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Prevalence of Jaundice in the Neonatal Intensive Care Unit

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ABSTRACT

Neonatal jaundice is one of the leading complications among newborns in the neonatal intensive care unit (NICU). The purpose of this review was to determine the prevalence of jaundice in the NICU. This was a review of the literature. The review focused on "The prevalence of jaundice in infants, and how the use of phototherapy compared to other forms of treatment affect the rate of jaundice occurrence through the types of treatment by the end of the care regimen." Various studies on neonatal jaundice were used and interpreted throughout this review on jaundice prevalence in the NICU. Throughout this review, themes revealed an examination of bilirubin levels within the first 48 hours of a newborn's life is a diagnostic tool that allows for immediate treatment. Phototherapy was the most reliable and commonly used form of treatment to aid in the resolution of hyperbilirubinemia. The use of phototherapy allows for the breakdown of excess bilirubin present in the blood, which causes the newborn to exhibit signs and symptoms of jaundice. The additional essential theme found were maternal and fetal factors, including a low birth rate, prolonged birth, maternal lifestyle and education, and the prolonged length of stay. Upon this systematic review, it was concluded that there is significant evidence and supporting data to determine that jaundice is prevalent in the NICU.

1. INTRODUCTION:

Jaundice is a significant and prevalent issue in the NICU. Topics highlighted in this study are the basics of jaundice and research methods used, the presentation of neonatal jaundice, specific causes, effective treatments or interventions, and a summary of the findings. These were used to emphasize the common theme of excess bilirubin in the blood. The buildup of bilirubin is a significant jaundice indicator in the NICU. Hyperbilirubinemia is defined as a significant influence on the occurrence of jaundice in newborns. "Physiological jaundice typically appears in over 80% of newborn babies" [1]. A high percentage indicates an increased prevalence.

There are different forms of childhood jaundices, with occurrences ranging from minor to significant complications. All jaundice forms are mentioned regardless of the types indicating jaundice appears to be a prevalent matter in the NICU. The prevalence is so high that advancements have been made concerning treatment and identification of early signs of symptoms. Therapy availability is a significant theme appearing throughout this review due to the frequency of jaundice. Treatment must be administered immediately due to the increased risk of neurotoxicity, damage to the brain, and death [2].

The combination of maternal and fetal factors is also an essential theme in this review. Le et al. [3] stated, "low maternal knowledge of jaundice, traditional beliefs, and newborn care practices, and short hospital stays after birth with the absence of routine newborn follow-up may prevent or delay recognition of jaundice." Infant factors are generated during development within maternal practices. The lifestyle of the mother is a common factor in the review. This indicates the child can be affected as a mother's untoward lifestyle practices may lead to a higher chance of this diagnosis.

1.1 Purpose

The purpose of this study was to identify the prevalence of jaundice in the NICU through the strategic analysis of research. This review stems from various studies with different approaches to associate jaundice and its prevalence in diverse NICUs.

1.2 Question

Regarding the prevalence of jaundice in infants, how does phototherapy use compared to other forms of treatment affect the rate of jaundice occurrence through the types of treatment by the end of the care regimen?

2. METHODS

During this literature review, a precise interpretation was used when exploring studies using the Cumulative Index of Nursing and Allied Health Literature (CINAHL), the National Center for Biotechnology Information (NCBI), Biomed Central (BMC), Mayo Clinic, and HINDAWI Journals. Each study was investigated, examined, and reconstructed into efficient evidence aiding in jaundice prevalence in the NICU. Literature chosen for review primarily ranged from 2014 to 2020. Most references remained within the top four tiers of evidence hierarchy with few references below the fourth tier. As noted in Figure 1, for the level of evidence, 1 is the highest, and VII is the lowest. Any studies conducted before 2014 were disregarded as there was no vital relevance as the research was outdated. Other studies excluded from this review were below level four on the nursing evidence hierarchy. The study content did not meet specific review criteria. The study's topic was too broad or narrow. These sources may also not have come from a credible website, leading to further dismissal. The terms analyzed throughout the review were: hyperbilirubinemia, phototherapy, neonatal jaundice, and prevalence.

Interventions were provided through education on jaundice, the recommendation for treatment, and contributing factors. Keywords and multiple themes are discussed below. Hyperbilirubinemia is the buildup of bilirubin in an infant, causing a yellow tint to the skin called jaundice. Jaundice is a medical condition due to the buildup of bilirubin. Phototherapy is a form of light treatment through blue rays used for jaundice. The key term prevalent is used throughout the study, which indicates a robust correlation distributed within a particular area.

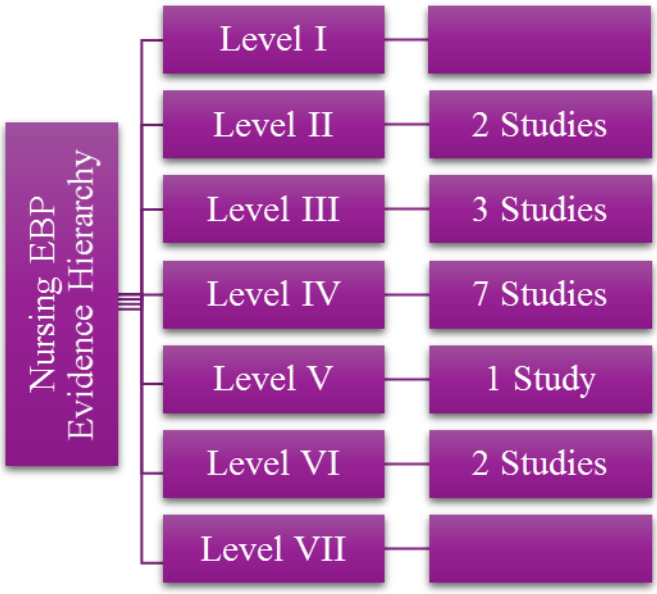

Figure No. 1. Ranking the evidence for studies used in the review: Prevalence of Jaundice in the Neonatal Intensive Care Unit.

3. LITERATURE REVIEW

This is a review of the literature for the prevalence of jaundice in the NICU. Each study provides critical and versatile information contributing to the prevalence of jaundice in the NICU. Information ranges anywhere between jaundice's physiology, jaundice treatment, factors contributing to increased risk for jaundice, postnatal screenings for jaundice, maternal lifestyle factors, and length of hospitalization. Most studies reported obtained information from medical records from different geographical areas.

3.1 Buildup of Bilirubin within Blood

Jaundice in a newborn is considered normal. However, if not treated, jaundice can lead to destructive, life-threatening issues. The occurrence of jaundice in a newborn is due to the breakdown of red blood cells, causing a buildup of a chemical compound called bilirubin, which is within the blood. If the concentration of non-conjugated bilirubin in the blood is too high, it breaches the blood-brain barrier, and bilirubin encephalopathy occurs with severe consequences for the child [2]. This could be toxic, as a continual buildup of bilirubin could cause neurotoxicity in the newborn. Additional complications that can lead to toxicity in the infant is

glucose-6-phosphate-dehydrogenase (G6PD). G6PD is an enzyme that is important for maintaining and protecting red blood cells. A deficiency in G6PD can lead to chronic bilirubin encephalopathy [4]. The lack of this protein, causing a buildup of bilirubin, further explains how easily the condition of jaundice can go from a common occurrence to a neurotoxic and debilitating illness. This buildup is also commonly referred to as hyperbilirubinemia, contributing to the issue, the imbalance between the production and clearance of bilirubin results in its buildup in the circulation [5]. As with any other buildup of substances within the body, the hyperbilirubinemia can lead to complications. A complication in the newborn's physiology can result in a buildup of the yellow-orange colored bilirubin that deposits in the newborns' sclera, skin, and mucous membranes resulting in physiological jaundice [5]. Many newborns begin to exhibit signs and symptoms of jaundice three or four days after birth. This does not allow the medical staff to monitor for possible jaundice presentations since most patients are discharged after 48 hours [5]. The buildup of bilirubin in the blood is later discussed as a significant theme.

3.2 Postnatal Screening for Hyperbilirubinemia

As previously mentioned, hyperbilirubinemia is an essential factor in the diagnosis of jaundice. The guidelines of the American Academy of Pediatrics (AAP) for monitoring neonatal jaundice recommend universal postnatal screening for hyperbilirubinemia within 48 h from discharge [1]. This revolves around the number of infants discharged from the hospital and how many would need to return as they developed neonatal jaundice. Data was gathered based on the conditions matching the neonates who required readmission and those who did not. Implementing a change in clinical practice related to jaundice in the NICU could be decreased if the screening process before a neonate's discharge was more methodical about testing for risk factors. Adding to the screening process necessary for discharge, a check for the presence of bilirubin circulating in the blood could decrease the number of infants who need to be readmitted for jaundice treatment [1].

By increasing the screening process, earlier detection of hyperbilirubinemia would assist when identifying occurrences. The bilirubin level of all babies should be checked with a non-invasive bilirubinometer before discharge [6]. This would assist in diagnosing jaundice before an infant returns home and would have to be hospitalized. From the study as a whole, the following was concluded: "We identified the hematocrit level, an infant weight loss > 5%, and a shorter LOS as

being additional risk factors for increased risk of readmission of low-risk neonates presenting with physiological jaundice" [1]. This presents potential risk factors of hyperbilirubinemia, contributing to the prevalence of neonatal jaundice in the NICU.

3.3 Therapy Availability for Decreasing Jaundice Process

Various treatment forms for jaundice are phototherapy, intravenous immunoglobulin (IVIg), exchange transfusion, and enhanced nutrition. Phototherapy is the most well-known form of treatment. Phototherapy is most often used to treat neonatal hyperbilirubinemia [1]. This indicates that phototherapy is used for most cases of jaundice. As discussed before, hyperbilirubinemia is the primary cause of jaundice. Stamatis et al. [8] described phototherapy as light energy in the blue region of the spectrum that uses heat to change bilirubin's shape and structure for proper excretion. If the bilirubin is unable to be excreted through urine and stool, this is when the buildup of bilirubin in the blood becomes significant. During this therapy, the infant would be mostly bare, apart from a diaper and protective patches to cover the eyes. It is necessary to monitor the bilirubin levels periodically during phototherapy until therapy is completed to prevent overtreatment [9]. Monitoring bilirubin levels allows health care providers to determine the effectiveness of phototherapy treatment.

Another form of treatment is IVIg. If jaundice is present in an infant due to the differences in blood type between the mother and infant, IVIg may be administered. This type of jaundice results from the infant carrying the mother's antibodies that inhibit the rapid breakdown of the baby's red blood cells. This is known as ABO incompatibility, where the antibodies of the neonate's blood type are different from that of the mothers. This is most common when the Rh-negative pregnant mother is exposed to Rh-positive fetal red blood cells. The neonate's cells would then coagulate with the mother's cells, which causes blood clots. IVIg therapy prevents antibodies from attaching to the antigen, which prohibits clots from occurring. This form of treatment may decrease jaundice and lessen the need for an exchange transfusion [10].

Exchange transfusion of blood is a different form of treatment for jaundice. This form is used when the jaundice is so severe that it does not respond to other treatments. When performing an exchange transfusion of blood, small amounts of blood is repeatedly withdrawn from the infant and replaced by donor blood. The exchanges allow the bilirubin and maternal antibodies to

become diluted, which decreases hyperbilirubinemia. This is only done when the neonate's jaundice is non-responsive to other treatment forms such as phototherapy and nutrition management. Despite those efforts, the neonate would still have jaundice systems and elevated bilirubin levels in the blood, which prompts the treatment with the exchange blood transfusion, replacing low and hyper bilirubin blood with normal bilirubin levels [10].

Enhanced nutrition is another form of treatment for jaundice in the NICU. Frequent feedings and supplementation may be recommended for an infant to receive adequate nutrition. A typical result found within different analyzed studies was that formula feed might be more beneficial to infants in preventing jaundice. Boskabadi et al. [11] found, "filling the gap between nutritional needs and the amounts provided by breastmilk." This allowed for evaluating the difference between the different types of nutrition used to feed an infant. The research was conducted to define the difference between feeding an infant's maternal breast milk or formula. Results indicated that jaundice is prevalent enough in the NICU. It is considered appropriate to provide infants with strict formula feed or a mixture of formula feed and breast milk to decrease the risk of furthering the jaundice process.

3.4 Maternal Lifestyle Factors and Education

Maternal lifestyle factors and knowledge related to jaundice play a role in the prevalence of newborns' possible diagnoses. Although there are various lifestyles, some of the most critical factors consist of environmental inhalants and the infant's diet. If a mother lives in an environment where there may be harmful fumes, this could affect an infant's jaundice. Henderson [7] stated, “frequent use of insecticide spray indoors resulted in 1.21 times higher incidence of neonatal hyperbilirubinemia.” Insecticide spray is a chemical inhalant proven by evidence-based practice to influence hyperbilirubinemia, thus leading to jaundice.

The diet the mother provides for her baby is also an essential factor in the development of jaundice in an infant within the NICU; “Maternal education in complementary feeding has some role in infants' linear growth and WHO growth parameters in children of developing countries” [11]. This information indicates that a mother's education level regarding how they should feed their children is vital regarding decreasing the prevalence of jaundice; "Breastfeeding, preterm labor, and infection were underestimated as potential risk factors of neonatal jaundice (NNJ)"

[12]. During this review, it was found that jaundice has a higher prevalence when breastfed. Breastfeeding has been the leading cause of prolonged jaundice worldwide [11]. This statement is from one of the multiple sources that revealed how a mother feeds her child is considered part of her lifestyle and affects jaundice in the newborn. Based on the information provided, when it comes to an infant with jaundice, the mother should consider refraining from breastfeeding to improve the newborn's quality of health.

3.5 Low Neonatal Birth Weight is a Cause of Concern

Low neonatal birth weight can also be a factor to consider as to why neonates could develop jaundice. Adoba et al. [13] stated, “low neonatal birth weight and prolonged duration of labor are associated with neonatal jaundice." These factors most often accompany the presence of jaundice in an infant related to underdevelopment. Throughout this study, additional sources were used to show further that low birth weight was a risk factor in potentially developing neonatal jaundice. Low neonatal birth weight was a considerable theme that contributed to children developing jaundice. "Most neonates with jaundice had low birth weight compared to those without jaundice" [13]. Additional factors such as preeclampsia, G6PD deficiency, and ABO compatibility, accompanied the infant's underdevelopment related to low birth weight. Low birth weight for a neonate is such a risk because a baby with low birthweight may have trouble eating, gaining weight, and fighting off infections. It was concluded that low neonatal birth weight was one of the most common associations with neonatal jaundice development.

3.6 Prolonged Duration of Labor may Cause Symptoms of Jaundice

Another factor that can contribute to the development of jaundice in neonates is prolonged labor. Adoba et al. [13] claimed, “neonates delivered by mothers with a formal occupation and those who had prolonged duration of labor were significantly more likely to have neonatal jaundice.” In this study, prolonged duration of labor was a leading factor. Many of the infants who developed jaundice had mothers who labored longer than the control group. The research was supported by the clinical relationship between a longer duration of labor and cephalohematoma, a risk factor for severe hyperbilirubinemia. A community-based study in Nepal also supported the research study referenced by conducting a similar study where mothers who had prolonged

labors, their neonates more often developed jaundice than those with mothers who had expected birth durations.

3.7 Hospital Length of Stay Because of Jaundice

The length of stay at the hospital plays an integral role in determining jaundice development in newborns. As previously stated, the average length of hospital stay is about 48 hours if there are no complications present. The average presentation time of jaundice in newborns is about three to four days, which means there is no opportunity in the first hospital stay to truly determine if a newborn is exhibiting signs and symptoms of jaundice. Many newborns are readmitted for treatment of jaundice when the parents notice the infant exhibiting symptoms. A study performed in 2014 that evaluated 979 infants found that jaundice was one of the most common and medically significant complications for newborns [3]. This means one of the most common complications among many others was jaundice, therefore giving credibility to the prevalence. One way to prevent readmission could be to require parents to schedule an appointment after discharge that would fall between the potential timing of exhibiting signs and symptoms to have the newborn's bilirubin checked. Blumovich et al. [1] revealed, "several reports suggested that implementation of universal postnatal screening for hyperbilirubinemia within 48 hours from discharge might decrease hospital readmission rates due to neonatal jaundice." This would reassure the parents and the doctor that jaundice could be ruled out past the after-birth hospital stay.

3.8 Summary of Research Evidence

This review mentions three key themes on neonatal jaundice. The assumption that jaundice is, in fact, prevalent in the NICU is supported as there is an abundance of information priorly researched and interpreted by other professionals. These themes consist of the buildup of bilirubin in the blood that causes jaundice and the screenings that detect it, the availability of therapy for treatment, and the maternal and fetal factors contributing to the development of jaundice. The buildup of bilirubin in blood and screenings explains how jaundice occurs physiologically in the body, what occurs within the blood to cause jaundice in infants, and what can be screened for what is screened to detect these occurrences. The availability of treatment was the next theme identified throughout the review. Treatments for the disease process consist

of phototherapy, intravenous immunoglobulins, exchange therapy, and nutritional therapy to correct elevated bilirubin levels. The final theme was infants and maternal factors. This contributed to the development of jaundice in the infant with low neonatal birth weight, prolonged labor, postnatal screenings, education, the pregnant mother's lifestyle, and the length of the hospital stay.

Neonatal jaundice is caused by the increased bilirubin circulating in the blood [1,2,4-6,14,15]. Hyperbilirubinemia is the most prominent theme identified throughout the review. This is concerning the primary pathophysiology of the build-up of bilirubin, which begins the development of the diagnosis. Jaundice in the newborn is usually normal. It is caused by the breakdown of red blood cells, resulting in the buildup of bilirubin in the infant's circulation due to newborn transitional physiology. However, bilirubin can be toxic, particularly in the brain, where its presence can result in death or devastating long-term neurological damage [5]. Once the buildup of bilirubin in the blood has been screened, the next theme is therapy available to treat hyperbilirubinemia with phototherapy, intravenous immunoglobulins, nutrition therapy, and exchange transfusions.

Forms of treatment for jaundice included exchange transfusion, intravenous immunoglobulins, nutrition therapy, and phototherapy. All studies included in this review mentioned phototherapy as the most common form of neonatal jaundice treatment [1,3,7,9,16,17]. Concerning the question reviewed in this study, phototherapy has been identified as the primary form of treatment used to prevent further complications for neonates with hyperbilirubinemia [9]. “Neonatal jaundice should be considered as the main policy in all health care settings” [14]. Phototherapy is presented as the most common form of therapy and a very effective treatment method with minimal neonate risk. Nutritional therapy and intravenous immunoglobins can treat jaundice. However, in comparison, intravenous immunoglobin is only a necessary treatment when the cause of jaundice is ABO incompatibility, while nutritional therapy is to make sure the baby maintains a healthy weight. Simultaneously, phototherapy effectively reduces hyperbilirubinemia levels at a molecular level [1].

Another theme presented was maternal and infant factors. This theme was presented through the contribution of low neonatal birth weight, prolonged labor, the procedure of postnatal screenings, education, and lifestyle of the pregnant mother, along with the length of the hospital stay. All themes mentioned can cause a higher chance of the newborn developing jaundice. One of the most mentioned maternal factors affecting the presence of jaundice was breastfeeding. Breastfeeding is more likely to cause jaundice because of the life alterations that occur as the infant adjusts to life outside of the womb, such as new feeding habits [11.12]. The pregnant mother's education and lifestyle come into play as the mother's activities can put the infant at risk for developing jaundice once born, such as exposure to pesticides. Maternal education about prenatal care is imperative in reducing infant risks. This contributes to the theme as it further supports the impact maternal factors have on jaundice occurrence.

Infant factors in this theme provide evidence that jaundice is increased because they influence the newborn's presentation. Screening of bilirubin and phototherapy is one of the treatments, which, if not done, could result in an extended hospital stay or readmission for the neonate to the hospital even after the initial presentation of jaundice has been resolved. The low neonatal birth weight contributed to jaundice development. The low birth weight would usually mean the infant was underdeveloped and therefore had a higher risk of developing complications, including jaundice. Prolonged labor duration was another infant factor. It put the infant at risk for developing cephalohematoma, a pooling of blood under the scalp that caused red blood cell destruction and increased bilirubin in the blood. Postnatal screening is not a factor that leads to the development of jaundice. However, it can aid in early detection and lead to a prompt treatment to reduce the infant's risk of developing complications. Lastly is the length of hospital stay, usually 48 hours, if there are no complications. However, this is a factor because jaundice symptoms usually present three to four days after birth, so the mother should make it a priority to schedule an appointment to assess the infant for signs and symptoms during that time-frame. The information from maternal and infant factors supports the theme by stating how each factor contributes to the prevalence of jaundice and how each one can put the infant at additional risk for developing the disease process of jaundice.

As illustrated in Figure 2, each prominent theme encompasses the idea that jaundice is a prevalent disorder in the NICU. The instances mentioned in the analysis of the extent of a risk

factor can be considered standard treatment. “Prenatal and postnatal care services are needed to reduce the negative impact of NNJ for children from low resourced settings” [16]. The studies highlighted the risk factors and causes for developing jaundice and provided ideas of what can be done to lower risks and prevent jaundice in future neonates. Each study used in this review originated from versatile geographical areas. This aids in demonstrating that jaundice is a prevalent issue in NICU from all places, which allows for the widespread implementation of clinical interventions to help reduce the occurrence of jaundice.

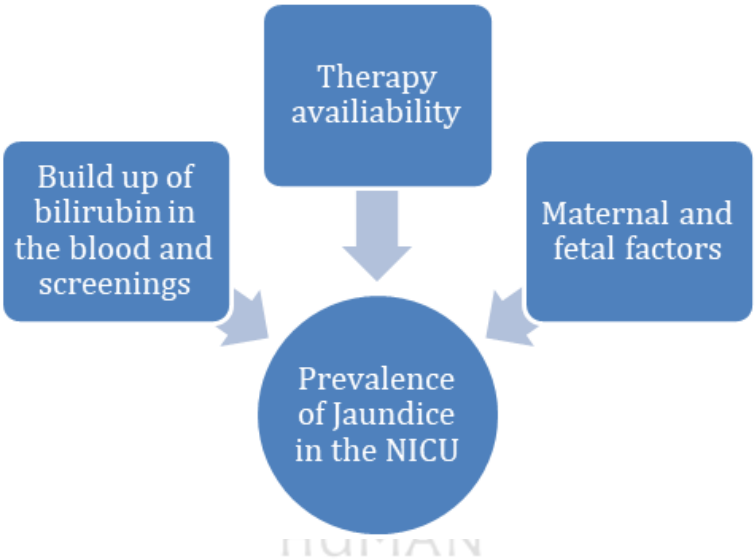

Figure No. 2. Emerging Themes for Jaundice Prevalence in the Neonatal Intensive Care Unit

4. DISCUSSION

Determination for change in practice is based on researched evidence and the prevalence of neonatal jaundice in the NICU. Change in practice could be adjusted based on the presentation of symptoms and determine when treatment is required. Many hospitals implement screenings for hyperbilirubinemia as standard practice. The need for this implementation post-birth is for the hospital to recognize and diagnose an infant early. This is because of the first few days of an infant's life in which jaundice is exhibited. In the search conducted for the review, it was also revealed that, while other kinds of treatment are used for neonatal jaundice, the most common form and the most effective treatment is phototherapy. The review also identified many risk factors that may increase a neonate's potential for developing jaundice. This provided many

ideas for recommendations and implementations to reduce neonatal jaundice risk in the neonatal intensive care unit by proxy.

4.1 Weakness

This review's potential weakness was that resources were limited due to the lack of full text, accredited journals, and peer-reviewed journals. Another weakness was the need for more sources that fell into me through IV in evidence hierarchy levels. This would have provided an increasing number of studies that had both case-controlled and randomized attributes that would have backed claims or statements throughout the paper without the possibility of bias. Using more studies also would have yielded more precise and quantitative results.

4.2 Strengths

The strengths of this review were that jaundice is a well-known and extensively researched disorder. The vast number of potential resources for this study and the information gathered were from outside research groups to eliminate personal bias. The data gathered for this study was not gathered from one distinct group but several different studies and research experiments. Another strength stems from implementing strict criteria from the nursing evidence hierarchy when selecting exemplary research studies. While using this hierarchy, most information was taken from higher tiered studies, therefore eliminating weak evidence. Jaundice is a common disorder in neonatal intensive care units, so gathering information regarding the signs, symptoms, risk factors, treatment, and causes was not difficult.

4.3 Recommendations

A recommendation would be to evaluate a broader range of audiences other than what was used to enhance the qualitative and quantitative study results. This would be performed to identify the pattern of responses from the broader groups' opinions related to jaundice's prevalence in the NICU, diversifying, and enhancing results. A review of the study by an individual who is not medically minded or trained could give useful information to make the results more understandable and simpler to understand for a more general audience. Systematic reviews would have also helped collect secondary data and appraise the research studies used.

Randomized controlled studies could have helped determine the causes of jaundice and how abundantly the highlighted factors contributed to the occurrence.

5. CONCLUSION

Neonatal jaundice is a prevalent condition in the NICU. Throughout this review, research methods were discussed, and the subject of neonatal jaundice itself, how it presents, what factors can lead to it developing and re-developing, and the treatments used to deal with the condition. The studies used were presented and criticized based on subjects covered with directly cited quotes that included relevant information vital to the review. These studies and the corresponding knowledge presented were summarized to reiterate main points and culminate in proposed clinical practice implementations. This review was compiled to be used in the clinical setting to reduce the risk and prevalence of neonatal jaundice in NICU newborns and prevent those treated and treated successfully from having a relapse. The use of phototherapy, along with other treatments, signs, symptoms, and research, used all present neonatal jaundice as a prevalent disorder in the NICU and revealed that there are ways of amending clinical practice to limit its occurrence in newborns. Upon this systematic review, it can be concluded that there is significant evidence and supporting data to determine that jaundice is prevalent in the NICU.

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