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Open Access Original Article

An Audit of the Management of Neonatal Jaundice in a Level 2 Neonatology Unit of a Maternity Hospital Against the 2023 NICE Guidelines

Review began 09/23/2026
Review ended 10/10/2026
Published 10/28/2026

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DOI: 10.7759/cureus.118703

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Abstract

Background

In Pakistan, neonatal jaundice is a common cause of neonatal morbidity. This audit was conducted to evaluate adherence by the local team to NICE (National Institute for Health and Care Excellence) guidelines in the management of neonatal jaundice in children under 28 days of life admitted to the Level 2 Neonatology Unit of Maternity Hospital and to identify any deviations from NICE guidelines regarding the assessment, monitoring, and treatment to improve care provided to neonates with jaundice.

Methods

Around 46 neonates admitted and diagnosed with visually apparent jaundice or at risk of jaundice at the Neonatal Unit of Maternity Hospital were included from February 2024 to April 2024. We included data on history, clinical examination, serum total bilirubin measurements, and jaundice management and analyzed them using IBM SPSS Statistics for Windows, Version 26 (Released 2018; IBM Corp., Armonk, NY, USA).

Results

We included 46 neonates with a mean age of 3.17 ± 1.371 days, gestational age of 35.07 ± 2.768 weeks, and mean weight of 2.17 ± 0.677 kg. Visual jaundice was present in 91.3% (N = 42/46), but only 21.7% (N = 10/46) had serum bilirubin levels requiring phototherapy, with a p-value of 0.27. Interventions were proactive: 21.7% (N = 10/46) received phototherapy, and 52.2% (N = 24/46) had bilirubin monitoring. Risk factor documentation and follow-up plans were high: 87% (N = 40/46) and 84.8% (N = 39/46), respectively. Patient education was thorough, at 93.5% (N = 43/46). There was 54.3% (N = 25/46) adherence to NICE guidelines regarding serum bilirubin levels, need for phototherapy, bilirubin monitoring frequency, patient education, and follow-up plans in the local setup, compared with the 100% (N = 46/46) standard, emphasizing the need for improvement.

Conclusion

While the audit indicates satisfactory levels of guideline adherence in certain areas of neonatal jaundice management, it also highlights significant areas for improvement, which are crucial for optimizing care outcomes in the management of jaundice in neonates.

Categories: Quality Improvement, Pediatrics, Gastroenterology
Keywords: clinical audit, evidence based-medicine, neonatal jaundice, nice guidelines, serum total bilirubin

Introduction

Jaundice in neonates is a common medical problem that is sometimes benign but sometimes causes significant brain damage and death [1,2]. However, this cause of neonatal mortality and morbidity could be prevented [3]. With the introduction of NICE (National Institute for Health and Care Excellence) guidelines, the management of jaundice in newborns has been standardized [4].

The Neonatology Unit of Maternity Hospital, Lahore, where this study was carried out, is one of the largest maternity hospitals in Pakistan and is affiliated with King Edward Medical University, Lahore [5]. Its history dates back to 1930 [5]. It is a teaching hospital that has an attached neonatal unit managed by a neonatology fellow and three medical officers. The unit is supervised by consultant neonatologists. It has phototherapy lamps and other equipment. Staff are well-trained in managing neonates with jaundice.

Many studies indicate that jaundice is one of the main causes of morbidity and mortality in neonates around

the world [6-9]. Various studies have shown that the prevalence of neonatal jaundice is high, including both physiological and pathological causes [10]. Various clinical audits have been conducted on jaundice in different countries worldwide. A clinical audit conducted in Nigeria suggests that providing a transcutaneous bilirubinometer and educating parents would minimize complications associated with jaundice, such as acute bilirubin encephalopathy. An audit conducted in the UK in 2011 showed 15% performance in identifying the risk factors for jaundice, compared with the 100% standard [4]. The audit conducted by Ravindran and Ashraf also showed the importance of transcutaneous bilirubinometer measurement in reducing blood tests [4].

The rationale for this clinical audit is to address lapses in the management of neonatal jaundice within the Neonatology Unit of Maternity Hospital, based on evidence-based guidelines such as the NICE guidelines (2023). By conducting a clinical audit to assess adherence by the local team to NICE guidelines, identify deviations from these guidelines, and suggest recommendations, the study aims to improve the quality of neonatal care and reduce preventable and treatable causes of neonatal mortality and morbidity by emphasizing areas of success and areas for improvement. Furthermore, no local district data compare the management of jaundice in neonates with international guidelines. Therefore, this clinical audit is a quality improvement initiative in this regard.

Study objectives

Primary Objective

The primary objective of this study is to assess adherence to the 2023 NICE guidelines for the management of neonatal jaundice in neonates admitted to the Level 2 Neonatology Unit of Maternity Hospital.

Secondary Objectives

The secondary objectives of this study are (i) to evaluate compliance with NICE recommendations regarding serum bilirubin measurement, phototherapy indications, and bilirubin monitoring frequency; (ii) to assess documentation of jaundice risk factors, parental education, and follow-up plans regarding the management of neonatal jaundice; and (iii) to identify gaps in guideline adherence and areas for improvement in neonatal jaundice management.

Materials And Methods

Around 46 neonates admitted and diagnosed with visually apparent jaundice or at risk of jaundice at the Neonatal Unit of Maternity Hospital were included from February 2024 to April 2024. The audit was conducted after obtaining approval from the relevant Institutional Ethics Committee. Before the babies were selected, informed consent was obtained from the parents/caregivers of the babies.

Neonates with jaundice managed according to the departmental guidelines were compared with NICE guidelines. Information was obtained from the parents as well as from hospital records using a predesigned questionnaire developed by the researcher for the study. The babies were also examined generally to determine their weight on admission, severity of jaundice, and whether phototherapy was needed. Blood samples were collected from the babies for serum total, conjugated, and unconjugated bilirubin, full blood count, blood groups, random blood glucose, and blood culture, and the babies were managed according to the institutional protocol.

Data regarding patient education were also collected. Patient education included the causes of jaundice; how to recognize jaundice in a baby; what to do if a baby had jaundice; the significance of identifying jaundice on the first day of life and seeking immediate medical attention; the importance of monitoring the baby's urine and stool color; reassurance that jaundice in newborns is very common and that most cases are benign and self-resolving; reassurance that the baby can continue breastfeeding; the likely duration of treatment; and reassurance that breastfeeding, diaper changing, and cuddling can usually continue during phototherapy.

The data obtained were uploaded into IBM SPSS Statistics for Windows, Version 26 (Released 2018; IBM Corp., Armonk, NY, USA) and analyzed. Qualitative variables were expressed as frequencies and percentages, and cross-tabulation was performed to examine the relationship between two categorical variables. The association between two qualitative variables would be tested using the chi-square test. Given the small sample size and the presence of zero or small expected cell counts, Fisher's exact test was considered where applicable. A p-value of less than 0.05 would be considered statistically significant.

Summary of NICE guidelines

Neonates should be considered at increased risk of jaundice if the gestational age is less than 38 weeks, a previous sibling had neonatal jaundice requiring phototherapy, the baby is exclusively breastfed, or the baby has visible jaundice in the first 24 hours of life. These babies should be visually examined for jaundice, especially within the first 72 hours of life [11].

If visible jaundice is present within the first 24 hours of life, the serum bilirubin concentration should be measured by the clinical laboratory within two hours and every six hours thereafter until the bilirubin concentration is below the age-dependent cutoff in the treatment threshold graph.

If visible jaundice develops after the first 24 hours of life and the neonate has a gestational age of >35 weeks, the bilirubin should be measured using a transcutaneous bilirubinometer within six hours. If the bilirubin is >250 μmol/L or such an instrument is not available, a laboratory serum bilirubin measurement is required.

Treatment of jaundice should be provided by phototherapy or exchange transfusion according to the NICE graphs. Neonates at increased risk of hyperbilirubinemia who do not become visibly jaundiced within 72 hours of birth can receive routine care.

Results

Respondents profile information

Table *1* provides a comprehensive overview of various variables related to neonatal jaundice management, with frequencies and percentages illustrating the distribution within the sample of 46 neonates at Lady Willingdon Hospital. These variables show important aspects such as age, gender, gestational age, weight, clinical assessments, interventions, deviations from guidelines, reasons for deviation, recommendations, and feeding practices.

Variables	Frequency (N=46)	Percentages (%)
Neonates age (in days)		
1	3	6.5%
2-7	41	89.1%
Above 7	2	4.3%
Gender		
Females	24	52.2%
Males	22	47.8%
Gestational age		
28-32	7	15.2%
33-37	35	76.1%
38 and above	4	8.7%
Weight		
Less than 2.5	13	28.3%
2.5-3.2	29	63.0%
Above 3.2	4	8.7%
Jaundice on visual inspection		
Yes	42	91.3%
No	4	8.7%
SBT Level		
In phototherapy range	10	21.7%
Out of phototherapy range	36	78.3%
Phototherapy		
Yes	10	21.7%
No	21	45.7%
Not Needed	15	32.6%

Bilirubin monitoring		
Yes	24	52.2%
No	22	47.8%
Documentation of risk		
Yes	40	87.0%
No	6	13.0%
Follow-up plans		
Yes	39	84.8%
No	7	15.2%
Patient education		
Yes	43	93.5%
No	3	6.5%
Deviation from guidelines		
Yes	21	45.7%
No	25	54.3%
Reason for deviation		
Lab reports not timely delivered	7	15.2%
Preterm sick child with minimal sampling	12	26.1%
Limited resources for investigations	2	4.3%
No deviations found	25	54.3%
Recommendations		
Not followed guidelines: lab coordination needed for timely delivery of lab reports; transcutaneous bilirubinometer recommended; proper resource reallocation	21	45.7%
Followed guidelines	25	54.3%
Feeding practices		
Mother feed	28	60.9%
Formula feed	11	23.9%
Feed not started	7	15.2%

TABLE 1: Respondents profile information

$p < 0.05$ was considered statistically significant.

SBT: serum bilirubin level

The data from Table *1* reveal important aspects of neonatal jaundice management at the Neonatal Unit of Maternity Hospital. Around 89.1% (N = 41/46) of neonates were aged two to seven days, with a mean ± SD of 3.17 ± 1.371 days and a median of three days (range: 1-10 days), suggesting a critical period for jaundice susceptibility. There were gender-based differences in jaundice occurrence (52.2% females (N = 24/46) and 47.8% males (N = 22/46)). Most neonates (76.1% (N = 35/46)) were born between 33 and 37 weeks of gestation, with a mean ± SD of 35.07 ± 2.768 weeks and a median of 36 weeks (range: 28-40 weeks), indicating an increased risk of jaundice among preterm and post-term cases.

Around 63.0% (N = 29/46) of neonates (Table *1*) weighed within the reported normal range of 2.5-3.2 kg, with a mean ± SD of 2.17 ± 0.677 kg and a median of 2.3 kg (range: 0.7-3.4 kg), suggesting that jaundice could affect normal-weight babies as well as those with low birth weight. Visual jaundice was prevalent (91.3% (N

= 42/46)), but only 21.7% (N = 10/46) had serum bilirubin levels requiring phototherapy, suggesting that factors other than visual inspection can affect the decision to initiate phototherapy. Interventions were proactive: 21.7% (N = 10/46) received phototherapy, and 52.2% (N = 24/46) had bilirubin monitoring. Risk factor documentation and follow-up plans were high (87% (N = 40/46) and 84.8% (N = 39/46), respectively), indicating adherence to guidelines in these areas (Table *1*).

Patient education (Table *1*) was thorough, with 93.5% (N = 43/46) of caregivers being informed. Counseling addressed signs of worsening jaundice and feeding practices. Deviations from guidelines were noted in 45.7% (N = 21/46) of cases, suggesting the need for better coordination and resource allocation. Feeding practices in Table *1* were diverse: 60.9% (N = 28/46) were fed breast milk, 23.9% (N = 11/46) were fed formula, and feeding had not started in 15.2% (N = 7/46).

In conclusion, these findings suggested adherence to guidelines regarding risk factor assessment, patient education, bilirubin monitoring, and follow-up plans. Recommendations included improved coordination with the laboratory, the use of other monitoring tools such as a transcutaneous bilirubinometer, and the promotion of breastfeeding. There was 54.3% (N = 25/46) adherence to NICE guidelines in the local setting, compared with the 100% standard, emphasizing the need for improvement.

Evaluation of adherence and implementation of NICE guidelines for neonatal jaundice at local hospital

Table *2* evaluates adherence to and implementation of NICE guidelines for neonatal jaundice based on the visual inspection of jaundice. It shows the relationship between visual inspection findings and serum bilirubin levels, phototherapy, bilirubin monitoring, documentation of risk factors, follow-up plans, patient education, and feeding practices.

Association of jaundice on visual inspection with SBT level						
Jaundice on visual inspection	SBT			Chi-square	p-value	Fisher exact test
	In phototherapy range	Out of phototherapy range	Total			
Yes	10	32	42	1.217	0.270	0.562
No	0	4	4			
Total	10	36	46			

Association of jaundice on visual inspection with phototherapy							
Jaundice on visual inspection	Phototherapy				Chi-square	p-value	Fisher exact test
	Yes	No	Not needed	Total			
Yes	10	17	15	42	5.215	0.074	0.129
No	0	4	0	4			
Total	10	21	15	46			

Association of jaundice on visual inspection with bilirubin monitoring						
Jaundice on visual inspection	Bilirubin monitoring			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	24	18	42	4.779	0.029*	0.045
No	0	4	4			
Total	24	22	46			

Association of jaundice on visual inspection with documentation of risk						
Jaundice on visual inspection	Documentation of risk			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	36	6	42	0.643	0.423	1.000
No	4	0	4			

Total	40	6	46			
Association of jaundice on visual inspection with follow-up plans						
Jaundice on visual inspection	Follow-up plans			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	39	3	42			
No	0	4	4	24.408	0.000*	0.000
Total	39	7	46			
Association of jaundice on visual inspection with patient education (based on NICE guidelines)						
Jaundice on visual inspection	Patient education			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	40	2	42			
No	3	1	4	2.454	0.117	0.244
Total	43	3	46			
Association of jaundice on visual inspection with feeding practices						
Jaundice on visual inspection	Feeding practices				Chi-square	p-value	Fisher exact test
	Mother feed	Formula feed	Feed not started	Total			
Yes	24	11	7	42			
No	4	0	0	4	2.816	0.245	0.333
Total	28	11	7	46			

TABLE 2: Comparison of the frequency of neonates with jaundice on visual inspection with serum bilirubin levels, phototherapy, bilirubin monitoring, documentation of risk factors, follow-up plans, patient education, and feeding practices

$p < 0.05$ was considered statistically significant. Values marked with * are statistically significant.

SBT: serum bilirubin levels

Table 2 identifies correlations between jaundice detected through visual inspection in neonates and several key factors relevant to their care.

The relationship between visual jaundice and serum bilirubin levels reveals no significant association between these variables (chi-square = 1.217, $p = 0.270$), indicating that visual jaundice alone may not reliably predict the need for phototherapy. Table 2 demonstrates that, out of 42 cases of visual jaundice, 10 received phototherapy, while 32 did not. Although the chi-square value (5.215) suggests a possible association, the p-value (0.074) indicates that this association is not statistically significant, implying the involvement of factors other than visual inspection in treatment decisions.

There is a significant association between visual jaundice and the need for monitoring (chi-square = 4.779, $p = 0.029$), suggesting that visual inspection is a valuable indicator for assessing the need to monitor serum bilirubin levels in neonates. Moreover, Table 2 reveals that the association between jaundice detected through visual inspection and documentation of risk factors was not statistically significant (chi-square = 0.643, $p = 0.423$; Fisher's exact test, $p = 1.000$). Therefore, there was insufficient evidence to demonstrate a statistically significant association between jaundice detected through visual inspection and documentation of risk factors in the study population. This finding may reflect the high prevalence of visible jaundice and frequent documentation of risk factors in the study population, alongside the small sample size and limited variability between groups. However, the absence of statistical significance does not establish the absence of an association.

Table 2 also examines the association between visual jaundice and the formulation of follow-up plans.

Among the 42 cases with visual jaundice, 39 had documented follow-up plans, while three did not. This finding emphasizes the need for post-treatment monitoring and care for neonates with jaundice.

Regarding patient education (Table 2), there is a borderline association between the provision of education and jaundice detected through visual inspection, indicating the need for improvement in this area. In terms of feeding practices among the neonates, 24 were breastfed, 11 received formula, and seven had not started feeding. The chi-square value of 2.816 and a p-value of 0.245 indicate no statistically significant association between visual jaundice and specific feeding practices, suggesting that factors other than feeding practices may influence the presence of jaundice on visual inspection (Table 2).

In summary, the comprehensive analysis of Table 2 highlights the multifaceted aspects of neonatal jaundice management, emphasizing the roles of risk documentation, clinical assessment, monitoring, and follow-up plans in improving the quality of care for neonates with jaundice. Areas for improvement, such as initiating phototherapy based on serum bilirubin levels rather than visual inspection alone and ensuring adequate patient education, are also identified.

Table 3 presents a detailed analysis of the relationship between the documentation of risk factors and various aspects of neonatal jaundice management. It evaluates adherence to and implementation of NICE guidelines for neonatal jaundice based on the documentation of risk factors identified during visual inspection, with a particular focus on serum bilirubin levels, phototherapy, bilirubin monitoring, follow-up plans, patient education, and feeding practices.

Association of documentation of risks with SBT level

Documentation of risks	SBT			Chi-square	p-value	Fisher exact test
	In phototherapy range	Out of phototherapy range	Total			
Yes	10	30	40	1.917	0.166	0.315
No	0	6	6			
Total	10	36	46			

Association of documentation of risks with phototherapy

Documentation of risks	Phototherapy				Chi-square	p-value	Fisher exact test
	Yes	No	Not needed	Total			
Yes	10	15	15	40	8.214	0.016*	0.018
No	0	6	0	6			
Total	10	21	15	46			

Association of documentation of risks with bilirubin monitoring

Documentation of risks	Bilirubin monitoring			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	24	16	40	7.527	0.006*	0.008
No	0	6	6			
Total	24	22	46			

Association of documentation of risks with jaundice on visual inspection

Documentation of risks	Jaundice on visual inspection			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	36	4	40	0.643	0.423	1.000
No	6	0	6			
Total	42	4	46			

Association of documentation of risks with follow-up plans

						Fisher exact

Documentation of risks	Follow-up plans			Chi-square	p-value	test
	Yes	No	Total			
Yes	38	2	40			
No	1	5	6	24.814	0.000*	0.000
Total	39	7	46			

Association of documentation of risks with patient education (based on NICE guidelines)

Documentation of risks	Patient education			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	40	0	40			
No	3	3	6	21.395	0.000*	0.001
Total	43	3	46			

Association of documentation of risks with feeding practices

Documentation of risks	Feeding practices				Chi-square	p-value	Fisher exact test
	Mother feed	Formula feed	Feed not started	Total			
Yes	22	11	7	40			
No	6	0	0	6	4.436	0.109	0.110
Total	28	11	7	46			

TABLE 3: Comparison of the frequency of neonates with documented risk factors in relation to serum bilirubin levels (SBT), phototherapy, bilirubin monitoring, jaundice on visual inspection, follow-up plans, patient education, and feeding practices

$p < 0.05$ was considered statistically significant. Values marked with * are statistically significant.

SBT: serum bilirubin levels

When considering the relationship between the documentation of risk factors and serum bilirubin levels, out of 40 cases with documented risks, 10 were within the phototherapy range based on serum bilirubin levels, while 30 were not. Statistical analysis shows no significant association between these variables (chi-square = 1.917, $p = 0.166$), indicating that documentation of risk factors alone may not reliably predict the need for phototherapy based on serum bilirubin levels.

Regarding the significant association between the documentation of risk factors and the actual administration of phototherapy (Table *3*; chi-square = 8.214, $p = 0.016$), it is important to note that documented risks may influence the decision to administer phototherapy. Similarly, the correlation between the documentation of risk factors and the need to monitor serum bilirubin levels, with 24 cases requiring monitoring and 16 not requiring it, showed a significant association (chi-square = 7.527, $p = 0.006$). Therefore, this significant difference implies that serum bilirubin levels should be monitored when a baby has risk factors for jaundice.

Moreover, Table *3* reveals a statistically insignificant association (chi-square = 0.643, $p = 0.423$) between visual jaundice and the documentation of risk factors, likely for the reasons explained above.

Additionally, Table *3* highlights a significant correlation between the documentation of risk factors and the formulation of follow-up plans. Among the 40 cases with documented risks, 38 had follow-up plans, while two did not, highlighting the necessity of structured post-treatment follow-up monitoring and care in cases with documented risks.

In terms of patient education (Table *3*), all 40 cases with documented risks received education according to NICE guidelines. The statistical analysis yielded a highly significant association (chi-square = 21.395, $p < 0.001$), emphasizing the importance of education in managing neonatal jaundice effectively and ensuring that caregivers are well informed about risk factors and necessary precautions.

Regarding feeding practices (Table 3), among the 40 cases with documented risks, 22 neonates were fed breast milk, 11 received formula, and seven had not started feeding. The statistical analysis yielded a chi-square value of 4.436 and a p-value of 0.109, indicating no statistically significant association between the two variables and highlighting the need for comprehensive assessments and individualized care plans.

Identification of deviations

Table 4 presents an analysis of deviations from guidelines, reasons for deviation, and recommendations in neonatal jaundice management based on visual inspection.

Association of jaundice on visual inspection with deviation from guidelines

Jaundice on visual inspection	Deviation from guidelines			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	21	21	42	3.680	0.055	0.114
No	0	4	4			
Total	21	25	46			

Association of jaundice on visual inspection with reason for deviation

Jaundice on visual inspection	Reason for deviation					Chi-square	p-value	Fisher exact test
	Lab reports not delivered promptly	Preterm sick child with minimal sampling	Limited resources for investigations	No deviations found	Total			
Yes	7	12	2	21	42	3.680	0.298	0.458
No	0	0	0	4	4			
Total	7	12	2	25	46			

Association of jaundice on visual inspection with recommendations

Jaundice on visual inspection	Recommendations			Chi-square	p-value	Fisher exact test
	Not followed guidelines	Followed guidelines	Total			
Yes	17	25	42	5.215	0.022*	0.037
No	4	0	4			
Total	21	25	46			

TABLE 4: Comparison of the frequency of neonates with jaundice on visual inspection in relation to deviations from guidelines, reasons for deviation, and recommendations

$p < 0.05$ was considered statistically significant. Values marked with * are statistically significant.

Table 4 provides an analysis of deviations from guidelines in neonatal jaundice management based on visual inspection, along with the reasons for these deviations and corresponding recommendations. Of the 42 cases assessed visually for jaundice, 21 exhibited deviations from guidelines, while 21 adhered to them. A chi-square value of 3.680 and a p-value of 0.055 indicate a borderline association between visual jaundice and guideline adherence. Further examination of the reasons for deviations revealed delayed delivery of laboratory reports (seven cases), preterm illness necessitating minimal sampling (12 cases), and limited resources for investigations (two cases). However, the statistical analysis yielded a chi-square value of 3.680 and a p-value of 0.298, suggesting no significant association between visual jaundice and specific reasons for deviation and indicating that other reasons for deviations from guidelines should also be investigated.

Additionally, Table 4 highlights recommendations based on guideline adherence. Among the 42 cases with visual jaundice, 17 did not follow the guidelines, while 25 adhered to them. The chi-square value of 5.215 and a p-value of 0.022 indicate a statistically significant association between visual jaundice and adherence

to guidelines, emphasizing that, although some deviations occurred due to limited resources, the guidelines were followed in many cases.

In summary, Table 4 emphasizes the importance of adherence to guidelines in the management of neonatal jaundice based on visual inspection. It identifies common reasons for deviations and emphasizes the significance of following recommended practices to improve patient outcomes. Further attention to guideline adherence and addressing the reasons for deviations are crucial for improving the quality of care for neonates with visual jaundice.

Table 5 presents an analysis of deviations from guidelines, reasons for deviation, and recommendations in neonatal jaundice management based on documented risks.

Association of documentation of risk with deviation from guidelines

Documentation of risks	Deviation from guidelines			Chi-square	p-value	Fisher exact test
	Yes	No	Total			
Yes	21	19	40	5.796	0.016*	0.025
No	0	6	6			
Total	21	25	46			

Association of documentation of risks with reason for deviation

Documentation of risks	Reason for deviation					Chi-square	p-value	Fisher exact test
	Lab report not delivered promptly	Preterm sick child with minimal sampling	Limited resources for investigations	No deviations found	Total			
Yes	7	11	2	20	40	2.651	0.449	0.684
No	0	1	0	5	6			
Total	7	12	2	25	46			

Association of documentation of risks with recommendations

Documentation of risks	Recommendations			Chi-square	p-value	Fisher exact test
	Not followed guidelines	Followed guidelines	Total			
Yes	15	25	40	8.214	0.004*	0.006
No	6	0	6			
Total	21	25	46			

TABLE 5: Comparison of the frequency of neonates with documented risk factors in relation to deviations from guidelines, reasons for deviation, and recommendations

$p < 0.05$ was considered statistically significant. Values marked with * are statistically significant.

Table 5 provides a detailed assessment of the relationship between the documentation of risk factors in neonatal jaundice cases and several key aspects, including deviations from guidelines, reasons for deviations, and corresponding recommendations. Table 5 shows that, out of 40 cases with documented risks, 21 exhibited deviations from guidelines, while 19 adhered to them. The statistical analysis revealed a significant association (chi-square = 5.796, $p = 0.016$) between the documentation of risk factors and deviations from guidelines, indicating that factors other than risk assessment played a role in neonatal jaundice management.

Further exploration of the reasons for deviations (Table 5) revealed that, among cases with documented risks, seven involved delayed delivery of laboratory reports, 11 were associated with preterm and sick neonates requiring minimal sampling, two were attributed to limited resources for investigations, and no deviations were found in 20 cases. The statistical analysis indicated no significant association (chi-square = 2.651, $p = 0.449$) between the documentation of risk factors and specific reasons for deviation, suggesting

that risk documentation is not the sole factor in determining deviations from guidelines.

Moreover, Table *5* highlights recommendations based on risk factor assessment in neonatal jaundice management. Among the cases with documented risks, 15 did not follow the guidelines, while 25 adhered to them. The statistical analysis demonstrated a significant association (chi-square = 8.214, p = 0.004) between the documentation of risk factors and adherence to guidelines, emphasizing the importance of thorough risk documentation in promoting adherence to evidence-based practices.

In summary, Table *5* reveals the critical role of risk documentation in neonatal jaundice management and highlights adherence to guidelines, although areas for improvement remain.

Discussion

The present study has shown that neonatal jaundice is a common neonatal disorder in our setting (91.3%; N = 42/46) and thus a common cause of morbidity and mortality. This finding is consistent with the results of available studies, which showed that neonatal jaundice is one of the leading causes of neonatal morbidity and mortality worldwide [6-8].

This study showed that, although guidelines were followed in the local setting, there were potential areas for improvement, such as the inability to obtain samples from sick and preterm neonates promptly. In such cases, the availability of a transcutaneous bilirubinometer could have helped. Other reasons identified were delays in laboratory test results and limited resources. These findings are consistent with those of a clinical audit conducted at a mission hospital in Western Nigeria [1]. This audit in Nigeria also suggested providing effective equipment, such as a transcutaneous bilirubinometer, and educating parents to prevent neonatal jaundice and complications associated with it, such as acute bilirubin encephalopathy, thereby improving neonatal health outcomes.

This clinical audit emphasizes the need for patient education, which has also been highlighted in other studies. A study conducted in Ghana showed that “Out of the 175 respondents, 135 (77.1%) had heard about neonatal jaundice but only 7(5.2%) knew one or more correct forms of treatment of it; 67(49.6%) knew one or more danger signs and 86(63.5%) knew one or more complications” [3].

An audit conducted in the UK in 2011 showed poor performance in identifying risk factors for jaundice (15% compared with the 100% standard). Our audit showed 87% (N = 40/46) adherence to the documentation of risk factors in the management of neonatal jaundice. There was 90% compliance with NICE guidelines (standard: 100%) regarding serum bilirubin measurement for infants with jaundice. However, our study demonstrates that all neonates who were either visibly jaundiced or had a risk factor for jaundice. Significant variation between the two studies was noted in the measurement of jaundice using a transcutaneous bilirubinometer. The audit conducted by Ravindran and Ashraf showed that 83% of infants (29/35) with jaundice onset >24 hours had a transcutaneous bilirubin measurement, which reduced the number of blood tests performed on these infants [4]. Although a transcutaneous bilirubinometer is not available in our setting, this finding highlights an area for improvement. There was also variation regarding patient education, with only 75% of the parents of infants with jaundice receiving information leaflets on newborn jaundice. Our study demonstrated that 93% of parents of infants with neonatal jaundice received patient education [4].

This audit provides real-world evidence of adherence to the 2023 NICE neonatal jaundice guidelines in a Level 2 Neonatal Unit of a Pakistani maternity hospital. Overall adherence was 54.3% (N = 25/46), identifying important gaps in bilirubin assessment, monitoring, and documentation. The findings highlight the limitations of visual assessment alone and support standardized bilirubin measurement and management. This study provides a locally relevant baseline for targeted staff education, standardized protocols, quality improvement interventions, and subsequent re-audits to improve neonatal care and safety.

In one of the audits conducted in Ghana, it was found that many physicians in low-resource settings were required to treat newborns presumptively when jaundice was suspected on visual inspection rather than wait for serum laboratory test results, as rapid diagnostic tools, such as transcutaneous bilirubin meters, were unavailable. This was also the case in the present audit [12].

Overall, this audit is important for identifying areas for improvement in the screening and management of neonatal jaundice, given the high incidence of hyperbilirubinemia in newborns. This is reflected in a study conducted by Tikmani et al. [13], which reported a detected rate of neonatal jaundice of 39.7 per 1,000 live births in developing countries such as Pakistan. Moreover, severe hyperbilirubinemia is associated with kernicterus. Informed guidance on hyperbilirubinemia management, including preventive treatment thresholds, is essential to safely minimize neurodevelopmental risks, as suggested in a study conducted by Slaughter et al. in 2022 [14]. Several studies have suggested that phototherapy may elicit a series of short- and long-term harmful effects associated with conditions including hemolysis, allergic diseases, DNA damage, and even cancer [15,16]. Therefore, adopting a standardized approach to phototherapy treatment thresholds is important for neonates with jaundice.

Another international guideline for the management of hyperbilirubinemia in neonates is provided by the American Academy of Pediatrics (AAP). However, the AAP considers gestational age, postnatal age, and neurotoxicity risk factors, whereas NICE primarily uses gestational and postnatal age. Therefore, treatment decisions may differ between the two guidelines. These differences reflect variations in guideline methodology rather than the quality of care. The AAP guideline provides useful international context supporting objective bilirubin assessment, appropriate treatment thresholds, monitoring, and follow-up. In this study, NICE was used as the primary audit standard because it was the guideline selected for assessing local practice in this setting. The AAP guideline was not used as a separate audit standard because differences in treatment thresholds and risk stratification could result in different assessments of compliance [2,17]. Another international comparator is the guideline provided by the Canadian Paediatric Society [18]. A study conducted by Zhang et al. [19] also compared NICE, AAP, and other international guidelines and highlighted differences in bilirubin measurement, visual assessment, phototherapy, and follow-up.

Strengths of the study

This audit uses recognized evidence-based standards. The study was conducted in a Level 2 Neonatology Unit of a maternity hospital, making the findings directly relevant to routine neonatal care in a resource-limited or local setting. Moreover, the audit evaluated several important aspects of jaundice management, including clinical assessment, serum bilirubin measurement, phototherapy, bilirubin monitoring, documentation of risk factors, patient education, and follow-up planning, rather than focusing on treatment alone. The audit also demonstrated relatively high compliance in areas such as risk-factor documentation (87%), follow-up planning (84.8%), and patient education (93.5%), allowing the unit to recognize and maintain existing good practices. By identifying overall adherence of 54.3% compared with the expected standard of 100%, the study provides a baseline from which interventions, staff education, protocols, and subsequent re-auditing can be developed.

Limitations of the study

This audit has a small sample size, as only 46 neonates were included. This limits the statistical power of the study and reduces the ability to generalize the findings to the wider neonatal population. It is a single-center study. The audit was conducted in one neonatal unit, so the results may not be representative of other hospitals, neonatal units, or healthcare settings in Pakistan. The data were obtained from existing medical records; therefore, the study depended on the accuracy and completeness of the documentation. Missing documentation may have been interpreted as non-adherence, even when an action was performed but not recorded.

Conclusions

In conclusion, while the audit indicates satisfactory levels of guideline adherence in certain areas of neonatal jaundice management, it also highlights significant areas for improvement. Addressing these gaps is crucial for optimizing care outcomes in the management of neonatal jaundice at the local hospital. By focusing on enhanced training, resource allocation, and a strengthened review process, the hospital can better meet the standards set forth in the NICE guidelines.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Maryam Shahid, Abdullah Hussain

Acquisition, analysis, or interpretation of data: Maryam Shahid, Rukiya Tariq

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Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. Institutional Review Board issued approval 330/RC/KEMU. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the

submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

Acknowledgements

We acknowledge the efforts of the staff at the hospital where this quality improvement project was carried out.

References

1. Idowu JM: Audit of neonatal jaundice as experienced at a mission hospital in Western Nigeria . Open J Pediatr. 2024, 14:50-62. 10.4236/ojped.2024.141006
2. Kemper AR, Newman TB, Slaughter JL, et al.: Clinical practice guideline revision: management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2022, 150:58859. 10.1542/peds.2022-058859
3. Amegan-Aho KH, Segbefia CI, Glover ND, Ansa GA, Afaa TJ: Neonatal jaundice: awareness, perception and preventive practices in expectant mothers. Ghana Med J. 2019, 53:267-72. 10.4314/gmj.v53i4.3
4. Ravindran R, Ashraf T: 1327 audit on management of neonatal jaundice . Arch Dis Child. 2012, 97:378. 10.1136/archdischild-2012-302724.1327
5. Injustice to an “alma mater” . (2014). https://www.dawn.com/news/1085228.
6. Ipek IO, Bozaykut A: Clinically significant neonatal hyperbilirubinemia: an analysis of 646 cases in Istanbul . J Trop Pediatr. 2008, 54:211-3. 10.1093/tropej/fmm115
7. Udo JJ, Anah MU, Ochigbo SO, Etuk IS, Ekanem AD: Neonatal morbidity and mortality in Calabar, Nigeria: a hospital-based study. Niger J Clin Pract. 2008, 11:285-9.
8. Okechukwu AA, Achonwa A: Morbidity and mortality patterns of admissions into the special care baby unit of University of Abuja Teaching Hospital, Gwagwalada. Niger J Clin Pract. 2009, 12:389-94.
9. Ekwochi U, Ndu IK, Nwokoye IC, Ezenwosu OU, Amadi OF, Osuorah D: Pattern of morbidity and mortality of newborns admitted into the sick and special care baby unit of Enugu State University Teaching Hospital, Enugu state. Niger J Clin Pract. 2014, 17:346-51. 10.4103/1119-3077.130238
10. Abbey P, Kandasamy D, Naranje P: Neonatal jaundice. Indian J Pediatr. 2019, 86:830-41. 10.1007/s12098-019-02856-0
11. Jaundice in newborn babies under 28 days . (2023). Accessed: April 17, 2024: https://www.nice.org.uk/guidance/cg98.
12. Bakari A, Wolski AV, Otoo B, et al.: Neonatal jaundice treatment versus recommendations: the challenge of treatment without rapid diagnostic capability. Int J Environ Res Public Health. 2025, 22:1032. 10.3390/ijerph22071032
13. Tikmani SS, Warraich HJ, Abbasi F, et al.: Incidence of neonatal hyperbilirubinemia: a population-based prospective study in Pakistan. Trop Med Int Health. 2010, 15:502-7.
14. Slaughter JL, Kemper AR, Newman TB: Technical report: diagnosis and management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2022, 150:8865. 10.1542/peds.2022-058865
15. Wang J, Guo G, Li A, Cai WQ, Wang X: Challenges of phototherapy for neonatal hyperbilirubinemia (review). Exp Ther Med. 2021, 21:231. 10.3892/etm.2021.9662
16. Chu L, Xue X, Qiao J: Efficacy of intermittent phototherapy versus continuous phototherapy for treatment of neonatal hyperbilirubinaemia: a systematic review and meta-analysis. J Adv Nurs. 2021, 77:12-22. 10.1111/jan.14535
17. American Academy of Pediatrics Subcommittee on Hyperbilirubinemia: Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. Pediatrics. 2004, 114:297-316. 10.1542/peds.114.1.297
18. Barrington KJ, Sankaran K; Canadian Paediatric Society, Fetus and Newborn Committee: Guidelines for detection, management and prevention of hyperbilirubinemia in term and late preterm newborn infants. Paediatr Child Health. 2007, 12:1-12. 10.1093/pch/12.suppl_B.1B
19. Zhang M, Tang J, He Y, et al.: Systematic review of global clinical practice guidelines for neonatal hyperbilirubinemia. BMJ Open. 2021, 11:e040182. 10.1136/bmjopen-2020-040182