

Effect of a Designed Nursing Care Protocol on Clinical Outcomes of Neonates with Hyperbilirubinemia

Ghada.M,Ashor¹, Maha.I,Khalifa², Fady.M,El-Gendy³, Jaklein,R.Younis⁴

^{1,2,4} Pediatric Nursing Department, Menoufia University, Egypt

³Faculty of Medicine, Menoufia University, Egypt

Abstract: Neonatal hyperbilirubinemia is the most common health hazard of neonates which have toxic effects on the brain and cause serious complications. Providing care to neonates with hyperbilirubinemia is a condition that requires safe knowledge and skills from the nurses to achieve optimal health outcomes. **Aim:** to examine the effect of a designed nursing care protocol on clinical outcomes for neonates with hyperbilirubinemia. **Research design:** quasi experimental design was utilized. **Setting:** It was conducted at neonatal intensive care units in Shebin El-Kom Teaching Hospital and El Gamea El Sharea for neonates. **Sample:**, all nurses (37) who work in the previous mentioned settings and a convenient sample (120) neonates were selected. **Instruments:** three tools were used: nurses' knowledge structured questionnaire, Nurses' practices observational checklist and Neonatal assessment sheet. **Result:** It showed significant improvement in nurses' knowledge and practices after implementation of educational program regarding neonatal hyperbilirubinemia. As well, implementation of nursing care protocol improved clinical outcomes of neonates with hyperbilirubinemia. **Conclusion:** It was concluded that, implementation of the designed nursing care protocol improved nurses' knowledge and practices regarding care of neonates with hyperbilirubinemia on posttest than on pre test. Also, it improved clinical outcomes of neonates with hyperbilirubinemia. **Recommendation:** ongoing inservice education programs must be designed and implemented at neonatal intensive care units to improve nurses' knowledge and practices concerning care provided for neonates with hyperbilirubinemia.

Keywords: Hyperbilirubinemia, Nursing care protocol; clinical outcomes.

1. INTRODUCTION

Neonatal period is the most vulnerable Period of life with higher mortality and morbidity rate in human life. An estimated 40 percent of deaths in children less than five years of age occur during the first 28 days of life. The average daily mortality rate during the neonatal period is close to 30 fold higher than during the postnatal period. During 2010, an estimated 7.7 million children under five years of age died worldwide. This included 3.1 million neonatal deaths, 2.3 million post neonatal deaths and 2.3 million childhood deaths (age 1-4 years)[1]. (Rajaratnam et al., 2010).

It is estimated that, neonatal hyperbilirubinemia is one of the most common health hazards in both term and preterm infants. Almost 60% of full-term and 80% of preterm neonates develop jaundice during the first week of their lives [2]. (Xiong et al., 2012). Jaundice is among the main causes of neonates' hospitalization [3]. (Raghavendra & Sheila, 2014). About 75% of all neonates referring to hospital during the first postnatal week suffer from jaundice [4]. (Maisels & McDonag, 2008).

Excessive amounts of bilirubin build up in the blood stream and cause brain damage and can result in death or lifelong illnesses, problems with vision, hearing difficulties and mental retardation. When jaundice left untreated, Kernicterus begins to develop and it can result in permanent neurologic damage and other dangerous complications [5].(Cloherty et

al., 2014). The key to prevention is early diagnosis and quick treatment to control level of bilirubin [6]. (Anderson, 2012). Nurses play an integral role in the implementation of universal screening for elevated bilirubin levels in the newborn. Nurses should assess family's level of understanding and discourage behaviors that are not recommended such as the administration of supplemental water. In addition, facilities and health care providers should promote and support breast feeding as it helps to decrease bilirubin levels (Association of Women's Health, Obstetric & Neonatal Nurses [7].(AWHONN), 2005).

Besides, nurses play a vital role in coordinating communication among all members of the newborn's care team, including physicians, laboratory personnel and parents[8]. (Stark & Lannon, 2009). Also, one of the most integral nursing care for neonatal hyperbilirubinemia is the care during phototherapy. Proper nursing care enhances the effectiveness of phototherapy and minimizes its associated complications. Nurses' responsibilities for newborns under phototherapy include general assessment, providing protection for eyes and genital area, carefully monitoring thermoregulation, ensuring effective irradiance delivery, proper positioning, maximizing skin exposure, maintaining adequate hydration, daily weighing and supporting parent- neonate interaction [9]. (Hockenberry & Wilson, 2011).

Providing care to neonates with hyperbilirubinemia is a condition that requires safe knowledge and skills to achieve optimal health outcomes[10]. (Stokowski, 2011). Consequently, neonatal nurses' should acquire advanced up to date knowledge and practices to save newborns' life (American Academy of Pediatrics (AAP), 2004). For this reason, the current study was implemented to examine the effect of a designed nursing care protocol on clinical outcomes for neonates with hyperbilirubinemia.

2. METHODS

Aim of the Study:

To examine the effect of a designed nursing care protocol on clinical outcomes for neonates with hyperbilirubinemia.

Research Hypothesis:

1. Implementation of a designed nursing care protocol will improve nurses' knowledge and practices regarding care of neonates with hyperbilirubinemia on post test than on pretest.
2. Implementation of a designed nursing care protocol will result in improved clinical outcomes of neonates on post and follow up tests than on pretest.

Research design:

A quasi-experimental design was utilized for this study (pre and posttest).

Settings:

This study was conducted at Neonatal Intensive Care Units (NICUs) in Shebin El-Kom Teaching Hospital and El Gamea El Sharea for neonates.

Sample:

All nurses providing care for neonates with hyperbilirubinemia were included in this study. The number of studied nurses in Shebin El Kom Teaching hospital and Elgameai El Sharea Hospital was 17 and 20 respectively. A convenient number of neonates with hyperbilirubinemia who fulfilled the criteria for sample selection were included in the study and their number was 120.

Inclusion criteria for neonates:

All neonates with hyperbilirubinemia who were free from any other health problems were included in this study.

Instruments:

In order to achieve the purpose of the study, three instruments were utilized for data collection:-

Instrument one:- Nurses' Knowledge Structured Questionnaire (Appendix I). It was designed by the researcher after reviewing relevant literature to collect data about nurses' characteristics, nurses' knowledge about hyperbilirubinemia and

International Journal of Novel Research in Healthcare and Nursing

Vol. 3, Issue 3, pp: (62-76), Month: September - December 2016, Available at: www.noveltyjournals.com

its related care. Reliability was assessed using Cronbach's test retest ($r = 0.541$). It was divided into three parts as the following:

- **Part one:** Characteristics of the studied nurses. It included questions about age, qualifications, years of experience and training courses
- **Part two:** Nurses' knowledge about neonatal hyperbilirubinemia. It included 26 questions about definition, types, characteristics, causes, normal bilirubin level, risk factors, signs and symptoms, investigations, management and complications.
- **Part three:** Nurses' knowledge about nursing care related to hyperbilirubinemia. It included 14 questions concerning visual assessment of jaundice, methods of assessing bilirubin level, initiation and stopping of phototherapy, areas of neonates' body which were covered during phototherapy, position of neonates during phototherapy, specific precautions during phototherapy, observations followed during phototherapy and steps followed to reduce side effects from phototherapy.

The Scoring system for each question as follows:

Scoring items	Score
Complete answer	2
In complete answer	1
Don't know	0

Instrument two: Nurses' practices observational checklist (Appendix II). It was developed by researcher to assess nurses' practices for neonates who suffer from hyperbilirubinemia. It included three parts:

- **Part one:** Immediate nursing care on admission. It included observation of nurses' practices while providing immediate care for neonates on admission. It consisted of nurses' assessment for presence of other neonatal health problem, following aseptic technique, caring of incubator, assessing vital signs, assessing color of newborn by Kramer's rule, measuring bilirubin level, plotting total serum bilirubin and deciding with physician the proper management of neonatal hyperbilirubinemia.
- **Part two:** Nursing care during phototherapy. It involved observation of nursing care for neonates under phototherapy. It contained neonatal clothing, positioning, temperature, care for eye patches, eye care, skin care, hydration, monitoring serum bilirubin, side effects of phototherapy, cessation of phototherapy and nursing documentation.
- **Part three:** Discharge planning. It included observation of nursing care regarding discharge planning such as advising parents about how to assess signs and symptoms of newborn jaundice, when to contact health care professionals, encouraging mothers to continue breast feeding and advising parents about the importance of follow up.

The Scoring system for this part is:-

Scoring items	Score
Correct done	2
Incorrect done	1
Not done	0

Instrument three:- Neonatal assessment structured sheet (Appendix III). It was developed by the researcher to assess clinical outcomes of neonates with hyperbilirubinemia. It included name, gestational age, postnatal age, date of admission, date of discharge, type of feeding, type of hyperbilirubinemia, treatment modalities, physiological measurements, weight, total serum bilirubin, signs and symptoms of hyperbilirubinemia, complications of hyperbilirubinemia and side effects of phototherapy.

Reliability:

The reliability of the tool was computed using split-half method ($r=0.88$). This method was used to assess the homogeneity of the tool.

Validity:

For validity assurance, three instruments were provided to a jury including one pediatric nursing professor, two pediatric nursing assistant professors and two assistant professors in pediatrics.

Ethical Consideration:

A written acceptance to share in the study was obtained from the director of each setting. For protection of human rights an interview was conducted with head nurses of the two previously mentioned settings to inform them about the purpose of study, and request their assistance to facilitate the work. Nurses were informed about the privacy of their information, nature of the study and their right to withdraw. An oral approval to share in the study was obtained from nurses and parents to allow their neonates share in the study. Therefore, the objectives of the study, its importance, safety and confidentiality were obtained.

Pilot study:

It was carried out on five nurses and five neonates (10% of the sample) after the instruments were developed and before starting the data collection to test the practicability, applicability and to estimate the needed time to fill the instruments. No necessary modifications were done. Therefore, the pilot study was included in the total sample.

3. PROCEDURE OF DATA COLLECTION

Data collection started in the middle of January 2015 and lasted until the end of December 2015. Data collected five days per week. The researcher introduced herself to the nurses who will share in the study, explained the purpose of study and methods of data collection. The instrument one was distributed between nurses. It took 20 minutes to fill out the questionnaire. Instrument two was used by the researcher for data collection about nurses practices. Nurses were not informed that they were assessed. Nurses were assessed five days per week during the morning and afternoon shifts.

Before implementing the nursing care protocol, the neonatal assessment sheet was filled out by the researcher to assess clinical outcomes of neonates with hyperbilirubinemia. It included Signs and symptoms of hyperbilirubinemia, bilirubin level, complications of hyperbilirubinemia and side effects from phototherapy. Areas of weaknesses of the nurses' knowledge and practices were identified and the objectives were set. The researcher designed a health education program to implement a protocol for the management of neonates with hyperbilirubinemia on the basis of knowledge and practices obtained from collected data using instrument one, two and three and review of literature.

To provide health education, nurses were divided into nine groups. Each group contained four nurses. Each nurse received two health education sessions. Each session lasted for an hour. The researcher conducted lectures, group discussion and distributed an explanatory related booklet. Sessions were conducted in NICUs in previously mentioned settings.

The first session was about general knowledge related to neonatal hyperbilirubinemia such as definition of hyperbilirubinemia, causes, types, normal bilirubin level, risk factors, signs and symptoms, investigations, management and complications of hyperbilirubinemia.

The second session was about the standardized nursing care for neonates with hyperbilirubinemia. The researcher provided summary about knowledge provided in the first session. Afterwards, the protocol of nursing care was discussed (Immediate care on admission, care during phototherapy and discharge planning). Direct reinforcement in the form of material rewards as well as affection and encouragement were provided as positive feedbacks. After 3 months, assessment of nurses' knowledge and adherence to nursing care protocol was done using instruments one and two. Also, assessment of clinical outcomes for neonates was done using instrument three. After 6 months, reassessment of nurses' knowledge and adherence to nursing care protocol was done using instruments one and two. Also, reassessment of clinical outcomes for neonates was done using instrument three.

Data analysis:

Data was entered and analyzed by using SPSS (Statistical Package for Social Science) statistical package version 21. Graphics were done using Excel program. Quantitative data was expressed as mean & standard deviation ($X \pm SD$) and analyzed by using Friedman test and ANOVA test for comparison between means.

Qualitative data was expressed in the form of number and percentage. It was analyzed by using chi-square test (X^2). Pearson correlation was used for explaining relationship between normally distributed quantitative variable. A statistical significant difference was considered if $P < 0.05$.

4. RESULTS

Table I: characteristics of studied nurses: it was obvious from this table that, more than one third of studied nurses (48.6%) were in age group of 25-30 years. Regarding nurses' qualifications, less than half of studied nurses (45.9%) had nursing diploma (secondary nursing school). In relation to years of experience, approximately one third of studied nurses (35.1%) had 1 < 5 years of experience. Regarding training courses, the majority of studied nurses (94.6%) did not attend any previous training courses.

Table II: characteristics of studied neonates: as indicated in the table, more than half of studied neonates on pre intervention, after 3 and 6 months were males (62.5%, 57, 5% and 70%). According to type of feeding, the majority of studied neonates on pre intervention, after 3 and 6 months had artificial feeding (92.5%, 77.5% and 82.5%). Two thirds of studied neonates on pre intervention, after 3 and 6 months had physiological jaundice (67.5%, 62.5% and 62.5%). In relation to treatment modalities, the majority of studied neonates on pre intervention, after 3 and 6 months were under double phototherapy (77.5%, 87.5% and 77.5%). However, no statistical significant differences were found between neonates at 5% level of statistical significance.

Table III: distribution of neonates according to gestational age and postnatal age. as indicated in the table, the mean and standard deviation of gestational age of studied neonates on pre intervention, after 3 and 6 months were 37.43 ± 0.68 , 37.28 ± 0.68 and 37.30 ± 0.65 respectively. According to postnatal age, the mean and standard deviation of studied neonates on pre intervention, after 3 and 6 months were 4.60 ± 2.96 , 4.40 ± 2.24 and 4.58 ± 2.15 respectively. Therefore, there were no statistical differences between studied neonates on pre intervention, after 3 and 6 months.

Table IV: mean scores of nurses' knowledge about neonatal hyperbilirubinemia on pre intervention, after 3 and 6 months. as indicated in the table, the mean and standard deviation of knowledge scores on pre intervention were 24.14 ± 7.1 compared to 48.3 ± 3.1 and 46.3 ± 3.3 after 3 and 6 months respectively. There were obvious highly statistical significant differences between nurses at 1% level of statistical significance.

Table V: mean scores of nurses' knowledge about nursing care of neonate with hyperbilirubinemia on pre intervention, after 3 and 6 months. it indicated in the table, the mean and standard deviation of knowledge scores on pre intervention were 18.7 ± 2.26 compared to 26.4 ± 0.86 and 25.7 ± 1.11 after 3 and 6 months respectively. Therefore, there were highly statistical significant differences between nurses' knowledge at 1% level of statistical significance.

Table VI: distribution of nurses according to their practices regarding immediate care on neonatal admission on pre intervention, after 3 and 6 months. this table revealed that nurses had more adequate performance related to following aseptic technique, incubator care and color of newborn by Kramer's Rule after 3 months (40.5%, 67.6% and 94.6%) compared to (13.5%, 27% and 0%) on pre intervention. On pre intervention, none of nurses assessed color of newborn according to Kramer's Rule. For this reason, there were highly statistical significant differences between nurses at 1% level of statistical significance.

Table VII: mean scores of total nurses' practices about neonatal hyperbilirubinemia on pre intervention, after 3 and 6 months. the table illustrated that nurses had the highest mean scores of performance after 3 months (12.8 ± 2.11 Vs 25.3 ± 2.79 , 33.4 ± 4.15 Vs 67.8 ± 2.78 and $.00 \pm .00$ Vs 7.4 ± 1.25). Therefore, there were highly statistical significant differences between nurses at 1% level of statistical significance.

Table VIII: means and standard deviation of physiological measures of studied neonates on pre intervention, after 3 and 6 days. this table showed that physiological measures were within normal range after 3 months and 6 months (e.g Temperature $37.10 \pm .17$ and $37.17 \pm .25$). Therefore, there were statistical significance difference between studied neonates on pre intervention, after 3 months and 6 months at 5% level of statistical significance.

Figure I: Duration of hospitalization before intervention, after 3 and 6 days.

This figure showed that before intervention neonates had more prolonged hospitalization period than after 3 and 6 months.

Figure II: Total serum bilirubin on before intervention, after 3 months and 6 days.

This figure showed total serum bilirubin on before intervention, after 3 and 6 months. As illustrated in the figure, total serum bilirubin was reduced after 3 and 6 months.

Figure III: Correlation between total knowledge and total practice of studied nurses

This figure illustrated that there were a positive correlation between total knowledge and total practices at 1% level of statistical significance.

Figure IV: Pearson correlation between total nurses' practices and occurrence of side effects of phototherapy.

This figure showed there was a negative correlation between total level of nurses' practices and occurrence of side effects of phototherapy.

Figure V: Pearson correlation between total nurses' practices and complications of hyperbilirubinemia.

PART ONE: CHARACTERISTICS OF STUDIED SAMPLE

TABLE : I Characteristics Of Studied Nurses

Characteristics of studied nurses	No (n=37)	%
Age (years)		
<20	2	5.4
20 <24	11	29.7
25 <30	18	48.6
>30	6	16.2
Qualifications		
Secondary nursing school	17	45.9
Technical nursing institute	12	32.4
Bachelor or post-graduate nursing	8	21.6
Experience years		
<1	4	10.8
1 <5	13	35.1
5<10	8	21.6
>10	12	32.4
Training courses		
No	35	94.6
Yes	2	5.4

TABLE: II Characteristics Of Studied Neonates

Characteristics of studied neonates	Pre intervention (n=40)		After 3 months (n=40)		After 6 months (n=40)		χ^2	P -value
	No	%	No	%`	No	%		
Gender							1.36 ^{ns}	>0.05
Male	25	62.5	23	57.5	28	70.0		
Female	15	37.5	17	42.5	12	30.0		
Type of feeding								
Artificial feeding	37	92.5	31	77.5	33	82.5	3.50 ^{ns}	>0.05
breast +artificial feeding	3	7.5	9	22.5	7	17.5		
Type of hyperbilirubinemia								
physiological	27	67.5	25	62.5	25	62.5	.29 ^{ns}	>0.05
Pathological	13	32.5	15	37.5	15	37.5		
Treatment modalities								
Double phototherapy	31	77.5	35	87.5	31	77.5	1.72 ^{ns}	>0.05
triple phototherapy	9	22.5	5	12.5	9	22.5		

NB: ^{ns} p> 0.05

TABLE: III Distribution Of Neonates According To Gestational Age And Postnatal Age.

Gestational age and post natal age	Pre intervention (n=40)	After 3 months (n=40)	After 6 months (n=40)	ANOVA test	p- value
	Mean ± SD	Mean ± SD	Mean ± SD		
Gestational age	37.43 ± 0.68	37.28 ± 0.68	37.30 ± 0.65	0.58 ^{ns}	>0.05
Postnatal age	4.60 ± 2.96	4.40 ± 2.24	4.58 ± 2.15	0.078 ^{ns}	>0.05

NB: ^{ns} p>0.05

PART Two: KNOWLEDGE OF NURSES ABOUT NEONATAL HYPERBILIRUBINEMIA

Table: IV Mean Scores Of Nurses' Knowledge About Neonatal Hyperbilirubinemia On Pre Intervention, After 3 And 6 Months.

Knowledge scores	Pre intervention (n=37)	After 3 months (n=37)	After 6 months (n=37)	Friedman test	P -value
Mean ± SD	24.14 ± 7.1	48.3 ± 3.1	46.3 ± 3.3	61.056**	P< 0.001

N B: **P<0.001

Table: V Mean Scores Of Nurses' Knowledge About Nursing Care Of Neonate With Hyperbilirubinemia On Pre Intervention, After 3 And 6 Months

Knowledge score	Pre intervention (n=37)	After 3 months (n=37)	After 6 months (n=37)	Friedman test	P -value
Mean ± SD	18.7 ± 2.26	26.4 ± 0.86	25.7 ± 1.11	63.748**	P< 0.001

N B: **P<0.001

PART THREE: PRACTICES OF NURSES REGARDING NEONATAL HYPERBILIRUBINEMIA.

Table :VI Distribution Of Nurses According To Their Practices Regarding Immediate Care On Neonatal Admission On Pre Intervention, After 3 And 6 Months.

Nurses' performance for immediate care	Pre intervention (n= 37)		After 3 months (n=37)		After 6 months (n=37)		X ²	P -value
	No	%	No	%	No	%		
Following aseptic technique							6.80**	P< 0.001
Inadequate	32	86.5	22	59.5	26	70.3		
Adequate	5	13.5	15	40.5	11	29.7		
Incubator care							15.26**	P< 0.001
Inadequate	27	73.0	12	32.4	13	35.1		
Adequate	10	27.0	25	67.6	24	64.9		
Color of newborn by Kramer's Rule							94.75**	P< 0.001
Inadequate	37	100.0	2	5.4	2	5.4		
Adequate	0	0.0	35	94.6	35	94.6		

Table: VII Mean Scores Of Total Nurses' Practices About Neonatal Hyperbilirubinemia On Pre Intervention, After 3 And 6 Months.

Total performance score	Pre intervention (n=37)	After 3 months (n=37)	After 6 months (n=37)	Friedman test	P -value
	Mean ± SD	Mean ± SD	Mean ±SD		
Immediate care on admission	12.8 ± 2.11	25.3 ± 2.79	23.8 ± 2.45	57.38**	.000
Nursing care of neonates under phototherapy	33.4 ± 4.15	67.8 ± 2.78	65.05 ± 4.34	61.12**	.000
Discharge planning	.00 ± .00	7.4 ± 1.25	6.9 ± 1.38	62.03**	.000

NB: **P<0.001

PART FOUR: CLINICAL OUTCOMES OF NEONATAL HYPERBILIRUBINEMIA

Table : VIII Means And Standard Deviation Of Physiological Measures Of Studied Neonates On Pre Intervention, After 3 And 6 Days.

Physiological measures of studied neonates	Pre intervention (n=40)	After 3 days (n=40)	After 6 days (n=40)	Friedman Test	P -value
	Mean & SD X ± SD	Mean & SD X ± SD	Mean & SD X ± SD		
Temperature	37.4 ± .50	37.10 ± .17	37.17 ± .25	7.347*	.025
Pulse	137.5 ± 6.11	136.5 ± 3.49	138.7 ± 3.99	5.722 ^{ns}	.057
Respiration	42.8 ± 2.23	41.1 ± 1.80	41.8 ± 2.08	9.569*	.008

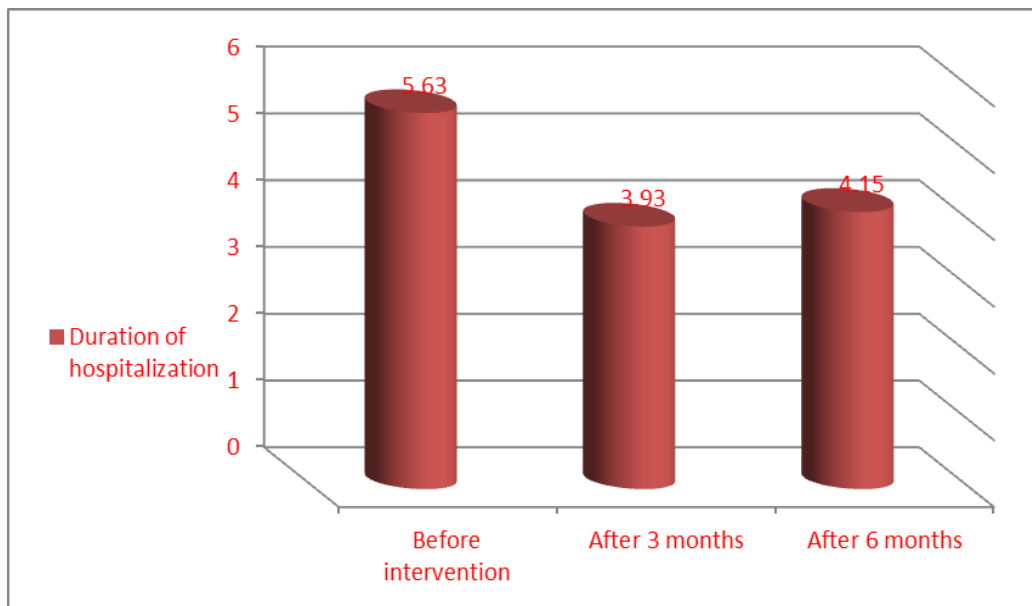


Figure (1): Duration of hospitalization before intervention, after 3 and 6 days.

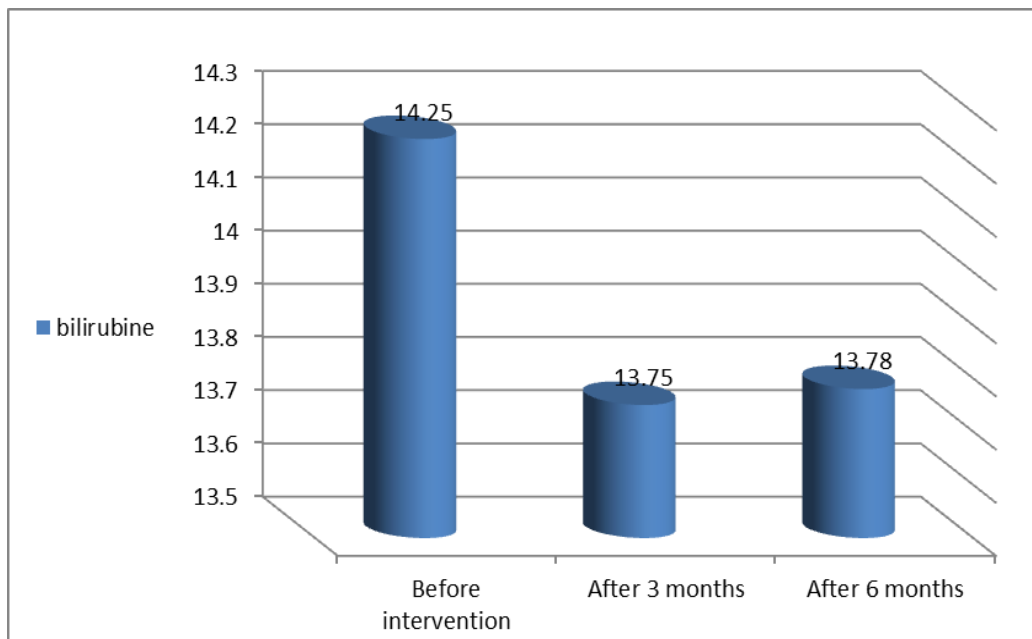


Figure (2): Total serum bilirubin on before intervention, after 3 months and 6 days

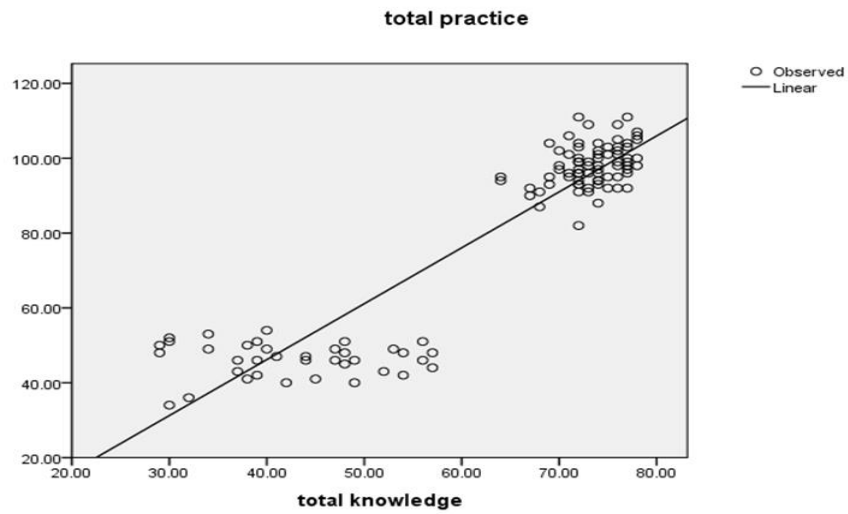


Figure (3): Correlation between total knowledge and total practice of studied nurses.

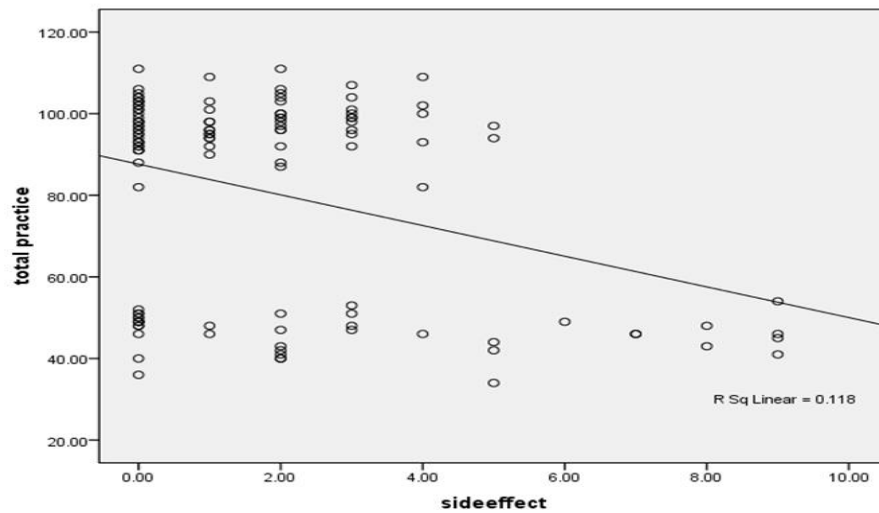


Figure (4): Pearson Correlation between total nurses' practices and occurrence of side effects of phototherapy.

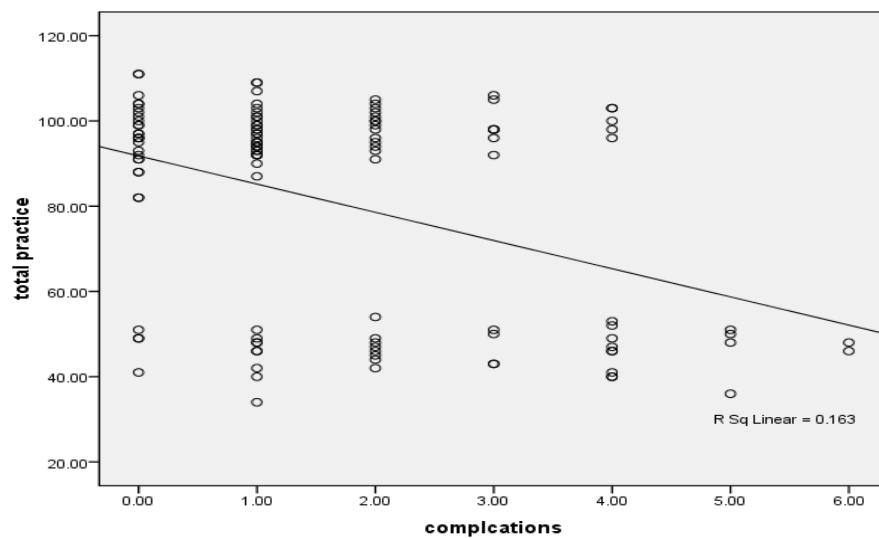


Figure (5): Pearson Correlation between total nurses' practices and complications of hyperbilirubinemia.

5. DISCUSSION

Neonatal jaundice is the most common health hazard of neonates. It is caused by hyperbilirubinemia that appears in almost 60% of the term neonates and approximately in more than 80% of the premature neonates in the first three days after birth (Henny-Harry, & Trotman, 2012; National Collaborating Centre for Women's and Children's Health, 2010).

The most appropriate nursing intervention for neonates with hyperbilirubinemia is to monitor bilirubin level, identify infants at risk for developing severe form of hyperbilirubinemia and implement prescribed treatment effectively when indicated (Watson, 2012).

The current study hypothesized that nursing care protocol will improve nurses' knowledge and practices regarding care for neonates with hyperbilirubinemia on post test than on pretest. Also, it is hypothesized that implementation of nursing care protocol will result in improved clinical outcomes of neonates on post and follow up tests than on pretest.

Regarding characteristics of studied nurses, the present study illustrated that more than one third of studied nurses were in age group 25-30 years. This finding was consistent with Abolwafa et al., (2013) who conducted a research about "Developing educational program for nurses related to infection control of invasive procedures in neonatal units at El-Minia University and general hospitals " and found that more than two thirds of them aged 20<30 years. This reflects that more than one third of nurses had few years of experience in NICU.

Also, this study showed that less than half of nurses were diploma nurses. This finding was in line with El- Shahat (2014) who conducted a research about " assessment of nurses' knowledge and practice about care needed for newborn under phototherapy in neonatal intensive care unit (NICU)". It was found that less than half of studied nurses had nursing diploma. Meanwhile, such finding was inconsistent with Mohamed (2015) who conducted a research about "effect of clinical pathway on care of neonates having hyperbilirubinemia" and reported that three fifths of studied neonates had secondary school of nursing diploma. The National Association of Neonatal Nurses (NANN) (2005) recommended that nurses who work in NICUs must be graduates from baccalaureate degree programs to be prepared as highly qualified nurses and to be more mature in age.

For years of experience, the current study showed that approximately one third of studied nurses had 1<5 years of experience in NICU. This finding was in agreement with Mohamed (2010) who conducted a research about "assessment of nurses' knowledge and practice regarding care given for neonates with hyperbilirubinemia". It was found that the highest percentages of studied nurses had 1<10 years of experience. " NANN" (2008) recommended that, nurses who work in NICU must receive professional training to become qualified neonatal nursing practitioners. Also, they need life- long training to be able to identify new trends in neonatal nursing. In USA, The neonatal nurse practitioner must have two years' experience in caring for neonates in order to be a practitioners in NICU. It is assumed that years of experience have a significant positive effect on the nurses' knowledge and performance which result in improving quality of care provided and neonate's outcome.

The findings of the current study revealed that the majority of studied nurses did not attend any previous training courses. This finding may be due to the shortage of nurses' number, absence of continuing education department in the hospital, lack of motivation for training as well as increased work load in Neonatal Intensive Care Units. These findings were in the same line with a study done by El-Shahat (2015) about "assessment of nurses' knowledge and practices about care needed for newborn under phototherapy in neonatal intensive care units (NICU) in Ismailia city". Also, it was found that majority of nurses did not attend any training sessions related to neonatal jaundice.

As well, these findings were in agreement with El Sayed (2007) who conducted a research about "pain management practices used by nurses working at neonatal care units" and found that the majority of studied nurses did not receive previous training courses. This may be one of the leading causes for lack of knowledge and skills among nurses caring for neonates having hyperbilirubinemia. So, neonatal nurses were in need for training to improve the quality of care. Additionally, Carol (2009) mentioned that formal training courses play an important role in enhancing and updating nurses' knowledge, performance and improving the quality of care given to neonates.

Regarding characteristics of studied neonates, the present study illustrated that more than half of studied neonates on pre intervention, after 3 and 6 months were males. It was clearly stated by several authors that male infants were at higher risk for developing severe jaundice than female infants (Zoubir et al., 2011). This finding was consistent with a study done by El Mazzahy (2013) about "neurological outcome of neonates with severe hyperbilirubinemia with different modalities of treatment". It was found that the ratio of attending males to females was 1.4 to 1. Also, these results were in agreement with Sabry (2014) in his study "The nurse's role in the prevention of acute bilirubin toxicity among neonates undergoing exchange transfusion". He reported that the incidence of hyperbilirubinemia was higher among males than females.

Regarding type of feeding, the current study represented that the majority of studied neonates on pre intervention, after 3 and 6 months had artificial feeding. This finding was consistent with El-Sayed et al., (2013) who conducted a research about "Effect of phototherapy on behavior of jaundiced neonates" and revealed that the majority of studied neonates (80%) were fed by bottle.

For type of hyperbilirubinemia, the present study revealed that two thirds of studied neonates on pre intervention, after 3 and 6 months had physiological jaundice. These results agreed with Alkohotani et al., (2014) who conducted a research about "The frequency of different types of neonatal jaundice in the Makah region" and revealed that the most common type of jaundice was physiological jaundice.

In relation to treatment modalities, the current study reflected that the majority of studied neonates on pre intervention, after 3 and 6 months were under double phototherapy. This finding was consistent with Ragab (2012) who conducted a study about "The effect of applying BIND tool on the early detection of neurological signs among neonates with hyperbilirubinemia under phototherapy at neonatal intensive care unit." He stated that double phototherapy was used for all neonates as an emergency measure.

For gestational age of studied neonates, the present study revealed that they ranged from 36 to 38 weeks with a mean of 37.43 ± 0.68 . For postnatal age of neonates, the present study revealed that postnatal age ranged from 2 to 15 days with a mean of 4.60 ± 2.96 . This finding was in line with Mohamed (2008) in his study about "Prevalence of glucose-6-phosphate dehydrogenase deficiency among newborns with indirect hyperbilirubinemia". He reported that the age of the neonates ranged from after birth to day 10 with a mean age 4.5 ± 2 days. Also, these results came in agreement with Sabry (2013) who revealed that mean age on admission was 4.56 ± 1.59 .

Regarding mean score of nurses' knowledge about neonatal hyperbilirubinemia on pre intervention, after 3 and 6 months. As illustrated from the results, the mean and standard deviation of knowledge scores on pre intervention were low as 24.14 ± 7.1 compared to 48.3 ± 3.1 and 46.3 ± 3.3 after 3 and 6 months respectively. This illustrated that on pre intervention level of nurses' knowledge was lower than after 3 and 6 months. This finding came in agreement with WHO (2006). They stated that there was inadequate nurses' knowledge and performance and attributed this deficiency to one or more of the following reasons lack of orientation program prior to work, lack of nursing care conference during work and lack of supervision.

However, this finding was in consistent with Shrestha (2013) who conducted a research about "Knowledge and practices of nursing personnel regarding the care of neonates under phototherapy". This study showed that on pretest, the majority of nurses (92%) had knowledge about not to use lotions or ointment on the skin of baby during the time of phototherapy, changing the position of neonates during the phototherapy and covering the eyes of baby during the phototherapy. The National Association of Neonatal Nurses (NANN) (2008) identified that neonatal nurses must be proactive in the assessment and management of hyperbilirubinemia in the newborn. They added that neonatal nurses must take steps to increase awareness and identify strategies within their institutions and practice to enhance the processes of diagnosis and management of hyperbilirubinemia.

Regarding mean scores of nurses' knowledge about nursing care of neonates with hyperbilirubinemia on pre intervention, after 3 and 6 months. As illustrated from the results, the mean and standard deviation of knowledge scores on pre intervention were 18.7 ± 2.26 compared to 26.4 ± 0.86 and 25.7 ± 1.11 after 3 and 6 months respectively. This illustrated that nurses had higher level of knowledge mean score after 3 months. This was attributed to the effect of training and instructions that were provided by the researcher. This was in line with Devi & Jena (2015) who conducted research about "Effectiveness of Video Assisted Teaching Module (VATM) on Knowledge Regarding Care of Newborn Baby under

Phototherapy among Female Health Workers". They observed that the overall mean score during posttest was 35.364 ± 1.58 revealed the effectiveness of the module.

Concerning distribution of nurses according to their practices of immediate care upon neonatal admission on pre intervention, after 3 and 6 months. The present study showed that on pre intervention most of nurses (86.5%) had inadequate performance regarding following the aseptic technique. These results agreed with Abo-Zaid (2008) who conducted a research about "Quality of nursing care for high risk neonates receiving total parental nutrition". They found that the majority of nurses had incompetent level of hand washing performance. This might be due to hand washing was not followed routinely by the majority of nursing procedures due to insufficient or lack of training and knowledge about measures of infection control at NICU and improper application of infection control standards at NICU. This could reflect the importance of conducting a training program for nurses regarding infection control. Simultaneously,

Regarding mean scores of total nurses' practices about neonatal hyperbilirubinemia on pre intervention, after 3 and 6 months. The results illustrated that nurses had the highest mean score after 3 months. This could be due to the implementation of a nursing care protocol for neonates with hyperbilirubinemia.

Concerning correlation between total knowledge and total practices. The present study reflected that there were highly statistical significant positive correlations between total knowledge and total practices. This finding agreed with Abd-El Galil (2007) who proved that, there were a statistical significant correlation between nurses' knowledge and their performance. On the contrary, Fathy (2004) who conducted study about "Intervention nursing program for care of high risk neonates at Mansoura Hospitals" and found that there was no statistically significant differences between nurses' knowledge and performance.

In relation to physiological measures of neonates on pre intervention, after 3 and 6 months, the present study revealed that physiological measures were within normal range after 3 and 6 months while on pre intervention most of neonates had hyperthermia and tachypnea. This might be attributed to the fact that phototherapy was associated with a potential risk of temperature instability. However, this risk could be prevented by close attention to body temperature as clarified by Wolff et al., (2012) who conducted a study about "Management of neonates with hyperbilirubinemia: improving timelines of care using a clinical pathway".

For duration of hospitalization before intervention, after 3 and 6 months. It was clear that, neonates had more prolonged hospitalization period before the implementation of protocol than after 3 and 6 months. This result was in line with Mohamed (2015) who conducted study about "Effect of clinical pathway on care of neonates having hyperbilirubinemia" and found that the mean of hospitalization period for the study group was 2.98 ± 1.24 days as compared to 4.53 ± 2.03 days for the control group. Reduced duration of hospitalization might be due to the implementation of nursing care protocol for neonates with hyperbilirubinemia.

Regarding total serum bilirubin before intervention, after 3 and 6 months, it was found that total serum bilirubin level was reduced after 3 and 6 months. This finding agreed with Stokowski (2011) who studied "Fundamentals of phototherapy for neonatal jaundice" and mentioned that phototherapy achieved a decline in serum bilirubin level when neonates received appropriate nursing care. This result could be attributed to the adherence of nurses to the designed nursing care protocol.

Concerning distribution of neonates according to signs and symptoms of hyperbilirubinemia on pre intervention, after 3 and 6 months. The present study showed that after 3 and 6 months of application for nursing care protocol, the number of neonates who had yellowish coloring and poor feeding showed more decline on the 4th and 5th day. This might be attributed to the effect of the implementation of nursing care protocol for neonates with hyperbilirubinemia.

Regarding distribution of neonates according to occurrence of phototherapy related side effects on pre intervention, after 3 and 6 months. The current study illustrated that after 3 and 6 months of application of nursing care protocol most neonates had fewer side effects of phototherapy than before the application of this protocol of care. This result was consistent with Mohamed (2015) who conducted study about "Effect of clinical pathway on care of neonates having hyperbilirubinemia" and found that there were statistical significant differences between study and control groups regarding the occurrence of watery diarrhea, transient skin rashes and hyperthermia. The current results were attributed to increased knowledge of nurses as well as their adherence to the practical guidelines of the designed nursing care protocol for neonates with hyperbilirubinemia.

International Journal of Novel Research in Healthcare and Nursing

Vol. 3, Issue 3, pp: (62-76), Month: September - December 2016, Available at: www.noveltyjournals.com

For correlation between total nurses' practices and occurrence of side effects of phototherapy, it was found that the higher level of nursing practices, the fewer the frequency of side effects of phototherapy. This could be attributed to nurses adherence to guidelines related to reducing side effects of phototherapy such as monitoring temperature, performing eye care and performing skin care.

6. CONCLUSION

Based on the finding of the present study, the following is concluded: Implementation of the designed nursing care protocol improved nurses' knowledge and practices regarding care of neonates with hyperbilirubinemia on posttest than on pretest. Also, it improved the clinical outcomes of neonates with hyperbilirubinemia on post and follow up tests than on pretest.

7. RECOMMENDATIONS

In the light of the findings obtained from the current study and its conclusion, the following recommendations are suggested:

A. Recommendations for Clinical Nursing Practice:

1. Ongoing in-service education programs should be designed and implemented at neonatal intensive care units to improve nurses' knowledge and practices on the basis of nurse's actual needs.
2. A standardized clinical nursing protocols and guidelines about neonatal hyperbilirubinemia should be available in each neonatal intensive care unit.
3. Newly staff nursing members who provide care for newborns with hyperbilirubinemia in neonatal intensive care units should be well oriented with each standardized international nursing care protocols to ensure competent nursing care.

B. Recommendations for Education:

1. In- service educational training programs about neonatal hyperbilirubinemia should be developed and provided for neonatal nurses in neonatal intensive care units.
2. A standardized neonatal care protocols for neonatal hyperbilirubinemia should be integrated into pediatric nursing curriculum.
3. Educational training programs for nurses should include following aseptic technique, caring of incubator, assessing vital signs, assessing color of newborn by Kramer's rule, measuring bilirubin level, plotting total serum bilirubin and deciding with physician the proper management of neonatal hyperbilirubinemia.

C. Recommendations for Hospital polices:

1. In each hospital, there should be specialized units for developing nurses knowledge and practices (training unit) based on nurses needs for practices.
2. The hospital administrative authority should develop up-dated neonatology care policies and procedures for nurses and should be annually reviewed and approved by the quality assurance committee.
3. Provide adequate medical and nursing supervision, guidance and regular feed back to nurses concerning their knowledge, attitude and performance.
4. Strict policies should be developed to ensure nurses adherence to infection control rules such as hand washing and wearing gloves.
5. Library and internet access for all medical and nursing staff should be established at hospitals settings and should contain the most recent publications related to neonatal hyperbilirubinemia.

International Journal of Novel Research in Healthcare and Nursing

Vol. 3, Issue 3, pp: (62-76), Month: September - December 2016, Available at: www.noveltyjournals.com

6. Advanced booklets and electronic media regarding clinical protocols for neonatal hyperbilirubinemia should be available at each neonatal intensive care unit.

D. Recommendations for Research:

Future studies should be applied on a larger sample to investigate the effect of designed nursing care protocol on clinical outcomes of neonates with hyperbilirubinemia to ensure the generalizability of results.

REFERENCES

- [1] Abai, G., Henry, J., Lian, C.B., Bill, H. & Ratu, I. (2011). Improving the knowledge and practice on early detection of neonatal jaundice by nurses in Kuching District. *International Journal of Public Health Research Special Issues*, 5(4); pp.92-99.
- [2] Abd El- Monieum, H.A. (2001). Impact of training program on the Performance of nurses working in intensive care unit in Zagazig University. Unpublished Doctoral thesis. Faculty of Nursing. Ain Shams University.
- [3] Abd El-Galil, N.I. (2009). Monitoring Quality of Nursing Care in Neonatal Care Units at Hospitals. Affiliated to Ministry of Health, Dakahlia Governorate, Unpublishe, Master Thesis, Faculty of Nursing, Mansoura University, Egypt, PP: 65-86.
- [4] Abolwafa, N. F., Ouda, W.E., Mohamed, F.Z. & Masoed, E. S. (2013). Developing educational program for nurses related to infection control of invasive procedures in neonatal units at El-Minia University and General Hospitals. *J Am Sci*;9(10):286-293. Retrieved from <http://www.jofamericanscience.org>
- [5] Abou-Zaid, S.A. (2008). Quality of Nursing Care for High Risk Neonates Receiving Total Parental Nutrition. Unpublished, Master Thesis, Faculty of Nursing, Ain Shams University, Egypt, pp:104-108.
- [6] Ahmed, R. M., Mohamed, A. R., Mahmoud, F. S. & Zaki, A.M. (2014). Quality of Nursing Care Provided for Neonates with Tracheoesophageal Fistula. *Journal of Education and Practice*; 5(3):186-199.
- [7] Alexander, S. (2010). Phototherapy. In: *Practices in Children's Nursing: Guidelines for Community and Hospital*. 3rd ed. Trigg E. and Mohammed T.A. (Eds). Churchill Livingstone, Edinburgh, 195-199.
- [8] Ali, S.M.(2008). Assessment of knowledge and practices of nurses working in neonatal intensive care units toward neonatal jaundice in Kirkuk and Hawler cities. Unpublished Master thesis. Retrieved from [http://hmu.edu.krd/Portals/0/Nazar/Nursing %20MSc.pdf](http://hmu.edu.krd/Portals/0/Nazar/Nursing%20MSc.pdf).
- [9] Alkhotani, A., NourEldin, E., Zaghloul, A. & Mujahid, S. (2014). The frequency of the different types of neonatal jaundice. Nature publishing group. Retrieved from [http:// www.nature.com](http://www.nature.com)
- [10] Allam, N.A. (1989). Nursing management of babies suffering from neonatal jaundice in Ain Shams Obstetrics & Gynecology Hospitals and Cleopatra Hospital, Master Thesis, High Institute of Nursing, Ain Shams University. Retrieved from <http://www.eul.edu.eg>.
- [11] American Academy of Paediatrics. (2004). Clinical practices guideline: Management of hyperbilirubinemia in the new born infant 35 or more week of gestation. *Paediatrics*, 114, 297-316.
- [12] Retrieved from: <http://www.pediatrics.org/cgi/content/full/114/1/297>.
- [13] Anderson, C. (2012). Prevention of kernicterus. Retrieved from <http://www.ehow.com>.
- [14] Association of Women's Health, Obstetric and Neonatal Nurses (AWHONN).(2005). *Hyperbilirubinemia in the neonate: Risk assessment, screening and management*. Washington, DC. Author.
- [15] Bahbah, M.H., El Nemr, F.M., El Zayat, R.S. & Aziz, E.A. (2015). Effect of phototherapy on serum calcium level in neonatal jaundice. *Menoufia Med J* ;28:426-30.

International Journal of Novel Research in Healthcare and Nursing

Vol. 3, Issue 3, pp: (62-76), Month: September - December 2016, Available at: www.noveltyjournals.com

- [16] Barakat, S. (2015). Neonatal Jaundice: Review. The Journal of MENA Sciences, 1(2), 1-6. Retrieved from <http://www.jomenas.org>
- [17] Bhutani, V. K. (2011). Phototherapy to prevent severe neonatal hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Committee on Fetus and Newborn, & American Academy of Pediatrics. Pediatrics, 128(4).
- [18] Bhutani, V.K. & Wong, R.J. (2013). Bilirubin neurotoxicity in preterm infants: Risk and prevention. J Clin Neonatol. 34(2);131:139
- [19] Canadian Pediatric Society. (2007). Guidelines for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants (35 or more weeks' gestation). Paediatrics and Child Health, 12(5), 1B–12B.
- [20] Carol, C. (2009). Application and development of pediatric nursing guidelines. Journal of Pediatric Nursing, 88(6):81.88
- [21] Centers for Disease Control and Prevention. (2001). Kernicterus in full-term infants: United States. MMWR Morbidity and Mortality Weekly Report, 50, 491–494.