



**Arab American University**  
**Faculty of Graduate Studies**

**The Relationship between Using Intensive Phototherapy in  
Decreasing the Need for blood Exchange in Neonatal Jaundice  
in the West Bank of Palestine: A Retrospective Study**

By

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**This thesis was submitted in partial fulfillment of the  
requirements for the Master`s degree in Neonatal Nursing**

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## Thesis Approval

### **The Relationship between Using Intensive Phototherapy in Decreasing the Need for blood Exchange in Neonatal Jaundice in the West Bank of Palestine: A Retrospective Study**

By

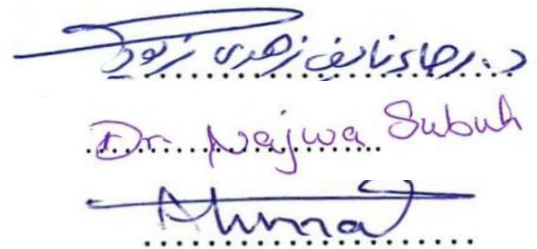
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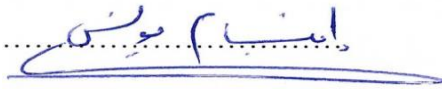
## Declaration

I certify that this thesis submitted for the degree of master is the result of my research, except where otherwise acknowledged, and that this study (or any part of the same) has not been submitted for a higher degree to any other university or institution.

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Date: 25/8/2024

## **Acknowledgments**

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## Abstract

**Background:** The most prevalent condition found during the 1<sup>st</sup> week of life is newborn jaundice. 10% of infants have the potential to have serious hyperbilirubinemia, which requires strict treatment and surveillance. Although phototherapy successfully treats the majority of neonatal jaundice, high-risk neonates may require (ET).

**Aim:** to assess the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.

**Methodology:** A retrospective, descriptive, quantitative study design was conducted at tertiary care hospitals (Governmental & private) on the north of West Bank which contain neonatal intensive care units (NICU) and treat hyperbilirubinemia with intensive phototherapy and blood exchange. A convincing sample was composed of (323) neonates who participated in the study during the data collection period.

**Result:** a virtually equal gender distribution of 48.0% male and 52.0% female. According to growth chart research, most (91.0%) of babies were delivered full term. Normal deliveries accounted for 54.8%, while 44.3% were born via Caesarean section, and breastfeeding was the most common feeding option (64.4%). A considerable portion (16.4%) underwent double-volume exchange transfusions, whereas the majority (83.6%) received intensive phototherapy treatments. Blood group A was the most common (55.7%), and total serum bilirubin levels decreased from 30 mg/dl at birth to 11.0 mg/dl by the seventh day.

**Conclusion:** the findings imply that intensive phototherapy and associated clinical parameters are critical in the management of hyperbilirubinemia. Intensive phototherapy in order is a

safe and effective treatment for severe hyperbilirubinemia. Patients with hyperbilirubinemia may require a more rigorous rationale for Blood Exchange. However, a contingency plan for emergency Blood Exchange should be implemented as soon as intensive phototherapy begins, especially for infants with risk factors. If intensive phototherapy is proven to be effective, it is recommended to minimize the use of Blood Exchange.

Key Word: Hyperbilirubinemia, Neonate, Intensive Phototherapy, Blood Exchange.

## Table of Contents

NO.	Subject	Page
	Thesis Approval	i
	Declaration	ii
	Acknowledgments	iii
	Abstract	iv
	List of Tables	ix
	List of Appendices	x
	List of Abbreviations	xi
	Chapter One: Introduction	
1.1	Background	1
1.2	Problem statement	4
1.3	Significant of Study	5
1.4	Study Objective	6
1.5	Study Questions	6
1.6	Study hypothesis	7
1.7	Study Variables	8
1.7.1	Dependent Variables	8
1.7.2	Independent Variables	8
	Chapter Two: Literature Review	

2.1	Introduction	9
2.2	Neonates Demographic Data & Characteristic	9
2.3	Clinical Characteristics & Assessment	12
2.4	ABO Incompatibility between Mother and Neonates	15
2.5	Treatment of Neonatal Jaundice and TSB Chart	16
2.6	Intensive Phototherapy Vs Exchange Transfusion in Neonatal Jaundice	26
Chapter Three: Methodology		
3.1	Introduction	32
3.2	Study design	32
3.3	Study Setting	33
3.4	Study Duration	33
3.5	Study Population	33
3.6	Sample and Sampling	34
3.7	Inclusion Criteria	34
3.8	Exclusion Criteria	35
3.9	Sample Size	35
3.10	Study Instrument	36
3.11	Study Validity and Reliability	37
3.12	Pilot Study	39
3.13	Ethical Considerations	39
3.14	Analysis Plan	40

	Chapter Four: Results	
4.1	Introduction	41
4.2	Part 1: Socio-demographic Data	42
4.3	Part II: Clinical Characteristics	46
4.4	Part III + Part IV: Subjective and Objective Notes	48
4.5	Part V: ABO Incompatibility Between Mothers and their Neonates	50
4.6	Part VI: Total Serum Bilirubin Readings	51
4.7	Correlations	58
4.8	Hypothesis	67
	Chapter Five: Discussion	
5.1	Introduction	70
5.2	Demographic Data	70
5.3	Clinical Characteristics	71
5.4	Subjective and Objective Notes	72
5.5	Total serum Bilirubin finding	73
5.6	Treatment	74
	Chapter Six: Conclusion and Recommendations	
6.1	Conclusion	75
6.2	Recommendation	75
References		77
Appendices		83
الملخص		93

## List of Tables

NO.	Subject	Page
Table 1	Reliability Statistics	42
Table 2	Distribution of the study population according to Socio-demographic data	43
Table 2.1	Distribution of the chosen sample based on hospital	44
Table 2.2	Numerical Demographics of neonates	46
Table 3	Means and Standard Deviation of Clinical Characteristics	47
Table 4	Clinical Characteristics of Neonates	47
Table 5	Subjective and Objective Notes of Neonates	49
Table 6	ABO and Rh of Mothers and Neonates	51
Table 7	Total Serum Bilirubin Reading Mean and Count of Neonates	52
Table 8	Demographics with Treatment Used for Neonates	53
Table 9	Numerical Data with Treatment Used for Neonates	57
Table 10	Correlations with Treatment Used for Neonates	59
Table 11	ANOVA with Treatment and Bilirubin Levels of Neonates	63
Table 12	Treatment and Bilirubin Levels Significance of Neonates	65

## List of Appendices

Appendix		
Appendix I	Study Tools	83
Appendix II	IRB Approval	90
Appendix III	تسهيل مهمة الحكومة	91
Appendix IV	تسهيل مهمة المستشفيات الخاصة	92

## List of Abbreviations

AAP: American Academy of Pediatrics

ABE: acute bilirubin encephalopathy

aOR: Adjusted odds ratios

BEP: Bilirubin Encephalopathy

BET: blood exchange transfusion

BL: bilirubin level

BIND: bilirubin-induced neurological dysfunction

CPT: Conventional Phototherapy

DAT: Direct Antiglobulin Test

DPT: double phototherapy

DVET: double-volume exchange transfusion

EHB: extreme hyperbilirubinemia

ET: Exchange Therapy

ETCO<sub>c</sub>: end-tidal CO

G6PD: glucose-6-phosphate dehydrogenase

GA: Gestational Age

HB: hyperbilirubinemia

IPT: Intensive Phototherapy

IVIG: Intravenous Immunoglobulin

IRB: Institutional Review Board

LEDs: light-emitting diodes

LMIC: low and middle-income countries

NICU: neonatal intensive care units

PT: phototherapy

SPSS: Statistical Package for the Social Sciences

SPT: single phototherapy

TSB: total serum bilirubin

V/S: vital signs

## **Chapter One**

### **Introduction**

#### **1.1 Background**

The most prevalent condition found during the 1<sup>st</sup> week of life is newborn jaundice (Alfakhri et al., 2019). Although it has the possible to cause neuro deficit in both preterm and term newborns, it usually resolves without consequences. Early detection and treatment can prevent the modification of hyperbilirubinemia to bilirubin neurodeficit (Alfakhri et al., 2019).

10% of infants have the potential to have serious hyperbilirubinemia, which requires strict treatment and surveillance. Severe hyperbilirubinemia is characterized as bilirubin levels over the Exchange Therapy (ET) threshold or a diagnosis of Bilirubin Encephalopathy (BEP). Severe hyperbilirubinemia can cause BEP, which is linked to a greater likelihood of infant mortality, cerebral palsy, hearing problems, and long-period neurodevelopmental difficulties. Neonatal hyperbilirubinemia kills 1309 newborns per 100,000 live births in the first six days of life. It is also the sixth leading cause of newborn death. (Abdelazeem, Soliman, and Askar. 2017).

As known neonatal hyperbilirubinemia is a common and typically benign disease. Severe infant hyperbilirubinemia, on the other hand, might result in death and significant morbidity. When phototherapy works to help newborns with severe hyperbilirubinemia, the only option is a double-volume blood exchange transfusion (BET). Because this technique has a significantly high risk of complications, infant hyperbilirubinemia

recommendations are necessary for preventing hyperbilirubinemia (HB) toxicity and the challenges of invasive therapy (Al-Lawama et al., 2022).

In the United States, a bilirubin evaluation and risk factor detection are typically advised for all inpatient infants. Furthermore, obstetricians in the US consider early tests of all pregnant women at risk of having a newborn with severe hyperbilirubinemia to be an essential procedure. Although phototherapy successfully treats the majority of neonatal jaundice, high-risk neonates may require exchange transfusion (ET) (Marzoog, Mohammed, and Habib. 2020).

Risk factors for developing significant hyperbilirubinemia include lower gestational age, with the risk increasing with each additional week less than 40 weeks. Additionally, jaundice appearing within the first 24 hours after birth, predischage transcutaneous bilirubin (TcB) or total serum bilirubin (TSB) concentrations nearing the phototherapy threshold, and hemolysis from any cause—especially if suspected due to a rapid increase in TSB or TcB levels—are significant risk factors. Other factors include receiving phototherapy before discharge, having a parent or sibling who required phototherapy or exchange transfusion, a family history or genetic ancestry indicative of inherited red blood cell disorders like glucose-6-phosphate dehydrogenase (G6PD) deficiency, exclusive breastfeeding with suboptimal intake, scalp hematoma or significant bruising, Down syndrome, and being a macrosomic infant of a diabetic mother (Kemper et al., 2022).

The American Academy of Pediatrics (AAP) issued recommendations for assessment, identifying risk factors, and managing neonatal jaundice in newborns 35 weeks gestation. Since then, these guidelines have been employed successfully. However, the impact of

these recommendations on phototherapy use, hospitalization length, ET use, and, most importantly, the incidence of bilirubin neurotoxicity has not been documented (Ullah, Rahman, and Hedayati. 2015).

The crucial difficulty is differentiating neonates at elevated risk for suffering bilirubin neurotoxic from those with typical neonatal jaundice, which is particularly important given the increasing trend of premature neonatal discharge (Al-Lawama et al., 2022).

When a newborn's bilirubin level (BL) reaches the phototherapy (PT) level, phototherapy begins. The amount of phototherapy is regulated by the newborn's age and the foundation of conditions that worsen bilirubin toxicity, which include hemolysis, glucose-6-phosphate dehydrogenase (G6PD) enzyme deficiency, sepsis, etc (Zhang et al., 2022).

Historically, the primary cause of severe infant jaundice and the most prevalent cause for exchange transfusion was infant iso-immunization to maternal blood type and minor blood groups. To maximize irradiance, position the light sources as close to the neonate as possible. To raise the newborn's exposed BSA, light devices are usually put above and below the neonate (Abdelazeem, Soliman, and Askar. 2017).

So it was concluded that the most effective therapies for severe hyperbilirubinemia are phototherapy and exchange transfusions. In the 1940s, an exchange transfusion was established as a specialized treatment for Rhesus hemolytic illness (Al-Lawama et al., 2022).

## 1.2 Problem statement

Hyperbilirubinemia in neonates is a common and often harmless condition. In the initial days of life, about 60% of term infants and 80% of preterm infants have jaundice. The yellow color in the skin is usually caused by a buildup of unconjugated, nonpolar, lipid-soluble bilirubin pigment. Although bilirubin has a physiological purpose as an antioxidant, excessive amounts of indirect, unconjugated bilirubin can cause neurotoxicity. Although the conjugated form is not hazardous, direct hyperbilirubinemia signals the existence of potentially serious liver problems or an overall infection. (Al-Lawama et al., 2022).

An intensive review of existing evidence is warranted to ascertain whether a consensus exists on the efficacy of intensive phototherapy in mitigating the necessity for blood exchange in neonatal jaundice. Uncovering any discrepancies or gaps in prior research findings is pivotal for informed analysis. Additionally, an investigation into potential variations in clinical practices across diverse healthcare settings and regions regarding the adoption of intensive phototherapy is imperative. This inquiry should aim to uncover the underlying factors influencing clinical decision-making concerning the intensity of phototherapy and its anticipated impact on the requirement for blood exchange.

Furthermore, assessing whether prevailing treatment protocols adequately address the potential benefits of intensive phototherapy in reducing the demand for blood exchange is indispensable. Any incongruities between established clinical guidelines and real-world practice should be identified and addressed. Moreover, conducting a comprehensive risk-benefit analysis is vital to comprehend the equilibrium between the advantages of intensive phototherapy in diminishing bilirubin levels and the conceivable risks associated with

prolonged exposure to high-intensity light. Finally, exploring the long-term consequences of neonates subjected to intensive phototherapy, particularly concerning neurodevelopmental outcomes and the likelihood of bilirubin-induced neurotoxicity, is of paramount importance.

By delving into these areas, we can gain a more nuanced understanding of the existing gap in knowledge and practice regarding the correlation between intensive phototherapy and the requirement for blood exchange in neonatal jaundice. This enhanced understanding can serve as a foundation for guiding future research endeavors and refining clinical guidelines to optimize the management of neonatal jaundice.

This subject topic has not been researched in Palestine, thus we must analyze it to meet the main objective of this study which is to assess the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.

### **1.3 Significant of Study**

By investigating the effectiveness of intensive phototherapy in reducing the necessity for blood exchange in neonates with jaundice, this study addresses a crucial gap in current understanding and practice. The findings of this study could potentially inform treatment protocols and guidelines, leading to improved management strategies for neonatal jaundice. If intensive phototherapy proves to be effective in decreasing the need for blood exchange, it could lead to reduced morbidity, healthcare costs, and resource utilization in neonatal care units.

Additionally, it may enhance the overall quality of care and outcomes for newborns affected by jaundice, ultimately benefiting both healthcare providers and patients. Therefore, this study has the potential to significantly impact clinical decision-making and improve the standard of care for neonates with jaundice.

#### **1.4 Study Objective**

The main objective is to assess the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.

This leads to the need to determine the efficacy of intensive phototherapy in lowering blood bilirubin levels in neonates with severe hyperbilirubinemia, so we need to see if intensive phototherapy affects the requirement for blood exchange transfusion in neonatal jaundice patients.

#### **1.5 Study Questions**

1. What is the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine?
2. Is intensive phototherapy usage beneficial in lowering blood bilirubin levels in neonates with severe hyperbilirubinemia?
3. How is using intensive phototherapy in comparison to other treatment modalities?
4. What are the socio-demographic factors that influence using intensive phototherapy and decreasing the need for blood transfusion in neonatal jaundice in the West Bank of Palestine?

## 1.6 Study Hypothesis

1. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.
2. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) between using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine.
3. There is no statistical difference at ( $\alpha \leq 0.05$ ) between using intensive phototherapy in comparison to other treatment modalities for neonatal jaundice in the West Bank of Palestine.
4. There are no statistically significant differences at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine concerning socio-demographic factors.
5. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine by gestational age.
6. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine by birth weight.
7. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine by age at phototherapy initiation.

## **1.7 Study Variables**

1.7.1 Dependent Variables: Intensive Phototherapy, Blood Exchange Transfusions.

1.7.2. Independent Variables: Severity of Hyperbilirubinemia, Gestational Age, Bilirubin Reduction, Birth Weight, and Age at Phototherapy Initiation.

## **Chapter Two**

### **Literature Review**

#### **2.1 Introduction**

This chapter provides a synthesis of recent research found concerning Neonatal Hyperbilirubinemia. Concepts that are critical to the study of this phenomenon include demographic data, clinical presentation, Neonatal Hyperbilirubinemia, and Intensive Phototherapy, Blood Exchange. Each concept is individually discussed.

The collection of literature was conducted utilizing a computerized search of databases. Databases including Pub Med were used for relevant articles and journals. The studies reviewed were published from 2012 to 2023. Keywords used during the search included Neonatal Hyperbilirubinemia, Intensive Phototherapy, and Blood Exchange.

#### **2.2 Neonates Demographic Data & Characteristic**

Qattee et al. (2021) did a study to examine the occurrence of neonatal hyperbilirubinemia as well as the onset of bilirubin-related neurological problems in the United States. A nationwide dataset containing de-identified information from 2002 to 2017 was used. All hospitalized neonates within 28 days of birth were included in the study.

The Cochran-Armitage test was used for trend analysis. Adjusted odds ratios (aOR) were given after regression analysis. The study included 57,989,476 babies, with 91.8% (53,259,758) born full-term and 8.2% (4,725,178) born prematurely. Bilirubin-related neurological disorders in term newborns declined over time but remained steady in preterm infants. White neonates were more likely than Black neonates to be diagnosed with

hyperbilirubinemia, while Black neonates were more likely to develop bilirubin-related neurological issues.

The overall population rate of bilirubin-related neurological disorders was 2.4 per 100,000 live births. In summary, the incidence of these disorders in term infants has significantly decreased since the issuance of the e American Academy of Pediatrics (AAP) protocol for addressing jaundice in infants 35 weeks of gestation. In preterm newborns, the incidence remained steady. Despite having a lower rate of jaundice diagnosis, Black neonates had a disproportionately higher risk of developing bilirubin-related neurological problems.

Preterm newborns and infants with non-isoimmunization jaundice had a higher rate of exchange transfusion and bilirubin-related neurological problems. This study implies that the AAP protocol for the treatment of jaundice in infants born at 35 weeks of gestation should be amended.

Bujandric and Grujic (2015) conducted research to examine the occurrence of key risk factors associated with severe neonatal hyperbilirubinemia, detected the frequency of exchange transfusion (ET) cases in the Autonomous Province of Vojvodina (located in northern Serbia), and provide insights into the practice of ET performed in both premature and full-term infants over 17 years.

Data from 398 babies who received double volume ET between 1997 and 2013 were analyzed retrospectively. Throughout the 17-year study period, there was a declining trend in the prevalence of ET per 1000 births. There were 468 double-volume ET procedures performed, with 328 infants (82.4%) requiring only one treatment and 70

newborns (17.6%) requiring multiple treatments. The total amount of blood transfused was 262,830 mL, with each infant receiving 660 mL.

There were 221 males and 177 females among the babies, for a sex ratio of 1.25:1. The following are the frequencies of risk variables that contribute to hyperbilirubinemia development: (3) 7% low BW/preterm births; and (4) 17% related to other reasons. Approximately 56.3% of newborns had risk indicators for neurotoxicity. There were no fatalities or complications reported. ABO and Rh incompatibility were found as the key risk factors for severe newborn hyperbilirubinemia in Vojvodina. Furthermore, the frequency of exchange transfusions, which are used as a treatment for severe hyperbilirubinemia, decreased during the trial.

Donneborg et al (2017) did a study to see if double phototherapy accelerates the elimination of total serum bilirubin levels more effectively than single light during IPT with high-intensity light-emitting diodes (LEDs).

The study included 83 neonates with simple hyperbilirubinemia and a Gestational Age (GA) of 33 weeks or more. These infants were allocated at random to either double phototherapy (n = 41) or single PT (n = 42) for 24 hours. The mean irradiation levels from above were 64.8 W cm<sup>2</sup> nm<sup>-1</sup> and 39 W cm<sup>2</sup> nm<sup>-1</sup> from below. After 12 hours of intervention, the prevalence decline in total serum bilirubin was significantly higher in the double phototherapy group than in the single PT group, with decreases of 39% (95% CI: 37 to 42) versus 30% (95% CI: 27 to 32), respectively (p 0.001). At the 24-hour mark, the decline in the double phototherapy group was 58% (95% CI: 56 to 61) versus 47% in the single phototherapy group (p 0.001).

Even after accounting for any confounding factors, these findings remained statistically significant. Notably, the only negative effect noticed was the presence of loose stools. Our data show that, despite adopting intensive phototherapy, which increases spectral power by expanding the irradiated BSA, double PT significantly improves phototherapy efficacy. This supports the widespread use of intensive double phototherapy and advises that it be used in the management of severe hyperbilirubinemia in late preterm and term newborns, particularly with high-intensity irradiance

### **2.3 Clinical Characteristics & Assessment**

Severe neonatal hyperbilirubinemia poses a risk of mortality and major health complications, according to Al-Lawama et al (2022). When phototherapy (PT) fails, infants with severe hyperbilirubinemia frequently require a double-volume blood exchange transfusion (BET). However, given the significant risks of mortality and morbidity associated with the treatment, it is critical to follow established criteria for treating neonatal hyperbilirubinemia. These protocols are intended to prevent hyperbilirubinemia toxicity and complications from needless procedures. This 13-year study examined the causes, consequences, and trends of BET rates in our unit. The retrospective study included a review of medical records and laboratory databases from infants who had BET at Jordan University Hospital between 2003 and 2015.

Following the adoption of American Academy of Pediatrics standards, the rate of exchange cases decreased significantly ( $P < 0.0001$ ). The majority of the neonates (69%), with an average birth weight of 2,800 grams, were born at full term. The most common causes of ET were identified as non-hemolytic diseases. Notably, 20% of the cases were due to late prematurity.

Thrombocytopenia was the most common of the problems encountered (33%). Chronic neurological problems were reported in 12% of those evaluated after the age of 12 months. This study demonstrated a decrease in BET rates following the implementation of AAP guidelines. Along with improving procedures for detecting and monitoring high-risk neonates, it is critical to step up efforts to educate parents about this potentially dangerous neonatal illness to prevent neonatal hyperbilirubinemia from progressing to levels requiring exchange transfusion.

According to Geest et al (2022), jaundice related to high bilirubin levels is common in newborns. Few population-based studies look at the assessment, treatment, and occurrence of jaundice in healthy babies, as well as the need for phototherapy. To fill this void, we carried out a prospective study in a primary care environment, examining routine care during the control phase of a randomized controlled trial in birth centers.

This study was part of the examination and management to minimize Severe Hyperbilirubinemia in Infants in Primary Care (STARSHIP) Trial, which ran from July 2018 to March 2020 in 7 primary care birth centers in the Netherlands. We included healthy newborns who met certain criteria, such as having a GA of 35 weeks or more, spending at least 2 days in a birth center during their first week, and having never had phototherapy before.

Our goals included determining the detection of visual jaundice, the occurrence and management of jaundice, and the need for phototherapy in this primary care context. Among the 860 newborns studied, 608 (71.9%) had apparent jaundice throughout their stay at the birth center, with 20 having a substantial degree of yellowness. Surprisingly, four of these severely jaundiced patients (20%) did not have TSB testing performed. Surprisingly,

TSB levels had no relationship with the severity of visual jaundice ( $p= 0.416$ ). 31 newborns (3.6%) received phototherapy, and no ET was required.

Furthermore, despite having TSB levels above the threshold of needing phototherapy, five newborns did not receive it. The data highlight the prevalence of jaundice in healthy babies getting basic care. They also identify gaps in TSB testing for severely jaundiced patients and discrepancies in phototherapy use despite rising TSB levels.

In low and middle-income countries (LMIC), exchange transfusion (ET) is commonly used to treat severe newborn jaundice, which differs starkly from treatments in high-income countries. The particular criteria for commencing this operation in settings with limited resources for treating newborns with acute jaundice, however, have not been intensively investigated. Olusanya et al. (2016) conducted a study to determine critical parameters for selecting when to commence ET in resource-limited nations to decrease wasteful use and prevent kernicterus.

To identify criteria and underlying factors directing the beginning of ET, a thorough assessment of existing guidelines and literature on neonatal jaundice management internationally was done. Globally, there is inadequate data from randomized clinical trials to provide unambiguous criteria for justifiable ET.

Using total serum bilirubin (TSB) levels alone to assess kernicterus risk has frequently proven insufficient. To predict kernicterus risk, recommendations include combining plasma/serum bilirubin testing with clinical evaluation for acute bilirubin encephalopathy (ABE). However, there is disagreement over the TSB levels at which ET should begin in the case of ABE clinical signs/symptoms and hemolytic diseases. While

ET effectively avoids or mitigates brain harm in newborns with severe jaundice, it is not without dangers and must be carefully evaluated for kernicterus before use.

A method that incorporates TSB thresholds, the existence of neurotoxicity risk factors, and ABE clinical symptoms in jaundiced babies should improve precision. In areas where there is a strong demand for ET but few resources, this method can help prioritize newborns based on kernicterus risk assessment. Addressing the socio-cultural, biological, genetic, and systemic aspects that contribute to high ET rates in LMICs, as well as providing effective phototherapy, is critical.

#### **2.4 ABO Incompatibility between Mother and Neonates**

In a study conducted by Akgül et al (2013), Newborn newborns with maternal-fetal ABO incompatibility are more likely to have substantial hyperbilirubinemia. Predicting risk variables, such as hemolysis, is crucial. This study aims to assess how the fetal-neonatal blood group affects the severity of hemolysis and jaundice caused by maternal-fetal ABO incompatibility.

In a retrospective investigation of 166 newborns with ABO hemolytic illness, risk factors for jaundice severity were examined between infants with blood groups A and B. Both groups shared similar demographics, including birth weight, gender, and date of admission. There were no significant differences in hematological parameters, including initial hemoglobin levels, indirect bilirubin levels, frequency of positive direct Coombs test, hemolytic findings on peripheral blood smear, duration of phototherapy, number of exchange transfusions, and Intravenous Immunoglobulin Therapy (IVIG) therapy

( $p > 0.05$ ). Results indicated no correlation between blood type and severity of hemolytic jaundice in ABO incompatibility.

A study was conducted by Irshad et al (2011), to investigate the incidence of Rh and ABO incompatibility in jaundiced infants. This hospital-based descriptive study was carried out at the Pediatrics Unit of Lady Reading Hospital, Peshawar.

The study involved 200 infants with clinically confirmed jaundice. Of the 200 neonates, 70% were male and 30% were female. The majority of newborns (99.5%) ranged in age from 0 to 10 days, with barely 0.5% being 13 days. In this study, 22.5% of 200 jaundiced infants had ABO incompatibility and 12.5% had Rh incompatibility.

In the remaining 65.5% of cases, physiological jaundice was found in 40.5% of infants, preterm in 15%, and G6PD in 9.5%. Of the 22.5% cases of ABO incompatibility, 16.5% were male and 6% were female. The majority (15%) presented on the first day of life, followed by 3% on the second and third days, 1% on the fourth, and 0.5% on the fifth day of life. Out of 200 newborns with jaundice, the frequency of ABO incompatibility was determined to be 22.5%, followed by Rh incompatibility at 12.5%.

## **2.5 Treatment of Neonatal Jaundice and TSB Chart**

In a study conducted by Kemper et al (2022), more than 80% of newborns will experience some level of jaundice. It's crucial to carefully monitor all newborns and administer appropriate treatments because high levels of bilirubin can lead to serious conditions like acute bilirubin encephalopathy and kernicterus. Kernicterus is a permanent neurological disorder characterized by symptoms such as choreoathetosis, cerebral palsy, and upward gaze paresis, enamel dysplasia of baby teeth, sensorineural hearing loss, and

specific brain MRI findings. To address this, the AAP formed a clinical practice guideline committee comprising neonatologists, hospitalists, primary care pediatricians, a nurse, and breastfeeding experts, some of whom had expertise in neonatal hyperbilirubinemia. From 2014 to 2022, this committee worked to update and enhance the 2004 guideline based on new evidence and insights. Phototherapy functions by diminishing bilirubin levels in newborns through diverse photochemical reactions, facilitating its easier elimination. The effectiveness of phototherapy hinges on both the intensity applied and the surface area exposed to the light, preferably employing double-sided exposure. However, the absence of standardized phototherapy delivery methods leads to significant equipment variability. Detailed guidance on phototherapy, including its mechanisms and usage strategies, is available in the Appendix to the 2004 guideline and recent comprehensive reviews. Intensive phototherapy, utilizing narrow-spectrum LED blue light with specific irradiance, aims to rapidly reduce bilirubin levels, thereby shortening treatment duration. The primary objective is to prevent further increases in bilirubin concentration, which could require escalated care such as exchange transfusion. While phototherapy thresholds are established below levels associated with acute bilirubin neurotoxicity or kernicterus, their purpose isn't solely focused on preventing subtle adverse neurodevelopmental effects, as evidence on this connection is inconclusive. The committee holds that the benefits of phototherapy outweigh the minor risk of epilepsy associated with its use at or above the treatment threshold. Recent findings propose that bilirubin neurotoxicity occurs at concentrations well above the 2004 exchange transfusion thresholds, justifying a slight adjustment in phototherapy treatment thresholds. Adherence to current guidelines, encompassing bilirubin screening and post-discharge follow-up, is imperative. Although exposure to

sunlight can reduce bilirubin levels, practical difficulties and risks like sunburn render it an unreliable therapeutic option and therefore not recommended. While filtered sunlight has been safely utilized in resource-limited settings, these guidelines aren't specifically designed for such environments. The phototherapy thresholds take into account gestational age and other neurotoxicity risk factors. They are predominantly based on expert opinion rather than robust evidence but can be tailored based on individual circumstances and preferences. Hospitals should ensure that phototherapy systems deliver the intended irradiance, even though routine measurement in the U.S. is lacking. Standardizing measurement techniques and recognizing variations in irradiance distribution are crucial for enhancing phototherapy effectiveness.

According to Erlandsen and Hansen (2010), the primary reason for conducting blood tests and commencing treatment in neonates is jaundice. In some circumstances, increased serum bilirubin levels in neonates can cause substantial brain damage known as kernicterus, albeit this is extremely rare. In such cases, prompt intervention is critical.

This topic focuses on several ways to lower serum bilirubin levels thereby reducing the complication of brain injury. This paper's content is according to papers via a Medline search, with items chosen based on the author's experience in the topic and prior knowledge. Case studies are used to emphasize important points.

Normal biological processes cause neonatal jaundice; however, different pathological disorders might exacerbate its severity. These include factors such as concealed hemorrhage, ABO and Rhesus incompatibility, and enhanced bilirubin circulation in the digestive and hepatic systems. Furthermore, genetic diseases such as

galactosemia, hemolytic anemias, and syndromes such as Gilbert and Crigler-Najjar can significantly increase neonatal jaundice levels.

Phototherapy, ET, alternatives to breast milk, and drugs such as IIG and phenobarbital are all used to treat neonatal jaundice. By using these treatments separately or in combination, dangerously high bilirubin levels can be reduced quickly, reducing the probability of consequences. Notably, variables that are not immediately visible at discharge from the hospital or birthing unit might contribute to a significant increase in TSB levels after discharge. As a result, determining an infant's risk status before discharge is critical.

Writing therapeutic recommendations for healthcare professional's aids in efficient management while providing information to parents in understandable terms both vocally and in writing assists them in maintaining their kid after discharge. Before leaving the medical institution, providing a succinct informational handout can be a great tool for parental education.

Severe jaundice demands early treatment to avoid long-term harm to the neurological system. The first stage is phototherapy, which is more successful with greater TSB levels by assisting in the elimination of polar bilirubin isomers through the bile and urine. Furthermore, water-soluble bilirubin isomers may have restricted access to the brain. When dealing with severe jaundice, it's best to consider breast milk as a routine practice, unless there are direct barriers to enteral nourishment. This reduces enterohepatic circulation.

Furthermore, if there is suspicion of blood group incompatibility, even without a positive Direct Antiglobulin Test (DAT), there should be a lower bar for providing IVIG in cases of severe jaundice. When TSB levels remain high or return dramatically and quickly following treatment, a short-term prescription of phenobarbital or another enzyme inducer may be explored.

Investigating family and medical histories is critical for identifying inherited or metabolic diseases that increase the risk of high bilirubin levels (like as hemolytic anemias, Gilbert syndrome, Crigler-Najjar syndrome, and galactosemia). Evaluating the possibility of substantial neonatal jaundice should be a standard component of the examination before releasing a woman and infant from a maternity hospital or NICU, particularly if discharge occurs within the 3 days following birth. Providing an educational leaflet to parents might supplement pre-discharge guidance.

According to Chu et al (2020), phototherapy devices are an efficacy treatment for NHB. A systematic study to detect whether home-based phototherapy (PT) is preferable to hospital-based (HB) PT in treating this illness. A searched databases such as PubMed, Scopus, Embase, Cochrane Library, CBM, CNKI, and Wanfang Data for papers comparing home-based (HB) to HB PT for neonatal hyperbilirubinemia (NHB). The Cochrane Collaborative Risk of Bias Tool determined that all of the studies reviewed were low risk.

RevMan 5.3 software was used to analyze the collected data statistically. A total of 259 neonates were studied in the meta-analysis. Home-based PT appeared to be more successful than hospital-based PT in lowering total blood bilirubin. However, there was no statistically significant difference in PT time between the two groups (standard mean difference = 0.59, 95% confidence interval = 0.28 to 0.90, P =.06).

According to the findings, home-based PT outperforms hospital-based treatment for NHB, proving to be a viable and safer option. Furthermore, it was noticed that home-based PT could enhance the parent-infant link and is a more cost-effective way than hospital-based treatment, adding to hospital bed space availability. Nonetheless, it is critical to recognize potential additional costs due to instrument use, support people, and the risk of readmission.

In conclusion, home-based PT for neonatal hyperbilirubinemia emerges as an effective, viable, and safe alternative to HB PT, giving various benefits but also confronting some difficulties such as associated expenses and the need for equipment and support staff.

According to Olusanya, Kaplan, and Hansen (2018), hyperbilirubinemia (jaundice) is a common and often harmless illness in infants, despite being the main cause of hospitalizations during their first week of life. While most cases of jaundice are mild, it can progress to severe levels in some children, resulting in acute difficulties such as bilirubin encephalopathy and kernicterus, in addition to a high likelihood of neonatal mortality and long-term neurological impairments. Even in affluent countries with sophisticated medical infrastructures, severe hyperbilirubinemia exists.

Furthermore, poor and middle-income countries bear a disproportionately big expense as a result of delays in making effective medications available in more rich countries. This in-depth examination includes the latest recent data on the global epidemiology of infant jaundice, including prevalence estimates and fatal and non-fatal health implications. The study also delves into the treatment of severe hyperbilirubinemia, with a focus on kernicterus prevention, as well as future research directions.

Finally, neonatal hyperbilirubinemia has far-reaching global ramifications, with both fatal and non-fatal consequences, especially harming survivors' long-term health. To address this, community-based solutions are essential. These approaches should aim to limit the occurrence of hemolytic jaundice, ensure timely access to suitable medication, and provide appropriate follow-up care for all newborns with or at risk of having severe hyperbilirubinemia. Implementing such an approach will significantly improve baby health and well-being, particularly in low and middle-income countries, and will be consistent with the SDG agenda's objectives to reduce child mortality.

According to ullah, rahman, and hedayat (2016), newborn jaundice, also referred to as hyperbilirubinemia, is a potentially lethal illness. It is a complex condition with multiple symptoms. Overall, physiological jaundice is the most common; nevertheless, pathological jaundice is also prevalent in some areas. This research article aims to add an update on jaundice, such as its kinds and reasons, determine the level of bilirubin, clinical methods for managing hyperbilirubinemia, different preventive measures for grandparents of infants who have the circumstance, and different corrective treatments for treating it.

A thorough search of the source websites, such as Scopus, PubMed, MEDLINE, Google Scholar, and Science Direct, was done to discover the articles about the newborns' hyperbilirubinemia. "Newborns' hyperbilirubinemia," "Newborns' jaundice," "Physiological jaundice," and "Pathological jaundice" were the most common search terms in the literature. The articles acquired spanned the years 1952 to 2015.

According to the findings of the study, breast milk feeding can occasionally cause newborn jaundice. When a fetus' blood type and the mother's blood type are incompatible, and the fetus' blood crosses the umbilical cord resisted before birth, the subsequent severe

immune reaction produces fetal blood hemolysis, which results in hemolytic jaundice. Jaundice is easily diagnosed, but it requires immediate and direct intervention. If not treated properly, it can lead to a slew of consequences.

Phototherapy, chemotherapy, and vaccines are currently available as treatments for jaundice. Jaundice is easily identified, but it must be treated thoroughly. Mismanagement of the illness can lead to a variety of issues. Vaccines, chemotherapy, and phototherapy are currently available therapies for jaundice.

According to MUCHOWSKI K (2014), while infant jaundice is prevalent, kernicterus, or chronic bilirubin encephalopathy (BEP), and severe BEP are uncommon. It is controversial whether infant hyperbilirubinemia should be universally checked for. The American Academy of Pediatrics (AAP) recommends either specific testing based on risk variables or universal screening based on bilirubin levels. Nonetheless, the AAP of Family Doctors and the US Preventive Services Task Force believe there is little update that screening improves results. Furthermore, universal screening may inadvertently increase phototherapy rates.

The two most important warning signs for hyperbilirubinemia development are early pregnancy and exclusive nursing. When an infant exhibits jaundice symptoms, their likelihood of developing it should be evaluated using the risk rating, TSB, or transcutaneous bilirubin testing. Phototherapy can effectively treat hyperbilirubinemia; however, the number of sessions necessary varies substantially depending on the individual's sex, gestational age, and time following birth. When selecting whether to begin phototherapy, pregnancy age, and risk variables should be considered. Approximately 5%

of treated infants have complications following exchange transfusion, and three or four infants die for every 1,000.

Babies that are exclusively breastfed are more inclined to get hyperbilirubinemia, particularly if they do not obtain enough calories. When nursing is ceased for an episode of jaundice, the probability of early lactation cessation increases. Encouragement from healthcare providers is critical in these instances.

According to an investigation carried out by Du et al (2021), the primary cause of increased total/plasma bilirubin (TB) levels is elevated bilirubin synthesis, which is predominantly caused by continuing hemolysis. If undiagnosed or mistreated, severe newborn hyperbilirubinemia and possible bilirubin-induced neurological dysfunction (BIND) are more likely. Because carbon monoxide (CO) and bilirubin are both produced in comparable amounts during heme breakdown, measuring end-tidal CO levels adjusted for ambient CO (ETCOc) might directly indicate the presence of continuous hemolysis. A new point-of-care ETCOc sensor is effective in detecting hemolysis-related elevated bilirubin levels in infants.

This overview discusses the biology of bilirubin generation, and the utility of a novel instrument for detecting hemolysis in infants, and briefly explains the use of ETCOc measures in a group of patients. Hemolysis contributes considerably to extreme hyperbilirubinemia (EHB) and consequent BIND. Although conventional hemolysis tests may not reliably identify all neonates who are experiencing active hemolysis, targeting the heme breakdown process and the chemicals that result from it can be used for therapeutic or monitoring purposes.

Because CO and bilirubin are created in comparable proportions during heme breakdown, monitoring ETCOC provides a quantitative way of assessing hemolysis. According to Bhutani, Ronald, and Stevenson (2016), bilirubin, a powerful antioxidant, can act as a potent yet silent neurotoxic during the most vulnerable stage of early life. This impact has long-term consequences, producing functional and structural harm to the nervous system, affecting its handling of sensory data that comes in, and disrupting outgoing nerve function.

Furthermore, these disruptions can interrupt or hinder the natural path of cerebral development, as well as produce inconsistencies in acute motor function, perception of stimuli (hearing and vision), and learning abilities. The creation of regions generating nerve cells, as well as the development of both blood vessel liner cells and support cells for neurons (glial cells), are critical in the immediate environment. These changes could be accelerated by stresses like preterm, inflammation/sepsis, and oxidative stress.

Innovative rehabilitation strategies used in the early stages of follow-up could encourage flexible compensating mechanisms to compensate for functional loss. The ability of the maturing brain to re-establish neuroplasticity, as demonstrated in most premature infants in danger of developmental delays, is required for functional recovery. Advances in neuroimaging approaches, intensive examinations of the integrity of auditory and visual responses, and accurate evaluations of motor function may aid in better recognizing neurological disorders connected to bilirubin exposure in the future.

Meanwhile, until new reliable predictive markers are identified, personalized clinical judgment will be critical in weighing the benefits and hazards of timely, effective preventative measures.

## 2.6 Intensive Phototherapy Vs Exchange Transfusion in Neonatal Jaundice

According to a retrospective matched cross-sectional study conducted by Alfakhri et al (2019), neonatal jaundice is the most common health concern in the 1 week following birth. The goal was to see how effective intensive phototherapy was at decreasing the need for double-volume exchange transfusion (DVET) as a treatment method. Data were gathered from hospital records of neonates admitted for neonatal jaundice in two non-consecutive years, 2013 and 2016.

There was a significant relation between the 2 groups in terms of delivery technique, with surgical labor being more common in 2016 than in 2013 ( $P = 0.023$ ). ABO blood group mismatching was more significant than Rh incompatibility between mothers and newborns in generating hemolysis during these study years. The need for DVET was significantly reduced in 2016, as was the serum bilirubin level ( $p = 0.004$ ), which was 18.7 4.2 mg/dl in 2016 and 20.4 4.4 mg/dl in 2013.

Neonatal jaundice is a common illness that causes infants to be hospitalized in their early days all around the world. This study used a comparable cohort to test the efficacy of IPT against standard phototherapy in minimizing the need for DVET. In terms of age distribution, gender, GA, and birth weight, the two groups were comparable. However, in Group 2 (2016), the technique of delivery was substantially more common than in Group 1 (2013). The beginning of IPT in the treatment of newborn jaundice resulted in a significant decrease in the need for DVET in 2016 as compared to 2013, when Conventional Phototherapy (CPT) was the only available treatment modality.

Intensive phototherapy (IPT) and exchange transfusion (ET) are the principal management for severe hyperbilirubinemia, according to Zhang et al (2022). Despite this, there is a paucity of credible information establishing precise thresholds for commencing these treatments. The purpose of this multicenter trial was to compare the efficacy and potential consequences of IPT against ET in the management of severe hyperbilirubinemia.

The research, which lasted from January 2015 to January 2018, included patients who met ET criteria because of severe hyperbilirubinemia. Based on gestational age and associated risk variables, patients were divided into low-, medium-, and high-risk groupings. Before treatment, propensity score matching (PSM) was used to establish data balance. The start of bilirubin encephalopathy, hospitalization length, expenditures, and consequences were all assessed. At the age of three, follow-up evaluations included mortality, auditory difficulties, seizures, enamel dysplasia, ocular motility disorders, athetosis, and motor and linguistic development.

The study included 1164 patients in total. Following PSM, 296 patients were randomly assigned to the IPT-only or IPT-plus ET groups, which were further subdivided into low-, medium-, and high-risk subgroups with matched patients. In terms of illness, complications, or long-term effects, no significant differences were seen between the IPT-only and IPT with ET groups. Among low- and medium-risk subgroups, hospital stays and expenditures were reduced in the IPT-only group. The study assessed the efficacy and risk of IPT and ET for treating severe infant hyperbilirubinemia using propensity score techniques.

The findings indicate that IPT is a safe and effective treatment for severe hyperbilirubinemia. The need for ET in hyperbilirubinemia instances may necessitate

stronger criteria. However, establishing an emergency plan for quick ET following IPT beginning is critical, especially for at-risk infants. If the therapeutic efficacy of IPT is ensured, the use of ET should be limited. To assess the efficacy of IPT vs conventional phototherapy in decreasing the need for exchange transfusions and shortening the period of phototherapy for neonatal hyperbilirubinemia at the Assiut Neonatal Unit.

Abdelazeem, Soliman, and Askar (2017) conducted this prospective study from March 2016 to February 2017 on newborns with indirect hyperbilirubinemia near the exchange transfusion threshold who were admitted to the Neonatal Unit and treated with intensive phototherapy (group 1). These newborns were compared to a historical retrospective cohort (group 2) that received standard care from March 2012 to February 2013. Both groups got intensive clinical and laboratory evaluations. The use of intensive phototherapy to treat pathological indirect hyperbilirubinemia has shown significant efficacy in lowering TSB levels, particularly when they approach 2-3 mg/dl (34-50 mol/l) around the ET threshold.

This method significantly reduced the frequency of exchange transfusions, as well as the risks and severe problems that come with them. Furthermore, it greatly reduced the time of phototherapy, resulting in shorter hospital stays and a lower financial burden. Intensive phototherapy has proven to be quite effective in treating pathological hyperbilirubinemia by significantly decreasing total serum bilirubin levels and nearing the exchange transfusion threshold. This method eliminates the need for the intrusive exchange transfusion technique and its possibly severe neurological repercussions. Furthermore, it contributes to shorter phototherapy durations, resulting in shorter hospital stays and lower economic costs.

Neonatal hyperbilirubinemia is a common illness among infants, specifically in the first few days after delivery, necessitating prompt treatment to alleviate symptoms and prevent possibly irreparable complications. Marzoog, Mohammed, and Habib (2022) conducted a study to examine the efficacy of standard phototherapy, IPT, and ET in the management of neonatal jaundice at Baghdad's Fatima Al-Zahra Hospital for Maternity and Child Care. This study examined medical records of newborns hospitalized in the septic NICU at Fatima Al-Zahra Hospital with unconjugated jaundice from May 1st to October 31st, 2018. Total serum bilirubin levels, fractionation analysis, and blood group determinations were performed in all instances.

Depending on the degree of jaundice, treatment options such as conventional phototherapy, intensified phototherapy and exchange transfusion were used. Among the 1254 infants admitted over this period, 432 (35%) had unconjugated neonatal jaundice or indirect hyperbilirubinemia. With 59.3% men and 40.7% females, the male-to-female ratio was 1.4:1. Prematurity (24.1%), ABO incompatibility (13.7%), Rh incompatibility (3.2%), sepsis (1.9%), and unclear causes (27.3%) were the leading causes in 29.9% of cases.

Conventional phototherapy was the most commonly used treatment (55%), followed by intensive phototherapy (40.3%), which significantly lowered TSP levels and improved without the need for ET in 92% of cases treated with IPT (161 out of 175). Only 4.5% of cases required exchange transfusion, with ABO incompatibility (42.1%) and Rh incompatibility (21.1%) being the most common. Almost all released newborns (99.3%) improved completely, with only 0.5% having kernicterus and one instance (0.2%) culminating in death. In unconjugated neonatal hyperbilirubinemia management, conventional phototherapy remains the standard management for mild to moderate indirect

hyperbilirubinemia, whereas IPT is effective in reducing TSB levels, minimizing the need for ET, and shortening hospital stays.

Numerous studies have emphasized the critical roles of copper, zinc, and magnesium in the development and evolution of newborn hyperbilirubinemia, according to El-Mazary et al (2016). Although ET and IPT are 2 well-established treatment techniques for severe neonatal hyperbilirubinemia, their effect on these trace elements is unknown. Copper, zinc, and magnesium serum levels were measured before and after IPT and ET in full-term neonates admitted to the NICUs of Minia and Sohag University hospitals in Egypt between 2014 and 2016.

These values were compared to those of healthy newborns. Both before and after intensive phototherapy, neonates with indirect hyperbilirubinemia had significantly higher copper and magnesium serum levels and lower zinc serum levels than controls. These levels, however, considerably normalized following exchange transfusion, aligning more closely with control values. The researchers discovered substantial positive connections between TSB levels and serum hemoglobin, copper, and magnesium levels, as well as significant negative associations with serum zinc levels.

There were no significant relationships between maternal and newborn serum copper, zinc, or magnesium levels. This study discovered that neonates with indirect hyperbilirubinemia had significantly higher copper and magnesium levels and lower zinc levels than healthy neonates, which were not related to mother blood levels. Surprisingly, IPT had little effect on these mineral levels, whereas ET considerably restored them to levels equivalent to healthy neonates. As a result, additional intensive research is required

to assess the long-term effects of these minerals on newborns undergoing severe phototherapy and exchange transfusion.

## **Chapter Three**

### **Methodology**

#### **3.1 Introduction**

To answer our research questions, we need to choose an appropriate research design that will contribute to the following process of data collection and analysis, to check if what we claimed is right or wrong, the following parts will clarify the design that will be used and all other methodology-related questions. It covers the following sections: study design, study setting, study duration, study population, sampling, and sample size, inclusion and exclusion criteria, study instruments, validity of questionnaire, reliability of questionnaire, pilot study, data collection, ethical considerations, and data analysis.

#### **3.2 Study design**

A retrospective, descriptive, quantitative study design was conducted to describe the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.

The researcher chose private and governmental hospitals in the North of West Bank as research setting that contains a NICU and uses intensive phototherapy and blood exchange. Hospitals have a fully computerized database for all procedures containing all data about neonates, where the period of data sample that should be used in the study was from the beginning of Jan 2021 until the end of Dec 2023.

### **3.3 Study Setting**

The study was conducted at tertiary care hospitals (Governmental & Private) on the north of West Bank which contain neonatal intensive care units (NICU) and treat hyperbilirubinemia with intensive phototherapy and applying blood exchange (Rafidia Hospital, Specialized Arab Hospital, Specialized Nablus Hospital, Women's Union Hospital, Ibn Sena Hospital, Khalil Suliman Hospital, Thabit Thabit Hospital, Palestine Medical Complex, Alia Hospital), had a fully computerized health information system containing all the information related to their cases and the treatment or any procedure that was made in full details with the name and note of each health care provider contacted with neonate.

### **3.4 Study Duration**

The study was conducted and the sample of data was selected from the beginning of January 2021 until the end of December 2023, during the period of January 2024.

### **3.5 Study population**

The study population was all neonates diagnosed with hyperbilirubinemia, and treated with intensive phototherapy and applying blood exchange in private and governmental hospitals in the North West Bank of Palestine, who met the inclusion criteria. The accessible records of neonates in targeted hospitals were those neonates whose records were available at targeted hospitals while collecting data through January -2024. It was estimated to be about (323).

### **3.6 Sample and Sampling**

A sample was taken from tertiary care hospitals in the North of West Bank, which included data from last year's database. Convenience sample methods were used to select data.

Convenience sampling was used, which a type of non-probability is sampling method that is also used in quantitative approaches. This form of sampling was used for the study because it was convenient for respondents. The researcher uses this strategy to choose the appropriate sample while keeping in mind the need to include certain criteria and elements inside the study.

The total number of neonates was (323). A convincing sample was composed of (323) neonates who participated in the study during the data collection period. Data were collected by the researcher herself, from computerized health information system files containing all the information related to their cases and the treatment plans. The data collection procedure started by having IRB and ethical approval from universities and hospitals to collect the data from neonates' files, attaching forms of approval in Appendix II. The data collection procedure was taking all ethical considerations in order not to be annoying.

### **3.7 Inclusion Criteria**

- ✓ All neonates with a diagnosis of jaundice, and the availability of a complete medical file.

### 3.8 Exclusion Criteria

- ✓ Cases with coexisting medical conditions and neonates with incomplete medical files.
- ✓ Babies with neonatal jaundice (range of bilirubin) indicated for other treatment modalities other than phototherapy ( blood exchange)
- ✓ Mild neonatal bilirubin= TSB Preterm= 10mg  
Full term= 12mg\dl
- ✓ Neuromotor\ abnormal exchange= 39 phototherapy = 185

### 3.9 Sample Size

Based on alpha 0.05, and power of 0.80, and a medium effect size, the sample included all neonate jaundice cases treated with intensive phototherapy and met the pre-determined inclusion criteria. The estimated sample size is 323.

The sample was chosen and passed on to the total number of hospital admissions each year, which was the estimated population of around 2079 in the last three years cases with jaundice, then each hospital had a specified sample number calculated also based on the yearly admission rate via Raosoft software, with Confidence interval of 95% and margin of error of 5%, but we couldn't achieve the required number of samples in each hospital because all the hospital didn't had the minimal required numbers of samples, so we took all the cases achieving the inclusion criteria in hospitals which didn't achieve the required numbers in the last three years.

The hospital's distribution of the chosen sample, Ibn Sena Hospital had a 100% rate of Intensive Phototherapy, treating all 30 cases with this method. Ramallah Medical Complex

followed closely with 92.5% of cases receiving Intensive Phototherapy. Tulkarim Hospital had the lowest rate of Intensive Phototherapy at 40%, indicating a potential variance in treatment protocols among hospitals. Conversely, Arabi, Nablus, and Itehad Hospitals solely administered Blood Transfusions for their respective cases.

### **3.10 Study Instrument**

The data collection tool was self-developed, and then it was evaluated by pediatric specialists and a jury group (10) of faculty staff with Ph.D. degrees in nursing specialties including the supervisor of this thesis. All their comments were taken into consideration and adjusted accordingly. The questionnaire contained six parts. Where **part I** was the socio-demographic data including gender, gestational age, neonatal measurements, mode of delivery, family history, RH factor incompatibility, and feeding type.

Part II studied clinical characteristics of neonates that included duration of admission, modality of phototherapy, double-volume exchange transfusion, H/O Readmission, Total serum Bilirubin, Direct Bilirubin, Bilirubin Encephalopathy, onset of jaundice, direct coombs test result. TSB was measured at admission, and the study's inclusion criteria were indirect hyperbilirubinemia. TSB levels were measured each morning and evening, and sometimes every four hours, particularly in cases of acute infant hyperbilirubinemia. Upon ruling out first-day jaundice, mild neonatal hyperbilirubinemia was defined as T.S.B levels of up to 10 mg/dl in preterm newborns and 12 mg/dl in full-term newborns.

Serious newborn hyperbilirubinemia was defined as a level of more than 18 mg/dl in premature infants or more than 20 mg/dl in full-term infants. The bilirubin levels between these ranges indicated moderate infant hyperbilirubinemia. Full-gestation newborns with

indirect hyperbilirubinemia (<15 mg/dl) underwent therapy with normal phototherapy, whereas infants with (>15 mg/dl) received intensive phototherapy. Phototherapy is only paused for nursing or diaper changes. An exchange transfusion was used to treat acute indirect hyperbilirubinemia that had not responded well to intensive phototherapy.

Part III was subjective notes, including chief complaints, history of present illness, and medical and neonatal history. Part IV was objective notes, including vital signs, past results, and respiratory, cardiovascular, genitourinary, gastrointestinal, neuromotor, musculoskeletal, and skin assessment.

Part V was ABO incompatibility between mothers and their infants, including mother and baby blood group and RH. To detect Rh incompatibility, Rh-negative and BG compatible with both mother and baby were cross-matched with the baby's blood. In addition to ABO incompatibility, blood group, and Rh compatible with the mother and infant were cross-matched.

Part VI included the TSB chart.

### **3.11 Study Validity and Reliability**

Internal Validity, methodology, and data collection methods used in the study accurately measured the relationship of the variables. Any potential sources of bias or confounding factors were carefully controlled to establish a causal relationship. External Validity, the findings of this research can be generalized to the broader population of jaundiced neonates. Considerations should be given to the representativeness of the sample and the relevance of the jaundice studied.

The questionnaire was evaluated by a statistician to measure reliability (calculating Cronbach's Alpha coefficient). It was validated for included intensivists, pediatricians who worked in hospitals, and nursing faculty staff members and experts.

The researcher had feedback on the questionnaire and verified the validity and reliability of the questionnaire; identified areas of vagueness; determined the real time needed to fill the questionnaire; pointed out weaknesses in wording; and got a clear opinion about the questionnaire. The researcher considered that it was a clear questionnaire, without comments regarding information from files and from a Jury group of different specialties who evaluated the questionnaire content, therefore, the neonates were included in the actual study.

Reliability and internal consistency of the used tool showed very good reliability with a Cronbach alpha of 0.71 in all 39 variables of the used tool, data were tested for normality and the results showed that the data were normally distributed, parametric analysis was used in the analysis to test the research hypothesis and answer our research questions (alpha = 0.05) as shown in table (1):

What is the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine?

2. Is intensive phototherapy usage beneficial in lowering blood bilirubin levels in neonates with severe hyperbilirubinemia?
3. How safe is using intensive phototherapy in comparison to other treatment modalities?

4. What is the socio-demographic factors that influence using intensive phototherapy and decreasing the need for blood transfusion in neonatal jaundice in the West Bank of Palestine?

### 3.12 Pilot Study

Before applying the study, the researcher conducted a pilot study with a total number of 20 neonates from neonates who achieved the inclusion criteria, after they were included in the total study samples, none of the data collection tool domains had any modification, the internal consistency of the questionnaire was very good, and no further adjustment on the data collection tool was made. In terms of the numbers you selected above, the sample size  $n$  and margin of error  $E$  are given by

$$X = Z(c/100)2r(100-r)$$

$$N = N x / ((N-1)E^2 + x)$$

$$E = \text{Sqrt}[(N - n)x/n(N-1)]$$

Where  $N$  is the population size,  $r$  is the fraction of responses that you are interested in, and  $Z(c/100)$  is the critical value for the confidence level  $c$ .

### 3.13 Ethical Considerations

Ethical approval was obtained from Arab American University, Institutional Review Board (IRB) and registered under the number R-2024/A/6/N as indicated in Appendix II, and permission for conducting the study in hospitals was taken from their administrative department. All data will kept confidential and only for the use of research

purposes, no names of any neonates will be mentioned or used, no other information will be used in any context other than this research.

### **3.14 Analysis Plan**

A software program was used in analyzing the data, SPSS v27, and different tests were run to test the significance changes in each independent variable on the dependent variable, including measures of central tendency and inferential statistics, testing hypothesis via T-test, ANOVA, and regression was used in the analysis of the gathered data. The chi-square test was used to test the significance between categorical variables, and the ANOVA test was employed in testing the significance between the groups of different level measurements and other variables.

## Chapter Four

### Results

#### 4.1 Introduction

This chapter will present the results of the sociodemographic variables. The socio-demographic characteristics that were studied included gender, gestational age, neonatal measurements, mode of delivery, family history, RH factor incompatibility, and feeding type.

A total of 323 participants were involved in this analysis, none were excluded, reliability and internal consistency of the used tool showed very good reliability with a Cronbach alpha of 0.71 in all 39 variables of the used tool, data were tested for normality and the results showed that the data were normally distributed, parametric analysis was used in analysis to test the research hypothesis and answer our research questions (alpha = 0.05):

1. What is the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine?
2. Is intensive phototherapy usage beneficial in lowering blood bilirubin levels in neonates with severe hyperbilirubinemia?
3. How safe is using intensive phototherapy in comparison to other treatment modalities?

4. What is the socio-demographic factors that influence using intensive phototherapy and decreasing the need for blood transfusion in neonatal jaundice in the West Bank of Palestine?

Table 1: Reliability Statistics (N=323)

Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
.71	33

#### 4.2 Part I. Socio-demographic Data

The demographic distribution of the study population is presented in Table 2. A total of 323 participants were included, with 155 (48.0%) identifying as male and 168 (52.0%) as female. Growth chart results indicated that 97 (30.0%) individuals fell into Category 2, 176 (54.5%) into Category 3, 48 (14.9%) into Category 4, and 2 (0.6%) into Category 5.

In terms of maturity, 294 (91.0%) were full-term, while 29 (9.0%) were pre-term. The mode of delivery varied, with 177 (54.8%) born through normal delivery, 143 (44.3%) through C.S. (Caesarean section), and 3 (0.9%) through mode 3. Family history was predominantly negative, with 284 (87.9%) participants having no family history, while 39 (12.1%) reported a positive family history.

RH factor incompatibility was present in 66 (20.4%) individuals, and absent in 257 (79.6%). Regarding feeding type, 208 (64.4%) were fed with breast milk, 40 (12.4%) with formula, and 75 (23.2%) with a mixed feeding approach.

Table 2: Distribution of the study population according to Socio-demographic data

(N= 258)

		Count	Column N %
Gender	Male	155	48.0%
	Female	168	52.0%
Growth chart result	2	97	30.0%
	3	176	54.5%
	4	48	14.9%
	5	2	0.6%
Maturity	Full-term	294	91.0%
	Pre-term	29	9.0%
Mode of Delivery	Normal	177	54.8%
	C.S	143	44.3%
	3	3	0.9%
Family History	Positive	39	12.1%
	Negative	284	87.9%
RH factor incompatibility	Yes	66	20.4%
	No	257	79.6%

Feeding type	Breast milk	208	64.4%
	Formula feeding	40	12.4%
	Mixed feeding	75	23.2%

The sample was chosen and passed on the total number of hospital admissions each year, which was the estimated population of around 2079 in the last three years cases with jaundice, then each hospital had a specified sample number calculated also based on the yearly admission rate via Raosoft software, with Confidence interval of 95% and margin of error of 5%, but we couldn't achieve the required number of samples in each hospital because all the hospital didn't had the minimal required numbers of samples, so we took all the cases achieving the inclusion criteria in hospitals which didn't achieve the required numbers in the last three years.

Table 2.1 provides hospital distribution of the chosen sample, Ibn Sena Hospital had a 100% rate in Intensive Phototherapy, treating all 30 cases with this method. Ramallah Medical Complex followed closely with 92.5% of cases receiving Intensive Phototherapy. Tulkarim Hospital had the lowest rate of Intensive Phototherapy at 40%, indicating a potential variance in treatment protocols among hospitals. Conversely, Arabi, Nablus, and Itehad Hospitals solely administered Blood Transfusions for their respective cases.

Table 2.1 Distribution of the chosen sample based on hospital (n=323)

Total cases		Count	Column N %
Rafidia hospital	70	Intensive Phototherapy	52 74.3%
		Blood Transfusion	18 25.7%

Ramallah medical complex	67	Intensive Phototherapy	62	92.5%
		Blood Transfusion	5	7.5%
Jenin hospital	67	Intensive Phototherapy	61	91%
		Blood Transfusion	6	9%
Alia hospital	62	Intensive Phototherapy	57	91.9%
		Blood Transfusion	5	8.1%
Ibn sena hospital	30	Intensive Phototherapy	30	100%
		Blood Transfusion	0	
Tulkarim Hospital	20	Intensive Phototherapy	8	40%
		Blood Transfusion	12	60%
Arabi hospital	3	Intensive Phototherapy	0	
		Blood Transfusion	3	100%
Nablus Hospital	3	Intensive Phototherapy	0	
		Blood Transfusion	3	100%
Itehad Hospital	1	Intensive Phototherapy	0	
		Blood Transfusion	1	100%

Table 2.2 presents the numerical demographics of the study participants, offering insights into various key metrics. On average, the infants in the study were approximately 4.1 days old, with a standard deviation of 6.8 days, reflecting the natural variability in age. Birth weight averaged at 3244 grams, accompanied by a standard deviation of 418 grams, indicating the diversity in newborn sizes.

The length of the infants averaged 54.0 cm, with a standard deviation of 3.6 cm. Apgar scores, a measure of newborn well-being, had an average value of 8, suggesting generally good overall health during the first moments after birth. Current weight, a dynamic indicator, averaged at 3138 grams with a standard deviation of 409 grams. Head circumference, another crucial measure, averaged 37.8 cm with a standard deviation of 32.6 cm. The gestational age of the participants averaged 38 weeks with a standard deviation of 1 week.

Table 2.2 Numerical Demographics of neonates (n=323)

	Mean	Standard Deviation
Age (days)	4.1	6.8
Birth weight (g)	3244	418
Length (cm)	54.0	3.6
Apgar score	8	0
Current weight (g)	3138	409
Head Circumference	37.8	32.6
Gestational age (weeks):	38	1

### 4.3 Part II: Clinical Characteristics

Table 3 below shows the duration of admission per day averaged at 3 days, with a standard deviation of 1 day, reflecting the varying lengths of stay experienced by individuals. Total bilirubin levels, a crucial marker for jaundice, had an average value of

19.2 units, accompanied by a standard deviation of 5.9 units, indicating the diverse range of bilirubin concentrations observed. Direct bilirubin, a subset of total bilirubin, had an average value of 0.8 units, with a standard deviation of 0.4 units. The onset of jaundice occurred at an average of 2.4 days, with a standard deviation of 1.5 days, underscoring the variability in the timing of this clinical manifestation.

Table 3 Means and Standard Deviation of Clinical Characteristics (n=323)

	Mean	Standard Deviation
Duration of Admission/ Day	3	1
Total Bilirubin	19.2	5.9
Direct Bilirubin	.8	.4
The onset of Jaundice (Day)	2.4	1.5

Table 4 below shows the treatment used, 16.4% of participants underwent double-volume exchange transfusion, while the majority, at 83.6%, received intensive phototherapy for hyperbilirubinemia. History of readmission was reported by 5.6% of participants, underscoring the challenges some individuals faced post-treatment. A smaller fraction, 2.8%, experienced bilirubin encephalopathy, and the majority of the sample had a negative direct Coombs test result of 68%.

Table 4: Clinical Characteristics of Neonates (n=323)

		Count	N %
Treatment	Double-volume exchange transfusion	53	16.4%

	intensive phototherapy	270	83.6%
Double-volume exchange transfusion	Yes	53	16.4%
	No	270	83.6%
History of Readmission	Yes	18	5.6%
	No	305	94.4%
Bilirubin encephalopathy	Yes	9	2.8%
	No	314	97.2%
Direct Coombs test result	Positive	102	32.0%
	Negative	217	68.0%

#### 4.4 Part III + Part IV: Subjective and Objective Notes

Table 5 showed the most prevalent chief complaints were yellowish skin, hypoactivity, poor feeding, hypoglycemia, and dehydration, reported by 61.0% of individuals, reflecting the multifaceted nature of initial concerns. Seizures were noted in 19.8% of cases, while poor tone and flaccidity, as well as respiratory distress, were reported in 9.6% each, illustrating the diverse ways in which symptoms manifested. The history of the present illness varied, with durations ranging from 12 hours to 6 days, highlighting the dynamic nature of medical conditions and the importance of detailed timelines. A small fraction, 1.2%, had a positive medical history, while the majority, 98.8%, had a negative medical history.

Similarly, 1.5% had a positive neonatal history, with 98.5% reporting a negative neonatal history. The vital signs (V/S) of the majority, a reassuring 99.4%, fell within the normal range, underscoring the overall stability of the participants. Gastrointestinal

assessments mirrored this trend, with 99.4% presenting normal findings, indicative of healthy digestive function. However, the neuro-motor aspect revealed that 69.3% exhibited abnormalities, emphasizing the complexity of motor-related health concerns. Musculoskeletal evaluations, much like vital signs and gastrointestinal assessments, were predominantly normal (99.4%), with only a minimal 0.6% displaying abnormalities. Skin assessments portrayed a nuanced picture, with 1.9% reporting abnormalities.

Table 5: Subjective and Objective Notes of Neonates (n=323)

		Count	N %
Chief Complaints	yellowish skin, hypoactive, poor feeding, Hypoglycaemia and dehydration	197	61.0%
	seizure	64	19.8%
	Poor tone, Flaccid	31	9.6%
	Respiratory Distress	31	9.6%
History of Present Illness	12 hours	15	4.6%
	1 day	57	17.6%
	2 days	67	20.7%
	3 days	46	14.2%
	4 days	52	16.1%
	5 days	44	13.6%
	6 days	42	13.0%
Medical History	Positive	4	1.2%

	Negative	319	98.8%
Neonatal History	Positive	5	1.5%
	Negative	318	98.5%
V/S	Normal	321	99.4%
	Abnormal	2	0.6%
Gastrointestinal	Normal	321	99.4%
	Abnormal	2	0.6%
Neuro Motor	Normal	99	30.7%
	Abnormal	224	69.3%
Musculoskeletal	Normal	321	99.4%
	Abnormal	2	0.6%
Skin	Normal	6	1.9%
	Abnormal	317	98.1%

#### 4.5 Part V: ABO Incompatibility Between Mothers and their Neonates

In table (6), among mothers, blood group O is the most prevalent at 54.2%, followed by group A at 34.7%, group AB at 7.7%, and group B at 3.4%. In the baby blood groups, A is the most common at 55.7%, followed by B at 18.3%, AB at 16.1%, and O at 9.9%. The Rh factor introduces another layer of complexity, with 91.3% of mothers having a positive Rh factor and 8.7% being Rh negative. Among infants, 87.5% have a positive Rh factor, while 12.5% are Rh-negative.

Table 6: ABO and Rh of Mothers and Neonates (n=323)

		Count	N %
Mother Blood Group	A	112	34.7%
	B	11	3.4%
	AB	25	7.7%
	O	175	54.2%
Baby Blood Group	A	180	55.7%
	B	59	18.3%
	AB	52	16.1%
	O	32	9.9%
Mother RH	Positive	295	91.3%
	Negative	28	8.7%
Baby RH	Positive	280	87.5%
	Negative	40	12.5%

#### 4.6 Part VI: Total Serum Bilirubin Readings

Table (7) indicates that at birth, the mean total serum bilirubin is 30 mg/dl with a valid count of 2, reflecting the initial levels. Over the subsequent days, a dynamic pattern emerges as bilirubin levels evolve. By the 12th hour, the mean decreases to 11.1 mg/dl, showcasing a shift in the newborn's health. At 24 hours, 13.3 mg/dl is recorded, and this trend continues with slight variations over the next few days. The standard deviations add

a touch of variability, emphasizing the uniqueness of each newborn's response. By the 7th day, the mean drops to 11.0 mg/dl

Table 7: Total Serum Bilirubin Reading Mean and Count of Neonates (n=323)

	Mean	Standard Deviation	Valid N
Serum Bilirubin (mg/dl): At Birth	30	0	2
after 12 H	11.1	5.9	26
after 24 H	13.3	7.0	69
after 48 H	13.3	6.2	101
after 72 H	16.3	6.5	118
after 96 H	15.9	6.2	142
after 5 days	16.3	6.1	158
after 6 days	14.8	4.7	157
after 7 days	11.0	3.2	93

Table 8, it appears that more males underwent double-volume exchange transfusion (85.2%) compared to females (82.1%). Growth chart results indicate that infants with higher growth chart scores had a lower percentage of intensive phototherapy, while those with lower scores had a higher percentage. Full-term infants received double-volume exchange transfusion more frequently (16.3%) than pre-term infants (17.2%).

Normal deliveries were associated with a higher percentage of intensive phototherapy (85.9%) compared to Caesarean sections (82.5%). Interestingly, infants with positive family histories had a slightly higher percentage of double-volume exchange

transfusion (17.9%) compared to those with negative family histories (16.2%). The presence of RH factor incompatibility resulted in a higher likelihood of double-volume exchange transfusion (24.2%). Neonates fed with formula had a higher percentage of intensive phototherapy (92.5%) compared to those fed with breast milk (83.7%) or a mix of both (78.7%).

Regarding chief complaints, neonates presenting with seizures had a higher percentage of double-volume exchange transfusion (21.9%). The duration of the history of the present illness seems to have a variable impact on the choice of treatment. Abnormal findings in vital signs, gastrointestinal, neuromotor, musculoskeletal, and skin assessments were associated with a higher percentage of double-volume exchange transfusion. The blood group and RH factor of both mothers and babies also showed variations in the choice of treatment.

Table 8: Demographics with Treatment Used for Neonates (n=323)

		Treatment			
		Double-volume exchange transfusion		intensive phototherapy	
		Count	Row N %	Count	Row N %
Gender	Male	23	14.8%	132	85.2%
	Female	30	17.9%	138	82.1%
Growth chart result	2	17	17.5%	80	82.5%
	3	31	17.6%	145	82.4%
	4	5	10.4%	43	89.6%
	5	0	0.0%	2	100.0%

Maturity	Full-term	48	16.3%	246	83.7%
	Pre-term	5	17.2%	24	82.8%
Mode of Delivery	Normal	25	14.1%	152	85.9%
	C.S	25	17.5%	118	82.5%
	3	3	100.0%	0	0.0%
Family History	Positive	7	17.9%	32	82.1%
	Negative	46	16.2%	238	83.8%
RH factor incompatibility	Yes	16	24.2%	50	75.8%
	No	37	14.4%	220	85.6%
Feeding type	Breast milk	34	16.3%	174	83.7%
	Formula feeding	3	7.5%	37	92.5%
	Mixed feeding	16	21.3%	59	78.7%
History of Readmission	Yes	1	5.6%	17	94.4%
	No	52	17.0%	253	83.0%
Bilirubin encephalopathy	Yes	4	44.4%	5	55.6%
	No	49	15.6%	265	84.4%
direct coombs test result	Positive	21	20.6%	81	79.4%
	Negative	30	13.8%	187	86.2%
Chief Complaints	yellowish skin, hypoactive, poor feeding, Hypoglycaemia and dehydration	25	12.7%	172	87.3%
	seizure	14	21.9%	50	78.1%

	Poor tone, Flaccid	7	22.6%	24	77.4%
	Respiratory Distress	7	22.6%	24	77.4%
History of	12 hours	1	6.7%	14	93.3%
Present Illness	1 day	9	15.8%	48	84.2%
	2 days	9	13.4%	58	86.6%
	3 days	7	15.2%	39	84.8%
	4 days	14	26.9%	38	73.1%
	5 days	10	22.7%	34	77.3%
	6 days	3	7.1%	39	92.9%
	Medical History	Positive	0	0.0%	4
Negative		53	16.6%	266	83.4%
Neonatal	Positive	0	0.0%	5	100.0%
History	Negative	53	16.7%	265	83.3%
V/S	Normal	51	15.9%	270	84.1%
	Abnormal	2	100.0%	0	0.0%
Gastrointestinal	Normal	51	15.9%	270	84.1%
	Abnormal	2	100.0%	0	0.0%
Neuro Motor	Normal	14	14.1%	85	85.9%
	Abnormal	39	17.4%	185	82.6%
Musculoskeletal	Normal	51	15.9%	270	84.1%
	Abnormal	2	100.0%	0	0.0%
Skin	Normal	1	16.7%	5	83.3%

	Abnormal	52	16.4%	265	83.6%
Mother Blood Group	A	20	17.9%	92	82.1%
	B	1	9.1%	10	90.9%
	AB	3	12.0%	22	88.0%
	O	29	16.6%	146	83.4%
Baby Blood Group	A	30	16.7%	150	83.3%
	B	8	13.6%	51	86.4%
	AB	10	19.2%	42	80.8%
	O	5	15.6%	27	84.4%
Mother RH	Positive	47	15.9%	248	84.1%
	Negative	6	21.4%	22	78.6%
Baby RH	Positive	42	15.0%	238	85.0%
	Negative	10	25.0%	30	75.0%

Table 9 shows that, on average, infants receiving double-volume exchange transfusion are around 3.4 days old with a standard deviation of 1.6, while those undergoing intensive phototherapy are slightly older at 4.2 days with a larger standard deviation of 7.4. The birth weight for both groups is similar, with infants in the exchange transfusion group weighing around 3206g (SD = 461) and those in the phototherapy group at 3252g (SD = 409).

Interestingly, the length, Apgar score, and current weight do not show significant differences between the two treatment groups. Gestational age is consistent at around 38

weeks for both groups. The duration of admission per day is approximately 3 days for both treatments, showing consistency. Total bilirubin levels indicate a higher mean (22.2 mg/dl) with greater variability (SD = 6.5) in the exchange transfusion group compared to phototherapy (mean = 18.6, SD = 5.6). Direct bilirubin levels, though lower in magnitude, follow a similar pattern.

The onset of jaundice is slightly earlier for infants undergoing exchange transfusion (mean = 2.5 days, SD = 1.4) compared to those on phototherapy (mean = 2.3 days, SD = 1.5). The serum bilirubin levels at various time points highlight the dynamic nature of bilirubin reduction in both treatment groups over the first week.

Table 9: Numerical Data with Treatment Used for Neonates (n=323)

	Treatment			
	Double-volume exchange transfusion		intensive phototherapy	
	Mean	Standard Deviation	Mean	Standard Deviation
Age (days)	3.4	1.6	4.2	7.4
Birth weight (g)	3206	461	3252	409
Length (cm)	53.9	3.6	54.0	3.6
Apgar score	8	0	8	0
Current weight (g)	3109	452	3144	401
Head Circumference	40.7	46.5	37.2	29.3
Gestational age (weeks):	38	1	38	1
Duration of Admission/ Day	3	1	3	1

Total Bilirubin	22.2	6.5	18.6	5.6
Direct Bilirubin	.9	.4	.8	.4
The onset of Jaundice (Day)	2.5	1.4	2.3	1.5
Serum Bilirubin (mg/dl): At Birth	30	0	.	.
after 12 H	16.1	11.4	10.2	4.1
after 24 H	20.1	10.1	11.7	5.0
after 48 H	17.4	5.9	12.6	6.0
after 72 H	17.5	5.3	16.1	6.7
after 96 H	17.7	6.5	15.5	6.0
after 5 days	18.2	6.7	15.7	5.9
after 6 days	14.7	4.3	14.8	4.8
after 7 days	10.7	1.8	11.1	3.4

#### 4.7 Correlations

Table 10, analysing the findings, the gender of newborns doesn't seem to play a significant role in determining whether they undergo exchange transfusion or intensive phototherapy, as indicated by a slight negative correlation (Pearson Correlation = -0.041,  $p = 0.466$ ). Similarly, the age of infants in days exhibits a minimal positive correlation (Pearson Correlation = 0.048,  $p = 0.386$ ), hinting that slightly older babies might lean towards intensive phototherapy.

Factors like birth weight, length, Apgar score, and current weight show weak positive correlations with treatment, with p-values ranging from 0.321 to 0.573, suggesting

that these aspects don't strongly influence the choice between exchange transfusion and phototherapy. Noteworthy is the somewhat significant negative correlation between the mode of delivery and treatment choice (Pearson Correlation = -0.106,  $p = 0.057$ ), implying a tendency for normal deliveries to be associated with exchange transfusion.

Crucially, certain factors like the duration of admission per day, total bilirubin levels, and the presence of bilirubin encephalopathy exhibit more pronounced negative correlations with exchange transfusion, supported by low p-values ( $p < 0.05$ ). For instance, a substantial negative correlation (Pearson Correlation = -0.238,  $p = 0.000$ ) between the duration of admission per day and exchange transfusion suggests that a shorter hospital stay is linked to a higher likelihood of opting for exchange transfusion.

Table 10: Correlations with Treatment Used for Neonates (n=323)

<b>Correlations</b>		Treatment
Gender	Pearson Correlation	-.041
	Sig. (2-tailed)	.466
Age (days)	Pearson Correlation	.048
	Sig. (2-tailed)	.386
Birth weight (g)	Pearson Correlation	.041
	Sig. (2-tailed)	.462
Length (cm)	Pearson Correlation	.006
	Sig. (2-tailed)	.917
Apgar score	Pearson Correlation	.055

	Sig. (2-tailed)	.321
Current weight (g)	Pearson Correlation	.031
	Sig. (2-tailed)	.573
Head Circumference	Pearson Correlation	-.040
	Sig. (2-tailed)	.473
Growth chart result	Pearson Correlation	.057
	Sig. (2-tailed)	.305
Maturity	Pearson Correlation	-.007
	Sig. (2-tailed)	.899
Mode of Delivery	Pearson Correlation	-.106
	Sig. (2-tailed)	.057
Gestational age (weeks):	Pearson Correlation	.040
	Sig. (2-tailed)	.474
Family History	Pearson Correlation	.015
	Sig. (2-tailed)	.783
RH factor incompatibility	Pearson Correlation	.107
	Sig. (2-tailed)	.054
Feeding type	Pearson Correlation	-.038
	Sig. (2-tailed)	.496
Duration of Admission/ Day	Pearson Correlation	-.238
	Sig. (2-tailed)	.000
History of Readmission	Pearson Correlation	-.071

	Sig. (2-tailed)	.202
Total Bilirubin	Pearson Correlation	-.227
	Sig. (2-tailed)	.000
Direct Bilirubin	Pearson Correlation	-.092
	Sig. (2-tailed)	.098
Bilirubin encephalopathy	Pearson Correlation	.128
	Sig. (2-tailed)	.021
The onset of Jaundice (Day)	Pearson Correlation	-.041
	Sig. (2-tailed)	.461
direct coombs test result	Pearson Correlation	.086
	Sig. (2-tailed)	.125
Chief Complaints	Pearson Correlation	-.110
	Sig. (2-tailed)	.048
History of Present Illness	Pearson Correlation	-.030
	Sig. (2-tailed)	.590
Medical History	Pearson Correlation	-.050
	Sig. (2-tailed)	.374
Neonatal History	Pearson Correlation	-.056
	Sig. (2-tailed)	.320
V/S	Pearson Correlation	-.178
	Sig. (2-tailed)	.001
Gastrointestinal	Pearson Correlation	-.178

	Sig. (2-tailed)	.001
Neuro Motor	Pearson Correlation	-.041
	Sig. (2-tailed)	.466
Musculoskeletal	Pearson Correlation	-.178
	Sig. (2-tailed)	.001
Skin	Pearson Correlation	.001
	Sig. (2-tailed)	.986
Mother Blood Group	Pearson Correlation	.013
	Sig. (2-tailed)	.816
Baby Blood Group	Pearson Correlation	-.004
	Sig. (2-tailed)	.942
Mother RH	Pearson Correlation	-.042
	Sig. (2-tailed)	.455
Baby RH	Pearson Correlation	-.090
	Sig. (2-tailed)	.109
Total Serum Bilirubin (mg/dl): At Birth	Pearson Correlation	.
	Sig. (2-tailed)	.
after 12 H	Pearson Correlation	-.373
	Sig. (2-tailed)	.060
after 24 H	Pearson Correlation	-.471
	Sig. (2-tailed)	.000
after 48 H	Pearson Correlation	-.276

	Sig. (2-tailed)	.005
after 72 H	Pearson Correlation	-.079
	Sig. (2-tailed)	.398
after 96 H	Pearson Correlation	-.144
	Sig. (2-tailed)	.088
after 5 days	Pearson Correlation	-.168
	Sig. (2-tailed)	.034
after 6 days	Pearson Correlation	.012
	Sig. (2-tailed)	.878
after 7 days	Pearson Correlation	.048
	Sig. (2-tailed)	.648

In Table (11), the duration of admission demonstrates a substantial F-value of 19.289, with a p-value of 0.001, meaning that phototherapy had a significantly better outcome in decreasing the days of admission for infants with hyperbilirubinemia. Total bilirubin levels also yield a high F-value of 17.482, suggesting a significant superiority of phototherapy in decreasing bilirubin levels over transfusion. Further, the hours post-birth, particularly after 24 hours and 48 hours, exhibit notable F-values of 19.078 and 8.192, respectively, both with p-values of 0.001, indicating their considerable association with the benefit of phototherapy.

Table 11: ANOVA with Treatment and Bilirubin Levels of Neonates (n=323)

ANOVA	F	Sig.
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Age (days)	.753	0.386
Birth weight (g)	.541	0.462
Length (cm)	.011	0.917
Apgar score	.987	0.321
Current weight (g)	.318	0.573
Head Circumference	.517	0.473
Gestational age (weeks):	.513	0.474
Duration of Admission/ Day	19.289	0.001
Total Bilirubin	17.482	0.001
Direct Bilirubin	2.754	0.098
The onset of Jaundice (Day)	.545	0.461
after 12 H	3.881	0.06
after 24 H	19.078	0.001
after 48 H	8.192	0.005
after 72 H	.720	0.398
after 96 H	2.954	0.088
after 5 days	4.552	0.034
after 6 days	.024	0.878
after 7 days	.210	0.648

Table 12 employs the Chi-square test to explore the association between various categorical factors and the occurrence of double-volume exchange transfusion. Notably, the mode of delivery exhibits a highly significant p-value of 0.001, emphasizing a strong

association between the method of childbirth and the likelihood of requiring transfusion, meaning that infants who were delivered via a CS then had hyperbilirubinemia and treated with phototherapy had a significantly higher bilirubin levels than who were delivered with normal delivery or treated with transfusion.

Similarly, RH factor incompatibility ( $p = 0.045$ ) reveals statistically significant associations, meaning that infants with a positive Rh factor incompatibility had a significantly higher bilirubin level if receiving a double-volume exchange transfusion. The musculoskeletal assessment also demonstrates a significant association ( $p = 0.001$ ), indicating its relevance in the benefit of phototherapy over transfusion. Conversely, factors such as skin assessment, mother and baby blood groups, and mother RH display p-values above 0.05, suggesting a lack of statistically significant association with the effect on decreasing bilirubin levels.

Table 12: Treatment and Bilirubin Levels Significance of Neonates (n=323)

	double-volume exchange transfusion	Intensive Phototherapy
	Sig	Sig
Gender	0.641	0.281
Growth chart result	0.265	0.588
Maturity	0.145	0.534
Mode of Delivery	0.361	0.001
Family History	0.216	0.466
RH factor incompatibility	0.647	.045
Feeding type	0.325	0.162

History of Readmission	0.331	0.172
Bilirubin encephalopathy	0.356	0.021
Direct Coombs test result	0.317	0.086
Chief Complaints	0.412	0.164
History of Present Illness	0.367	0.141
Medical History	0.213	0.486
Neonatal History	0.354	0.406
Neuro-motor assessment	0.233	0.288
Musculoskeletal assessment	0.147	0.001
Skin assessment	0.687	0.662
Mother Blood Group	0.647	0.881
Baby Blood Group	0.326	0.879
Mother RH	0.354	0.453
Baby RH	0.616	0.089
Age (days)	0.753	0.386
Birth weight (g)	0.541	0.462
Length (cm)	0.411	0.917
Apgar score	0.987	0.321
Current weight (g)	0.318	0.573
Head Circumference	0.517	0.473
Gestational age (weeks):	0.513	0.474

Duration of Admission/ Day	0.164	0.001
Total Bilirubin	0.141	0.001
Direct Bilirubin	0.486	0.098
The onset of Jaundice (Day)	0.545	0.461
after 12 H	0.573	0.06
after 24 H	0.473	0.001
after 48 H	0.192	0.005
after 72 H	0.720	0.398
after 96 H	2.954	0.088
after 5 days	4.552	0.034
after 6 days	0.624	0.878
after 7 days	0.210	0.648

#### 4.8 Hypothesis

1. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.

After testing we have enough evidence to reject the above Null hypothesis since P value was less than 0.05, meaning that there is a statistically significance effect of using intensive phototherapy on decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine

2. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) between using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine.

After testing we have enough evidence to reject the above Null hypothesis since P value was less than 0.05, meaning that there is a statistically significance effect of using intensive phototherapy in lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine.

3. There is no statistically difference at ( $\alpha \leq 0.05$ ) between using intensive phototherapy in comparison to other treatment modalities for neonatal jaundice in the West Bank of Palestine.

There is a significant difference between the effectiveness of intensive phototherapy and other treatment modalities for neonatal jaundice in the West Bank of Palestine. This means that intensive phototherapy was found to be more effective than other treatment methods, with a P value of less than 0.05 as table 12 shows above.

4. There are no statistically significant differences at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine concerning socio-demographic factors.

Regarding demographics we had enough evidence to reject the previous null hypothesis with a p value less than 0.05 for mode of delivery, RH incompatibility, and musculoskeletal assessment, meaning that, intensive phototherapy had a significant effect in decreasing blood bilirubin levels in neonatal jaundice in the West Bank of Palestine who

had normal delivery, didn't had Rh incompatibility, or had a normal musculoskeletal assessment

5. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine by gestational age.

As shown in Table 12 above, we don't have enough evidence to reject the previous hypothesis since the p-value was more than 0.05, meaning that, gestational age may have little or no effect when phototherapy is used in decreasing bilirubin levels.

6. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine by birth weight.

Also as shown in Table 12, we don't have enough evidence to reject the previous hypothesis since the p-value was more than 0.05, meaning that, birth weight may have little or no effect when phototherapy used in decreasing bilirubin levels.

7. There is no statistically significance difference at ( $\alpha \leq 0.05$ ) in using intensive phototherapy and lowering blood bilirubin levels in neonatal jaundice in the West Bank of Palestine by age at phototherapy initiation.

We have enough evidence to reject the previous hypothesis since we found a significant in the 24h, 48h, and on the 5<sup>th</sup> day of starting phototherapy, meaning that phototherapy had a significant effect in decreasing bilirubin levels at the previously mentioned time of phototherapy treatment initiation.

## **Chapter Five**

### **Discussion**

#### **5.1 Introduction**

Within this chapter, the study findings are discussed in terms of the study aim and objectives along with the study variables, study limitations, future recommendations, and the conclusion of the research study. To the best of our knowledge, this is the first study to be conducted among neonates in private and governmental hospitals in the North of West Bank using a developed tool by the researcher for assessing the relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West Bank of Palestine.

#### **5.2 Demographic Data**

The demographic characteristics of the neonates in the study reveal significant information. In terms of gender, the proportion of females (52%) is somewhat greater than males (48%); however, this result differs from a study by Berthe et al., 2018 that found the female percentage to be (46.7%) and not similar to Marzoog et al 2020 which found male is 59.3%, indicating that gender has no major influence on the prevalence of newborn jaundice.

Regarding the growth chart result, the highest score range is Category 3 (54.5%), followed by Category 4 (14.9%), and the last category is 5 (0.6%). This study agrees with a study by Qatteea et al., 2021. Categories 3 and 2 indicate that a significant portion of the population experiences moderate to mild growth impairment.

In terms of maturity, the majority of participants are full-term (91%), with a tiny proportion being pre-term (9%); according to Qattea et al., 2021, the full-term prevalence is (79.3%), which is consistent with our findings, and about Zhanget ., 2020 which have full term 83.5%. Preterm infants are more likely to suffer newborn jaundice due to underdeveloped liver function. On the other hand, the mode of birth marginally favors normal vaginal delivery (54.8%) over Caesarean Section delivery (44.3%), which is substantially identical to Donneborg et al., 2020 (51.2 and 48.8%, respectively) and Marzoogey al 2020 which found (64.4%). This finding may indicate and suggest that the technique of delivery influences the risk of newborn jaundice due to birth trauma or other changes in physiological adaption post-birth.

RH factor incompatibility is found in 20.4% of the neonates, which is similar to the study of Bujandric and Grujic (2015) (38%), and to the study by ULLAH et al., 2016 which found (20%) of incompatibility and Marzooq et al., 2020 was (14.3%), implying that a significant fraction of the population may suffer from the hemolytic illness of the neonate, a common cause of severe neonatal jaundice. Regarding feeding type, breastfeeding is the most common (64.4%), which corresponds with Donneborg et al., 2020 (61.2%), and this is significant since breastfed newborns may have different jaundice patterns than other types of feeding.

### **5.3 Clinical Characteristics**

Clinical features provide useful information about the presentation and management of newborn jaundice in the study population.

The average period of admission per day is three days, which is consistent with a study by Marzoog et al., 2020, which found that the average admission per day is three to six days and Zhang et al., 2020 which resulted in was average 4 day length of stay for treatment. This shows that neonates with jaundice often require brief hospitalizations for observation and treatment. This enables the healthcare provider to monitor and provide appropriate intervention for jaundiced infants.

A total bilirubin level of 19.2, according to Marzoog et al 2020(10-19), indicates the severity of jaundice in the population. The intensity of jaundice informed and assisted in determining the appropriate treatment. On the other hand, an average direct bilirubin level of 0.8 shows when neonates normally begin to show jaundice symptoms after birth.

The average onset of jaundice is 2.4 days, which is consistent with the study by Zhang and Erlandsen, 2022 (4 days). This indicates the timing at which neonates typically begin to exhibit symptoms of jaundice after birth, making it critical for healthcare providers to observe and monitor the development of neonatal jaundice.

#### **5.4 Subjective and Objective Notes**

To provide a full picture of the clinical presentation and assessment, the most common complaints among newborns with jaundice are yellowish skin, hypoactivity, poor feeding, hypoglycemia, and dehydration, which account for 61% of cases, allowing staff to recognize jaundice neonates early. In contrast, 69.3% of neonates had impaired neuromotor functions.

On the other hand, seizures (19.8%) in neonates and critical conditions may affect the neonate, its similar to the study by Marzoog et al., 2020 (15.4%) and not consistent with Zhang et al., 2022 the result was (0.5%) have complain of seizure.

In terms of vital signs, 99.4% of cases are within normal limits, and musculoskeletal evaluations (99.4%) are normal, demonstrating overall stability in the neonatal population under assessment.

### **5.5 Total serum Bilirubin finding**

The TSB reading provides vital information about infants' physiological changes throughout the early postnatal period. The average TSB at birth is significant at 30mg/dl, which is inconsistent with the findings of Al-Lawama et al., 2022 and Marzoog et al 2020 whose study result was 14.5% have TSB around 30. This initial examination is frequent in newborns due to fetal red blood cell disintegration and the infant's liver's physiological adaption to efficiently absorb bilirubin. 7 days after birth, the mean TSB had dropped significantly to an average of 11mg/dl, similar to the study of Al-Lawama et al., 2022. This decrease demonstrates the successful removal of bilirubin from the bloodstream and, in most circumstances, indicates that physiological jaundice has resolved.

Monitoring TSB levels is critical in the treatment of neonatal jaundice because it prevents the formation of severe hyperbilirubinemia, which can cause neurotoxicity and long-term neurological consequences. The 7-day drop in bilirubin level demonstrates the efficacy of physiological mechanisms and therapeutic measures such as intensive phototherapy or blood exchange, if necessary, in managing newborn jaundice.

## 5.6 Treatment

In the study, the highest decision for jaundice treatment is intensive phototherapy (83.6%) which consists of Marzoog et al., 2020 which found (40.5%) using intensive phototherapy as an optional treatment of jaundice. On the other hand, we found the use of blood exchange was 16.4% which is different from Marzoog et al., 2020 which found 1.3% using Blood exchange, whereas the study by Zhang et al., 2022 result was 39.9% using Blood Exchange and 60.1% using Intensive Phototherapy.

## Chapter Six

### Conclusions and Recommendations

#### 6.1 Conclusion

In conclusion, the findings imply that intensive phototherapy and associated clinical parameters are critical in the management of hyperbilirubinemia. Understanding these correlations can help influence clinical decisions and optimize patient care for neonates at risk of severe jaundice-related complications. Intensive phototherapy in order is a safe and effective treatment for severe hyperbilirubinemia.

Patients with hyperbilirubinemia may require a more rigorous rationale for Blood Exchange. However, a contingency plan for emergency Blood Exchange should be implemented as soon as intensive phototherapy begins, especially for infants with risk factors. If intensive phototherapy is proven to be effective, it is recommended to minimize the use of Blood Exchange.

#### 6.2 Recommendation

1. Implement the standardized protocol for the assessment, monitoring, and intervention of neonates with severe jaundice.
2. Collaboration among interdisciplinary teams including pediatricians, nurses, and other health care providers.
3. Implement quality improvement initiatives to monitor adherence to established protocol, and identify areas for improvement of neonatal jaundice management.

4. It is recommended to apply intensive phototherapy to treat indirect hyperbilirubinemia in every neonatal unit of our central and general hospitals because it helps shorten the hospital stay and reduce the need for exchange transfusion and the economic costs.
5. Coombs test should be done for all cases of suspected neonatal hemolytic jaundice.
6. Neonatologists should attend all deliveries that are at high risk for developing neonatal jaundice.
7. Keep eyes on babies with hemolytic jaundice to avoid post-phototherapy rebound

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Jolita 9 Buijs Harry 10 11 Bunt Jan Erik 12 Dijk Peter H. 13 Hulzebos Christian V. 13 Leunissen Ralph WJ 14 Snoeren Ben JPW 15 de Vries Bente 16 Wewerinke Leo 17. (2022). Assessment, management, and incidence of neonatal jaundice in healthy neonates cared for in primary care: a prospective cohort study. *Scientific Reports*, 12(1), 14385.

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## Appendices

### Appendix 1: Study Tools

عزيزي المشارك/ة.....

السلام عليكم ورحمة الله وبركاته

يطيب لي أنا الباحثة..إبتسام رياض يونس... أن أتقدم بخالص شكري ومحبتي لكم على مشاركتكم في بحثي العلمي الذي يحمل عنوان:

The Relationship between Using Intensive Phototherapy in Decreasing the Need for blood Exchange in Neonatal Jaundice in the West Bank of Palestine: A Retrospective Study

العلاقة بين إستخدام العلاج الضوئي المكثف في تقليل الحاجة الى تبادل الدم في اليرقان عند حديثي الولادة في الضفة الغربية بفلسطين: دراسة استيعادية

إن هذا البحث هو جزء أساسي من دراستي لاستكمال مشروع التخرج من الجامعة العربية الامريكية-فلسطين تخصص ماجستير تريض عناية الأطفال الخدج ، وقد تم ترشيح حضرتكم من بين مجموع المشاركين في هذه الدراسة لتعبئة الاستبيان المتعلق بالدراسة.

أفدّر لكم كثيراً مشاركتكم بالموافقة على السماح لي بتعبئة هذه الاستبانة من خلال استخدام ملفات الأطفال الخدج الذين دخلوا قسم الحضانة سابقا في مستشفاكم الكريم. علماً بان الوقت المتوقع للانتهاء من تعبئتها من قبلي لكل ملف طفل هو 20 دقيقة. والسماح لي باستعمال ملفات الأطفال الخدج والمشاركة في هذه الدراسة هي طوعية ولديكم الحق في الانسحاب والمعارضة في أي وقت. كما أن سماحكم لي باستخدام المعلومات المستقاة من ملفات الأطفال الخدج ستُعامل بسرية تامة ولا تستخدم الا لأغراض البحث العلمي فقط، مع العلم أن كتابة اسم الطفل هو اختيارياً..

لذا أرجو التكرم السماح لي بتعبئة الاستبانة كاملةً بدقة وواقعية والايحاز لمن يلزم في مؤسساتكم العامرة بتقديم الدعم ويد العون لي...

شكرا لتعاونكم ومشاركاتكم الكريمة

الباحثة/ ابتسام رياض يونس

جوال/0595104294

الرقم التسلسلي:

الجزء 1

		<input type="checkbox"/> أنثى		<input type="checkbox"/> ذكر		1- الجنس Gender	
						2- العمر (الأيام) Age (days)	
Current Weight (Kg):		Apgar Score:		Length (cm):		Birth Weight (kg):	
Mother ABO:		Growth Chart Result:		Head Circumference:		Baby ABO:	
				<input type="checkbox"/> Preterm		<input type="checkbox"/> Term	
Others: <input type="checkbox"/> specify.....		Breach <input type="checkbox"/>		Forceps <input type="checkbox"/>		<input type="checkbox"/> C.S	
						Normal <input type="checkbox"/>	
						5- Mode of Delivery	
						6- Gestational age (weeks):	
<input type="checkbox"/> Negative				<input type="checkbox"/> Positive			
						7- Family History	
						8- RH factor incompatibility	
Mixed feeds <input type="checkbox"/>		Formula feeds <input type="checkbox"/>		Breast milk <input type="checkbox"/>			
						9- Feeding types	

Duration of Admission/ Day		
Modality of Phototherapy	<input type="checkbox"/> Conventional	<input type="checkbox"/> Intensive
Double-volume exchange transfusion	<input type="checkbox"/> Yes	<input type="checkbox"/> No
H/O Readmission	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Total Bilirubin		
Direct Bilirubin		
Bilirubin encephalopathy	<input type="checkbox"/> Yes	<input type="checkbox"/> No
The onset of Jaundice		
direct coombs test result	<input type="checkbox"/> Positive	<input type="checkbox"/> Negative

Chief Complaints		1 2
History of Present Illness		1 3
Medical History	<input type="checkbox"/> Positive	<input type="checkbox"/> Negative
Neonatal History	<input type="checkbox"/> Positive	<input type="checkbox"/> Negative
Vitals		2 2

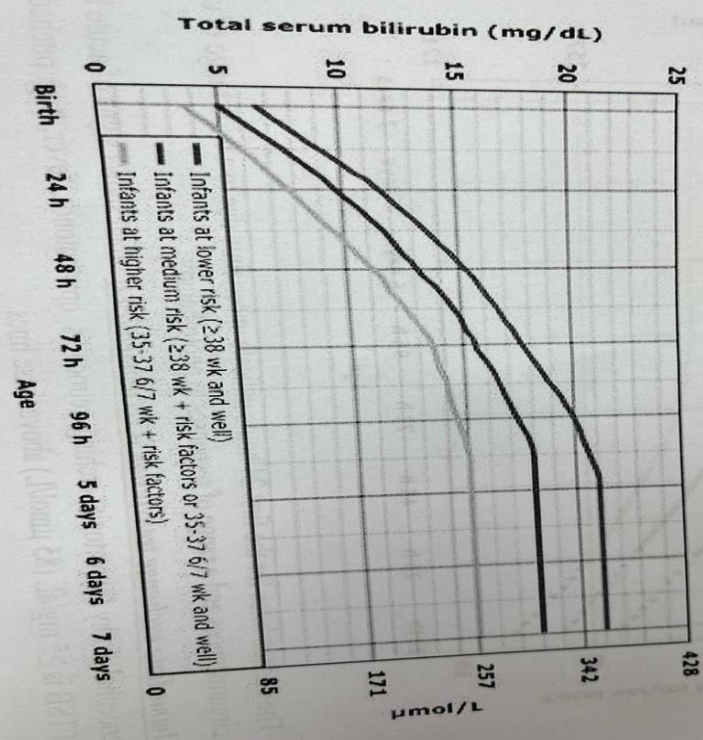
Past Results		2
		3
Respiratory		2
		4
Cardiovascular		2
		5
Genitourinary		2
		6
Gastrointestinal		2
		7
Neuro Motor		2
		8
Musculoskeletal		2
		9
Skin		3
		0

Mother Blood Group	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> AB	<input type="checkbox"/> O	1
					2
Baby Blood Group	<input type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> AB	<input type="checkbox"/> O	1
					3

Part VII.: Total Serum Bilirubin (mg/dl): Chart				Birth	12 hr	24 hrs	48 hrs	72 hrs	96 hrs	5 days	6 d	7 d	
Mother RH	<input type="checkbox"/> Positive						<input type="checkbox"/> Negative						1
													4
Baby RH	<input type="checkbox"/> Positive						<input type="checkbox"/> Negative						1
													5


500-1000	5-7	12-15
1000-1500	7-10	15-18
1500-2500	10-15	18-20
>2500	>15	>20

Guidelines for phototherapy in hospitalized infants of 35 or more weeks gestation



شكرا لحسن تعاونكم

## Appendix II: IRB Approval



**Arab American University**  
*Institutional Review Board - Ramallah*

**الجامعة العربية الأمريكية**  
 مجلس أخلاقيات البحث العلمي - رام الله

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**IRB Approval Letter**

**Study Title:** "The Relationship between Using Intensive Phototherapy and Decreasing the Need for blood exchange in Neonatal Jaundice in the West Bank of Palestine: A Retrospective Study"

**Submitted by:** Ibtisam Riyad Abdel Fatah Younis


**Date received:** 5<sup>th</sup> December 2023

**Date reviewed:** 3<sup>th</sup> January 2024

**Date approved:** 4<sup>th</sup> January 2024

Your Study titled "The Relationship between Using Intensive Phototherapy and Decreasing the Need for blood exchange in Neonatal Jaundice in the West Bank of Palestine: A Retrospective Study" with archived number R-2024/A/6/N was reviewed by the Arab American University IRB committee and was approved on the 4<sup>th</sup> January 2024.

**Sajed Ghawadra, PhD**  
 IRB-R Chairman  
 Arab American University of Palestine



الجامعة العربية الأمريكية - فلسطين  
 مجلس أخلاقيات البحث العلمي - رام الله  
**IRB-R**  
 ARAB AMERICAN UNIVERSITY - PALESTINE  
 INSTITUTIONAL REVIEW BOARD - RAMALLAH

**General Conditions:**

1. Valid for 6 months from the date of approval.
2. It is important to inform the IRB-R with any modification of the approved study protocol.
3. The Bord appreciates a copy of the research when accomplished.

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رام الله - فلسطين

Tel: 02-294-1999      E-Mail: [IRB-R@aaup.edu](mailto:IRB-R@aaup.edu)      Website: [www.aaup.edu](http://www.aaup.edu)

### تسهيل مهمة الحكومة. Appendix III.

<p>State of Palestine Ministry of Health Education in Health and Scientific Research Unit</p>		<p>دولة فلسطين وزارة الصحة وحدة التعليم الصحي والبحث العلمي</p>
<p>Ref:..... Date:.....</p>		
<p>الرقم: ١٦٤ / ٢٠٢٤ / ج التاريخ: ١١ / ١١ / ٢٠٢٤</p>		
<p>عطفة الوكيل المساعد لمجمع فلسطين الطبي المحترم،،، الوكيل المساعد لشؤون المستشفيات والطوارئ المحترم،،، تحية واحترام،،،</p>		
<p><u>الموضوع: تسهيل مهمة بحث</u></p>		
<p>يرجى تسهيل مهمة الطالبة: ابتسام رياض عبد الفتاح يونس - ماجستير تمريض حديثي الولادة - الجامعة العربية الامريكية، بعنوان:</p>		
<p><b>'The effect of intensive phototherapy in decreasing the need for blood exchange in neonatal jaundice in the West -Bank of Palestine'</b></p>		
<p>حيث ستقوم الطالبة بجمع معلومات عن حول موضوع البحث من خلال تعبئة استبانة، وذلك في:</p>		
<ul style="list-style-type: none"> <li>- مستشفى رفيديا - مستشفى عاليه - مستشفى جنين - مستشفى طولكرم</li> <li>- مجمع فلسطين الطبي</li> </ul>		
<p>مع العلم ان مشرف الدراسة: د. رجاء زيود. على ان يتم الالتزام بالمحافظة على اخلاقيات البحث العلمي وسرية المعلومات، وعدم التعرض للمعلومات التعريفية للمشاركين. على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث، التمتع بعدم النشر لحين الحصول على موافقة وزارة الصحة.</p>		
<p>مع الاحترام،،،</p>		
<p>د. عبد الله القواسمي رئيس وحدة التعليم الصحي والبحث العلمي</p>		
		
<p>نسخة: عميد كلية الدراسات العليا المحترم/ الجامعة العربية الامريكية</p>		
<p>Telfax.:09-2333901</p>	<p>scientificresearch.dep@gmail.com</p>	<p>تلفاكس: 09-2333901</p>

## تسهيل مهمة المستشفيات الخاصة Appendix IV

<p>Arab American University Faculty of Graduate Studies</p>		<p>الجامعة العربية الأمريكية كلية الدراسات العليا</p>
2024/1/11		
الى من يهمة الامر		
<p><u>تسهيل مهمة بحثية</u></p>		
تحية طيبة وبعد،		
<p>تُهديك كلية الدراسات العليا في الجامعة العربية الأمريكية أطيب التحيات، وبالإشارة الى الموضوع أعلاه، تشهد كلية الدراسات العليا في الجامعة أن الطالبة ايضام رياض عبد الفتاح يونس والتي تحمل الرقم الجامعي 202112507 هي طالبة ماجستير في برنامج تمريض حديثي الولادة وتعمل على رسالة الماجستير الخاصة بها بعنوان:</p>		
<p>"The Relationship between using intensive phototherapy and decreasing the need for blood exchange in neonatal jaundice in the West-Bank of Palestine"</p>		
<p>تحت إشراف الدكتور رجاء زيد، نأمل من حضرتكم الإيعاز لمن يلزم لمساعدتها للحصول على المعلومات اللازمة للدراسة من خلال فحص سجلات المرضى، علماً أن المعلومات ستستخدم لغاية البحث فقط وسيتم التعامل معها بغاية السرية، وقد أعطيت هذه الرسالة بناء على طلبها.</p>		
<p>وتفضلوا بقبول فائق الاحترام</p>		
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## الملخص

المقدمة: الحالة الأكثر انتشاراً خلال الأسبوع الأول من الحياة هي اليرقان عند الأطفال حديثي الولادة. 10% من الأطفال لديهم احتمالية الإصابة بفرط بيليروبين الدم الخطير، الأمر الذي يتطلب علاجاً ومراقبة صارمة. على الرغم من أن العلاج بالضوء يعالج بنجاح غالبية حالات اليرقان الوليدي، إلا أن حديثي الولادة المعرضين لمخاطر عالية قد يحتاجون إلى العلاج التبادلي بنقل الدم (ET).

الهدف: تقييم العلاقة بين استخدام العلاج الضوئي المكثف وتقليل الحاجة إلى تبادل الدم في اليرقان الوليدي في الضفة الغربية لفلسطين.

المنهجية: تم إجراء تصميم دراسة وصفية وكمية بأثر رجعي في مستشفيات الرعاية الثالثة (الحكومية والخاصة) في شمال الضفة الغربية والتي تحتوي على وحدات العناية المركزة لحديثي الولادة (NICU) وعلاج فرط بيليروبين الدم بالعلاج الضوئي المكثف وتبادل الدم، عينة مقنعة. تكونت من (323) حديثي الولادة الذين شاركوا في الدراسة خلال فترة جمع البيانات.

النتيجة: شملت الدراسة حول اليرقان الوليدي والعلاج الضوئي في الضفة الغربية لفلسطين 323 حديثي الولادة، مع توزيع متساوي تقريباً بين الجنسين بواقع 48.0% ذكور و52.0% إناث. وفقاً لأبحاث مخطط النمو، تمت ولادة غالبية الأطفال (91.0%) بعد فترة حمل كاملة، وتندرج الأغلبية (54.5%) ضمن فئة النمو 3. وشكلت الولادات الطبيعية 54.8%، في حين وُلدت 44.3% عن طريق العمليات القيصرية والرضاعة الطبيعية. كان خيار التغذية الأكثر شيوعاً (64.4%). ما يقرب من 88% ليس لديهم تاريخ عائلي للإصابة باليرقان، ولكن 20.4% لديهم عدم توافق عامل RH. كانت البشرة الصفراء، وقلة النشاط، وسوء الأكل، والجفاف هي الشكاوى السريرية الأكثر شيوعاً لدى 61.0% من المرضى، مما أدى إلى الإقامة في المستشفى لمدة ثلاثة أيام. خضع جزء كبير (16.4%) لعمليات نقل دم متبادلة، في حين تلقت الأغلبية (83.6%) علاجات مكثفة بالضوء. كانت فصيلة الدم A هي الأكثر شيوعاً (55.7%)، وانخفض إجمالي مستويات البيليروبين في الدم من 30 ملجم/ديسيلتر عند الولادة إلى 11.0 ملجم/ديسيلتر بحلول اليوم السابع. أشارت تحليلات الارتباط إلى وجود روابط قليلة بين الخصائص الديموغرافية وخيارات العلاج، ومع ذلك، كانت مدة الاستشفاء ومستويات البيليروبين

مرتبطة سلبا مع عمليات نقل الدم. توفر هذه الدراسة معلومات مفيدة حول إجراءات إدارة اليرقان عند الرضع والخصائص السريرية في الضفة الغربية.

الخلاصة: النتائج تشير إلى أن العلاج بالضوء المكثف والمعلومات السريرية المرتبطة به أمر بالغ الأهمية في إدارة فرط بيليروبين الدم. يمكن أن يساعد فهم هذه الارتباطات في التأثير على القرارات السريرية وتحسين رعاية المرضى لحديثي الولادة المعرضين لخطر المضاعفات الشديدة المرتبطة باليرقان. العلاج الضوئي المكثف هو علاج آمن وفعال لفرط بيليروبين الدم الشديد. قد يحتاج المرضى الذين يعانون من فرط بيليروبين الدم إلى مبررات أكثر صرامة لتبادل الدم. ومع ذلك، ينبغي تنفيذ خطة طوارئ لتبادل الدم في حالات الطوارئ بمجرد بدء العلاج الضوئي المكثف، وخاصة بالنسبة للرضع الذين يعانون من عوامل الخطر. إذا ثبت أن العلاج الضوئي المكثف فعال، فمن المستحسن تقليل استخدام تبادل الدم.

الكلمات المفتاحية: فرط بيليروبين الدم، حديثي الولادة، العلاج الضوئي المكثف، تبادل الدم.