Skink – to – skin contact: Direct continuous and prolonged skin – to –skin contact is provided between the mother and her baby to promote thermal control.

2- Exclusive breast feeding: skin – to – skin contact promotes lactation and feeding interaction for adequate nutrition and to improve desired weight gain (Parul D, 2009).

2.1.14.3 Benefits of KMC:

1- Helps in thermal control and metabolism.

2- KMC results in increased duration and rate of breast feeding.

3- KMC satisfies all five senses of the infants. Baby feels warmth of his mother (touch), listen to mothers voice and heart beats (hearing); sucks the breast to feed (taste), smells the mothers odor (olfaction). And makes eye contact with mothers (vision).

4- During KMC the baby has more regular breathing.

5- KMC protects against nosocomial infection and reduces incidence of severe illness including pneumonia during infancy.
6- Daily weight gain is slightly better with KMC & the discharge of hospital could be earlier than conventional care.

7- KMC facilitate better mother – infant bondage.

8- KMC is one of the best methods of transporting small babies.

9- Mother feels increased confidence, self – steam, sense of fulfillment and deep satisfaction. Father feels more relaxed, comfortable and better bonded (Appendix 4).

10- KMC does not require additional staff compared to incubator care. (Adele P, 2010).

2.1.14 Preparation for KMC:

Counseling:
- Explain the benefits of KMC to mother and her family.
- Demonstrate the procedure to the mother gently with patience.
- Answer the questions as asked by the mother and family members.
- Allow the mother to interact with some one who have already practicing KMC for her baby.
- Discuss about the procedure to the mother in – law, husband or any other members of the family (Parul D, 2009).

2.1.14.5 Mother’s clothing:
Mother should wear front – open, light dress.

2.1.14.6 Babies clothing:
The infant wearing only a diaper and hat, a blanket is placed over him. (Parul D, 2009)

2.1.14.7 KMC procedure:
Kangaroo positioning:
- The baby should be placed between the mother’s breasts in an upright position.
- Baby’s head should be turned to one side and in slightly extended position which helps to keep the air way, open and allow eye to eye contact between mother and baby.
- Baby’s hip should be flexed and abducted in a frog like position. The arms should also be flexed and placed on mother’s chest.
- Baby’s abdomen should be placed at the level of mother’s epigastrium (Rashmi G, 2010).

2.1.14.8 Time of initiation of KMC:
- KMC should be initiated gradually with smooth transition from conventional care to continuous KMC.
- KMC can be started as soon as the baby is stable in neonatal care unit.
- Short KMC sessions can be initiated during recovery with ongoing medical treatment, i.e., I.V fluid, O2 therapy, etc.
- KMC can be provided while the baby is with gavage feeding (Parul D, 2009).

2.1.14.9 Duration of KMC:
- Duration of KMC should not be less than one hour to avoid frequent handing of the baby.
- Gradually the length of sessions should be increased up to 24 hours a day. Interruption only can be done for changing of diapers.
- KMC should be continued in postnatal ward and home.
- When mother is not available then other family members such as father, grand mother can provide KMC (Parul D, 2009).

2.1.14.10 Discontinuation of KMC:
- KMC can be continued until the baby gains weight around 2500 gm or reached 40 weeks of post-conception age.
- KMC can be discontinued if the baby start wriggling to show discomfort or pulls limbs out and cries.
- Mother can provide KC after the baby bath and during cold night. (Parul D, 2009).

2.1.15 The Incubator:
Incubators are apparatus for maintaining optimal conditions of high risk preterm neonates. It is essential to provide an ideal micro environment. The main function of incubators are isolation, maintenance of thermoneutral ambient temperature, desired humidity and administration of oxygen. It is desirable to nurse extremely low birth weight, stable babies (less than 1000 gm) in the incubator. There should be easy access to the baby for all nursing procedures and easier observation of the baby from a distance. It should be easy to clean (Gerald B, Sandra L, 2010).
The incubator may be portable type for transport of sick babies or stationed in the nursery. It can be open box type or closed type. The closed type incubators (Isolite) are used for intensive care and equipped with portholes for access to the infant. The servo-control system is ideal in isollette incubator. Skin sensor is affixed to the abdominal skin midway between umbilicus and xiphisternum and incubator is set for maintenance of desired skin temperature between 36.5° & 37.5°C. Infant nursed under servo-mode should be watched to ensure that skin probe in place. Sterile water to be used in the humidity tank to prevent infection. Expert nursing skills is essential for intensive care of the high risk neonates in the incubator. The incubator should be kept ready to receive the baby at any time. Is placed in a suitable place away from any heat source. Keep the incubator warm for use and decide the desirable temperature according to baby's weight and age. When the baby is placed in the incubator, suitable position to be done and the baby is kept naked for good observation. Sensor probe to be fixed on the abdomen by a tape when the baby - mode incubator is used. It gives the reading of skin temperature. The heater inside the incubator warms the air to help to reach the set temperature of the baby. Provide gentle care and disturb the baby least. Use porthole for clean procedures e.g. feeding, suctioning, injections, etc. and other side for dirty procedures like, changing, cleaning, etc. Use gloves during procedures and special care to be taken to keep the portholes clean. Do not use the same incubator for more than seven days continuously. Routine care of the baby should be provided with precautions of prevention of infection (Parul D., 2009). As infant's condition improve, they can be weaned from an incubator. Dress the infant as if he or she were going to be in a bassinet, then set the incubator about 2°F (1.2°C) below the infant's temperature. After a half – hour, assess whether the infant is able to maintain body temperature. If so, lower the incubator temperature another 2°F and continue until room temperature is reached. If an infant can not maintain adequate temperature as the incubator temperature level is lowered, the infant is not yet ready for room-temperature air, and the weaning process needs to be slowed or stopped until the baby is more mature or better able to self-regulate temperature (Adelle, P, 2010).

Explanation to be given to the parent regarding indications and important of incubator care, condition of the baby and possible outcome. Parents can be involved in baby care, whenever possible for routine activities. When the baby is removed from an isollette or incubator, it is important that infant should be dressed and warped with adequate clothing to conserve heat. A knitted cap should be used to prevent heat loss.
from the head. The parents should be informed about the routine care and warning
signs for problems of the baby. (Emily S. et al., 2009).

2.1.15.1 **Daily care of incubator:**
- **Replenish humidity tank up to the black line with distilled H₂O**
- **Wipe down the inside wall with disinfectant according to hospital policy while changing sheet and having infant on scale.**
- **Wipe the outside wall every 8h with disinfectant.**
- **Wipe the plastic cover mattress with disinfectant.**
- **Change bed sheet daily and whenever needed.**
- **Monitor O₂ flow rate and concentration as prescribed**
- **Check that temperature is between 28 – 32°C.**
- **Check that humidity is between 55 – 65%,**
- **Replace incubator every 7 days. Date of replacement should be indicated clearly on incubator**
- **Wash hands.** (Rashmi G, 2010)

2.1.15.2 **Terminal care of incubator:**
- **Wash hands**
- **Switch electricity off from incubator and the wall socketed.**
- **Invert humidity tank to drain it and dry it well.**
- **Remove all detachable parts.**
- **Wash it with hot soapy water, rinse and dry well**
- **Inspect the mattress cover carefully for signs of tear or loss of impermeability.**
- **Wash mattress with soap and water, dry it well.**
- **Wash the floor of incubator with water and dry it well.**
- **Expose the whole unit to adequate fresh air and sunshine.**
- **Change the air filters according to manufacturer instruction.**
- **If disinfection's required, wipe the inside and outside wall, floor and mattress of the incubator with a dilute hypo chloride solution. But should be rinsed off.**
If the incubator has integral humidifier, (can't be removed) to disinfected it, raise the temperature of water at least 70°C for 10m.
- **If the humidifier is removable, detach it and send it to autoclave** (Rashmi G, 2010)

2.1.16. **Physical Facilities and Staffing of the Neonatal Units**

2.1.16.1 **Resources required for neonatal care:**
- **Thermometers.**
- Baby trays.
- Facilities for cleaning
- Facilities for skin and cord care.
- Baby scales.
- Emergency resuscitation equipments
- Neonatal stethoscope.

2.1.16.2 Nursing staff for nursery:
Nurse-baby ratio is 1 to 6.

2.1.16.3 Intermediate Care Unit:
Nurse/patient ration 1: 4 in each shift.

Equipments:
- Incubators.
- Phototherapy unit.
- Cardio-respiratory monitor
- Pulse oximeter
- Syringe pump.
- Jaundice meter
- Glucocheck.
- Radiant warmer
- Resuscitation kit.
- Oxygen source
- Suction for every incubator
- Ventilator to be used for short-term ventilation.
- Oxygen head boxes
- Baby trays.

2.1.16.4 Intensive Care:

Medical staff:
Registered pediatrician and consultant on call.

Nursing staff:
Specialized nurse for 2 babies:

Equipments:
- Infusion and syringe pump
- One portable incubator.
- Babies trays.
Autoclave for incubator and mops
Minimum 10 incubators
Phototherapy units
Cardio-respiratory monitor for every patient.
Pulse oximeter for every patient
Jaundice meter
Glucocheck.
Radiant warmers/ incubator.
Resuscitation kit.
Oxygen outlet, one compressed air outlet, and one suction for each incubator.
Blood gas analyzer
Minimum 2 CPAP and one ventilator
Non invasive blood pressure machine 1/5 incubator
Pipe system mandatory
8 electric outlets for each incubator
Reserve oxygen cylinder or oxygen concentration and compressor
Availability of portable X-Ray machine
Lab services available for 24 hours including microbiology (Nursing Staff, Alexandria University, 2013).

2.2. Respiratory distress Syndrome:
Respiratory distress syndrome (RDS) of the newborn, also known as a hyaline membrane disease, is a breathing disorder of premature babies. In healthy infants, the alveoli, the small, air-exchanging sacs of the lungs are coated by surfactant, which is a soap-like material produced in the lungs as the fetus matures in preparation for birth. If premature newborns have not yet produced enough surfactant, they are unable to open their lungs fully to breathe. [www.nhibi.gov/health/dici/disease/rds/rds-all.html](http://www.nhibi.gov/health/dici/disease/rds/rds-all.html).

RDS also occurs when there has been asphyxia, cesarean delivery, multiple births, and maternal diabetes because these conditions interfere with surfactant production. It occurs less frequently however, when chronic fetal stress, such as herion addition, maternal hypertension, prolonged rupture of membranes or antenatal corticosteroids cause the lungs to mature more quickly (Dudell & Stoll, 2007).
2.2.1 Pathophysiology:

Preterm infants are born before the lungs are fully prepared to serve an efficient organs for gas exchange. RDS results from a combination of structural and functional immaturity of the lungs. Premature infants are born with numerous underdeveloped and many uninflatable alveoli. In addition the fetal chest wall is highly compliant because of the predominant of cartilage rather than bone; and the diaphragm, the dominant respiratory muscle is prone to fatigue. Functionally, the fetal lungs are deficient in surfactant which is surface-active phospholipid secreted by type II cells in alveolar epithelium. Surfactant is first produced at about 24 weeks gestational age, but the type II cells in the lungs do not fully mature until about 36 weeks of gestation. Acting much like adetergent, this substance reduces the surface tension of fluids that line the alveoli and respiratory passages, resulting in uniform expansion and maintenance of lung expansion at low intra alveolar pressure. Immature development of these functions produces consequences that seriously compromise respiratory efficiency. (Gerald B & Sandra L, 2010).

Deficient surfactant production causes unequal inflation of alveoli on inspiration and the collapse of the alveoli on end expiration. Without surfactant infants are unable to keep their lungs inflated and therefore exert a great deal of effort to re-expand the alveoli with each breath. It has been estimated that each breath requires as much negative pressure (60 to 73 cm H$_2$O) as the initial lung expansion at birth. This inability to maintain lung expansion produces wide spread atelectasis. With deficient surfactant, areas of hypoinflation begin to occur and pulmonary resistance increases. Blood then shunts through the foramen ovale and the ductus arteriosus as it did during fetal life. The lungs are poorly perfused, affecting gas exchange. As a result, the production of surfactant decreases even further. The poor oxygen exchange that results leads to tissue hypoxia, which causes the release of lactic acid. This combined with increasing carbon dioxide level resulting from the formation of the hyaline membrane on the alveolar surface, leads to severe acidosis. Acidosis causes vasoconstriction, and decreased pulmonary perfusion from vasoconstriction further limits surfactant production. With decreased surfactant production, the ability to stop alveoli from collapsing with each expiration becomes impaired. This vicious cycle continues until the oxygen, carbon dioxide exchange in the alveoli is no longer adequate to sustain life without ventilator support (Adele P., 2010).
2.2.2 Clinical Manifestations

Infants with RDS can develop respiratory distress either acutely or over a period of hours depending on the acuity of pulmonary immaturity, associated illness factors, and gestational maturity. In a matter of a few hours, breathing gradually becomes more rapid (> 60 breaths/min). Infants may display retractions which result from a compliant chest wall. Weak chest wall muscles and the highly cartilaginous rib structure produce an abnormally elastic rib cage, resulting in indrawing or retraction of the skin between the ribs. During this early period the infant's colour may remain satisfactory, and auscultation reveal air entry. Within a few hours respiratory distress becomes more obvious. The respiratory rate continues to increase (to 80 to 120 breaths/minute), and breathing becomes more labored. It is significant to note that infants will increase the rate rather than the depth of respiration. There is an audible expiratory grunt which is a useful mechanism observed in earlier stages of RDS. Flaring of the nares is also a sign that accompanies tachypnea, grunting, and retraction in respiratory distress (Marilyn J & David W, 2011).

2.2.3 Diagnostic evaluation:

The diagnosis of RDS is made on the clinical signs of grunting, central cyanosis in room air, tachypnea, nasal flaring, retraction and shock. A chest radiograph will reveal a diffuse pattern of radiopaque areas that look like ground glass (hazziness). Blood gas studies will reveal respiratory acidosis. A B-hemolytic, group B streptococcal infection may mimic RDS, as this infection is so severe in newborns that the insult to the lungs is enough to stop surfactant production. Cultures of blood, cerebrospinal fluid, and skin may be obtained to rule out this condition (Adele P, 2010).

2.2.4 Therapeutic management

The treatment of RDS includes all the general measures required for any premature infant, as well as those instituted to correct imbalances. The supportive measures are:

1) Maintain adequate ventilation and oxygenation.

2) Maintain acid-base balance.

3) Maintain a neutral thermal environment.

4) Maintain adequate tissue perfusion and oxygenation.

5) Prevent hypotension.

6) Maintain adequate hydration and electrolyte status.
Nipple and gavage feedings are avoided in any situation that creates a marked increase in respiratory rate because of the greater hazards of aspiration (Adele, P, 2010).

2.2.5 Surfactant Replacement

The administration of exogenous surfactant to preterm neonates with RDS has become an accepted and common therapy in most neonatal centers worldwide. Exogenous surfactant is derived from a natural source (e.g., porcine or bovine) or from the production of artificial surfactant. Surfactant may be administered at birth as a prophylactic treatment of RDS or later in the course of RDS as a treatment. Studies found improved clinical outcomes and fewer adverse effects when surfactant is administered prophylactically to infants at risk for developing RDS. Surfactant is administered via the ET tube directly into the infant's trachea. Determine proper dose of surfactant (varies with each preparation). Survanta = 4 ml/kg, infasurf = 3 ml/kg. As per physician, use birth weight if not used for prophylaxis. (Rashmi G, 2010). Studies have shown mixed results in comparing one surfactant product with another. One study found fewer complications and earlier improvement with natural surfactant use. The benefits of surfactant replacement therapy include improvements in blood gas values and ventilator settings, decreased incidence of pulmonary air leaks, decreased deaths from RDS, and an overall decreased infant mortality rate. Additional benefits of surfactant replacement therapy include decreased oxygen requirements within hours of administration and an overall decrease in the incidence of pulmonary air leaks (Depra L, Julia F., 2012).

Complications with surfactant administration:

1- Plugging of endotrachedal tube (ETT) by surfactant.
2- Oxygenatin desaturation requiring an increase in oxygen requirements.
3- Bradycardia due to hypoxia
4- Tachycardia due to a gitation with reflux of surfactant into the ETT.
5- Pulmonary hemorrhage.
6- Pulmonary barotrauma. (Rashmi G., 2010).

Nursing responsibilities with surfactant administration include assistance in the delivery of he product, collection and monitoring of arterial blood gases, monitoring of oxygenation, and assessment of the infant's tolerance of the procedure. (Rashmi G., 2010).
2.2.6 Oxygen Therapy

The goals of oxygen therapy are to provide adequate oxygen to the tissues, prevent lactic acid accumulation resulting from hypoxia, and at the same time, avoid the potentially negative effects of oxygen toxicity. Numerous methods have been devised to improve oxygenation. All require that the gas be warmed and humidified before entering the respiratory tract. If the infant does not require ventilatory assistance, oxygen can be given via a plastic hood placed over the head to supply variable concentrations of humidified oxygen. If oxygen saturation of blood can not be maintained at a satisfactory level and the carbone dioxide level (PaCO₂) rises, infants will require ventilatory assistance. CPAP (Continuous Positive air way pressure), the application of 3 to 8 cm H₂O (positive) pressure to the airway, uses the infant's spontaneous respiration to improve oxygenation by helping prevent alveolar collapse and increasing diffusion time. CPAP may be delivered via nasal prongs or an ET tube. Ventilation with CPAP is done entirely by the infant. If oxygenation is not improved and the infant requires assisted ventilation, intermittent mandatory ventilation (IMV) is used with positive end-expiratory pressure (PEEP). This allows infants to breathe at their own rate but provides positive pressure with end-expiratory pressure to prevent alveolar collapse and overcome airway resistance. (Depra L., Julia F., 2012).

2.2.6.1 Complications of positive pressure ventilation:

Although life saving, oxygen therapy is not without hazards. In the 1950s, however, its harmful effects were manifest when blindness occurred in premature infants given pure oxygen. Positive pressure introduced by mechanical apparatus has caused an increased incidence of air leaks that produce complications, such as pulmonary interstitial emphysema, pneumothorax, and pneumomediastinum. Other complications directly related to positive pressure include various problems associated with intubation, such as nasal, tracheal, or pharyngeal perforation; stenosis; inflammation; palatal grooves; subglottic stenosis; tube obstruction; and infection (Marilyn J & David W, 2011).

2.2.7 Prevention:

RDS rarely occurs in mature infants. Dating a pregnancy by sonogram and by documenting that the level of lecithin in surfactant obtained from amniotic fluid exceeds that of sphingomyclin by 2:1 are important ways to be certain an infant born by cesarean birth or has labor induced is mature enough that RDS is not likely to occur. Using a tocolytic agent such as terbutaline can help to prevent preterm birth for
a few days. Because steroids appear to quicken the formation of lecithin, it may be possible to prevent RDS in infants by administering two injections of a glucocorticosteroid, such as betamethasone, to the mother at 12 and 24 hours during this time. This is most effective when given between weeks 24 and 34 of pregnancy. (Adele P, 2010).

2.2.8 Nursing care management:
Care of infants with RDS involves all the observations and interventions previously described for preterm infants. In addition, the nurse is concerned with the complex problems related to respiratory therapy and the constant threat of hypoxemia and acidosis that complicates the care of patients in respiratory difficulty. The respiratory therapist, an important member of the neonatal care team, is often responsible for maintenance and regulation of respiratory equipment. Nevertheless, nurses should understand the equipment and be able to recognize when it is not functioning correctly. The most essential nursing function is to observe and assess the infant’s response to therapy. Continuous monitoring and close observation are mandatory because an infant’s status can change rapidly and because oxygen concentration and ventilation parameters are prescribed according to the infants’ blood gas measurements, and pulse oximetry readings. (Snow & Brandon, 2007).

Continuous pulse oximetry readings are recorded at least hourly. Continuous arterial pressure monitoring may be carried out with an "in line" transducer. Mucus may collect in the respiratory tract as a result of the infant's pulmonary condition. Suctioning should be performed only when necessary and should be based on individual infant assessment, which includes auscultation of the chest, evidence of decreased oxygenation, excess moisture in the ET tube, or increased infant irritability. The catheter should be inserted gently but quickly, the time the airway is obstructed by the catheter be limited to no more than 5 seconds, since continuous suction removes air from the lungs along with the mucus. To remove secretions without damage to the tracheobronchial mucosa, the suction catheter is premeasured and inserted to a predetermined depth to avoid extension beyond the ET tube. The pulse oximeter is observed before, during and after suctioning to provide ongoing assessment of oxygenation status and to prevent hypoxemia. Inspection of the skin is part of routine infant assessment. Position changes and the use of water pillows are helpful in guarding against skin breakdown. Mouth care is especially important when infant's are receiving nothing by mouth, and the problem is often aggravated by the
drying effect of oxygen therapy. Irritation to the nares or mouth that occurs, may be reduced by the use of water, soluble ointment (Marilyn J & David W., 2011).

2.3. Neonatal Jaundice

Jaundice is the visible manifestation of hyperbilirubinemia which is a common finding in the newborn and in most instances is relatively benign. However, in extreme cases, it can indicate a pathologic state. Hyperbilirubinemia may result from increased unconjugated or conjugated bilirubin. The unconjugated form is the type most commonly seen in newborn. (Donnal W., etal., 2009).

Neonatal jaundice is also termed as icterus neonaterum or as neonatal hyperbilirubinemia. Almost 60 percent of term neonates and about 80 percent of preterm neonates have bilirubin level greater than 5 mg/dL in the first week of life and about 6 percent of term babies will have bilirubin levels exceeding 15 mg/dL. The clinical jaundice in neonate appear on the face at a serum bilirubin level of 5mg/dL. Where as in adults, it is diagnosed as little as 2 mg/dL. The yellowish discoloration is first seen on the skin of face, nasolabial folds and tip of nose in the neonates. (Parul D, 2009).

2.3.1 Pathophysiology

Bilirubin is one of the breakdown products of the hemoglobin that results from red blood cell (RBC) destruction. When RBCs are destroyed, the breakdown products are released into the circulation, where the hemoglobin splits into two fractions: heme and globin. The globin (Protein) portion is used by the body, and the heme portion is converted to unconjugated bilirubin, an insoluble substance bound to albumin. In the liver the bilirubin is detached from the albumin molecule and, in the presence of the enzyme glucuronyl transferase, is conjugated with glucuronic acid to produce a highly soluble substance, conjugated bilirubin glucuronide, which is then excreted into the bile. In the intestine, bacterial action reduces the conjugated bilirubin to urobilinogen, the pigment that gives stool its characteristic color. Most of the reduced bilirubin is excreted through the feces; a small amount is eliminated in the urine. (Marilyn J & David W., 2011).

Normally the body is able to maintain a balance between the destruction of RBCs and the use or excretion of by – products. However, when developmental limitations or a pathologic process interferes with this balance, bilirubin accumulates in the tissues to produce jaundice. Possible causes of hyperbilirubinemia in the newborn are:

- Physiologic (developmental) factors (prematurity)
- An association with breast-feeding or breast milk
- Excess production of bilirubin (e.g., hemolytic disease, biochemical defects, bruises).
- Disturbed capacity of the liver to secrete conjugated bilirubin. (e.g., enzyme deficiency, bile duct obstruction)
- Combined over production and under excretion (increased hemolytic process)
- Some disease states (e.g., glucose 6-phosphate dehydrogenase [G6PD deficiency, hypothyroidism, galactosemia, infant of diabetic mother).
- Genetic predisposition to increased production (Native Americans, Asians) (Donna L. Wong et al., 2009).

2.3.2 Complications:
Unconjugated bilirubin is highly toxic to neurons; therefore, an infant with severe jaundice is at risk of developing bilirubin encephalopathy, a term that describes varying decrease of CNS damage resulting from the deposition of unconjugated bilirubin in brain cells. Kernicterus describes the yellow staining of the brain cells that may result in bilirubin encephalopathy. The damage occurs when the serum concentration reaches toxic levels, regardless of cause. There is evidence that a fraction of unconjugated bilirubin crosses the blood – brain barrier in neonates with physiologic hyperbilirubinemia. When certain pathologic conditions exist in addition to elevated bilirubin levels, the infant has an increased permeability of the blood – brain barrier to unconjugated bilirubin and thus potential irreversible damage. The exact level of serum bilirubin required to cause damage is not yet known. Multiple factors contribute to bilirubin neurotoxicity; therefore serum bilirubin levels alone do not predict the risk of CNS injury. Factors that enhance the development of bilirubin encephalopathy include respiratory acidosis, lowered serum albumin levels, intracranial infections such as meningitis, and abrupt fluctuations in blood pressure. In addition any condition that increases the metabolic demands for oxygen or glucose (e.g., fetal distress, hypoxia, hypothermia, or hypoglycemia) also increases the risk of CNS damage despite lower serum levels of bilirubin. Prodromal symptoms of bilirubin encephalopathy, consist of decreased activity, lethargy irritability, and a loss of interest in feeding. Within several days these findings are followed by rigid extension of all four extremities, fever, irritable cry, and seizures. Those who survive may eventually show evidence of neurologic damage, such as mental retardation,
delayed or abnormal motor movement (especially ataxia or athetosis), behavior disorders, perceptual problems or hearing loss (Marilyn J & David W., 2011).

2.3.3 Physiologic Jaundice

The most common cause of hyperbilirubinemia is the relatively mild and self-limited physiologic jaundice, or icterus neonatorum. Unlike hemolytic disease of the newborn, physiologic jaundice is not associated with any pathologic process. Although almost all newborns experience elevated bilirubin levels, only about half demonstrate observable signs of jaundice. (Adele P., 2010).

2.3.3.1 Characteristics of physiologic jaundice:

- It appears in between 30 – 72 hours of age in term babies and in preterm babies may appear earlier but not before 24 hours of age.
- Maximum intensity of jaundice is found on the 4\textsuperscript{th} day in term babies and 5\textsuperscript{th} to 6\textsuperscript{th} day in preterm babies.
- Serum bilirubin dose not exceed 15 mg/dL.
- Usually disappears by 7\textsuperscript{th} to 10\textsuperscript{th} day in term babies and by 14\textsuperscript{th} day in preterm babies.
- Subside spontaneously and no treatment is needed.
- Mother needs encouragement for exclusive breastfeeding for adequate hydration and reassurance.
- Careful observation for signs of complications along with essential neonatal care are important.
- May aggravated by prematurity, asphyxia, hypothermia, infections and drugs (Adele P., 2010).

2.3.4 Pathological Jaundice:

About 5 percent of neonates developing pathological jaundice. Appearance of jaundice within 24 hours of age is always pathological. Some causes of this condition may appear after 72 hours, though age of appearance of jaundice may overlap. Investigation should be done to ruled out the exact cause of pathological jaundice. (Adele P., 2010).

2.3.4.1 Types of pathological jaundice:

a) Prolonged unconjugated hyperbilirubinemia due to Rh – incompatibility, ABO-incompatibility, G-6 – PD deficiency, pyruvate kinase deficiency, vitamin K induced hemolysis, sepsis. Increased enterohepatic circulation in
pyloric stenosis or large bowel obstruction, hypothyroidism and breast milk jaundice.

b) Prolonged conjugated hyperbilirubinemia due to biliary atresia, neonatal hepatitis, generalized sepsis, urinary tract infections (E. Coli), lactosemia, total parenteral nutrition, etc. (Parul D., 2009)

2.3.4.2 Characteristics of Pathological Jaundice

Any of the following features indicate pathological jaundice and needs to be investigated:

- Clinical jaundice appears with 24 hours of birth and persist more than one week in term babies and more than 2 weeks in preterm babies.
- Bilirubin level is increasing by more than 5 mg/dl per day or 0.5 mg/dl per hour.
- Total bilirubin level is increasing by more than 15 mg/dl (hyperbilirubinemia)
- Direct bilirubin more than 2 mg/dl (conjugated hyperbilirubinemia).
- Palms and soles are yellow.
- Stool clay or white colored and urine is staining clothes (Parul D., 2009)

2.3.5 Jaundice Associated with Breastfeeding:

The breastfed infant has a higher risk of developing jaundice, which may begin early or late after birth.

2.3.5.1 Breastfeeding or early – onset jaundice:

Bilirubin levels greater than 12 mg/dl develop in 13% of breastfed infants by 1 week of age. The most common causes of jaundice in breastfed infants is insufficient intake, often called breastfeeding jaundice or early – onset jaundice. Serum bilirubin level may rise above 12 mg/dl and reach dangerous levels if intake is not increased. Lack of adequate suckling depress production of breast milk and increases the problem further. Glucose water will not reduce bilirubin levels and should be avoided. (Piazza and Stoll, 2007).

2.3.5.2 True breast milk jaundice: Also called late-onset breast milk jaundice, occurs after the first 3 to 5 days of life. It lasts 3 weeks to as long as 3 months for some infants. The total serum bilirubin usually peaks at 5 to 10 mg/dl and falls gradually over several months. Some infants reach level 20 mg/dl. The exact cause of true breast milk jaundice is unknown. Substances in breast milk may increase
absorption of bilirubin from the intestine or interfere with conjugation. This may be a form of physiologic jaundice in breastfed infants. (Emily S, et. al., 2009).

2.3.6 Clinical Manifestations:
The most obvious sign of hyperbilirubinemia is jaundice, the yellowish discoloration primarily of the sclera, nails, or skin. The clinical jaundice in neonates appear on the face at a serum bilirubin level of 5 mg/dl. The yellowish discoloration is first seen on the skin of the face, nasolabial folds and tip of nose in the neonates. It is detected by blanching the skin with digital pressure in the natural light. (Parul D., 2009).

2.3.7 Diagnostic Evaluation:
The degree of jaundice is determined by serum bilirubin measurements. Normal value of unconjugated bilirubin are 0.2 to 1.4 mg/dl. In the new born, levels must exceed 5 mg/dl before jaundice is observable. However evaluation of jaundice is not based solely on serum bilirubin levels, but also on the timing of the appearance of clinical jaundice; gestational age at birth; age in days since birth; family history, including maternal Rh factor; evidence of homolysis; feeding method; infant's physiologic status; and progression of serial serum bilirubin levels. The following criteria are indicators of neonatal hyperbilirubinemia or non physiologic jaundice that, when present, warrant further investigation as to the cause. It is not an all inclusive list; other factors are also evaluated:

- Appearance of clinical jaundice within 24 hours of birth.
- Persistent clinical jaundice over 2 weeks in full-term, formula fed infant.
- Total serum bilirubin levels over 12.9 mg/dl (term infant) or over 15 mg/dl (preterm infant); upper limit for breastfed infant: 15mg/dl.
- Increase in serum bilirubin over 5 mg/dl/day
- Direct bilirubin over 1.5 to 2 mg/dl. (Marilyn J & David W., 2011).

2.3.8 Physical examination:
The baby should be examined for yellowish discoloration of skin and mucous membrane. It should be done in natural light by blanching the skin, i.e., pressing the finger on the baby's skin till it blanches and skin is noted for yellow color. Clinical criteria is used to assess the extent of jaundice and rough estimation of serum bilirubin. jaundice proceeds downward to the trunk and extremities when it increases in intensity. A baby, with jaundice restricted to the face is having bilirubin about 5 mg/dl and when palms and soles are yellow then it is over 15 mg/dl. Clinical judgement is equally reliable with laboratory value, if done by experienced person.
The neonate should be examined for presence of IUGR and cephalhematoma, features of intraventricular hemorrhage, intrauterine infections and kernicterus. The baby should be assess for gestational age and general condition. (Parul D., 2009).

2.3.9 Non-invasive assessment of jaundice:
It is done with ingram icterometer and transcutaneous bilirubinometer. These methods are more accurate and less subjective in estimating jaundice. Ingram icterometerr is a piece of transparent plastic, which is painted with five transverse strips of graded yellow lines. This instrument is pressed over the nose of the baby and the color of the blanched skin is matched with appropriate yellow stripe and the level of jaundice is assessed by the marked level of bilirubin. Transcutaneous bilirubinometer is a costly and sophisticated equipment used to measure the intensity of jaundice by reflecting light rays on the blanched skin (Parul D., 2009).

Transcutaneous bilirubin levels are inaccurate on a baby who has already commenced phototherapy. However, it may be accurate when a photoopaque patch is applied to the baby's skin (normally the forehead). A transcutaneous bilirubinometer may be particulary useful in health care settings where total serum bilirubine level results are expected to take longer than 6 hours before becoming available. (www.health.gld.gov.au/dcy)

2.3.10 Laboratory Investigations:
Serum bilirubin level, (total, conjugated and unconjugated), Hb%, serum albumin, RBC morphology, direct coombsvs' test, blood culture, hematocrit value, reticulocyte count, sepsis screen, liver and thyroid function tests, TORCH liters can be done, etc. (Adele P, 2010).

2.3.11 Hemolytic Disease of the Newborn:
Hemolytic disease of the newborn is the commonest cause of hyperbilirubinemia in the neonates. It occurs due to blood group incompatibility between the mother and fetus. The common in compatibilities are Rh, ABO and minor groups. When abnormal destruction of red blood cells occurs, it is termed hemolytic disease. In the past, hemolytic disease of the new born was most often caused by an Rh blood type incompatibility. Because prevention of Rh antibody formation has been available for almost 40 years, the disorder is now most often caused by an ABO incompatibility. In both instances, the mother builds antibodies against an infant's red blood cells, leading to hemolysis (destruction) of the cells. The destruction of red cells.
cells causes severe anemia and hyperbilirubinemia from bilirubin released from red cells (Adele, P., 2010).

2.3.11.1 Rh in-compatibility: Rh – iso immunization is also called as erythroblastosis fetalis, theoretically, no direct connection exists between the fetal and maternal circulation, so no fetal blood cells should enter the maternal circulation. In actuality, occasional placental villi break and a drop or two of fetal blood does enter the maternal circulation. If the mother's blood type is Rh (D) negative and the fetal blood type is Rh positive (contains the D antigen), the introduction of fetal blood causes sensitization to occur, and the woman begins to form antibodies against the D antigen. Most of antibodies form in the woman's blood stream in the first 72 hours after birth because there is an active exchange of fetal – maternal blood as placental villi looses and the placenta is delivered. After this sensitization, in a second pregnancy there will be a high level of antibody D circulating in the woman's blood stream, which will then act to destroy the fetal red blood cells early in the pregnancy if the new fetus is Rh positive. By the end of pregnancy, a fetus can be severely compromised by the action of these antibodies crossing the placenta and destroying red blood cells. Some infants require intrauterine transfusions to combat red cell destruction. Preterm labor may be induced to remove the fetus from the destructive maternal environment. Administering phenobarbital to women during their last weeks of pregnancy has been tried to reduced symptoms in newborns as it speeds liver maturity so that the infant liver better converts indirect to direct bilirubin (Thomas, Muller, and Wilkinson, 2009).

The clinical manifestations of Rh- hemolytic disease of newborn may vary from stillbirth baby with hydrops fetalis or icterus gravis neonatorum or congenital hemolytic anemia. Normal baby without any features may also be found in some cases (Parul D, 2009).

2.3.11.2 ABO in-compatibility: it occurs commonly in ('O' groups mother and "A" or "B" group fetus. It is milder than Rh- hemolytic disease. Hemolysis can become a problem with a first pregnancy in which there is an ABO incompatibility as the antibodies to A and B cell types are naturally occurring antibodies or are present from birth in individuals whose red cells lack these antigens. Unlike antibodies formed against the Rh-D factor, these antibodies are of the large (IgM) class and do not cross the placenta. An infant of an ABO in compatibility, therefore is not born anemic, as the Rh- sensitized child. Hemolysis of the blood begins with birth, when
blood and antibodies are exchanged during the mixing of maternal and fetal blood as the placenta is loosened; destruction of red blood cells may continue for up to 2 weeks of age. Interestingly preterm infants do not seem to be affected by ABO incompatibility. This may be because the receptor sites for anti-A or anti-B antibodies do not appear on red cells until late in fetal life. Even in the mature newborn, a direct Coombs' test may be only weakly positive because of the few anti-A or anti-B sites present. (Adele, P. 2010).

2.3.12 Management of Neonatal Jaundice:
Management of neonatal jaundice is aimed at reduction of serum bilirubin level within safe limits and prevention of CNS toxicity as kernicterus and brain damage. The management include:

- Prevention of Rh-immunization by anti-D gammaglobulin to Rh-negative mother in case of birth of Rh-positive baby.
- Reduction of bilirubin level by phototherapy and exchange blood transfusion and prevention of hyperbilirubinemia.
- Reduction of enterohepatic circulation by drug therapy.
- Intensive neonatal nursing (Parul D, 2009).

2.3.12.1 Phototherapy:
It is non-invasive, inexpensive and easy method of degradation of unconjugated bilirubin by photooxidation. The light waves convert the toxic bilirubin into water soluble non-toxic form which is easily excreted from the blood in the bile, stool and urine. Phototherapy also enhances hepatic excretion of unconjugated bilirubin into intestinal lumen. An infant's liver processes little bilirubin in utero because the mother's circulation does this for an infant. With birth exposure to light apparently triggers the liver to assume this function. Additional light supplies by phototherapy appears to speed the conversion potential of the liver (Adele P, 2010).

It is recommended that phototherapy may be started early when serum bilirubin approaches 15 mg/dl. A full term healthy infant with hyper-bilirubinemia, in the absence of hemolysis or sepsis can be managed by phototherapy alone and there is no need of exchange blood transfusion (EBT) for such an infant. In preterm babies, phototherapy is started at a serum bilirubin level of 5 mg/dl or more to prevent the need for exchange blood transfusion. Prophylactic phototherapy may be indicated in very special circumstances such as extremely low birth weight or severely bruised
babies. Phototherapy can be given continuously or intermittently using fluorescence or halogen light (Depra L, Julie F., 2012).

2.3.12.1.1 Technique of Phototherapy

Blue light is most effective for phototherapy. White day light lamps are also effective. The wavelength of the light should have in the range of 420 to 600 nm for maximum absorption by the bilirubin. Blue light interferes with observation of skin color of the baby. A combination of white and blue lamps are preferred. A baby care unit with 6 to 8 light source or tube lights can be used which should be covered with plastic sheet or plexiglass. Light source is fixed over crib or incubator or it can be portable type. (Parul P. 2009).

2.3.12.1.2 General care of the baby during phototherapy:

- Place the baby in a supine position unless other clinical conditions prevent this.
- A naked infant placed under the light source at a distance of about 45 cm from the skin of the baby, (it can be reduced to 15 to 20 cm for intensive phototherapy).
- Baby's eyes should be covered to prevent retinal damage and eye care during phototherapy should be encouraged.
- Diaper to be kept on to cover the genitals especially in male baby to prevent gonadal damage.
- Position should be changed every two hours or after each feed for maximum exposure to light.
- Monitor the baby's temperature two hourly and ensure the baby is kept in an environment that will minimize energy expenditure (thermoneutral environment).
- More frequent (2 hourly) breast feeding to be given or extra fluid to be provided by IV infusion or NG tube feeding to prevent dehydration.
- Serum bilirubin level to be estimated at least every 12 hours.
- Support parents and carers and encourage them to interact with the baby.
- Constant observation should be made for urine, green or loose stool, skin rash, behavior change convulsions and features of any complications.

Phototherapy is discontinued when serum bilirubin level are less than 10 mg/dl for two times. Intensive phototherapy usually reduce 1 to 2 mg/dl of serum bilirubin within 6 hours exposure. (www.rcog.org.uk).
2.3.12.1.3 Complications of Phototherapy:
Though phototherapy is safe, there are some side effects found immediately or later in life. The immediate problems are dehydration, hypothermia, hyperthermia, loose stool or green stool, bronze-baby syndrome, electric shock, skin rash, hypocalcemia, etc. longterm problems may be found as disturbances of endocrine or sexual maturation, retinal damage and skin cancer (rare) (Parul D. 2009).

2.3.12.2 Home Phototherapy
Home phototherapy is primarily used for decreasing physiologic jaundice rather than that associated with blood incompatibility. It has the advantages of allowing for uninterrupted contact between the parents and a newborn and therefore has the potential to aid bonding. An infant's progress can be measured daily by transcutaneous bilirubinometer. A newer innovation for hyperbilirubinemia management is the phototherapy blanket, a fiberoptic blanket that is wrapped around the baby. It is especially suited for home phototherapy. Light generated by the blanket has the same effect on bilirubin levels as banks of overhead lights. The advantages of a blanket are that an infant can be held for long periods without interrupting the phototherapy, and eye patches are unnecessary. Parents need extensive teaching on how to care for the infant receiving home phototherapy. Home visits by nurses and frequent visits to the health care provider are essential to help ensure that the infant is making adequate progress and the parents understand how to provide care (Emily S., et al., 2007).

2.3.12.3 Drug therapy in neonatal jaundice: the drugs have very little role in the treatment of neonatal jaundice. The drugs which can be used to bind unonjugated bilirubin in the gut and to prevent its reticulation are charcoal, a gar, polyinyl pyrrolidone and cholestyramine. Albumin infusion can be given before EBT to facilitate more effective removal of bilirubin binding capacity. Combining phenobarbitone with phototherapy is no more effective than phototherapy a lone and hence is not used in routine clinical practice. (www.recog.org.uk).

Intravenous Immunoglobulin:
Use intravenous immunoglobulin (IVIG) (500mg/kg over 4 hours) as an adjunct to continuous multiple phototherapy in cases of Rhesus haemolytic disease or ABO haemolytic disease when the serum bilirubin continues to rise (www.recog.org.UK).

2.3.12.4 Management of Breast Feeding Jaundice.
Recommendations for prevention and management of early – onset jaundice in breast fed infants are to monitor for early stooling; initiate early and frequent breast –
feeding; and discourage the use of dextrose water, formula, or water. The infant’s weight, voiding, and stooling should be evaluated along with the breast – feeding. Bilirubin levels is are monitored in late – onset jaundice, and treatment options vary. If the serum bilirubin levels remain above 16 mg/dl for more than 24 hours, obtain a bilirubin reading 2 hours after breast – feeding, which may then be interrupted for 10 to 12 hours (provide fluid and calories during this time) and repeat levels drawn; with a serum bilirubin level decrease of 2 mg/dl or more, the infant may resume breast-feeding if levels are below 15 mg/dl. In the event that levels do not drop significantly; further evaluation is necessary. Home phototherapy and continued breast feeding are options for the family with a jaundice of new born. (Marilyn J & David W., 2011).

2.3.12.5 Exchange blood transfusion (EBT):

Is the most effective and reliable method for reduction of bilirubin level in case of severe hyperbilirubiremia to prevent kernicterus and to correct anemia. It is done in seriously affected Rh-isoimmunized erythroblastic babies to remove anti 'D' antibodies and Rh-positive RBCs coated with antibodies. It is given when phototherapy fails to prevent a rise in bilirubin to toxic level. Early indications for EBT in infants with Rh-hemolytic disease of the newborn are:

- Cordblood hemoglobin level – 10 gm/dl or less.
- Cord blood bilirubin level – 5 mg/dl or more.
- Unconjugated serum bilirubin level – 10 mg/dl within 24 hours or 15 mg/dl within 48 hours or rate of rise of more than 0 – 5 mg/dl per hour.

Preterm infants should be exchanged at a lower level of bilirubin (10 – 18mg/dl). EBT may be necessary in ABO incompatibility or in severe hyperbilirubinemia due to other causes when indirect serum bilirubin level is 20 mg/dl or more or bilirubin protein ratio is more than 3.5 during neonatal period (Parul D., 2009).

2.3.12.5.1 Nature and amount of blood for EBT:

- In Rh-isoimmunization - Rh-negative, ABO compatible blood is used.
- In ABO in compatibility - 0 group, Rh-compatible blood is used.

Fresh blood collected less than 72 hours is preferred. The quantity of blood used is 160 to 180 ml/kg for one exchange transfusion to replace 80 to 90 percent of fetal blood (Parul D., 2009).
2.3.12.5.2 Procedure of EBT:

Exchange blood transfusion is done in strict a septic technique by the expert team members in a well-equipped set-up. The process is very slow and continued over an hour. The baby must be kept warm and well-restraint. The stomach contents should be aspirated. Baby's cardiac status and temperature should be monitored continuously. The umbilical vein is catheterized as the site for transfusion. Air-tight blood transfusion set with four-way are required which should be rinsed with heparinized saline (10 units of heparin/ml). The donor blood should be at normal body temperature (37°C). Albumin may be administered 1 to 2 hours before the procedure to increase the number of bilirubin binding sites and to increase the efficiency of the transfusion. Be careful to monitor the rate of flow of the albumin transfusion, because rapid flow can quickly overburden an infant's heart (Rashmi G., 2010).

The donor's blood is injected slowly in amounts of (10–20 ml) depending upon the size of the baby. The amount can be 5 to 10 ml during each push or pull. Accurate record of in and out amount of blood should be maintained strictly. Calcium gluconate should be injected slowly after every 50 ml of exchange to prevent tetany, if CPD (citrate phosphate dextrose) blood is transfused. Hyperglycemia may occur during the transfusion from the dextrose in CPD. This may be followed by over production of insulin and hypoglycemia in the infant. The heparin content in heparinized blood may interfere with clotting after the transfusion. In addition, because of its low glucose concentration, heparinized blood may also lead to hypoglycemia. Administering protamine sulphate aids in the metabolism of heparin and restoration of clotting ability. Hb% and bilirubin estimation to be done before and after exchange transfusion. (Adele P., 2010).

After the transfusion, closely observe the infant for umbilical vessel bleeding. Redness or inflammation of the cord suggests infection. Report any changes in vital signs. Take and record a blood glucose determination at 1 hour after the procedure. Monitor the bilirubin levels for 2 or 3 days after the transfusion to ensure the level of bilirubin is not rising again and that no further transfusion is necessary. Erythropoietin may be administered to increase new blood cell growth and prevent extended anemia. Follow-up to detect complications and emotional support to the parents and family members. (Parul D. 2009).
2.3.12.5.3 Complications of EBT
Immediate complications are cardiac failure, air embolism, acidosis, tetany, sepsis, hyperkalemia, umbilical or portal vein perforation, hypoglycemia, thrombocytopenia, etc. Delayed complications include extrahepatic portal hypertension, portal vein thrombosis, HIV, hepatitis B and C infection, ulcerative colitis, etc. (Adele P., 2010).

2.3.13 Prevention of Pathological Jaundice in Neonates
- Administration of anti-'D' immunoglobulin to the Rh-negative mother having Rh-positive baby to prevent Rh-isoimmunization.
- Minimizing fetomaternal bleeding during delivery.
- Prevention of perinatal distress like hypoxia, hypothermia, hypoglycemia, etc.
- Adequate and early feeding to prevent dehydration and hypoglycemia to reduce enterohepatic recirculation.
- A voidance of jaundice aggravating drugs like vitamin 'K' in large dose.
- Aspiration of cephalhematoma, if present with jaundice.
- Treatment of sepsis and hepatitis.
- Administratin of phenobarbitone to improve uptake, conjugation and excretion of bilirubin by liver.
- Management of Rh-sensitized mother during antenatal period with rising titer of indirect Coomb's test (Marilyn J & David W., 2011).

2.4 Immunization
Immunization is a process of protecting an individual from a disease through introduction of live, or killed or attenuated organisms in the individual system. Immunization against vaccine – preventable diseases is essential to reduce the child mortality, morbidity and handicapped conditions. It gives resistance to an infectious diseases by producing or augmenting the immunity. Artificially acquired immunity is developed by the immunization. Acquired immunity can be active or passive. Active immunity is produced by stimulating immunological defense mechanism through administration of antigen usually prior to natural exposure to infection. Active immunizing agents are known as vaccines. Passive immunity is produced temporarily by supplying preformed exogenous animal or human antibody to suppress the disease, given soon after or prior to exposure of an infection. Passive immunity agents are antisera and immunoglobulins. (Adele P., 2010)
2.4.1 National Immunization Schedule

Immunization schedule should be planned according to the needs of the community. It should be relevant with existing community health problems. It must be effective, feasible and acceptable by the community. Every country has its own immunization schedule. National Immunization Schedule as recommended by Government of India for uniform implementation throughout the country was formulated. The schedule contains the age at which the vaccines are best given and the number of doses recommended for each vaccine. The schedule also covers immunization of women during pregnancy against tetanus (Rashmi G., 2010).

2.4.1.1. BCG Vaccination

BCG (Bacillus of Calmette and Guerin) vaccine is live attenuated bacterial vaccine. It produces active immunity to protect the child from tuberculosis. The presently available and used BCG vaccine is heat stable and in freeze dried form. It should be kept away from dried light and stored in a cool environment below 10°C (2° to 8°C). Normal saline is recommended as a diluent for reconstituting the vaccine. The reconstituted vaccine may be used up within 3 hours and then the left over vaccine should be discarded. The BCG vaccine is administered at birth or as soon as possible after birth, or at 6 weeks, if not given at birth. The standard site is the middle of deltoid muscle over the left upper arm.

The vaccine is given using a special tuberculin syringe in intradermal route. The dose is 0.05 ml in neonates and 0.1 ml in infants. A satisfactory injection should produce a wheel of 5 mm in diameter. The vaccine must not be contaminated with an antiseptic or detergent. If alcohol is used to swab the skin, it must be allowed to evaporate before the vaccine is injected. Complications following this vaccination are uncommon or may be mild, local abscess formation enlargement of axillary lymph glands, and osteomyelitis may develop. BCG immunization is contraindicated if the baby is suffering from generalized eczema, infective dermatosis, immunodeficiency conditions and HIV infected children with symptoms of AIDs. All asymptomatic HIV infected children should receive the BCG vaccine. The duration of protection is about 15 to 20 years (Parul D., 2009).
2.4.1.2 Polio vaccination:
Oral polio vaccine (OPV) was first described by Sabin in 1957. It contains live attenuated polio virus of three strains (types-1, 2 and 3). The recently available OPV is heat stabilized and can be kept without losing potency at 4°C for a year and for month at room temperature. The non-stabilized should be stored at 20°C in a deep freeze. The OPV is cheaper, easy to administer, protect the individual child from poliomyelitis and prevents its spread in the community. The OPV is very safe vaccine with out any adverse effects. OPV is administered with 'zero', dose at birth and then 3 doses at one onth interval from 6 weeks of age (6 weeks, 10 weeks and 14 weeks). OPV can be given with DTP and BCG at the same time and the same day. The dose is two drops and given orally. It is very important to complete primary course of OPV within 6 months. Because most polio cases occurs between 6 months to 3 years. One booster dose is recommended at 16 – 24 months of age. The contraindications for the administration of OPV include, acute infectious disease, fever, diarrhea, dysentery, leukemias, malignancy and corticosteroids therapy. After vaccination, breast feeding can be given if the baby is hungry, but hot drinks, hot milk or hot water should be withheld for ½ hour. The OPV should be administered in cool room rather than hot, humid and crowded room and the vial of the vaccine should be kept on ice pack. (Parul D., 2009).

3.4.1.3 DTP (Diphtheria, Tetanus, Pertussis) Vaccination:
DTP is a combined vaccine administered for the protection against three diseases, i.e., diphtheria, pertussis and tetanus. DTP vaccine is composed of diphtheria toxoid, tetanus toxoid and killed B- Pertussis bacilli. There are two types of DTP vaccine, i.e., plain and adsorbed. DTP vaccine should be stored between 4° to 8°C temperature and should not be frozen. The vaccine will lose potency if kept at room temperature over a longer period of time. For primary immunization, DTP vaccine is administered in 3 doses at 4 weeks interval at 6 weeks, 10 weeks and 14 weeks of age. Each dose is 0.5 ml and should be given deep intramuscularly. The site of injection for children below one year of age should be at lateral aspect of thigh (vatus lateralis muscle). In older children, it may be given in upper and outer quadrant of the gluteal muscle. The booster dose of DTP vaccine is given at 16 to 24 months of age followed by another booster dose of DT (Diphtheria, Tetanus) vaccine at the age of 5 to 6 years, without pertussis component. Following DTP vaccination mild reactions are common. In 2 to
6 percent vaccines, mild fever (about 39°) may develop and in 5 to 10 percent cases have swelling or pain occur for 48 hours. The most severe complications are neurological problems like encephalitis, prolonged convulsions and infantile spasms. DTV vaccination is contraindicated in progressive neurological problems and with severe reactions of first dose DTP (i.e., shock like state, temperature above 40°C persistent crying episodes, and convulsions). (Parul D., 2009)

**2.4.1.4 Measles vaccination:**
Measles vaccine is live attenuated and tissue culture vaccine, available as freeze dried product. It is safe and effective, heat stable and its diluting fluid should be stored at 2° to 8°C temperature to maintain their potency.

The measles vaccine is administered at the age of 9 months, before this age maternal antibody protects the infants. Single dose of vaccine is given with 0.5 ml amount in subcutaneous route. The reconstituted vaccine must be kept on ice and to be used within one hour and the left over vaccine must be discarded and never used after 4 hours of opening the vial. No booster dose is recommended as the immunity usually appears for long duration. After measles vaccination, reactions may develop as fever and rash on 5 to 10 days after immunization and induces a mild measles illness but in reduced frequency and severity. Severe reactions may develop following this vaccination. Toxic shock syndrome (TSS may develop with contaminated vaccine or if the same vial is used for more than one session on the same day or next day. The features of TSS are severe watery diarrhea, vomiting and high fever which usually develop within few hours of measles vaccination. This condition may cause death within 48 hours. Measles vaccine is contraindicated in infants below 6 months of age, acute illness, convulsions, allergy, active tuberculosis, malnutrition, immunodeficiency states, malignancy and immunosuppressive therapy. Measles vaccine can be combined and effectively administered with other live attenuated vaccines such as mumps and rubella. MMR vaccine can be given at the age of 15 months, 3 months following primary measles vaccination and is not included in National Immunization Schedule (Parul D., 2009).

**2.4.1.5 Hepatitis ‘B’ vaccination:**
Hepatitis ‘B’ vaccination is now included in the immunization schedule, in some states of India, as routine vaccine. But due to economical constraints, it is not included in the National immunization schedule. Hepatitis ‘B’ vaccines are available in two forms, it is given intramuscularly with the 3 doses in general at 0, 1, and 6 months or
4 doses at 0, 1, 2 and 12 months in highly endemic area. The dose of the vaccine is 0.5 ml for the child below 10 years and one ml above 10 years at the same time interval. Immunity levels provide protection for about 3 to 5 years. Booster doses may be administered after 3 to 5 years. Hepatitis ‘B’ vaccine is given for pre-exposure and post exposure prophylaxis. (Parul D., 2009)
2.5 Previous studies:

2.5.1 World wide:
The study on the Worldwide incidence of preterm birth: a systematic review of maternal mortality and morbidity aimed at analyzing preterm birth rates worldwide to assess the incidence of this public health problem, map the regional distribution of preterm births and gain insight into existing assessment strategies. Data on preterm birth rates worldwide were extracted during a previous systematic review of published and unpublished data on maternal mortality and morbidity during the period 2003 – 2007. The findings of the study showed that, in 2005, 12.9 million births, or 9.6% of all birth worldwide, were preterm. Approximately 11 million (85%) of these preterm births concentrated in Africa and Asia while about 0.5 million occurred in each of Europe and North America (excluding Mexico) and 0.9 million in Latin America. The highest rates of preterm birth were in Africa and North America (11.9% and 10.6% of all births, respectively), and the lowest in Europe (6.2%). The study concluded that, preterm birth is an important perinatal health problem across the globe. Developing countries, especially those in Africa and Southern Asia, incur the highest burden in terms of absolute numbers, although a high rate is also observed in North America. A better understanding of the causes of preterm birth and improved estimates of the incidence of preterm birth at the country level are needed to improve access to effective obstetric and neonatal care. (Bull World Health Organ 2010; 88:31-38).

2.5.2 In Developed Countries:
Study on Neonatal Mortality from Respiratory Distress Syndrome: lessons for low-resource countries during the period before 1950 to the period after 1990. The objective of the study was to better understand the interventions that have decreased the rates of RDS – specific mortality in high – income countries over the past 60 years. Then estimated the effects on RDS – specific mortality in low – resource settings. Of the sequential introduction of technologies and therapies for RDS, widespread use of oxygen and continuous positive air way pressure were associated with the time periods that demonstrated the greatest decline in RDS – specific mortality. The introduction of these technologies in low resource settings close to where most infants are born, such as local clinics, would save the most newborn lives. However, CPAP would be problematic without trained personnel, a supporting infrastructure, and innovative designs for resource – poor settings. Still, advances, in technology that
most improved survival rates for infants with RDS would not have greatly affected neonatal mortality with out overall improvements in general neonatal care, including better methods of thermoregulation, feeding practices, intravenous nutrition, and regionalized perinatal care. Without suitable infrastructure, personnel, and technology to take care of premature infants, the significant contribution of neonatal mortality to the overall mortality rate of childhood will not decrease. (http://pediatrics.aappublications.org/content/early/2005/04/27/peds.32010).

2.5.3. In developing countries:

2.5.3.1 In Tanzania: A registry based cohort study on cause – specific neonatal mortality in a neonatal care unit in northern Tanzania was conducted during the period 2000 to 2010. A total of 5033 in born neonates admitted to a neonatal care unit (NCU) in Kilimanjaro Christian Medical Centre (KCMC) were registered and the medical birth registry and neonatal registry were studied. The results of the study showed that, the leading causes of admission were birth asphyxia (26.8%), prematurity (18.4%), risk of infection (16.9%) neonatal infection (15.4%) and birth weight above 4000g (10.7%). Over all mortality was 10.7% (536 deaths). The study concluded that, birth asphyxia in normal weight babies and prematurity in low birth weight babies each accounted for one third of all deaths in this population. Strategies directed towards making obstetric and newborn care timely available with proper antenatal, maternal and newborn support with regular training on resuscitation skills would improve neonatal survival. (http://www.biomedcentral.com/1471-2431/12/116).

2.6.3.2 In Sudan: A hospital based study on evaluation of nursing care of preterm infants in neonatal care unit at Soba Hospital was conducted in the period between 2005 – 2006 and 20 nurses were included in this study. The study results showed that, the participants did their best in maintaining respiration by giving O₂ as prescribed, practices suctioning as needed and regularly checked the respiration rate, successes in maintain thermal stability by using incubator temperature control or heat warmer, and giving feeding as prescribed. In regard to measures taken to prevent infection control although they assured clean environmental and controlled visitors, but they were still not wear gown and masks prior entering the neonatal unit and only hear half of them they practice hand washing before entering the unit and handling the babies. The researcher recommended that the hospital polices should plan to supply the neonatal unit with facilities needed for neonatal care, staff should completed infection control program,
practice of documentation properly and increase of nursing staff because staff patient ratio should be 1 – 2 in intensive care and 1 – 4 in intermediate care. Manahil, O. 2006).

2.6.3.3 In Wad Medani

Hospital based study on study of morbidity and mortality pattern of neonates admitted into nursery unit in Wad Medani Maternity Hospital during the period from Jan – June, 2009. A total of 1211 out of 4098 in – born neonates were admitted during study period were included in the study. The results of the study showed that, the major indications for neonatal admissions were infections (24.8%), low birth weight (LBW) (25.4%) and asphyxia (10.7%). There were (11%) neonatal deaths. Preterm birth, LBW and birth asphyxia were the major causes of death among these neonates. The study concluded that, neonatal infection, preterm birth and LBW were the common causes of neonatal morbidity and mortality. There is an urgent need for more research concerning these common causes of morbidity and mortality.( Elhassan M. et al., 2009).

Another descriptive retrospective study on neonatal mortality and neonatal health services in Wad Medani Pediatric Teaching Hospital during the period from January to October 2003. All recorded neonatal deaths in (WMPTH) during the period of the study were reviewed. 210 death records were included in this study. Observations checklists were designed for the availability of special equipments and machines which are important for neonatal health service. The results showed that, the majority of deaths were due to prematurity (33.3%), neonatal sepsis (24.3%) and birth asphyxia (20%). The neonatal mortality to total neonatal admission from January to October 2003 was (14.6%) of total hospital deaths. The study concluded that, neonatal death in Wad Medani pediatric teaching hospital was found to be significantly high, strengthening of referral system was recommended and special equipment that are not available in the unit should be provided. (Mey M. et al., 2003).
CHAPTER THREE

3– Materials and Methods

3–1 Study design:
This study is an interventional hospital based study.

3–2 Study area:
This study was conducted at Wad Medani City, capital of Gezira State. It is located on the western east of the Blue Nile and about 186 km south of Khartoum. It is located in Gezira Scheme which is the largest agricultural project in Sudan. Wad Medani is largest city in Gezira state, which has population of 211,000 people. It is benefits form availability of health services including general hospitals’, specialized hospitals, health centers and primary care units.

3-2-1 Pediatric teaching hospital:

The hospital was established in 17 of March 1987. It has 21 wards for patients belonging to 7 Units. The hospital contains medical and surgical departments that cover all Gezira state.

Table (3-1) Distribution of manpower that caring for the neonates in UICU in pediatric teaching hospital:

<table>
<thead>
<tr>
<th>Type of health care provider</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultants</td>
<td>18</td>
</tr>
<tr>
<td>Registrars</td>
<td>7</td>
</tr>
<tr>
<td>Medical officers</td>
<td>20</td>
</tr>
<tr>
<td>House officers</td>
<td>42</td>
</tr>
<tr>
<td>Nurses</td>
<td>50</td>
</tr>
<tr>
<td>Dietitians</td>
<td>2</td>
</tr>
<tr>
<td>Lab technicians</td>
<td>16</td>
</tr>
<tr>
<td>Biomedical engineers</td>
<td>1</td>
</tr>
<tr>
<td>X–ray technicians</td>
<td>7</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>7</td>
</tr>
<tr>
<td>Physiotherapists</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>170</td>
</tr>
</tbody>
</table>

Source: Head department of NICU, statistical department of the hospital, February, 2013.

The NICU of pediatric hospital composed of one septic room which contain 3 beds, aseptic part which composed of two wards, one ward with 5 incubators which was
responsible for preterms’ care and another ward with 10 beds which is responsible for caring neonates with jaundice, RDS and other medical problems. There is also general ward out side for general care of neonates with less complicated problems and compose of tow rooms, one special room with 8 beds, two small rooms, each one with 6 beds and one general ward with 10 beds. The unit was sharing the hospital services e.g. X-ray department, laboratory pharmacy. There is no special consultant for NICU, only two medical officers. There is no separate room for breast feeding mothers, but the mothers are sitting outside near the neonatal wards.

3-2-2 Obstetric and Gynecology Hospital:

The hospital was established in 17th, March 2002. It is consider the second large hospital in the Sudan after Khartoum obstetric and Gynecology hospital. The hospital receives patients from different parts of the state and from neighbouring states. It has 44 wards for patients belonging to 12 units (statistical department of the hospital, 2012).

Table (3-2) Distribution of manpower that caring for the neonate in NICU obstetric and Gynecology Hospital

<table>
<thead>
<tr>
<th>Type of health care provider</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultants</td>
<td>2</td>
</tr>
<tr>
<td>Medical officers</td>
<td>14</td>
</tr>
<tr>
<td>Nurses</td>
<td>40</td>
</tr>
<tr>
<td>Dietitians</td>
<td>2</td>
</tr>
<tr>
<td>Lab technician</td>
<td>16</td>
</tr>
<tr>
<td>Biomedical engineers</td>
<td>3</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
</tr>
</tbody>
</table>

Sources: Statistical department of the hospital 2012.

The NICU in obstetric and Gynecology Hospital compose of two part, aseptic room which is consist of 10 incubators and 8 beds for caring of the preterm neonate and neonates with medical problems. Septic room which is responsible for infectious cases and consist of 2 incubators and 6 beds. Also the unit sharing the hospital services, there is no separate lab, pharmacy, etc. No special room for breast feeding, no X-ray department in the hospital.
3.3 Study Population:

Study population was nurses who were working in neonatal intensive care units in pediatric, obstetrics and Gynecology teaching hospitals during the period of the study from (July 2010 to July 2013).

3.3.1 Inclusion criteria:

All the nurses working in neonatal care units in pediatric, Obstetrics and Gynecology teaching hospitals and during the period of study from (July 2010 to July 2013) with their different qualifications.

3.3.2 Exclusion criteria:

- Nurses who are working in other departments of the hospital.
- Nurses under training.
- Students Nurse.

3.4 Sample size:

Total coverage of all (90) available nurses working in neonatal care units during the period of the study from (July 2010 to July 2013) in Wad Medani Pediatric, obstetrics and gynecology teaching hospitals.

3.5 Sampling Technique:

Total sampling was used for the study, during the period from (July 2010 to July 2013).

3.6 Data collection tools:

3.6.1 Assessment sheet was designed by the researcher in Arabic language included nurses’ socio-demographic characteristics such as age, qualifications, years of experience and attendance of previous training courses then nurses knowledge was reviewed regarding care of preterm infants, neonates with RDS, jaundice, and their knowledge regarding immunization of children before and after training program. (Appendix I).

This tool was used to measure the nurses' knowledge before and after the training program to evaluate the effect of the training program on their knowledge.
3.6.2 Modified Likert type scale was used to evaluate nurses’ perceived attitude.

3.6.3 An observational checklist was developed by the researcher to observe the actual nurses' performance before and after the training program. It included all nursing care and procedures needed for the care of pre term infants, neonates with RDS, and jaundice.

3.7 Phases of intervention:

3.7.1 Pre intervention phase:
- Permission was done from managers and directors of the two hospitals for data collection through official letters.
- A Pilot study was done on a sample of 7 nurses in an effort to test the validity and feasibility of the questionnaire instrument, according to the results obtained some questions were restructuring and some were deleted to decrease the chance that the study would yield unusable data to give the most accurate result.
- Before the training program assessment sheet was distributed for each available nurse to fill it within 45 – 60 minutes under the researcher guidance to identify the knowledge of the nurses regarding care of preterm infants neonates with RDS, jaundice, and their knowledge regarding immunization of children (Appendix I).
- Each nurse had observed for her clinical skills and attitude when caring of preterm infants, neonates with RDS, jaundice and incubator’s care, through an observation check list constructed by the researcher. (Appendix II).
- The duration of in service training program in pediatric teaching hospital was started from 17 – 20 December 2012 and in obstetric and gynecology hospital from 7 – 10 January 2013.

3.7.2 Program implementation:

The program was designed to equip the nurses with essential information and practice regarding care of preterm infants, neonates with RDS, jaundice, and immunization of children to improve their knowledge and performance when caring of the above neonates.
All the participants were attended the sessions and participated actively in practical sessions. The training team included experts in teaching and training: Pediatricians, Nursing lecturers specialized in pediatric nursing, General nursing lecturers, Clinical instructors, Biomedical Engineers and the head department of NICUs of pediatric and obstetric and Gynecology hospitals.

### 3.7.2.1 Aims of the training program:

The aim of this program is to upgrade nurses who working in neonatal care units in Wad Medani Pediatric, Obstetrics and Gynecology Teaching Hospitals with knowledge and skills needed in caring of premature infants, neonates with jaundice, and respiratory distress syndrome.

**Learning objectives:**

By the end of this course the nurse should be able to:-

- Define premature infant, neonatal jaundice, respiratory distress syndrome and immunization of children.
- Illustrate the causes of premature infant, neonatal jaundice, and respiratory distress syndrome.
- List the signs and symptoms of premature infant, neonatal jaundice, and respiratory distress syndrome.
- Identify the management of premature infant, neonatal jaundice, and respiratory distress syndrome.
- Demonstrate nursing care needed for premature infant, neonates with jaundice, and respiratory distress syndrome.
- Identify different types of vaccines, mode of administration, doses, time, contraindications and side effects.

### 3.7.2 Opening session:

1- Arrival of nurses and registration.
2- Welcoming words, the course co-ordinator, welcomes the nurses to the training, she gives short introduction about the objectives of the course and the expected outcomes and the time table was explained for the participants (Appendix 6).
3- The hospital director then welcomed the audience and explaining commitments of the hospital to the project and its role and responsibility to insure sustainability of its outcome.

4- To help trainers to get and know each others.

5- Pretest to assess nurses' knowledge, using "pre-assessments, sheet (appendix 1), and observational check list to assess nurses performance and attitude when caring of premature infant, neonates with jaundice, and respiratory distress syndrome (appendix II).

Session I:
Time: 1 hour
Title: Care of preterm infant (1)
Learning objectives :
By the end of the session, nurses should able to:

A- Define the following terms:
   1- Preterm infant.
   2- Low – birth weight infant.
   3- Very low – birth weight infant.
   4- Extremely low – birth weight infant.
   5- Kangaroo mother care (KMC).

B- Identify the characteristics of preterm infants.

C- Discuss the thermoregulation of preterm infants.

D- Demonstration of general care of preterm infant including Kangaroo mother care.

Teaching methods:
- Lectures
- Practical
- Audio visual aids (Video-role playing)
- Demonstration & redemonstration.

Evaluation methods
- Questionnaire (post test Appendix 1).
- Checklist to monitor nurses performance (Appendix 2)

Session II
Time: 1 hour
Title: Care of preterm infant (2).

Pretest:

Contents:
- Maintenance of fluid.
- Maintenance of nutrition
- Problems with skin.
- Problems with infections
- Discharge planning, follow-up an home care.

Teaching Methods:
- Lectures
- Practical
- Audio visual aids
- Demonstration

Evaluation methods:
- Questionnaire (post test Appendix 1).
- Checklist to monitor nurses performance (Appendix 2)

Session III:

Time: 45 minutes
Title: The incubator and incubator’s care.

Contents:
1- Definition of the incubator
2- Type of incubator
3- Parts of incubator
4- Work of incubator
5- Daily care of incubator.
6- Terminal care of incubator.

Teaching methods:
- Lecture
- Practical
- Audio visual aids
- Pressures (pictures demonstration)
- Demonstration.
Evaluation methods
- Questionnaire (post test Appendix 1).
- Checklist to monitor nurses performance (Appendix 2)

Session IV:
Time: 1 hour
Title: Respiratory distress syndrome (RDS)
Contents:
1- Definition of RDS
2- Pathophysiology
3- Manifestations
4- Therapeutic management
5- Nursing care of infant having RDS including care during oxygen administration.

Teaching methods:
- Lecture
- Practical
- Audio visual aids
- Pressures (pictures demonstration)
- Demonstration.

Evaluation methods
- Questionnaire (post test Appendix 1).
- Checklist to monitor nurses performance (Appendix 2)

Session V:
Time: 1 hour
Title: Neonatal jaundice
Contents:
1- Definition
2- Types of neonatal jaundice
3- Etiology
4- Therapeutic management
5- Phototherapy
6- Exchange transfusion
7- Nursing care of infant with jaundice
Teaching methods:
- Lectures
- Practical
- Audio visual aids
- Pictures demonstration (Pressures)
- Demonstration.

Evaluation methods
- Questionnaire (post test Appendix 1).
- Checklist to monitor nurses performance (Appendix 2)

Session VII:
Time: 1 hour
Title: Immunization
Pretests:
Contents:
1- Definition
2- BCG vaccination
3- Polio vaccination
4- DTP (Diphtheria, tetanus, Pertussis) vaccination
5- Measles vaccination
6- Hepatitis 'B' vaccination.

Teaching methods:
- Lectures
- Practical
- Audio visual aids
- Demonstration.

Evaluation methods
- Questionnaire (post test Appendix 1).
- Redemonstration.

3.8. Memory gap:
The duration of memory gap was 3 months started over the period from 10 January to 10 April 2013.
3.8.1 Post intervention program:
A post test was made using assessment sheet, to evaluate the effect of program on nurses' knowledge regarding neonatal nursing care. A certificate and copies of the program were gave to all participants after translation to Arabic language. All nurses were observed by the researcher during their performance using an observation checklists regarding neonatal care.

3.9 Data analysis:
The data were coded, entered, and analyzed using the statistical package for social science (SPSS) so as to show the result of the hypothesis of the study by using frequencies and percentages in tables, and figures, also P.value, Chi-square test to find the statically significant

3-10 Ethical Consideration:
- Permission from managers and matrons of Wad Medani Pediatric and obstetric and gynecology hospitals was made through official letters and verbal acceptance was obtained from them.
- All nurses in NICUs of Wad Medani Pediatric and obstetric and gynecology hospitals were informed about the aim of the study, it benefits and their acceptance and agreement was obtained from them.

3-12 Limitations:
- The availability of some equipments and supplies were not adequate in the neonatal care units.
- There was no special training room or class room followed the neonatal units.
- Collection of all neonatal nurses with their different shifts at one time was very difficult, but was organized by the metrons of the hospitals.
- No. budget.
CHAPTER FOUR
4- Results and Discussion

4-1 Results:

Table (4.1) Distribution of the selected sample according to their age.

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Frequency</th>
<th>Present %</th>
</tr>
</thead>
<tbody>
<tr>
<td>(20-25) years</td>
<td>18</td>
<td>20.0%</td>
</tr>
<tr>
<td>(26-30) years</td>
<td>28</td>
<td>31.1%</td>
</tr>
<tr>
<td>(31-35) years</td>
<td>30</td>
<td>33.3%</td>
</tr>
<tr>
<td>More than 35 years</td>
<td>14</td>
<td>15.6%</td>
</tr>
<tr>
<td>Total</td>
<td>90</td>
<td>100%</td>
</tr>
</tbody>
</table>

One third (33.3%) of the nurses aged from 31-35 years.

Figure (4.1) Distribution of the selected sample according to their qualification

The figure showed that near half (48.9%) of the nurses attained a diploma in nursing.
Table (4.2) Distribution of the selected sample according to their years of experience.  

<table>
<thead>
<tr>
<th>Years of experience</th>
<th>Frequency</th>
<th>Present %</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1-5) years</td>
<td>27</td>
<td>30.0%</td>
</tr>
<tr>
<td>(6-10) years</td>
<td>30</td>
<td>33.3%</td>
</tr>
<tr>
<td>(11-15) years</td>
<td>22</td>
<td>24.5%</td>
</tr>
<tr>
<td>More than 15 years</td>
<td>11</td>
<td>12.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

One third (33.3%) of the nurses their years of experience ranged between 6-10 years.

Figure (4.2) Distribution of nurses according to their training course about neonatal care.

12.2% of the nurses attended training course about neonatal care.
Table (4-3) Distribution of the selected nurses according to their knowledge regarding definition, characteristics, vital signs and thermoregulation of premature infant

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Definition of premature baby</td>
<td>4(4.4%)</td>
<td>26(28.9%)</td>
</tr>
<tr>
<td>Characteristics of premature baby</td>
<td>28(31.1%)</td>
<td>10(11.1%)</td>
</tr>
<tr>
<td>thermoregulation of premature baby</td>
<td>38(42.2%)</td>
<td>21(23.3%)</td>
</tr>
<tr>
<td>Maintenance of the temperature of premature baby</td>
<td>51(56.7%)</td>
<td>4(4.4%)</td>
</tr>
<tr>
<td>The vital signs of the neonate</td>
<td>10(11.1%)</td>
<td>40(44.5%)</td>
</tr>
<tr>
<td>Mean</td>
<td>29.1%</td>
<td>86.2%</td>
</tr>
</tbody>
</table>

Chi- square = 26.72  P. value = 0.001  
Chi- square = 20.43  P. value = 0.002

The table shows that the nurses’ knowledge in regard to definition, characteristics, thermoregulation and vital signs of premature infant had been significantly improved after training program. P value 0.002.
Table (4-4) Distribution of the selected nurses according to their knowledge regarding daily neonatal care, Kangaroo mother care, right position, and care regarding incubator. N=90

Chi-square = 26.521  P. value = 0.001  

Chi- square = 19.823  P. value = 0.003

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct Incomplete</td>
</tr>
<tr>
<td>The daily neonatal care</td>
<td>22(24.5%)</td>
<td>20(22.2%)</td>
</tr>
<tr>
<td>Kangaroo mother care (KMC)</td>
<td>4(4.4%)</td>
<td>29(32.2%)</td>
</tr>
<tr>
<td>Right position of the neonate in incubator:</td>
<td>13(14.4%)</td>
<td>40(44.5%)</td>
</tr>
<tr>
<td>Care regarding incubator</td>
<td>4(4.4%)</td>
<td>50(55.6%)</td>
</tr>
<tr>
<td>Mean</td>
<td>11.9%</td>
<td></td>
</tr>
</tbody>
</table>

Table (4-4) shows that, the nurses’ knowledge in regard to daily neonatal care, kangaroo mother care, right position and care regarding incubator had been significantly improved between pre-training program and post training program. P. value = 0.003
Table (4-5) Distribution of the nurses according to their knowledge regarding fluid regulation and problem which face the premature infant

N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Causes of easily fluid loss of premature baby</td>
<td>13(14.4%)</td>
<td>66(73.3%)</td>
</tr>
<tr>
<td>Amount of fluid needed by premature baby</td>
<td>21(23.3%)</td>
<td>22(24.5%)</td>
</tr>
<tr>
<td>Measurement of intake and output for premature baby</td>
<td>19(21.1%)</td>
<td>38(42.2%)</td>
</tr>
<tr>
<td>The problems which faced the premature infant</td>
<td>25(27.8%)</td>
<td>53(58.9%)</td>
</tr>
<tr>
<td>Mean</td>
<td>21.7%</td>
<td></td>
</tr>
</tbody>
</table>

Chi-square = 27.462  P. value = 0.001

Chi-square = 24.651  P. value = 0.003

The above table shows that, nurses’ knowledge in regard to fluid regulation and the problems of premature infant had been significantly improved after conduction of training program. P. value = 0.003
Table (4-6) Distribution of the selected nurses according to their knowledge regarding methods of feeding, precautions in preparing breast milk and observation of danger signs of premature infant

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Methods of feeding</td>
<td>4 (4.4%)</td>
<td>49 (54.5%)</td>
</tr>
<tr>
<td>Precautions regarding breast milk preparation</td>
<td>26 (28.9%)</td>
<td>18 (20.0%)</td>
</tr>
<tr>
<td>The danger signs which the nurse must observe and report on neonate</td>
<td>50 (55.5%)</td>
<td>22 (24.5%)</td>
</tr>
<tr>
<td>Mean</td>
<td>29.6%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 17.321   P. value = 0.000

Chi- square = 14.752   P. value = 0.001

There was much improvement showed in the statistically significant difference between the pre and post training program results.

P. value = 0.001
Table (4-7) Distribution of the selected nurses according to their Knowledge regarding Respiratory Distress syndrome (RDS) 
N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Neonates who are liable for developing RDS</td>
<td>15(16.7%)</td>
<td>30(33.3%)</td>
</tr>
<tr>
<td>Signs and symptoms of RDS</td>
<td>18(20.0%)</td>
<td>45(50.0%)</td>
</tr>
<tr>
<td>Treatment methods of RDS</td>
<td>25(27.8%)</td>
<td>27(30.0%)</td>
</tr>
<tr>
<td>Nursing care of neonates with RDS</td>
<td>50(55.6%)</td>
<td>28(31.1%)</td>
</tr>
<tr>
<td>Treatment by oxygen</td>
<td>20(22.2%)</td>
<td>55(61.1%)</td>
</tr>
<tr>
<td>Mean</td>
<td>28.4%</td>
<td>89.4%</td>
</tr>
</tbody>
</table>

Chi- square = 17.321   P. value = 0.000
Chi- square = 14.752   P. value = 0.001

Nurses’ knowledge in regard to care and management of neonates with respiratory distress syndrome had been significantly improved from (16.7%), (20%), after conduction of the training program. P.value 0.001.
Table (4-8) Distribution of the selected Nurses according to their knowledge regarding Definition, Characteristics, pathophysiology of neonatal jaundice and causes of hyperbilirubinemia N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Definition of neonatal jaundice</td>
<td>24(26.7%)</td>
<td>36(40.0%)</td>
</tr>
<tr>
<td>Factors lead to hyperbilirubinemia</td>
<td>25(27.8%)</td>
<td>35(38.9%)</td>
</tr>
<tr>
<td>Characteristics of physiological jaundice</td>
<td>16(17.8%)</td>
<td>24(26.7%)</td>
</tr>
<tr>
<td>Characteristics of pathological jaundice</td>
<td>10(11.1%)</td>
<td>32(35.5%)</td>
</tr>
<tr>
<td>Causes of pathological jaundice</td>
<td>5(5.6%)</td>
<td>35(38.9%)</td>
</tr>
<tr>
<td>mean</td>
<td>17.8%</td>
<td></td>
</tr>
</tbody>
</table>

Chi-square = 26.723    P. value =  0.001

Chi-square = 20.321   P. value = 0.000

Table (4-8) shows statistically significant improvement of participants’ knowledge after conduction of the training program. P. value = 0.000
**Table (4-9) Distribution of the selected nurses according to their knowledge regarding clinical assessment of neonates with jaundice, medical treatment and nursing care**

N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Clinical assessment of severe jaundice</td>
<td>12(13.3%)</td>
<td>37(41.1%)</td>
</tr>
<tr>
<td>Medical treatment of neonatal jaundice</td>
<td>18(20.0%)</td>
<td>30(33.3%)</td>
</tr>
<tr>
<td>Nursing care neonates with jaundice</td>
<td>22(24.5%)</td>
<td>50(55.5%)</td>
</tr>
<tr>
<td>Mean</td>
<td>19%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 18.462  P. value = 0.001

Chi- square = 16.321  P. value = 0.001

There was much improvement showed in the statistically significant difference between the pre and post training results. P. value = 0.001
Table (4-10) Distribution of the selected nurses according to their knowledge regarding Causes, Clinical pictures of hemolytic jaundice and method of prevention of neonatal jaundice

N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
<td>In correct</td>
</tr>
<tr>
<td>Causes of hemolytic jaundice</td>
<td>15(16.7%)</td>
<td>28(31.1%)</td>
<td>47(52.2%)</td>
</tr>
<tr>
<td>Clinical pictures of hemolytic jaundice</td>
<td>11(12.2%)</td>
<td>29(32.2%)</td>
<td>50(55.5%)</td>
</tr>
<tr>
<td>Methods of prevention of neonatal jaundice</td>
<td>18(20.0%)</td>
<td>32(35.5%)</td>
<td>40(44.4%)</td>
</tr>
<tr>
<td>Mean</td>
<td>16.3%</td>
<td></td>
<td>92%</td>
</tr>
</tbody>
</table>

Chi- square = 18.462  P. value =  0.001

Chi- square = 12.654  P. value =  0.003

Table (4-10) explains that. The nurses' knowledge had been significantly improved, after conduction of the training program. P.value = 0.003
Table (4-11) Distribution of the selected nurses according to their knowledge regarding phototherapy

N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>phototherapy Management</td>
<td>18(20.0%)</td>
<td>31(34.5%)</td>
</tr>
<tr>
<td>Necessary precautions during phototherapy</td>
<td>12(13.3%)</td>
<td>42(46.7%)</td>
</tr>
<tr>
<td>Nursing care during phototherapy</td>
<td>20(22.2%)</td>
<td>44(48.9%)</td>
</tr>
<tr>
<td>Side effects of phototherapy</td>
<td>13(14.4%)</td>
<td>27(30.0%)</td>
</tr>
<tr>
<td>mean</td>
<td>17%</td>
<td>90.8%</td>
</tr>
</tbody>
</table>

Chi- square = 7.47    df = 6      P. value =  0.02796

Chi- square = 4.904    df= 3      P. value =  0.01790

Nurses’ knowledge had been significantly improved after conduction of the training program. P.value = 0.01790
Table (4-12) Distribution of the selected nurses according to their knowledge regarding exchange blood transfusion method (EBT)

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Information about EBT</td>
<td>7(7.8%)</td>
<td>48(53.4%)</td>
</tr>
<tr>
<td>Process of EBT and necessary care</td>
<td>9(10.0%)</td>
<td>45(50.0%)</td>
</tr>
<tr>
<td>Complications of EBT</td>
<td>10(11.1%)</td>
<td>32(35.5%)</td>
</tr>
<tr>
<td>mean</td>
<td>9.6%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 19.321   P. value = 0.002  
Chi- square = 12.654   P. value = 0.00

The nurses knowledge had been significantly improved after conduction training program. P.value 0.000
Table (4-13) Distribution of the selected nurses according to their knowledge regarding Responsibility of incubator care and general Care of incubator

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre training programme</th>
<th>Post training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Correct Complete</td>
<td>Correct incomplete</td>
</tr>
<tr>
<td>Responsibility of incubator care</td>
<td>15(16.7%)</td>
<td>20(22.2%)</td>
</tr>
<tr>
<td>Daily care of incubator</td>
<td>18(20.0%)</td>
<td>40(44.4%)</td>
</tr>
<tr>
<td>Terminal care of incubator</td>
<td>30(33.3%)</td>
<td>25(27.8%)</td>
</tr>
<tr>
<td>Mean</td>
<td>23%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 20.543     P. value = 0.000  
Chi- square = 16.532     P. value = 0.002

In this table, it can be seen that, there was significantly improvement in nurses’ knowledge after conduction of the training program. P. value = 0.002
The table shows that, there was significant improvement of nurses’ knowledge in regard to immunization of children after conduction of the training program.

Chi- square = P. value =  0.000  
Chi- square = P. value =  0.002
Assessment of Nurses Attitude Regarding Nursing Care of preterm infant, neonate with respiratory distress syndrome & jaundice

Table (4-15) distribution of the nurses according to their attitude regarding maintenance of breathing of pre term infant

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- training programme</th>
<th>Post- training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance of Breathing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Participation of parents in positioning infant is very essential</td>
<td>74(82.2) 16(17.8) 0(0%)</td>
<td>90(100%) 0(0%) 0(0%)</td>
</tr>
<tr>
<td>The side – lying position facilitate drainage of respiratory secretions.</td>
<td>67(74.4) 23(25.6) 0(0%)</td>
<td>90(100%) 0(0%) 0(0%)</td>
</tr>
<tr>
<td>The prone position is associated with increased incidence of sudden infant death syndrome (SIDS)</td>
<td>14(15.6) 76(84.4) 0(0%)</td>
<td>90(100%) 0(0%) 0(0%)</td>
</tr>
<tr>
<td>Increased oxygen is essential before and after each suction.</td>
<td>0(0%) 12(13.3) 78(86.7)</td>
<td>90(100%) 0(0%) 0(0%)</td>
</tr>
<tr>
<td>Noise lead to increase oxygen need</td>
<td>0(0%) 61(67.81) 29(32.2)</td>
<td>82(91.1%) 8(8.9%) 0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>37.6%</td>
<td>98.2%</td>
</tr>
</tbody>
</table>

Chi- square = 263.554  df= 4  P. value = 0.000

There was significantly improvement in nurses’ attitude after the training program  P.value = 0.000
Table (4-16) distribution of nurses according to their attitude regarding maintenance of hydration of preterm infant

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- training programme</th>
<th>Post- training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td><strong>To maintain Hydration:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It's important to assess the intravenous sites at least every hour for signs of infiltration</td>
<td>67(74.4)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Small blood transfusion may be necessary to replace blood drawn for frequent laboratory tests</td>
<td>19(21.1)</td>
<td>71(78.9)</td>
</tr>
<tr>
<td>It's important to secure the intravenous catheter with adhesive plaster</td>
<td>71(78.9)</td>
<td>19(21.1)</td>
</tr>
<tr>
<td>Calculation of infant's intake and output is very important</td>
<td>73(81.1)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Weighing of newborn twice a day is very important to monitor his fluid status</td>
<td>61(67.8)</td>
<td>29(32.2)</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>64.7%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 97.491   df= 4   P. value = 0.000

Most of the nurses responded with positive attitude regarding maintenance of hydration and it was significantly improved after the training program P.value = 0.000
Table (4-17) Distribution of nurses according to their attitude regarding nutrition of preterm infant

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre-training programme</th>
<th>Post-training programme</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>To maintain nutrition:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It's important to assess tolerance of feeding</td>
<td>Agree 51(56.7)</td>
<td>Disagree 9(10%)</td>
<td>Didn't Know 30(33.3)</td>
<td>Agree 90(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Disagree 0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Didn't Know 0(0%)</td>
</tr>
<tr>
<td>It's important to aspirate the stomach contents to measure the residual amount of feeding before gavage feeding</td>
<td>Agree 43(47.8)</td>
<td>Disagree 47(52.2)</td>
<td>Didn't Know 0(0%)</td>
<td>Agree 80(88.9)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Disagree 10(11.1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Didn't Know 0(0%)</td>
</tr>
<tr>
<td>Normal gastric residuals are often replace to prevent loss of electrolytes.</td>
<td>Agree 15(16.7)</td>
<td>Disagree 22(24.4)</td>
<td>Didn't Know 53(58.9)</td>
<td>Agree 75(83.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Disagree 15(16.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Didn't Know 0(0%)</td>
</tr>
<tr>
<td>It's essential to use a tape to measure abdominal girth to defect distention every 4 – 8 hours.</td>
<td>Agree 24(26.7)</td>
<td>Disagree 30(33.3)</td>
<td>Didn't Know 36(40%)</td>
<td>Agree 75(83.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Disagree 15(16.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Didn't Know 0(0%)</td>
</tr>
<tr>
<td>Daily weighing of infant is essential</td>
<td>Agree 90(100%)</td>
<td>Disagree 0(0%)</td>
<td>Didn't Know 0(0%)</td>
<td>Agree 90(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Disagree 0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Didn't Know 0(0%)</td>
</tr>
<tr>
<td>It's important to assess intake and output daily</td>
<td>Agree 38(42.2)</td>
<td>Disagree 52(57.8)</td>
<td>Didn't Know 0(0%)</td>
<td>Agree 75(83.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Disagree 13(14.4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Didn't Know 2(2.2)</td>
</tr>
<tr>
<td>Mean</td>
<td>48.4%</td>
<td>89.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chi-square = 291.643  df= 10  P. value = 0.000  
Chi-square = 32.896  df= 5  P. value = 0.000

Nearly half of the nurses responded with positive attitude regarding nutrition of preterm infant and it was significantly improved after the training program p.value = 0.000
Table (4-18) Distribution of nurses according to their attitude regarding Kangaroo care

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- training programme</th>
<th>Post- training programme</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td><strong>Instituting Kangaroo care:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It's important to begin kangaroo care as soon as possible.</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>During kangaroo care, the infant is weared only a diaper and hat and a blanket is placed over him.</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>It's important to participate fathers in kangaroo care.</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>It's essential to explain Kangaroo care to the parents.</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

Chi-square can not be done because there are many cells with zeros

No one of the nurses (0%) responded with positive attitude regarding Kangaroo care before the training program and it was improved to 85.3% after intervention.
Table (4-19) Distribution of Nurses' attitude regarding care of neonate with Respiratory distress syndrome

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- training programme</th>
<th></th>
<th>Post- training programme</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agree</td>
<td>Disagree</td>
<td>Didn’t Know</td>
<td>Agree</td>
</tr>
<tr>
<td>Gavage feedings are avoided</td>
<td>22(24.4)</td>
<td>29(32.2)</td>
<td>39(43.3)</td>
<td>78(86.7)</td>
</tr>
<tr>
<td>Encourage parents to provide kangaroo care to facilitate respiration.</td>
<td>17(18.9)</td>
<td>24(26.7)</td>
<td>49(54.4)</td>
<td>76(84.4)</td>
</tr>
<tr>
<td>Encourage parents to name their infant to provide infant individual identify.</td>
<td>90(100%)</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
</tr>
<tr>
<td>Encourage parents to participate in new born care is important.</td>
<td>64(71.1)</td>
<td>26(28.9)</td>
<td>0(0%)</td>
<td>90(100%)</td>
</tr>
<tr>
<td>Mean</td>
<td>53.6%</td>
<td></td>
<td></td>
<td>92.8%</td>
</tr>
</tbody>
</table>

Chi-square = 193.035   df= 6   P. value = 0.000

More the half of the nurses (53.6%) responded with positive attitude regarding care of neonate with respiratory distress syndrome and it was significantly improved after the training program p.value = 0.000
## Table (4-20) Distribution of nurses according to their attitude regarding care of neonate with jaundice

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- training programme</th>
<th></th>
<th>Post- training programme</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agreement</td>
<td>Disagreement</td>
<td>Didn’t Know</td>
<td>Agreement</td>
</tr>
<tr>
<td>Phototherapy has side effects on the new born</td>
<td>0(0%)</td>
<td>57(63.3)</td>
<td>33(36.3)</td>
<td>89(98.9)</td>
</tr>
<tr>
<td>It’s important to explain the procedure of phototherapy to the parents.</td>
<td>41(45.6)</td>
<td>40(44.4)</td>
<td>9(10%)</td>
<td>84(93.3)</td>
</tr>
<tr>
<td>Encourage parents to participate in new born's care</td>
<td>61(87.8)</td>
<td>22(24.4)</td>
<td>7(7.8)</td>
<td>90(100%)</td>
</tr>
<tr>
<td>Assessment of parent's knowledge by the nurse is essential</td>
<td>60(66.7)</td>
<td>22(24.4)</td>
<td>8(8.9)</td>
<td>80(88.9)</td>
</tr>
<tr>
<td>Mean</td>
<td>50%</td>
<td></td>
<td></td>
<td>95.3%</td>
</tr>
</tbody>
</table>

Chi- square = 12.668  df= 4  P. value = 0.013

Half of the nurses (50%) responded with positive attitude regarding care of neonate with jaundice and it was significantly improved after the training program p.value = 0.001
Distribution of the Nurses according to their performance regarding care of premature infant, Neonate with Jaundice , Respiratory Distress Syndrome and incubator’s Care At Wad Medani Pediatric and obstetrics and gynecological Teaching Hospitals (2010- 2013)

Table (4-21) Distribution of the Nurses according to their performance regarding Maintenance of Breathing of premature infant

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant positing</td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td></td>
<td>50(55.6)</td>
<td>10(11.1)</td>
</tr>
<tr>
<td>Changing infant position</td>
<td>34(37.8)</td>
<td>17(18.9)</td>
</tr>
<tr>
<td>Suctioning practice</td>
<td>42(46.6)</td>
<td>12(13.3)</td>
</tr>
<tr>
<td>Monitoring &amp; recording of respiratory rate</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>35%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 5.714 df= 2 P. value = 0.057

Chi- square = 48.849 df= 3 P. value = 0.000

It can be seen that from table (4.17) the nurses’ performance was significantly improved after conduction of the training program. P.value = 0.000
Table (4-22) Distribution of the selected Nurses according to their performance regarding Maintenance of Temperature of Premature infant

\[ N=90 \]

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Monitoring &amp; recording of temperature</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Pre – warming of incubator before placing an infant in it</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Establishment of kangaroo mother care</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Rubbing of infant in warm blanket when removed from the incubator</td>
<td>45(50%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Warming of everything that comes into with the infant</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>10%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 42.275   df= 3   P. value = 0.000

Table (4-22) shows that, the nurses’ performance regarding maintenance of temperature was significantly improved as follow:

- No one of the participants pre warming the incubator before placing an infant, establish kangaroo mother care & warming everything that comes into contact with the infant before intervention, this was significantly improved after intervention. P.value = 0.000

- No one of the participants monitored and recorded the temperature before and after intervention.
The table (4-23) shows that the nurses’ performance in regard to maintenance of fluid of preterm infant was improved as follow:

- Their knowledge was good regarding insertion of intravenous catheter, feeding tube, regulation of infusion rates and weighing of the infant before intervention. This was improved after intervention. P.value = 0.7555
- No one of the respondents was practiced documentation correctly before and after intervention.
Table (4-24) Distribution of the Nurses according to their performance regarding skin care of premature infant

N= 90

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Item</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
<td>Not done</td>
</tr>
<tr>
<td>Infants bathe</td>
<td>0(0%)</td>
<td>4(4.4)</td>
<td>86(95.6%)</td>
</tr>
<tr>
<td>Changing of diaper</td>
<td>68(75.6%)</td>
<td>0(0%)</td>
<td>22(24.3)</td>
</tr>
<tr>
<td>Removal of disinfectants from the skin after invasive procedures</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
</tr>
<tr>
<td>Security of items to the skin</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Changing of position</td>
<td>33(36.7)</td>
<td>0(0%)</td>
<td>57(63.3%)</td>
</tr>
<tr>
<td>Mean</td>
<td>22.5%</td>
<td>50%</td>
<td>90(100%)</td>
</tr>
</tbody>
</table>

Chi-square = 27.635  df= 1  P. value = 0.000
Chi-square = 35.238  df= 2  P. value = 0.000

The nurses’ performance in regard to skin care of premature infant was significantly improved after intervention  P.value = 0.000

- In regard to infants bathe, removal of disinfectants from the skin and security of items to the skin were not practiced before and after training program except removal of disinfectants (86.7%) of the nurses were performed it correctly after the training program.
### Table (4.25) Distribution of the selected nurses according to their performance regarding maintenance of nutrition of premature infant

N=90

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Explain the benefits of breast feedings</td>
<td>14(15.5)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Helping mothers in maintaining lactation</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Demonstration of gavages feedings</td>
<td>65(72.2)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Measuring of abdominal girth</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Weighing of the infant</td>
<td>76(84.4)</td>
<td>14(15.6)</td>
</tr>
<tr>
<td>Recording of head circumference – length</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Assessing of intake &amp; output</td>
<td>50(55.6)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>32.5%</td>
<td>70%</td>
</tr>
</tbody>
</table>

Chi- square = 99.282   df= 3   P. value = 0.000  

Chi- square = 65.607   df= 2   P. value = 0.000

The performance of nurses in regard to maintenance of nutrition was significantly improved after the intervention  P.value = 0.000
### Table (4-26) Distribution of the selected nurses according to their performance regarding prevention of neonatal infection

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Proper hand washing and scrubbing before and after handling babies</td>
<td>0(0%)</td>
<td>63(70%)</td>
</tr>
<tr>
<td>Wearing of sterile gown before entering the baby care unit</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Using special or over shoes before entering the unit</td>
<td>4(4.4)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Using of mask</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Wearing of goggles</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Using aseptic technique for invasive procedures</td>
<td>24(26.7)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Usage of separate and disposable belongings for each infant</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Maintenance of general cleanliness of baby &amp; his surroundings</td>
<td>22(24.5)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Encouragement of exclusive breast feedings</td>
<td>40(44.4)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Disposal of needles</td>
<td>14(15.6)</td>
<td>76(84.4%)</td>
</tr>
<tr>
<td>Mean</td>
<td>21.6%</td>
<td>58.9%</td>
</tr>
</tbody>
</table>

Chi- square = 44.32  df= 4  P. value = 0.000

Chi- square = 146.19  df= 5  P. value = 0.000

The performance of nurses regarding prevention of neonatal infection was improved after intervention. P.value = 0.000
Table (4.27) Distribution of the selected nurses according to their performance regarding Kangaroo Care of premature infant

N=90

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establishing Kangaroo care</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clothing of infant during Kangaroo care</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positioning of infant during Kangaroo care</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explanation of advantages of kangaroo care to parents</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitation of breast feeding during Kangaroo care</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>0%</td>
<td></td>
</tr>
</tbody>
</table>

\[ \text{Chi-square} = 45.163 \quad \text{df} = 4 \quad \text{P. value} = 0.000 \]

It can be seen that from the table (4.23) there was no nurse practiced with the mother kangaroo care before the training program. But there was significant improvement after training program. The study group shows good practice differences which was highly significant.
Table (4-28) Distribution of the Nurses according to their performance regarding relieving anxiety of parents having premature infant

N=90

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Staying with the parents during their visit to neonatal care unit</td>
<td>23(25.6)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>A written information about neonatal care unit is gave to the parent</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Helping for parents to perform hand washing before touching the infant</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Clarifying all nursing care and its purpose</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>6.4%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 8.153   df= 2   P. value =   0.0170

The performance of nurses in regard to relieve of anxiety of parents having premature infant was improved after the training program. P.value=0.001
Table (4-29) Distribution of the selected nurses according to their performance regarding care of the new born with respiratory distress syndrome - care during Oxygen administration

N=90

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre- Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Warming and humidifying of oxygen before it given</td>
<td>69(76.7)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Water soluble ointment applied to the nares &amp; Mouth before oxygen administration</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Maintenance of flow rate of oxygen</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Assessing of vital signs</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Practicing oral hygiene</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Perform of suctioning</td>
<td>18(20%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>The infants positioning</td>
<td>25(27.8%)</td>
<td>65(72.2%)</td>
</tr>
<tr>
<td>Changing of neonatal position</td>
<td>42(46.7%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>34%</td>
<td>65.4%</td>
</tr>
</tbody>
</table>

Chi- square = 70.13  df= 3  P. value = 0.000

Chi- square = 28.882  df= 3  P. value = 0.000

Table (4-26) Shows that, the nurses’ performance regarding care during oxygen administration was significantly improved after conduction of the program. P. value = 0.000
Table (4.30) Distribution of the Nurses’ performance regarding care of newborn with Jaundice

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre - Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Taking blood sample for measurement of bilirubin</td>
<td>83(92.2%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Taking of vital signs</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Monitoring of intake and output</td>
<td>60(66.7%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

**nursing care during phototherapy:**

<table>
<thead>
<tr>
<th>Item</th>
<th>Pre - Training program</th>
<th>Post- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Covering of newborns eyes</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Covering of genitals</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Changing of position</td>
<td>13(14.4)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Checking &amp; recording of temperature</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Infant feedings</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Maintenance of fluid</td>
<td>82(91.1)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Correct distance between the light source &amp; skin of newborn</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Weighing of the newborn</td>
<td>76(84.4)</td>
<td>14(15.6)</td>
</tr>
<tr>
<td>Explanation of phototherapy procedure to parents</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Encouragement of parents to participate in newborns care</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Documentation</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
</tbody>
</table>

**Mean**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Done correctly</td>
<td>53.5%</td>
</tr>
<tr>
<td>Done incorrectly</td>
<td>72%</td>
</tr>
</tbody>
</table>

Chi- square = 181.184  df= 4    P. value = 0.000
Chi- square = 158.977  df= 6    P. value = 0.000

Table (4.25) shows that the nurses’ performance regarding care of newborn with jaundice was significantly improved after conduction of the training program. P. value = 0.000
Table (4-31): Distribution of the selected nurses according to their performance regarding Daily care of incubator

N=90

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- Training program</th>
<th></th>
<th>Post- Training program</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done Correctly</td>
<td>Done incorrectly</td>
<td>Not done</td>
<td>Done Correctly</td>
</tr>
<tr>
<td>Wash hands</td>
<td>38(42.2%)</td>
<td>21(23.3%)</td>
<td>31(34.5%)</td>
<td>74(82.2)</td>
</tr>
<tr>
<td>Wipe down the inside wall with disinfectant</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>55(61.1%)</td>
</tr>
<tr>
<td>while changing sheet</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change of bed sheet daily.</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>90(100%)</td>
</tr>
<tr>
<td>Wipe of the outside wall every 8 hours.</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Wipe of plastic cover mattress with disinfectant</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Check that temperature is between 28 – 32°C.</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>84(93.3%)</td>
</tr>
<tr>
<td>Check that humidity is between 55 – 65%</td>
<td>0(0%)</td>
<td>0(0%)</td>
<td>90(100%)</td>
<td>79(87.8%)</td>
</tr>
<tr>
<td>Wash hands</td>
<td>56(62.2%)</td>
<td>32(35.6%)</td>
<td>2(2.2)</td>
<td>84(93.3%)</td>
</tr>
<tr>
<td>Mean</td>
<td>13%</td>
<td>64.7%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 7.214  df= 1  P. value = 0.007  
Chi- square = 67.651  df= 5  P. value =  0.000

Table (4-28) Illustrates that the nurses’ performance regarding daily care of incubator was significantly improved after intervention. P. value =  0.000
Table (4-32) Distribution of the selected nurses according to their performance regarding Terminal care of incubator

<table>
<thead>
<tr>
<th>Items</th>
<th>Pre- - Training program</th>
<th>Post-- Training program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Done Correctly</td>
<td>Done incorrectly</td>
</tr>
<tr>
<td>Wash hand's</td>
<td>68(75.6%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Switch s of electricity off from incubator</td>
<td>90(100%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Invert humidity tank to drain it &amp; dry it well</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Wash it with hot soapy water, rinse and dry well</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Wash mattress with soap and water, dry it well</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Wash the floor of incubator with soap &amp; water and dry it well</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Expose the whole unit to adequate fresh air and sunshine</td>
<td>0(0%)</td>
<td>0(0%)</td>
</tr>
<tr>
<td>Mean</td>
<td>25%</td>
<td></td>
</tr>
</tbody>
</table>

Chi- square = 109.29    df= 4    P. value = 0.000

Table (4-29) shows that, the nurses’ performance regarding terminal care of incubator was significantly improved after intervention P. value = 0.000
4.2 Discussion:

This is an interventional hospital – based study aimed at assessing effect of a training program on nurses’ knowledge, attitude and practice regarding care of premature infant, neonate with RDS, jaundice, and their knowledge regarding immunization of children at Wad Medani pediatric and obstetric and Gynecology teaching hospitals during the period of the study from July 2010 to July 2013.

Knowledge of study population regarding care of premature infant, neonates with RDS, jaundice and immunization of children:

Socio-demographics characteristics data of the nurses were studied including their ages, qualifications, years of experience and history of attending training courses regarding neonatal care.

The result showed that one third (33.3%) of the nurses their ages between (31-35) years while only (15.6%) their ages were over 35 years. The majority (87.8%) of the nurses were not participated in any education program regarding neonatal care and only (12.2%) of them were attended training course regarding it.

In regard to the knowledge of the nurses about definition, characteristics and thermoregulation of premature infant (table 4-3) revealed that, before training program their knowledge was very limited, correct and complete answer in regard to the definition and the vital signs of premature infant were obtained by only (4.4%), (11.1%) but regarding characteristics and the thermoregulation, their knowledge was better as it was shown in the table. However, after implementation of the program, (92.2%) of the participants were able to give the correct definition of the premature infant and (88.9%) of them gave correct answers in regard to the vital signs. Also their knowledge regarding characteristics and thermoregulation of premature infant was significantly improved to (83%) and (86.7%) respectively, this indicated that, the implementation of the program was very effective in upgrading nurses’ knowledge, this is incompatible with Hanan, F. (2009) in her study to assess the nursing care given for high risk neonates in Ain Shams pediatric and maternity hospital Egypt, her study proved that total knowledge of the nurses regarding high risk neonate was average for 70%, three quarters of the studied nurses (75%) showed positive attitude toward care of high risk neonates and there was statistically significant difference between nurses attitude and their attending to training course regarding high risk neonate P.value <0.005. She recommended that establishment of in-service
educational program provide continuous education for nurses in neonatal intensive care units aiming at refreshing their knowledge, practice and attitude was of great importance.

In relation to participants’ knowledge on daily neonatal care, kangaroo mother care, right positioning of premature infant, table (4-4) revealed that, their knowledge had been significantly improved from (24.5%), (4.4%) and (14.4%) before intervention and raised to (84.4%), (87.8%) and (82.2%) especially their knowledge regarding kangaroo care, this result was consistent with Samya N. et al., (2013), in her study: impact of neonatal nurses’ guideline on improving their knowledge attitude and practice toward Kangaroo mother care, in the NICUs at Mansura University children hospital Egypt, her results revealed that, nurses’ mean knowledge scores of KMC, there were a highly statistically significance differences between nurses’ knowledge before and after guidelines intervention in the majority of statements toward benefits of KMC with total mean score (pre 29.7500 post 51.9167) at P.value 0.000 and she recommended that the effectiveness of neonatal nurses guideline on improving their knowledge and practice toward kangaroo mother care as a means of facilitating parent infant attachment, and provides valuable insights into the attitude and practices of neonatal nurses in promoting KMC within the highly specialized NICU environment.

Preterm infants lose fluid very easily, monitoring of fluid needed and intake and output is important in determining fluid balance by nursing personnel. Table (4-5) revealed strong association between nurses’ knowledge pre-intervention and post intervention. Only (14.4%) of the participants gave correct answers in regard to causes of easily fluid loss of premature infant, followed by (21%) of them gave correct and complete answers concerning measurement of intake and output, (23.3%) of them gave correct answers regarding fluid needed and (27.8%) of them gave correct answers in regard to problem which faces the preterm infant, and post intervention the knowledge was increased to over (80%). This findings is consistent with Safy S (2014) who studied the educational outcomes associated with providing a comprehensive guidelines program about nursing care of neonates receiving total paraental nutrition she stated that, the education program had a significant positive impact on nurses’ knowledge and practice outcomes.

The current study results showed that, the participants’ knowledge in regard to methods of feeding pre term infant, precautions regarding breast milk preparation,
table (4-6) revealed strong association between level of nurses’ knowledge and intervention program. Before intervention only (4.4%) of the participants gave correct and complete answers in regard to method of feeding and (28.9%) of them gave correct and complete answers regarding precautions concerning breast milk preparation whereas after the intervention program it was improved to (90%) , (95.6%) respectively. Safy S, (2014) added that, poor understanding or practice of feeding of preterm causes devastating complications, therefore good NICU nursing care for preterm neonates and close monitoring of complication is essential for successful nutrition.

Concerning respondents’ knowledge regarding respiratory distress syndrome table (4-7) showed that the participants’ knowledge was significantly improved between the pre intervention and post intervention phase. The mean score of knowledge before the training program was 28.4%, it was improved to 89.4%. More than half of the nurses (55.6%) gave correct answers in regard to nursing care of neonate with jaundice, but their knowledge regarding signs and symptoms and treatment was inadequate before the program and it was improved after the application of the program. This result is in contrast with MRS. Minideborah A, (2008) in her study to evaluate the effectiveness of a self instructional module on care of preterm babies with RDS for pediatric staff nurses working at selected hospitals in Bangalore she reported that, the nurses caring for premature babies with RDS must possess adequate knowledge of the underlying disease process as well as the different therapies in order to reduce the complications.

In the present study, there was statistically significant improvement between pre and post intervention in regard to definition, characteristics, pathophysiology of neonatal jaundice and causes of hyperbilirubinemia, table (4-8) showed that, the mean score of knowledge was (18%) before the intervention and post intervention increased to (88.5%) of the study sample. This result was incompatible with Neimat A, (2013). In her study aimed at assessing pediatric nurse role about management of neonatal jaundice under phototherapy in Jaafar Ibn Auf Pediatric hospital, Khartoum who stated that, the mean score of knowledge of her respondents was excellent as showed by their responses (96%). I think this was attributed to better health facilities and staffing of NICU of Jaffer Abn Auf Pediatric Hospital and the frequent establishment of training program regarding neonatal care.
The findings of the study in regard to clinical assessment of neonates with jaundice, medical treatment and nursing care table (4-9) revealed strong association between pre and post intervention, the mean score of knowledge before intervention was (19%) and it was increased to (88%) after intervention. Suhayla M, (2008) added that, regular training workshops should be conducted to bridge the knowledge among the nurses working in NICUs. Nurses should take their opportunity for continuing education to maintain knowledge and practices as well as updating neonatal jaundice nursing.

As regard the respondent’s knowledge concerning causes, clinical pictures of hemolytic jaundice and method of prevention. Table (4-10) showed strong association between pre and post intervention. Pre intervention the mean score of knowledge was only (16%) and it was increased to (92%) after the intervention. The pre intervention results were a greed with Nagat S. (2009) who stated that, nurses’ knowledge in regard to signs and symptoms of jaundice, complications, phototherapy, exchange blood transfusion was poor.

Concerning phototherapy, table (4-11) illustrated that nurses’ knowledge had been statically improved between pre and post intervention. The mean score of knowledge before the intervention was (17%) and it was improved to (91%) post intervention, this indicated that the implementation of training program was very effective in enhancing participant’s knowledge, this in agreement with Santoshi S, (2007) who stated that, the nursing personnel in NICUs should be provided with in-service education training in relation to care of neonates with phototherapy, the study will be helpful for providing information about existing knowledge and practices of nursing personnel staff and provide knowledge about the strength and weakness of the services provided by the hospital regarding phototherapy for future researcher.

The present study revealed that, there was strong association between nurses’ knowledge in regard to exchange blood transfusion method before and after training program. Table (4-12) showed that, the mean score of knowledge of the nurses’ before the program was only (10%) and it was improved to (90%) after the program. This indicated that, there was strong association between level of knowledge pre and post training P.value 0.000.

As regard to the participants’ knowledge concerning responsibility of incubator’s care and general care of the incubator. Table (4-13) revealed strong association between pre training and post raining program. The mean score of knowledge pre training
program was 23% and it was improved to 93% post training program. Only (16.7%) of the nurses agreed that the responsibility of incubator care is the responsibility of the nurse while the most of them referred it to the cleaner and biomedical engineer. They believed that because their number were limited and there is no system of auxiliary nurses who assisted health care professionals in different nursing duties in the hospital and take care of machines and instruments and aids in minor medical procedures.

The present study showed that; the participants’ knowledge related immunization of children table (4-14) was limited before the training program, the mean score of knowledge was only (14.5%). Before the program however, after implementing of the program, the mean score of knowledge of the participants was improved to (90%). This indicates that there was strong association between level of knowledge pre and post training P.value 0.002. Paula L., (2011) explained that neonatal nurses need to stay current on recommendations for immunizations commonly used in the neonatal intensive care unit (NICU). There are frequent updates and changes in immunization scheduling and types of vaccines available. Often premature infants have delayed immunization schedules.

**Attitudes of the nurses regarding care of preterm infant, neonate with respiratory distress syndrome and jaundice:**

The study reflects attitude of the participants in regard to maintenance of breathing of preterm infant, table (4-15) revealed that, more than three quarter of the nurses responded with positive attitude regarding participation of parents in positioning and agreed with that, the side-lying position facilitate drainage of respiratory secretion whereas, no one (0%) of the nurses responded positively in regard to increased of oxygen before and after each suction and noise lead to increase oxygen need before the training program, this negative attitude was changed to (100%) , (91.1%) respectively post training program. The result indicated that the intervention created positive change.

The present study demonstrated respondent’s attitudes and awareness regarding maintenance of fluid of preterm infant table (4-16) revealed that three quarters and more of the respondents were agreed that the intravenous sites should be assess at least every hour, calculation of intake and out put and weighing the newborn twice a day is very important. Most of the participants (78.9%) had positive attitude toward using of adhesive plaster in securing intravenous catheter, they gained this attitude from their practice because the adhesive plaster was used routinely for securing items
to the premature infant. Premature infants have fragile, permeable and easily damaged skin and transparent adhesive should be used instead, this is compatible with AWHONN (2007) who stated that, standard adhesive tape can be very damaging to the skin of preterm infants, especially during removal so, it should be used as little as possible.

The study reflects attitudes of the respondents regarding nutrition of preterm infant. Table (4-17) showed that pre intervention more than half of the nurses agreed with the items: assessing the tolerance of feeding and aspiration of the stomach contents before feeding. This behavior indicated that they had some knowledge, post intervention their attitudes was improved to (100%) and (88.9%) respectively. The result obvious that, there was a positive change pre and post program. Post program the awareness of the nurses was increased P.value 0.00.

Kangaroo care of preterm infant is a technique seeks to provide restored closeness of the newborn with mother or father by placing the infant in direct skin to skin contact with one of them. In the table (4-18) it can be seen that, no one of the participants responded with positive attitude regarding kangaroo mother care before training program. While (100%) agreed with it after the training program. This result was contradicted with Solomans N, (2010) in her study aimed at assessing knowledge and attitude of nurses and mothers towards Kangaroo mother care in eastern sub-district of Cape Town she stated that, the majority of hospital nursing staff was very positive toward kangaroo mother care and agreed that it was beneficial to both mother and infant.

The study indicated that, the respondents’ attitude regarding care of the neonate with respiratory distress syndrome table (4-19) was changed between pre intervention and post intervention phase, in regard to avoidance of gavage feeding and encouragement of parent to provide kangaroo care to neonate with RDS. There was significant effect P.value 0.00.

The present study demonstrated respondents’ attitude regarding care of infant with jaundice table (4-20) showed that, no one of the nurses was agreed that, phototherapy has side effects on the newborn before the training program, raised to (98.9%) after implementation of the training program. This indicated that, their knowledge regarding phototherapy was limited before the intervention and their attitude was changed after implementation of the program.
Practices of nursing staff regarding care of premature infant, neonates with RDS, jaundice and incubator’s care:

Regarding to the respondents’ performance concerning maintenance of breathing table (4-21) revealed that, the mean score of practices before the training program was 35% and improved to 72% after implementation of the program. More than half of the nurses were practiced suctioning and infant positioning correctly. These results were consistent with Hanan F, (2009) in her study aimed at assessing nurses’ knowledge, attitude and practice regarding care of high risk neonates at NICUs of pediatric and maternity hospital of AinShams, Egypt, she reported that, more than half of her nurses were competent regarding practices related to high risk neonates.

Regarding the nurses’ performance concerning maintenance of temperature of preterm infant table (4-22) revealed that, no one of the participants practice the measures for maintaining temperature before the training program correctly and no one checked the temperature of the preterm infant. One thermometer for vital signs in the NICU, the nurses were attributed this to the hospital policy, because their number was limited and they were engaged in all difficult procedures and routine care by their limited number and there is no auxiliary nurse system in NICU who assisted them in her heavy work and minor medical procedures like taking the vital signs. The mean performance scores after implementation of the program was 72.4%. This result was inconsistent with Rawda A, (2011) in her study aimed at assessing nurses’ knowledge and practice regarding nursing management of premature babies in NICU at Soba University hospital Khartoum she reported that, 100% of her study sample were checked the temperature correctly as a routine care.

Meanwhile, there were no statistical significant difference between participants mean score of performance before and after intervention toward maintenance of fluid of premature infant table (4-23) revealed that, nurses performance was good in regard to insertion of intravenous catheter and excellent regard delivery of fluid by infusion pump, but in regard to documentation, no one of the participants was practiced any form of documentation before and after the training program. All the participants they tried to do their best in documentation, but it was done incorrectly because there is no documentation forms guideline established by the hospital, they were documented what they had been done in the admission sheet of the patient which was wrong.

As regards to the nurses’ practice about skin care of premature infant table (4-24), the current study stated that nurses’ performance in regard to diaper care was good and
more than one third of nurses were changing infant position before intervention and it was improved to over 80% after intervention. No one of the participants practiced infant bath before and after intervention, because the NICU is not provided with equipments and solutions and there is no special room for bathing. This result is incompatible with Sohair A. etal., (2014) in her study aimed at assessing the effect of developmentally supportive care training program on nurses’ performance during tub bath provided for neonates in NICU at Benha specialized pediatric hospital Egypt. She reported that, there was highly statistically significance differences between the means of the total score of the nurses’ performance regarding tub bath for newborn infants before and after application of developmentally supportive care program, nurses’ who received the DSC program at a higher knowledge score and improved level of performance during newborn infant’s tub baths, the continuing education of the staff in NICU are vital to improve the quality of care provided for newborn infants.

Preterm newborn requires a larger amount of nutrients than the mature infant. Continuous assessment of the infant’s responses to all feeding methods helping the mother to feed comfortable and participation of the parents in newborns care was of great importance. Table (4-25) showed statistically significance improvement between participants’ practice before and after intervention in regard to preterm nutrition. The majority of the nurses were practiced gavage feeding and weighing of the infant correctly, while in regard to measurements of abdominal girth, head circumference and length, no one of the participants practiced them before and after intervention due to unavailable measurements facilities in NICU. Some of this findings is consistent with Rawda A., (2011) who reported that, majority of her study group were practiced nosogastric tube insertion and weighing of the newborns correctly.

Preterm infants have a lowered resistance to infection. They have a deficiency of IgM antibodies because of insufficient production. Safety precautions should be strictly enforced to prevent infections in NICU. Table (4-26) showed distribution of the nurses according to their performance regarding prevention of neonatal infections. There were statistically significant improvement of nurses’ practice and activity toward prevention of infection. The majority of nurses practice hand washing, using a septic technique for invasive procedures, maintaining cleanliness of baby and his surrounding, encourage mothers for exclusive breast feeding and disposal of needle
correctly after intervention when comparing to pre intervention. No one of the nurses wear sterile gown or mask before and after intervention due to limits facilities in NICU. Infrequent hand washing of some nurses related to increasing nursing work load, reduced availability of hand decontaminating agents, medicated soap, sprays and hand towels. Jeanie P, et al., (2005). Added that health care - associated infections are significant cause of morbidity and mortality among infants in NICU. Infants hospitalized in the NICU have the highest rates of health care - associated infection among the pediatric population. Among infants in the NICU, the blood stream, is the most common site of health care, associated infection in all birth groups. The infection rates ranging from (6) to more than (30) infections per (100) patients.

Kangaroo mothers care (KMC) is special way of caring low birth weight infants. Demonstration of the procedure by the neonatal nurse gently and with patience and educate the mother about KMC by giving information verbally about benefits and needs to provide. KMC in NICUs in Wad Medani was not be done and no one of the participants heard about it and nurses were very interested during the KMC sessions and its demonstration. They applied it to the premature infants’ mother and they were very surprised by the results in improving weight of the premature infants. Table (4-27) showed the highly statistically significance differences between nurses’ performance before and after intervention. No one of the participants perform KMC before the intervention and after application of the program the total mean score of performance was 79.6%.

These results were consistent with Samia E. et al., (2013). In their study aimed at evaluating the impact of neonatal nurse’s guidelines on improving their knowledge, attitude and practice toward KMC at Mansura University Children Hospital, they reported that, neonatal nurses’ guidelines were very effective on improving their knowledge toward KMC and provide valuable insights into the highly specialized NICU environment. Hospital supported for the mothers is needed to facilitate and continues early initiation of KMC through allowing the mother to visit her premature infants’ all of the time without restrictions.

Apparentely, the study results table(4-28) proved that, there were statistically significance differences between the items of nurses’ performance regarding relieving anxiety of parents having premature infant during pre and post program application except the item: A written information about neonatal care units is gave to the parents, this will aid in active participation of parents in neonate’s care because this
information will include the rules and regulations of the unit including visiting times and the problems of their neonate and methods of care and follow up. Due to the limited facilities of the hospital, this was not applied pre and post program application.

Respiratory distress syndrome refers to a condition of surfactant deficiency and physiologic immaturity of the thorax. The treatment of RDS includes all the general measures required for any premature infant. Table (4-29) revealed that, all the study sample were maintaining the flow rate of oxygen correctly and more than three quarters were warming and humidifying oxygen before it given, before the training program. No one of the participants assessed the vital signs and applied water soluble ointment to the nares and mouth before oxygen administration, before and after the program, due to the hospital policies in regard to vital signs and limited facilities of hospital in providing the NICU with such component.

Concerning nurses’ performance regarding care of newborn with jaundice table (4-30) demonstrated that there were highly statistically significance difference (P.value 0.000) between the nurses’ performance before and after program application. No one of the participants explained phototherapy procedure to parent and encouraged them to participate in newborn care before application of the program it was improved to three quarters (67%) after the program. This results compatible with Suhayla M, (2008) in her study which aimed at assessing knowledge and practices of nurses working in NICUS toward neonatal jaundice in Kirkuk and Hawler cities, she reported that, there were knowledge gap and lack of practices performance related to some statements exist among nurses in the locality concerning neonatal jaundice. Shresha S, (2007) added that, nursing personnel should be provided with in-service education training in relation to care of neonates with phototherapy. All of the participants were practiced infant feeding, covering of newborn’s eyes and genitals correctly before the intervention and three quarters and more of them were taking the blood sample, monitoring intake and output, practicing infant feedings and maintenance of fluid correctly. No one of the participants was practiced documentation correctly before and after application of training program due to limited facilities as I mentioned before.

Clearly table (4-31) demonstrated that, there were highly statistically significance differences (P.value 0.00) between nurses’ performance regarding daily care of incubator. Before the program the incubator’s care done by the cleaner and
biomedical engineer who regulate the humidity and temperature, no nurse involved in care except for the neonate inside it and the incubators were very dirty and dusty. After application of the incubator’ care sessions nurses agreed that, the care of incubator it is their responsibility. Their number was limited and there is no system of auxillary nurse in the NICU which is responsible for the such care. To solve this problem, the head nurse in the NICUs was assigned one nurse to be responsible for one incubator till the discharge of the neonate, then the final care to be under taken. They were tried to do their best in daily care but within the hospital facilities.

Table (4-32) also revealed that there was statistically significance differences regarding terminal care of the incubator after application of the training program. Before the program no one of the participants practiced any items of final care of incubator except practicing of hand washing and switched off electricity from incubator and it was improved to 85.7% (mean score of performance) after application of the program. All the incubators were sterilized by formaline for 48 hours after discharge of the neonate.

**Health facilities and staffing of neonatal intensive care units:**

The physical facilities for each unit were explained in appendix (III) which reflected limited facilities, even the gloves which distributed by the hospital were not enough for all necessary procedures in NICUs and the parents bought the gloves, medications and disinfectants needed by their neonates.

In Wad Medani pediatric teaching hospital, one nurse responsible for 30 beds of stable neonates with less complicated problems and in intermediate care unit one nurse responsible for 6 neonates and some times more and the same intermediate staff responsible for intensive care neonates. In obstetric and gynecology hospital, there is no room responsible for general care for stable neonates, in the intermediate nursery, one nurse responsible for 8 neonates and the same staff responsible for intensive care nursery.
CHAPTER FIVE

Conclusion and Recommendations

5.1 Conclusion:
Based on the results of the study, the study concluded that:

- Comprehensive training program resulted in significant improvement in nurses’ knowledge, attitude and practice in neonatal care.
- Sustaining of acquired practice skills application was negatively affected by the unavailability of necessary equipment and supplies eg. Hand washing facilities’ personal protective measures especially gown, masks and antiseptic solutions and unavailability of documentation system.
- Absence of knowledge and practice of some items of premature care eg., KMC
- Unavailability of demonstration or class room beside the NICUs
- In-service training was lacked in NICUs.

5.2 Recommendations:
Based on the findings of this study the following recommendations are suggested.

- Collaboration and continuing education of the nursing staff are vital to improve the quality of knowledge and practices for newborn infants.
- Supervision system should be developed by the hospital to assess the competency of nurses’ practice at periodic intervals.
- The medical and nursing administration should think seriously to train and create a cadre of specialized neonatal nurse, this will go along way in improving and sustaining quality neonatal care in the town.
- Level of education must be the prerequisite for working in NICU and post graduate diploma can be started to create a leadership cadre in neonatal nursing
- Updated learning facilities (books, journals) should be available at NICUs and a written information about NICUs should be gave to every family of neonate admitted to the units.
- Initiation of KMC in a well–equipped room with warming and comforting needs for premature neonates and their parents in NICUs and hospital support
is need to facilitate and continues early initiation of KMC through allowing the mother or father to visit the premature infant without restrictions.

- The NICUs should be provided with all emergency medications and solutions, equipment an supplies and protective measures to prevent infection medicated, hand scrub dispenses, gloves, gowns, disposable masks…)
- Neonatal nurses’ should be members in infection control committee with state ministry of health.
- Auxillary nurse system should be introduced in the NIC units and the number of nurses should be increased, this will allow them to engage in all responsibilities assigned for them.
- Future research is strategically targeted to fill the gaps and to provide more concrete information in the current evidence related to neonatal care.
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Appendix (I)

University of Gezira- Faculty of Medicine- Primary Health Care Center-
Program Of PhD In Community Health

Assessment sheet About Nurse's knowledge, attitude and practices
Regarding nursing care of the neonates in Intensive Care Units At Wad Medani Pediatric and obstetrics and gynecological Teaching Hospitals

1. No

2. Qualifications:
   a. Technical Nursing certificate
   b. B.sc in nursing
   c. Diploma in nursing
   d. Postgraduate

3. Years of experience:
   a. 1------5 yrs
   b. 5------10 yrs
   c. 10------15 yrs
   d. above 15 years

4. Are you practice any training courses in neonatal care?
   Yes ☐   No ☐

5. The premature baby is a baby who:
   a. Born before the beginning of the 38 weeks gestation
   b. His weight 2500 grams or less at birth.
   c. His weight 1500 grams or less at birth.
   d. His weight 1000 grams or less at birth.
   e. Born after 40 weeks gestation.

6. The following are True or False about the characteristics of premature baby:
   a. Small in size with large head.
   b. His length is less than 47cm & the head circumference is less than 33 cm.
   c. The head circumference is less than the chest circumference by more than 3cm.
   d. Poor response to stimulus.
   e. His eye are closed and protruding & the ear are soft & flat.

7. Indication of inadequate thermoregulation for premature baby the followings are True or False:
   a. poor feeding.
b. Irritability.
c. Decreased muscle tone.
d. Low blood sugar.
e. Weak growth of the baby.

8. The following are True / False about the right position for the newborn inside the incubator:
   a. On this side.
   b. Prone position for easy drainage of secretions from lungs.
   c. The position must be change every 2—3 hours.
   d. It’s better to be put on his back for easy observation.
   e. The prone position may cause sudden infant death syndrome (SIDS).

9. For the maintenance of the temperature of the premature baby the following are True / False:
   a. The temperature inside the incubator must be between $C31---32C$.
   b. The incubator should be with doubled sides to prevent loss of temperature.
   c. The humidity must be between 60%---65%.
   d. The doors of incubator must be always close.
   e. The equipments used for care it must be warm.

10. The daily neonatal care includes:
    a. Warmth of the neonate.
    b. Daily bathing of neonate to prevent infections.
    c. Encourage breast feeding.
    d. Cleaning neonatal eyes with cotton soiled with sterile water or normal saline.
    e. Use of olive oil after bathing to remove the oily layer that cover his skin.

11. The followings are True / False about the vital signs for the neonate:
    a. Important in identifying the diagnoses of the disease.
    b. The best method for taking temperature for the newborn is by rectum.
    c. The normal pulse range between 120---160 beats /minute.
    d. There is no difference in blood pressure readings which taken through the arm or thigh for the new born till the first year.
    e. The normal range for respiration range between 30—60 cycle/ minute.

12. The followings are True / False about the kangaroo mother care (KMC) for the neonate:
    a. Is the kind of care for small size baby.
    b. It require touching of mother’s skin with new born’s skin.
    c. It help in initiation of lactation from the breast.
    d. It require continuous availability of the mother with her neonate.
    e. Is the best method for continuous warmth of the small size baby.
13. The followings are True/False about the problems which faced the premature baby:
   a. Respiratory distress.
   b. Hypothermia.
   c. Hypoglycemia.
   d. Hyperbilirubinemia.
   e. Liable to infections.

14. The followings are True/False about the causes of easily fluid lost for premature baby
   a. Rapid respiratory rate.
   b. Use of oxygen.
   c. Thin skin with little subcutaneous fat.
   d. Incomplete development of the kidneys until 35 weeks of gestation.
   e. Heat from phototherapy.

15. The followings are True/False about the amount and fluid regulation for premature baby:
   a. The fluid needs of preterm infant range from 60---80 ml/kg/on the first day.
   b. The fluid needs of preterm infant in second and third day range from 90---140 ml/kg.
   c. The amount of the fluid increased if the newborn's weight is less than 1500 gram.
   d. The urinary output range between 2---5 ml/kg/hour.
   e. In phototherapy the fluid increase about 20---40 ml/kg/day.

16. The followings are True/False about the measurement of intake and output for premature baby:
   a. Measuring intake by adding intravenous fluid, oral fluid and by nasogastric tube.
   b. Measuring output by adding regurgitations-stools, urine and drainage tubes.
   c. Collection of urine by putting plastic bags that adhere to the perineum.
   d. Weighing wet diapers and subtracted the dry diapers from it to measure the amount of urine.
   e. 1 gram from the weighing of diaper equivalent to 1 ml of urine.

17. The followings are True/False about the care of premature inside incubator:
   a. The number of babies should not exceed two inside are incubator.
   b. Regulation of it's temperature according to the neonates weight.
   c. The same incubator should not be use for more than seven consequent days for newborn.
   d. The formalin can be used for sterilization of incubator after it's use.
   e. The incubator must be put in suitable place & away from heat resources.

18. The followings are True/False about the premature feeding:
   a. The feeding should be started with breast feeding if can be able to do it.
b. If the respiratory rate of premature is more than 60 he must be feed by nasogastric tube.
c. Aspiration of stomach contents every 2-4 hours before the following meal by nasogastric tube.
d. Vomiting & regurgitation they can be indicators for extra feeding.
e. If the aspirated contents of stomach is more than half of the last meal- the doctor should be reported.

19. The danger signs which the nurse observe & report on the neonate includes the followings:
   a. Excessive crying & irritability.
   b. Poor feeding & sucking.
   c. Rapid respiration more than 60 cycles per minute.
   d. Poor activity & poor response to stimulation.
   e. No urination within 48 hours from birth.

20. The followings are True/False about breast milk:
   a. It must restore in refrigerator for maximum period 48 hours.
   B. The hand should be washed with antiseptic during expression of milk & put it in sterile container.
   c. The milk can be store in ice form for 6 months.
   d. The ice form milk can be warm by putting it on calm fire.
   e. The milk can be expressed only for premature baby who was unable to breast feed.

21. The neonates whom are most liable for her respiratory distress syndrome (RDS) are:
   a. Premature baby.
   b. Neonates of cesarean section.
   c. Neonates of multiple pregnancy.
   d. Neonates of diabetic mothers.
   e. Neonates of mothers whom have high blood pressure.

22. Signs & symptoms of respiratory distress syndrome include the followings:
   a. Rapid respiration.
   b. Nasal flaring.
   c. Increased oxygen in the blood & decreased carbon dioxide.
   d. grunting on expiration is primary signs.
   e. Cyanosis of neonatal skin.

23. The followings are True/ False about the treatment of neonate who has respiratory distress syndrome:
   a. Installation of surfactant into the trachea immediately after birth or as soon as signs symptoms become apparent
   b. Oxygen administration.
   c. Mechanical ventilation.
d. Correction of blood acidosis.
e. Maintenance of neonatal temperature.

24. The followings are True/False about the nursing care of neonate who has respiratory distress syndrome:
   a. Continuous assessment for observing any change in infant's condition.
   b. Monitor the results of laboratory blood tests for abnormal in blood gases.
   c. Identifying on the appearance of any early signs of sepsis.
   d. Put the baby on prone position for easy drainage of secretions & increased oxygen amount.
   e. Observation of neonate for his ability for respiration without oxygen or with oxygen.

25. The followings are True/False about the treatment by oxygen:
   a. It given through tent, nasal canula, mask or incubator.
   b. The amount inhaled range between 30%---100%.
   c. Some of it's complication fibrosis behind eye lense and brain damage of newborn.
   d. The oxygen should be warmed & humidified before it given to premature.
   e. The oxygen should be stopped gradually.

26. The followings are True/False about the neonatal jaundice:
   a. Is the sign of hyper bilirubinemia.
   b. The yellow discoloration start on the face at a serum bilirubin level of 5 mg/dl.
   c. 80 percent of preterm neonates have bilirubin level greater than 5 mg/dl.
   d. There is three types of it pathological jaundice- physiological jaundice & hemolytic jaundice.
   e. It's most common in preterm neonates & small for date neonates.

27. The followings are True/False about the factors which lead to increased bilirubin in the blood:
   a. Hemolysis of excessive erythrocytes.
   b. Short red blood cell life in premature.
   c. Liver immaturity.
   d. Lacked of intestinal flora.
   e. Delayed feeding of the neonates.

28. The followings are True/False about the physiological jaundice:
   a. It also called non pathological jaundice.
   b. It appears in the first day of birth.
   c. The bilirubin level is not exceed 15 mg/dl.
   d. Usually disappears by 7th to 10th day in term baby & by 14th day in preterm baby.
   e. It disappears spontaneously & no treatment is needed.

29. The followings are True/False about the pathological jaundice:
   a. It occurs in about 5% of neonates.
b. It occurs in second or third day of birth.
c. There are two types of it.
d. The level of bilirubin increased with more than 5 mg/dl in the day.
e. The color of stool become white.

30. The followings are True/ False about the causes of pathological jaundice:
   a. Excessive hemolysis of red blood cells as the result of blood hemolysis diseases.
   b. Decreased liver enzyme which is responsible her changing of indirect bilirubin to direct bilirubin.
   c. Failure of excretion of direct bilirubin as result of blockage or absence of bile duct.
   d. The neonates born from diabetic mothers.
   e. Malaria.

31. The followings are True/ False about nursing care of neonates with jaundice:
   a. Taking history about previous babies with neonatal jaundice or having exchange blood transfusion.
   b. Examine in natural light by pressing finger on the baby's skin.
   c. Assess the danger of jaundice according to neonatal age.
   d. If the yellow discoloration reach the arms or the feet this means the level of bilirubin is above 15 mg/ dl & it must be reported to the doctor.
   e. Follow up of measurement of bilirubin, hemoglobin & comb's test.

32. The followings are True/ False about the clinical assessment of the danger of jaundice:
   a. The clear jaundice is one which appear in all skin in first day.
   b. It considered more dangerous if it's appear on the arms or feet on second day.
   c. If the newborn weight at birth is less than 2.5 kg or he delivered before 37th week are consider danger factors for the dangerous jaundice.
   d. The newborn with hemolysis or sepsis.
   e. The dangerous jaundice starts on third day and appear first on neonatal face.

33. The followings are True/ False about the causes of hemolytic jaundice:
   a. Is the important cause of pathological jaundice in neonates.
   b. One of it’s causes rhesus incompatibility between the mothers & the fetus.
   c. ABO – incompatibility between the neonate and his mother.
   d. G-6-PD deficiently in newborn
   e. Umbilical sepsis.

34. The followings are True/ False about the clinical pictures for newborn with hemolytic jaundice:
   a. Delivered as stillbirth.
   b. Delivered with acute anemia.
   c. Intrauterine death.
   d. The jaundice can appear only during half an hour of birth.
   e. Asphyxias at birth or hypothermia or hypoglycemia.
35. The followings are True/False about the management of neonatal jaundice:
   a. Is aimed at reduction of serum bilirubin level to prevent kernicterus & brain damage.
   b. Taking full history to determine the causes & laboratory investigation done.
   c. Reduction of bilirubin by phototherapy.
   d. Bilirubin level can be reduced by blood exchange to the neonate.
   e. The drugs have very little role in the treatment of jaundice.

36. The followings are True/False about the phototherapy:
   a. Is the method of less cost & easy use.
   b. The light waves convert the toxic bilirubin to non toxic.
   c. Enhances hepatic excretion of direct bilirubin.
   d. It started when serum bilirubin reaches 15 mg/dl.
   e. It's suitable to treat hyperbilirubinemia as result of blood hemolysis.

37. The followings are True/False about the precautions during phototherapy:
   a. The lamps must be covered with plastic cover to protect the neonates if any lamp broken.
   b. A combination of white & blue lamps are preferred for effective treatment.
   c. The distance from the light source to the skin of baby is about 45 cm.
   d. The lamps should be change every 2000 hours (three months) from it’s usage although it’s functioning.
   e. White screens should be put around the area of phototherapy for maximum light to the neonate.

38. The followings are True/False about the nursing care during phototherapy:
   a. Baby's eyes should be covered during phototherapy.
   b. Turning the neonate every 2---4 hours for maximum exposure to light.
   c. The temperature of neonate & incubator should be taken every half an hour daily.
   d. Measurement of urinary out put every 4 hours.
   e. Feeding of neonates every 2---3 hours.

39. The followings are True/False about the side effects of phototherapy:
   a. Green stool as result of excretion of bilirubin.
   b. Disturbance of fluid and electrolytes of neonates.
   c. Skin changes.
   d. Hypo or hyperthermia of neonate.
   e. Hypocalcemia of neonate.

40. The followings are True/False about exchange blood transfusion in neonates:
   a. Effective method for reduction of bilirubin in level to prevent kernicterus & anemia.
   b. Performed when phototherapy fails to prevent rise in bilirubin levels quickly.
   c. The first exchange reduces the need for subsequent exchange.
   d. It's given only to neonate with Rh - negative & their mothers with Rh- positive.
1. It's indicated when neonates' cord blood bilirubin level 10 gm/dl or less.

41. The followings are True/False about the process of exchange blood transfusion & the necessary care of the neonates:
   a. Fresh blood collected less than 72 hours is preferred.
   b. The quantity of blood used is 160---180 ml/kg for one exchange.
   c. The stomach contents should be aspirated before blood exchange to the neonate.
   d. Monitoring & recording vital signs every 5 minutes during the process of transfusion.
   e. The blood should be injected slowly & in aliquots of 10---20 ml.

42. The followings are True/False about the complications of exchange blood transfusion for the neonate:
   a. Electrolytes disturbance.
   b. Hypocalcimia.
   c. Sepsis.
   d. Hypoglycemia.
   e. Delayed complication include hepatitis B&C.

43. How can we prevent jaundice in neonates:
   a. Administration of anti-D immunoglobulin to Rh-negative mother having Rh-positive baby.
   b. Early feeding of neonates after birth.
   c. A voidance giving of vitamin k to the neonates in large doses.
   d. Administration of pheno baritones to improve conversion of bilirubin and easily excretion by liver.
   e. Maintenance of neonates temperature and blood sugar in normal range after birth.

44. The care of incubator is the responsibility of:
   a. The nurse.
   b. The worker who is responsible for general cleanliness.
   c. The technician.
   d. The newborn’s relatives.
   e. Others.

45. The daily care of incubator includes the followings:
   a. Replenish humidly tank with distilled water.
   b. Wipe down the inside wall with disinfectants.
   c. Check that the temperature is between 28° -- 32°C.
   d. Wipe the mattress with disinfectant.
   e. Wipe the outside wall every 8 hours with disinfectants.

46. The followings are True/False about the terminal care of the incubator:
   a. Switch electricity off from incubator.
   b. Drain humidity tank and dry it well.
c. Wash it with hot soapy water and dry it.
d. Wash the mattress with soap & water & dry it..
e. Detach the humidifier (if removable) & send it to autoclave.

47. **The followings are True / False about immunization of children:**
   a. Is a process of protecting child from a disease.
   b. Is introduction of a live or killed or attenuated organisms in the individual system.
   c. Its reduce the child mortality, morbidity and handicapped condition.
   d. It gives resistance to infectious diseases by producing or augmenting immunity.
   e. Artificially acquired immunity is developed by the immunization.

48. **The followings are True / False about the time, site amount & route of administration of BCG vaccine:**
   a. Is a live attenuated bacterial vaccine..
   b. Is administered at birth.
   c. The dose is 0.05ml in neonates.
   d. The standard site is the middle of deltoid muscle over the left upper arm.
   e. The vaccine given by intramuscular route.

49. **The followings are true / false about the complications & contraindication of BCG vaccine:**
   a. Local abscess formation from its complications.
   b. Enlargement of axillary lymphglands one of its complications.
   c. Osteomyelitis from its complication.
   d. Is contraindicated in generalized eczema.
   e. Asymptomatic infected children with Aids are contraindicated.

50. **The followings are True / False about polio vaccination:**
   a. Oral polio vaccine was first described by sabin in 1957.
   b. It contains live attenuated polio virus.
   c. The oral polio vaccine is very safe with out any adverse effects.
   d. The stabilized vaccine can be kept at 4\(^{0}\)c for a year.
   e. It protect the child from poliomyelitis & prevent it’s spread in the community.

51. **The followings are True / False about the doses & time of administration of oral polio vaccine:**
   a. The doses are two drops given by mouth.
   b. The zero dose at birth.
   c. The first dose after four weeks of birth.
   d. The second dose after one month from the first dose.
   e. The third dose after four weeks from second dose.

52. **The followings are True / False about the contra indications of polio vaccine:**
   a. Fever.
   b. Diarrhea.
   c. Dysentery.
d. Leukemias.
e. Corticosteroids therapy.

53. The followings are True / False about the DTP vaccination:
   a. Give protection against diphtheria, pertussis & tetanus.
   b. It has two types.
   c. The vaccine should be stored between 4° to 8° c.
   d. The vaccine will lose potency if kept at room temperature over a longer period of time.
   e. It should not be frozen.

54. The followings are True / False about the dose, route, site, reactions & contraindications of DTP vaccine:
   a. The dose is 0.5 ml.
   b. It should be given deep intra muscularly.
   c. The site of injection for children below one year of age at lateral aspect of thigh (Vastus lateralis muscle).
   d. One of its severe complications is encephalitis.
   e. One of its contraindication episodes of convulsions of first dose.

55. The followings are True / False about the time of triple vaccine:
   a. The first dose at birth.
   b. The second dose after six weeks of birth.
   c. The third dose after one month from the second dose.
   d. The first dose after 6 weeks of delivery.
   e. The total number of doses are three.

56. The followings are True / False about measles vaccination:
   a. measles vaccine is alive attenuated virus.
   b. Available as freeze dried product.
   c. It is safe and effective
   d. Its diluting fluid should be stored at 2° to 8°c temperature.
   e. The reconstituted vaccine must be kept on ice & to be used within one hour.

57. The followings are True / False about the dose, amount, route, reactions & contraindication of measles vaccination:
   a. Single dose.
   b. The route of injection is intra muscular.
   c. The amount of dose is 0.5 ml.
   d. One of its reaction is development of rash on 5 to 10 days after immunization.
   e. Measles vaccine is contraindicated in infants below 6 months of age.

58. The followings are True / False about Hepatitis ‘B’ vaccination:
   a. Is a modern vaccine in immunization schedule.
   b. Is available in two forms.
   c. The vaccine is given intramuscularly.
   d. The dose of the vaccine is 0.5ml for child below 10 years.
e. Immunity levels provide protection for about 3--5 years.

59. The followings are True / False about the time of hepatitis “B” vaccination:
   a. The first dose after birth.
   b. The first dose after six weeks of birth.
   c. The second dose after one month of first dose.
   d. The third dose after four weeks of second dose.
   e. The number of total doses are four.
Appendix (II)

Check lists About Nurse's performance Regarding nursing care of the neonates in Intensive Care Units At Wad Medani Pediatric and obstetrics and gynecological Teaching Hospitals (2010-2013)

Check list for Routine nursing care of premature infant.

<table>
<thead>
<tr>
<th>Procedures</th>
<th>Done correctly</th>
<th>Done incorrectly</th>
<th>Not done</th>
</tr>
</thead>
</table>
| **Maintenance of Breathing:**  
  - Infant positioning  
  - Changing infant position  
  - Suctioning practice.  
  - Monitoring & recording of respiratory rate. | | | |
| **Maintaining a neutral thermal environment.**  
  - Monitoring & recording of temperature  
  - Pre-warming of incubator before placing an infant in it.  
  - Establishment of kangaroo mother care  
  - Rubbing of infant in warm blanket when removed from the incubator  
  - Warming of everything that comes into contact with the infant. | | | |
| **To maintain hydration:**  
  - Insertion of intravenous catheter  
  - Insertion of feeding tube.  
  - Delivery of fluid by infusion pump  
  - Regulation of infusion rates.  
  - Calculation of infant's intake and output  
  - Weighing of the infant.  
  - Documentation . | | | |
| **To maintain skin integrity:**  
  - Infant's bathe.  
  - Changing of diaper.  
  - Removal of disinfectants from the skin after invasive procedures.  
  - Security of items to the skin.  
  - Changing of position | | | |
| **To maintain nutrition:**  
  - Explain the benefits of breast feedings  
  - Helping mothers in maintaining lactation. | | | |
- Demonstration of gavages feedings.
- Measuring of abdominal girth.
- Weighing of the infant
- Recording of head circumference – length
- Assessing of intake and output.

- **Prevention of neonatal infection:**
  - Proper hand washing and scrubbing before and after handling the babies.
  - Wearing of sterile gown before entering the baby care unit.
  - Using special or over shoes before entering the unit.
  - Using of mask
  - Wearing of goggles.
  - Using aseptic technique for invasive procedures.
  - Usage of separate and disposable belongings for each infant.
  - Maintenance of general cleanliness of baby & his surroundings.
  - Encouragement of exclusive breast feedings
  - Disposal of needles.

- **Instituting kangaroo care.**
  - Establishment of kangaroo care.
  - Clothing of infant during Kangaroo care.
  - Positioning of infant during kangaroo care.
  - Explanation of advantages of kangaroo care to parents.
  - Facilitation of breast feeding during kangaroo care.

- **For Parents feeling of anxiety for Having premature infant:**
  - Staying with the parents during their visit to neonatal care unit.
  - A written information about neonatal care unit is gave to the parent.
  - Helping of parents to perform hand washing before touching the infant.
  - Clarifying all nursing care and it’s purpose
### Distribution of the Nurses According to their Performance regarding incubator’s Care

<table>
<thead>
<tr>
<th>Items</th>
<th>Done correctly</th>
<th>Done incorrectly</th>
<th>Not done</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Daily care of incubator</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Wash hands</td>
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<tr>
<td>- Wipe down the inside wall with disinfectant while changing sheet.</td>
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<tr>
<td>- Wipe of the outside wall every 8 hours.</td>
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<tr>
<td>- Wipe of plastic cover mattress with disinfectant</td>
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<tr>
<td>- Change of bed sheet daily.</td>
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<tr>
<td>- Check that temperature is between 28 – 32°C.</td>
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<tr>
<td>- Check that humidity is between 55 – 65%.</td>
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<td></td>
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<tr>
<td>- Wash hands</td>
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<tr>
<td><strong>Terminal care of incubator:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Wash hands</td>
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<tr>
<td>- Switch s of electricity off from incubator</td>
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<tr>
<td>- Invert humidity tank to drain it &amp; dry it well</td>
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<tr>
<td>- Wash it with hot soapy water, rinse and dry well</td>
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<td></td>
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<tr>
<td>- Wash mattress with soap and water, dry it well</td>
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<tr>
<td>- Wash the floor of incubator with soap &amp; water and dry it well</td>
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<tr>
<td>- Expose the whole unit to adequate fresh air and sunshine</td>
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</tbody>
</table>

### Checklist for nursing care of new borne with Jaundice

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Done correctly</th>
<th>Done incorrectly</th>
<th>Not done</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Taking blood sample for measurement of bilirubin.</td>
<td></td>
<td></td>
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<tr>
<td>- Taking of vital signs</td>
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<td></td>
<td></td>
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<tr>
<td>- monitoring of intake and output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Nursing care during phototherapy:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- covering of newborn’s eyes</td>
<td></td>
<td></td>
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<tr>
<td>- Covering of genitals.</td>
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<td></td>
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<tr>
<td>- Changing of position</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>- Checking &amp; recording of temperature.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Infant feedings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Maintenance of fluid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Correct distance between the light source &amp; skin of the newborn.</td>
<td></td>
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</tr>
<tr>
<td>- Weighing of the newborn</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Explanation of phototherapy procedure to parents.</td>
<td></td>
<td></td>
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<tr>
<td>- Encouragement of parents to participate in newborn’s care.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Documentation</td>
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</tbody>
</table>
## Checklist for nursing care of newborn with respiratory distress syndrome

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Done correctly</th>
<th>Done incorrectly</th>
<th>Not done</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Care during oxygen administration:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Warming and humidifying of oxygen before it given.</td>
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<tr>
<td>- Water soluble ointment applied to the nares &amp; mouth before oxygen administration</td>
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<tr>
<td>- Maintenance of flow rate of oxygen.</td>
<td></td>
<td></td>
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<tr>
<td>- Assessing of vital signs</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Practicing oral hygiene</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Perform of suctioning</td>
<td></td>
<td></td>
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<tr>
<td>- The infant's positioning.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Changing of neonatal position</td>
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</tbody>
</table>

## Assessment of Nurses' Attitude Regarding Nursing care of preterm infant.

<table>
<thead>
<tr>
<th>Items</th>
<th>Agree</th>
<th>disagree</th>
<th>Didn't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Maintenance of Breathing:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Participation of parents in positioning infant is very essential</td>
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<tr>
<td>- The side – lying position facilitate drainage of respiratory secretions.</td>
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<tr>
<td>- The prone position is associated with increased incidence of sudden infant death syndrome (SIDS)</td>
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<tr>
<td>- Increased oxygen is essential before and after each suction.</td>
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<tr>
<td>- Noise lead to increase oxygen need.</td>
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<tr>
<td>- To maintain Hydration:</td>
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<tr>
<td>- It's important to assess the intravenous sites at least every hour for signs of infiltration.</td>
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<tr>
<td>- Small blood transfusion may be necessary to replace blood drawn for frequent laboratory tests.</td>
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<tr>
<td>- It's important to secure the intravenous catheter with adhesive plaster.</td>
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</tr>
<tr>
<td>- Calculation of infant's intake and output is very important.</td>
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<tr>
<td>- Weighing of newborn twice a day is very important to monitor his fluid status.</td>
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</tr>
<tr>
<td>- To maintain nutrition:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- It's important to assess tolerance of feeding.</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
- It's important to aspirate the stomach contents to measure the residual amount of feeding before gavage feeding.
- Normal gastric residuals are often replace to prevent loss of electrolytes.
- It's essential to use a tape to measure abdominal girth to detect distention every 4 – 8 hours.
- Daily weighing of infant is essential
- It's important to assess intake and out put daily

• Instituting Kangaroo care:
- It's important to begin kangaroo care as soon as possible.
- During kangaroo care, the infant is weared only a diaper and hat and a blanket is placed over him.
- It's important to participate fathers in kangaroo care.
- It's essential to explain Kangaroo care to the parents.

Assessment of Nurses' Attitude Toward Nursing care of infant with jaundice

<table>
<thead>
<tr>
<th>Items</th>
<th>Agree</th>
<th>Disagree</th>
<th>Didn’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Phototherapy has side effects on the new born</td>
<td></td>
<td></td>
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<tr>
<td>- It's important to explain the procedure of phototherapy to the parents.</td>
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<tr>
<td>- Encourage parents to participate in new born's care</td>
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<tr>
<td>- Assessment of parent's knowledge by the nurse is essential</td>
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Assessment of Nurses' Attitude Toward Nursing care of infant with Respiratory distress syndrome

<table>
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<th>Didn’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Gavage feedings are avoided</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>- Encourage parents to provide kangaroo care to facilitate respiration.</td>
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<tr>
<td>- Encourage parents to name their infant to provide infant individual identify.</td>
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<tr>
<td>- Encourage parents to participate in new born care is important.</td>
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### Physical facilities and staffing

<table>
<thead>
<tr>
<th>Facilities for hand-washing</th>
<th>Available &amp; effective</th>
<th>Available not effective</th>
<th>Not available</th>
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</thead>
<tbody>
<tr>
<td>- Water source</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Soap</td>
<td>√</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Touch tap</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Non touch tap</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>- Disinfectant</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>- Liquid hand wash</td>
<td></td>
<td>√</td>
<td></td>
</tr>
<tr>
<td>- Dryer</td>
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<td>√</td>
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<table>
<thead>
<tr>
<th>Personal protective equipments:</th>
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<tbody>
<tr>
<td>- Sterile gowns</td>
</tr>
<tr>
<td>- Special shoes</td>
</tr>
<tr>
<td>- Mask</td>
</tr>
<tr>
<td>- Gloves</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Equipments for disposables &amp; waste product:</th>
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<tbody>
<tr>
<td>- Safety boxes</td>
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<tr>
<td>- Specialized containers with covers.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Resources required for neonatal care:</th>
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<tbody>
<tr>
<td>- Thermometers</td>
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<tr>
<td>- Neonatal stethoscope</td>
</tr>
<tr>
<td>- Neonatal cuff</td>
</tr>
<tr>
<td>- Sphygmomanometers</td>
</tr>
<tr>
<td>- Baby weighing scales.</td>
</tr>
<tr>
<td>- Infant bath equipment</td>
</tr>
<tr>
<td>- Cord care facilities.</td>
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<tr>
<td>- Eye care facilities.</td>
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</table>

<table>
<thead>
<tr>
<th>Resuscitation equipments &amp; supply:</th>
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<tbody>
<tr>
<td>1- Face masks (size 0 and 1)</td>
</tr>
<tr>
<td>2- Oxygen source</td>
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<tr>
<td>3- Nasal canulas</td>
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</tbody>
</table>

| Emergency drug & solutions:               |

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Appendix (III)

Checklist for physical facilities and staffing of neonatal care unit of Medani Obstetrics and Gynecology Teaching Hospital (2010 – 2013)

135
- Dextrose 10% in water
- Dextrose 50%
- Epinephrine 1: 10.000 (adrenaline)
- Naloxane 0.02 mg /mL
- Normal saline solution
- Sodium bicarbonate 4.2%
- Volume expander (albumin)
- Vitamin K

- **Intubations equipment:**
  - Endotracheal tubes with adapters (sizes 2.5, 3, 3.5, 4 mm)
  - Laryngoscope (size 0 and 1)
  - Magill forceps.
  - Scissors 2

- **Suction equipment:**
  - Bulb syringe 3
  - Suction catheter
  - Mechanical suction 2

- **Nursing staff for nursery:**
  - Nurse – baby ratio

- **Intermediate care unit:**
  - Nursing staff:
  - Nurse – baby ratio 1 to 8 & more.

- **Intensive care:**
  - Medical staff:
  - Registered pediatrician and consultant on call

- **Nursing staff:**
  - One nurse for 6 babies & more

- **Equipment:**
  - Incubators (minimum 10) 8 2
  - Photo therapy units. 2 1
  - Cardio respiratory monitor. 
  - Pulse oximetry 1
  - Autoclave. 
  - Infusion pump 2
  - Syringe pump 
  - Jaundice meter. 
  - Gluco check. 1
  - Radiant warmer. 1
  - Blood gas analyzer. 

136
- Minimum 2 CPAP
- One ventilator.
- Electric out lets for each incubator.
- Reserve oxygen cylinder 10
- Availability of portable X-ray machine
- Lab services available for 24 hours.

<table>
<thead>
<tr>
<th>Physical facilities and staffing</th>
<th>Available &amp; effective</th>
<th>Available not effective</th>
<th>Not available</th>
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<tbody>
<tr>
<td><strong>Facilities for hand-washing</strong></td>
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</tr>
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<td>- Water source</td>
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<td><strong>Personal protective equipments:</strong></td>
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<td>- Mask</td>
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<td></td>
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</tr>
<tr>
<td>- Gloves</td>
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<td>1 box/week</td>
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<td><strong>Equipments for disposables &amp; waste product:</strong></td>
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<td></td>
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<tr>
<td>- Safety boxes</td>
<td>√</td>
<td></td>
<td></td>
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</tr>
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<td></td>
</tr>
<tr>
<td>- Baby weighing scales</td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td>- Infant bath equipment</td>
<td>√</td>
<td></td>
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<td>- Cord care facilities.</td>
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<tr>
<td><strong>Resuscitation equipments &amp; supply:</strong></td>
<td></td>
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</tr>
<tr>
<td>1-</td>
<td>Face masks (size 0 and 1)</td>
<td>1</td>
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<td>2-</td>
<td>Oxygen source.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-</td>
<td>Nasal canulas</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

- **Emergency drug & solutions:**
  - Dextrose 10% in water | ✓ |
  - Dextrose 50% | ✓ |
  - Epinephrine 1: 10.000 (adrenaline) | ✓ |
  - Naloxane 0.02 mg/mL | ✓ |
  - Normal saline solution | ✓ |
  - Sodium bicarbonate 4.2% | ✓ |
  - Volume expander (albumin) | ✓ |
  - Vitamin K | ✓ |

- **Intubations equipment:**
  - Endotracheal tubes with adapters (sizes 2.5, 3, 3.5, 4 mm) | ✓ |
  - Laryngoscope (size 0 and 1) | ✓ |
  - Magill forceps. | ✓ |
  - Scissors | ✓ |

- **Suction equipment:**
  - Bulb syringe | ✓ |
  - Suction catheter | ✓ |
  - Mechanical suction | 2 |

- **Nursing staff for nursery:**
  - Nurse – baby ratio is 1 > 10 |

- **Intermediate care unit:**

  - **Nursing staff:**
    - Nurse – baby ratio 1 > 5 Each shift. | ✓ |

  - **Intensive care:**
    - Medical staff: |
      - Registered pediatrician and consultant on call | ✓ |

  - **Nursing staff:**
    - The same staff of intermediate care |

  - **Equipment:**
    - Incubators (minimum 10) | 6 5 |
    - Photo therapy units. | 4 5 |
    - Cardio respiratory monitor. | ✓ |
    - Pulse oximetry | 1 |
    - Autoclave. | ✓ |
    - Infusion pump | 2 |
    - Syringe pump | ✓ |
    - Jaundice meter. | ✓ |
<table>
<thead>
<tr>
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<th>Quantity</th>
<th>Available</th>
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<td>Gluco check.</td>
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<tr>
<td>Radiant warmer.</td>
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</tr>
<tr>
<td>Blood gas analyzer.</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Minimum 2 CPAP</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>One ventilator.</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Electric outlets for each incubator.</td>
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<td>✓</td>
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<tr>
<td>Reserve oxygen cylinder</td>
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<tr>
<td>Availability of portable X-ray machine</td>
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</tr>
<tr>
<td>Lab services available for 24 hours.</td>
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<td>✓</td>
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</table>
Appendix IV
APPENDIX VI

بسم الله الرحمن الرحيم
جامعة الجزيرة
كلية الطب
مركز الرعاية الصحية الأولية والتثقيف الصحي
برنامج دكتوراه صحة المجتمع

أثر البرنامج التدريبي على معرفة واتجاهات وممارسات الممرضات حول العناية التمريضية بالأطفال حديثي الولادة بمستشفى الأطفال – مستشفى النساء والتوليد – ودمدني، السودان 2012م.

جدول تفصيلي للبرنامج

<table>
<thead>
<tr>
<th>المتحدث</th>
<th>عنوان الجلسة</th>
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</tr>
<tr>
<td>د. عبد العزيز عبد الله</td>
<td>ما تيسر من القرآن الكريم</td>
<td>8:30 - 8:40</td>
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<tr>
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<td>الترحيب بالحضور</td>
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</tbody>
</table>

**الريكست التمريضية:**

- **د. عبد العزيز عبد الله**
- **د. مها عمر**
- **أ/ فاطمة إدريس**
- **أ/ محمد خير مضوى**