EFFECT OF HANGING ADDITIONAL WHITE CURTAIN IN INCREASING EFFICACY OF PHOTOTHERAPY FOR NEONATAL JAUNDICE

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SUBMITTED TO THE MASTER OF NURSING SCIENCES DEPARTMENT OF NURSING SCIENCES, FACULTY OF MEDICINE, UNIVERSITY OF MALAYA AS A PARTIAL FULFILLMENT OF THE REQUIREMENT FOR COURSE MTGW 6161 NURSING RESEARCH PROJECT II

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ABSTRACT

**Background:** It has been reported that 60% of term neonates and 80% of the pre-terms develop neonatal jaundice (NNJ) in the first week of life. Bed occupancy for NNJ is on the rise in many hospitals and therefore, limited facilities may complicate the treatment to be given to these jaundiced neonates. **Objective:** To evaluate the effect of hanging additional white curtain on phototherapy unit on TSB level, length of hospital stay and adverse effects from phototherapy. **Methods:** Non-invasive single-blinded randomized controlled trial was conducted. One hundred and eight pre-term and term healthy jaundiced neonates requiring phototherapy were randomized into intervention and control groups. Neonates assigned into intervention group were nursed under phototherapy with the addition of white curtain hanging around the unit while those allocated into the control group were nursed under phototherapy without the addition of white curtain. **Results:** It was found that the baseline and demographic characteristics between the 2 groups were statistically insignificant \((p > 0.05)\) and was comparable. The mean for TSB level and length of hospital stay requiring phototherapy were significantly lower and shorter in intervention than in control group with \(p < 0.05\). The frequency and proportion of skin rashes from phototherapy were similar between intervention and control group with \(p > 0.05\). There were no other adverse effects reported. **Conclusion:** It is concluded in this study that hanging additional white curtain around phototherapy unit can hasten TSB reduction and shorten hospital stay without imposing more harm among pre-term and term jaundiced neonates.
ABSTRAK

Latar belakang: Enam puluh peratus daripada neonat penuh bulan dan 80% daripada neonat pra-matang mengalami jaundis neonatal (NNJ) pada minggu pertama. Oleh kerana kadar penggunaan katil untuk NNJ semakin meningkat di kebanyakan hospital, kemudahan terhad di sesetengah institusi tidak dapat menampung permintaan yang tinggi ini. **Objektif:** Untuk menilai kesan langsir putih yang digantung pada sekeliling unit fototerapi dari segi tahap serum bilirubin (TSB), tempoh penginapan hospital serta bilangan kes kesan sampingan akibat fototerapi. **Kaedah:** Kaedah bukan invasif, peruntukkan secara rawak dan terkawal telah dijalankan. Peruntukkan ini tidak diketahui oleh penilai yang berkaitan. Seratus lapan orang bayi sihat pra-matang dan cukup bulan yang mengalami jaundis telah diperuntukkan secara rambang kepada kumpulan intervensi atau kumpulan kawalan. Neonat yang diperuntukkan kepada kumpulan intervensi telah menerima fototerapi dengan penambahan langsir putih mengelilingi unit fototerapi manakala mereka yang diperuntukkan kepada kumpulan kawalan telah menerima fototerapi tanpa penambahan langsir putih. **Keputusan:** Data asas dan demografi antara kedua-dua kumpulan ini adalah tidak ketara dari segi statistik ($p > 0.05$) dan oleh itu, adalah setanding. Min bagi TSB dan tempoh penginapan hospital yang memerlukan fototerapi adalah lebih rendah, pendek dan ketara dari segi statistik dalam kumpulan intervensi berbanding kumpulan kawalan dengan nilai $p < 0.05$. Frekuensi dan peratusan kes ruam kulit akibat fototerapi adalah sama di antara kumpulan intervensi dan kumpulan kawalan dengan nilai $p > 0.05$. Tiada kesan sampingan lain yang telah dilaporkan. **Kesimpulan:** Dalam kajian ini, adalah disimpulkan bahawa penambahan langsir putih di sekeliling unit fototerapi boleh mempercepatkan penurunan TSB dan memendekkan tempoh penginapan hospital tanpa menyebabkan lebih banyak kes kesan sampingan di kalangan bayi pra-matang dan cukup bulan yang mengalami jaundis.
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Table of Content

Abstract ................................................................................................... ii

Acknowledgement .................................................................................. iv

Table of Content ........................................................................................ v

List of Figures ....................................................................................... viii

List of Tables .......................................................................................... ix

CHAPTER 1: INTRODUCTION ....................................................................................... I

1.0 Introduction .................................................................................................................. I

1.1 Background .................................................................................................................. 1

1.2 Problem Statement ....................................................................................................... 5

1.3 Research Question ........................................................................................................ 6

1.4 Aim of the Study ........................................................................................................ 7

1.5 Objectives .................................................................................................................... 7

1.5.1 General Objective .................................................................................................. 7

1.5.2 Specific Objectives ................................................................................................. 7

1.6 Hypothesis .................................................................................................................... 7

1.7 Conceptual Framework ............................................................................................. 9

1.8 Significance of the Study ........................................................................................... 9

1.9 Summary .................................................................................................................... 11

CHAPTER II: LITERATURE REVIEW ........................................................................ 12

2.0 Introduction ................................................................................................................ 12

2.1 Search Strategy ........................................................................................................... 12

2.2 Inclusion Criteria ........................................................................................................ 14

2.2.1 Type of Studies .................................................................................................... 14

2.2.2 Type of Participants ............................................................................................. 14

2.2.3 Types of Therapy ................................................................................................. 14

2.2.4 Types of Outcome Measures ............................................................................... 14

2.3 Screening for Eligibility ............................................................................................. 15

2.4 Study Characteristics and Findings ............................................................................ 17

2.4.1 Hanging White Reflecting Curtain ...................................................................... 17

2.4.2 Photo Lamps ........................................................................................................ 29
2.4.3 Other Modalities ................................................................. 30
2.4.4 Prophylaxis ........................................................................... 31
2.5 Summary .................................................................................. 34

CHAPTER III: METHODOLOGY ................................................. 35
3.0 Introduction ............................................................................. 35
3.1 Study Design ........................................................................... 35
3.2 Study Setting ........................................................................... 35
3.3 Sampling Methods ................................................................. 36
3.3.1 Target Population ............................................................... 36
3.3.2 Sample Size ....................................................................... 36
3.3.3 Inclusion and Exclusion Criteria ........................................... 36
3.4 Data Collection Procedure ..................................................... 37
3.5 Ethical Consideration ............................................................... 42
3.6 Pilot Study ............................................................................... 42
3.7 Summary .................................................................................. 43

CHAPTER IV: RESULTS .............................................................. 44
4.0 Introduction ............................................................................. 44
4.1 Data Analysis .......................................................................... 44
4.2 Results .................................................................................... 45
4.2.1 Demographic and Baseline Data ......................................... 46
4.2.1(a) Gestational Age .............................................................. 46
4.2.1(b) Post-Natal Age ............................................................... 48
4.2.1(c) Birth weight ................................................................. 51
4.2.1(d) Haemoglobin ............................................................... 53
4.2.1(e) Haematocrit ................................................................. 55
4.2.1(f) Reticulocyte count ......................................................... 57
4.2.1(g) Baseline Total Serum Bilirubin ..................................... 59
4.2.1(h) Irradiance ................................................................. 61
4.2.1(i) Actual Hours under Phototherapy during First 24 Hours ................................................................................. 64
4.2.1(j) Summary ....................................................................... 67
4.2.2 Primary Outcome Measures .............................................. 68
4.2.2(a) Total Serum Bilirubin Level ........................................... 68
4.2.2(b) Summary ..................................................................................................... 70
4.2.3 Secondary Outcome Measures ............................................................................. 71
  4.2.3(a) Length of Hospital Stay ............................................................................... 71
  4.2.3(b) Incidence of Adverse Effects from Phototherapy ....................................... 74
  4.2.3(c) Summary ...................................................................................................... 76
4.3 Findings ...................................................................................................................... 78
4.4 Summary .................................................................................................................... 79

CHAPTER V: DISCUSSION AND CONCLUSION ...................................................... 80
  5.0 Introduction ................................................................................................................ 80
  5.1 Discussion .................................................................................................................. 80
  5.2 Implication .................................................................................................................. 82
  5.3 Limitations .................................................................................................................. 84
  5.4 Recommendations ...................................................................................................... 84
  5.5 Summary .................................................................................................................... 85
  5.6 Conclusion .................................................................................................................. 85

REFERENCES ..................................................................................................................... 86
BIBLIOGRAPHY ................................................................................................................ 92
APPENDICES ..................................................................................................................... 93
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Figure 1.1 Proportions of NNJ Cases in Malaysia</td>
<td>2</td>
</tr>
<tr>
<td>Figure 1.2 Percentages of NNJ Cases in Malaysia by 3 Major States</td>
<td>3</td>
</tr>
<tr>
<td>Figure 1.3 Total Number of NNJ Cases at Sarawak General Hospital</td>
<td>4</td>
</tr>
<tr>
<td>Figure 1.4 Conceptual Framework</td>
<td>9</td>
</tr>
<tr>
<td>Figure 2.1 The PRISMA 2009 Flow Diagram</td>
<td>16</td>
</tr>
<tr>
<td>Figure 3.1 Flow Chart for the Data Collection Procedure</td>
<td>41</td>
</tr>
<tr>
<td>Figure 4.1 Bar Chart for the Frequency of Subjects' Gestational Age in Each Group</td>
<td>47</td>
</tr>
<tr>
<td>Figure 4.2 Bar Chart for the Frequency of Occurrence of Skin Rashes in Each Group</td>
<td>75</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 2.1 Search Strategy ................................................................. 13
Table 2.2 Summary of Highly Relevant Trials ........................................ 17
Table 2.3 Efficacy of Non-Invasive Interventions in Reducing TSB Level for NNJ ... 31
Table 4.1 Screening for Missing Data for Categorical Data ....................... 45
Table 4.2 Screening for Missing Data for Continuous Data ....................... 46
Table 4.3 Frequency and Crosstabulation of the Subjects’ Allocation and Gestational Age ......................................................... 46
Table 4.4 Pearson Chi-Square Test for Group Allocation and Gestational Age .... 48
Table 4.5 Symmetric Measures for Gestational Age .................................. 48
Table 4.6 Description for the Post-Natal Age of Participants ....................... 49
Table 4.7 Test of Normality for Post-Natal Age ..................................... 49
Table 4.8 Ranks for Post-Natal Age between Groups ................................ 50
Table 4.9 Mann-Whitney U Test for Post-Natal Age ................................. 50
Table 4.10 Description for the Birth Weight of Participants ......................... 51
Table 4.11 Test of Normality for Birth Weight ...................................... 51
Table 4.12 Ranks for Birth Weight between Groups ................................ 52
Table 4.13 Mann-Whitney U Test for Birth Weight between Groups ............... 52
Table 4.14 Description for the Haemoglobin of Participants ....................... 53
Table 4.15 Test of Normality for Haemoglobin Level ................................. 54
Table 4.16 Ranks for Haemoglobin between Groups ................................ 54
Table 4.17 Mann-Whitney U Test for Haemoglobin Level between Groups ...... 54
Table 4.18 Description for the Haematocrit of Participants .......................... 55
Table 4.19 Test of Normality for Haematocrit ....................................... 56
Table 4.20 Ranks for Haematocrit between Groups ........................................ 56
Table 4.21 Mann-Whitney U Test for Haematocrit between Groups ............... 57
Table 4.22 Description for the Reticulocyte Count of Participants .................. 57
Table 4.23 Test of Normality for Reticulocyte Count .................................... 58
Table 4.24 Ranks for Reticulocyte Count between Groups ............................ 59
Table 4.25 Mann-Whitney U Test for Reticulocyte Count between Groups ........ 59
Table 4.26 Description for the Baseline TSB of Participants ........................... 59
Table 4.27 Test of Normality for Baseline TSB ........................................... 60
Table 4.28 Ranks for Baseline TSB between Groups .................................... 61
Table 4.29 Mann-Whitney U Test for Baseline TSB between Groups ............... 61
Table 4.30 Description for the Irradiance of Photo Lamps ............................... 62
Table 4.31 Test of Normality for Irradiance of Photo Lamps Used .................... 62
Table 4.32 Ranks for Irradiance of Photo Lamps between Groups ................... 63
Table 4.33 Mann-Whitney U Test for Irradiance of Photo Lamps between Groups ... 63
Table 4.34 Description for the Actual Hours under Phototherapy during First 24 Hours ................................................................................. 64
Table 4.35 Test of Normality for Irradiance ................................................. 65
Table 4.36 Ranks for Actual Hours under Phototherapy during First 24 Hours between Groups .................................................................... 65
Table 4.37 Mann-Whitney U Test for Actual Hours under Phototherapy during First 24 Hours between Groups ................................................... 66
Table 4.38 Actual Hours under Phototherapy ................................................. 66
Table 4.39 Comparability for Baseline and Demographic Data ......................... 67
Table 4.40 Description for Day 1 TSB Level of Participants ............................ 68
Table 4.41 Test of Normality for Day 1 TSB ................................................ 69
Table 4.42 Ranks for Day 1 TSB Level between Groups ................................ 69
Table 4.43 Mann-Whitney U Test for Day 1 TSB Level between Groups ............... 70
Table 4.44 Total Serum Bilirubin Level after Initiation of Phototherapy ............... 70
Table 4.45 Description for the Length of Hospital Stay .................................... 71
Table 4.46 Test of Normality for Length of Hospital Stay ................................. 72
Table 4.47 Ranks for Length of Hospitalization between Groups ....................... 73
Table 4.48 Mann-Whitney U Test for Length of Hospital Stay between Groups ...... 73
Table 4.49 Frequency and Crosstabulation of the Subjects' Allocation and Occurrence of Skin Rashes ....................................................... 74
Table 4.50 Pearson Chi-Square Test for Group Allocation and Skin Rashes ........... 75
Table 4.51 Symmetric Measures for Skin Rashes .......................................... 76
Table 4.52 Length of Hospital Stay Needing Phototherapy ............................... 77
Table 4.53 Incidence of Adverse Effects from Phototherapy ............................. 78
CHAPTER I

INTRODUCTION

1.0 Introduction

Neonatal jaundice (NNJ) is yellowing of the skin or tissues with a total serum bilirubin (TSB) level of more than 85 μmol/L (5 mg/dl) (Hussain Iman Hj Muhammad Ismail, Ng and Thomas, 2012) and is common among the newborns. Phototherapy is the primary treatment for NNJ and is evaluated via TSB level (Hansen, 2012; Hussain Iman Hj Muhammad Ismail, Ng and Thomas, 2012). Adverse effects of phototherapy may include dehydration, hypo/hyperthermia, skin rashes and others (Hansen, 2012). It has been reported that hanging white curtain around phototherapy unit can multiply energy delivery by many folds (Djokomuljanto et al., 2006; Hansen, 2012).

1.1 Background

Neonatal jaundice is common throughout the world. It has been reported that 60% of term neonates and 80% of the pre-terms develop NNJ in the first week of life (Maisels & McDonagh, 2008; Welsh, 2010). As shown in Figure 1.1, cases of NNJ detected in Malaysia are on the rise. In 2009, 252237 (50.82%) cases of NNJ have been documented. The number continued to hike from 2010 to 2011 and 2012, with the frequencies from 272098 (55.39%) in 2010 to 287795 (56.25%) in 2011 and 300300 (59.02%) in 2012 (Department of Statistics Malaysia, 2010-2012; Malaysian Health Management Information System, 2010-2012).
Figure 1.1: Proportions of NNJ Cases in Malaysia

(Source: Department of Statistics Malaysia, 2010-2012; Malaysian Health Management Information System, 2010-2012)

Breaking down to 3 major state level, it was discovered that the percentage of NNJ cases in Sabah outstand those in Peninsular Malaysia as well as in Sarawak and at the same time, mounting annually from 76.54% in 2009 to 90.16% in 2012. Meanwhile, the annual trend for NNJ cases in Peninsular Malaysia and Sarawak seen from Figure 1.2 fluctuates, covering almost half of the total live birth each year. From 2009 to 2012, out of the total live birth in Peninsular Malaysia, the proportions of NNJ cases among neonates ranged from 47.29% to 60.21% whilst in Sarawak, the percentages extended from 51.58% to 53.15% (Department of Statistics Malaysia, 2010-2012; Malaysian Health Management Information System, 2010-2012).
Percentage of Neonatal Jaundice Detected (%)

<table>
<thead>
<tr>
<th>Year</th>
<th>Peninsular Malaysia</th>
<th>Sabah</th>
<th>Sarawak</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>60</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>2010</td>
<td>60</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>2011</td>
<td>60</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>2012</td>
<td>60</td>
<td>60</td>
<td>70</td>
</tr>
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Figure 1.2: Percentages of NNJ Cases in Malaysia by 3 Major States

(Source: Department of Statistics Malaysia, 2010-2012; Malaysian Health Management Information System, 2010-2012)

Zooming in to Sarawak, unpublished data attained from the Information and Documentation Unit, Sarawak State Health Department revealed that almost half (46.53%) of the total neonatal admissions throughout Sarawak were NNJ cases in 2013. According to the unpublished statistics retrieved from the Medical Record Unit, Sarawak General Hospital, the number of NNJ cases at Sarawak General Hospital, which is a tertiary hospital in Sarawak, showed a marked increase from year 2007 to 2009 as illustrated in Figure 1.3. Despite a drop from year 2009 to 2010, the number remained stationary throughout year 2010 to 2011.
Figure 1.3: Total Number of NNJ Cases at Sarawak General Hospital
(Source: Medical Record Unit, Sarawak General Hospital)

Majority of the NNJ resulted from physiological jaundice, which is a normal sequela to the circulating unconjugated bilirubin subsequent to the haemolysis of short-lifespan fetal erythrocytes. Furthermore, the liver function of neonates has yet to be at its optimum function to metabolize the unconjugated bilirubin and excrete the metabolized conjugated bilirubin. Nevertheless, there are also rare instances involving pathological jaundice which includes blood group incompatibility, glucose-6-phosphate dehydrogenase (G6PD) deficiency, haemolysis of other causes, sepsis, breastmilk jaundice, gastrointestinal obstruction and other causative factors. Haemoglobin level, haematocrit and reticulocyte count are among the parameters to determine the degree of haemolysis that is attributed to the neonatal jaundice.
Possible progression of NNJ without appropriate intervention can lead to severe and irreversible threat known as kernicterus, which is due to the toxic effect of the unconjugated bilirubin on the neural tissues that leads to the neurological dysfunctions. Therefore, according to the Paediatric Protocols for Malaysian Hospitals, treatment options such as conventional phototherapy, intensive phototherapy or exchange transfusion remain the mainstay based on the criteria and assessments done (Hussain Imam Hj Muhammad Ismail, Ng, & Thomas, 2012). Their efficacies are determined by the reduction of total serum bilirubin (TSB) level. Normally, phototherapy may impose adverse effects on the newborns undergoing the treatment. They include dehydration, skin rashes, hypo/hyperthermia and other possible adverse effects (Hansen, 2012). This however, differs from individual to individual.

1.2 Problem Statement

Bed occupancy for NNJ is on the rise in many hospitals. It has been reported that 60% of term neonates and 80% of the pre-terms develop NNJ in the first week of life (Maisels & McDonagh, 2008; Welsh, 2010). Proportion of cases related to NNJ in Malaysia is escalating yearly (Department of Statistics Malaysia, 2010-2012; Malaysian Health Management Information System, 2010-2012). According to many textbooks and clinical practice guidelines (CPG), phototherapy is the primary treatment for NNJ (Hansen, 2012; Hussain Imam Hj Muhammad Ismail, et al., 2012). Reflecting my clinical experience as a paediatric nurse, seasonally, I have observed that the surging number of NNJ admissions went beyond the availability of phototherapy units as well as the bassinets. It is notably known that the facilities available currently can sometimes fail to accommodate the large population of NNJ unless measures are taken to hasten the treatment to allow speedy turnover. Furthermore, findings from previous similar studies did not seemed to be
convincing due to gaps and biases such as the absence of blinding and controlling of confounding factors, which will be discussed in depth in Chapter 2.

1.3 Research Question

In formulating research questions, the technique of P.I.C.O., which stands for population, intervention, comparison and outcomes, has been adopted (Polit & Hungler, 1999). This study involved a population of neonates with hyperbilirubinaemia who are nursed under phototherapy. Intervention carried out was the hanging of additional white curtain around phototherapy unit in comparison with the units not hung with the additional white curtain to study the outcomes. The outcomes were the: (1) reduction of total serum bilirubin (TSB), (2) length of hospital stay needing phototherapy and (3) incidence of side effects from phototherapy. With that, three research questions as listed below have been constructed:

(1) What is the effect of hanging additional white curtain around phototherapy unit on the reduction of TSB level among neonates with hyperbilirubinaemia if compared to those under phototherapy without the addition of white curtain?

(2) What is the effect of hanging additional white curtain around phototherapy unit on the length of hospital stay requiring phototherapy among jaundiced neonates if compared to those under phototherapy without the additional white curtain?

(3) What is the effect of hanging additional white curtain around phototherapy unit on the incidence of side effects from phototherapy among neonates with hyperbilirubinaemia if compared to those under phototherapy without the addition of white curtain?
1.4 Aim of the Study
To explore the efficacy of hanging additional white curtain on phototherapy unit in hastening reduction of bilirubin level and in shortening hospital stay without imposing harm among jaundiced neonates.

1.5 Objectives

1.5.1 General Objective
To evaluate the effect of hanging additional white curtain on phototherapy unit on TSB level, length of hospital stay and adverse effects from phototherapy.

1.5.2 Specific Objectives
a) To examine the difference in baseline and demographic characteristics of neonates and mothers between the intervention and control group.

b) To compare TSB level between the intervention and control group at least every 24 hours until discharge after initiation of phototherapy.

c) To determine the difference in the length of hospital stay between the intervention and control group.

d) To identify incidences of adverse effects from phototherapy (dehydration, skin rashes, hypo/hyperthermia) in neonates from the intervention and control group.

1.6 Hypothesis
Null hypothesis (H₀) is a statement that was meant to be rejected. The expected outcome usually lies within the alternative hypothesis (Hₐ). Therefore, in accordance to the specific objectives of this study, the hypotheses are as followed:
Hypotheses 1

H₀: There will be no statistical significant difference in the baseline and demographic characteristics of neonates and mothers between the intervention and control group.

H₁: There will be statistical significant difference in the baseline and demographic characteristics of neonates and mothers between the intervention and control group.

Hypotheses 2

H₀: There will be no statistical significant difference in the reduction of TSB between the intervention and control group.

H₁: There will be statistical significant difference in the reduction of TSB between the intervention and control group.

Hypotheses 3

H₀: There will be no statistical significant difference in the length of hospital stay requiring phototherapy between the intervention and control group.

H₁: There will be statistical significant difference in the length of hospital stay requiring phototherapy between the intervention and control group.

Hypotheses 4

H₀: There will be no statistical significant difference in the incidence of side effects from phototherapy between the intervention and control group.

H₁: There will be statistical significant difference in the incidence of side effects from phototherapy between the intervention and control group.
1.7 Conceptual Framework

Figure 1.4 illustrates the conceptual framework of this study. In evaluating the effect of hanging additional white curtain on the efficacy of phototherapy for neonatal jaundice, the independent variables were made up of related baseline or demographic characteristics such as birth weight, baseline TSB and others. It was expected that the intervention, together with the independent variables, would affect outcome variables, which are the TSB level (in \( \mu \text{mol/L} \)) taken at least every 24 hour until discharge after the initiation of phototherapy, length of hospital stay (in hours) retrieved from the admission-discharge records as well as the incidence of adverse effects from phototherapy obtained from the medical and nursing documentations. The adverse effects from phototherapy may be dehydration, skin rashes, hypothermia, hyperthermia or others as documented by the clinicians and nurses.

![Conceptual Framework Diagram]

1.8 Significance of the Study

In developing countries like Malaysia, the percentage of NNJ is soaring every year. Therefore, approaches to optimize the efficacy of phototherapy in hastening the drop of TSB level are worthwhile to be studied. The use of extra white curtain in bringing down the
TSB level at a faster rate and therefore reducing the length of hospital stay without imposing more adverse effects benefits the patients, nurses as well as organizations. It is because hanging supplementary white curtain around phototherapy unit can amplify energy delivery by many folds (Djokomuljanto et al., 2006; Hansen, 2012).

In this study, if hanging additional low-cost white curtain around single phototherapy unit has proven to be effective in bringing down the TSB faster than conventional phototherapy without adding white curtain, it might be a valuable alternative to double phototherapy in the treatment of NNJ. This innovative, non-invasive and simple intervention is worthy of study so that safe treatment can still be delivered to the jaundiced neonates despite limited unit of photo lamps. When the newborns are discharged sooner, there will be more available facilities to tailor to the needs of the newly admitted jaundiced newborns. Besides, the disruption to family dynamics will be kept to the minimum as the mother and child will have to be away from home throughout the therapy. With that, complications associated to NNJ, hospitalization and separation can therefore be eradicated. Furthermore, hanging white curtain on phototherapy unit does not require nurses to put extra effort if compared to the conventional nursing interventions of 2-hourly turning. Turning of babies 2-hourly is not a standard care delivered to the neonates nursed under phototherapy in Sarawak General Hospital. Moreover, the latest edition of Paediatric Protocols for Malaysian Hospitals has omitted the turning of neonates during phototherapy (Hussain Iman Hj Muhammad Ismail, Ng and Thomas, 2012, pp. 111-113). The time-effectiveness of this intervention, blended with the reduction of complications, will lighten the workload of the nurses. In a fast-paced society, people are hoping for a cost-effective, fast and effective treatment. The rapid turnover of the neonates receiving phototherapy, lowered nosocomial infection, reduction of NNJ complications and the lightened nurses’ workload resulting in
nurses' better health can all result to the hike of organizational reputation and prestige due to the increased efficacy of phototherapy achieved at a shorter time frame. Although a few recent similar studies have been conducted, the materials used as the curtain differ from this trial. Moreover, this research will be able to complement the gaps of one existing literature using identical material by executing single-blinding, controlling confounding factors and implementing other improvements.

1.9 Summary

Neonatal jaundice (NNJ) is a common condition among the newborn, in whom majority of them resulted from physiological jaundice. It has been reported that 60% of term neonates and 80% of the pre-terms develop NNJ in the first week of life and the proportion of NNJ Malaysia is on the rise. This leads to increased hospital bed occupancy and workload as phototherapy is the primary treatment. Facing with the increment, some organizations were observed to be lacking facilities to properly treat the jaundiced neonates. Therefore, the efficacy of a simple and non-invasive therapy of hanging additional white curtain on phototherapy unit in hastening reduction of bilirubin level and length of hospital stay among jaundiced neonates without inflicting more adverse effects was explored. In view of the time-effectiveness and promising efficacy of the intervention, this study would significantly benefit the patients, nurses and organizations.
2.0 Introduction

Reviewing the literature prior to carrying out a research is essential because it exposes us to the existing knowledge and works done. Therefore, after the area of interest, which is related to neonatal jaundice (NNJ), has been identified, an extensive literature review has been done to enable a deep understanding on the topic. In the midst of reviewing the research articles, I have also identified gaps that could be improved on. The scope of this review encompasses a broader view of the best non-invasive phototherapy modalities, and zoomed in to the most cost-effective intervention requiring minimum workload in optimizing phototherapy. Hence, only the highly relevant articles selected were appraised.

2.1 Search Strategy

Phototherapy is the mainstay for NNJ (Hussain Imam Hj Muhammad Ismail, et al., 2012). In view of the rocketing number of NNJ in addition to the limited facilities, a variety of clinical trials to determine the best modalities to optimize phototherapy have been conducted, ranging from the invasive to the non-invasive ones. Randomized controlled trials (RCTs) that are highly related to non-invasive phototherapy amplification and the effect of hanging white curtain in increasing the efficacy of phototherapy for NNJ have been searched through electronic databases via the University of Malaya's Interaktif Webpage. Databases that include CINAHL, MEDLINE, ScienceDirect, Embase and The Cochrane Library were utilized to search for sources that meet the criteria. Keywords, MeSH terms and their synonyms, in combination with the other subject headings using