



Original Research Article

QUALITY IMPROVEMENT STRATEGIES FOR PREVENTING DIAPER DERMATITIS IN HOSPITALIZED NEONATES: INSIGHTS FROM A TERTIARY CARE NEONATAL CENTRE

Akanksha Bansal¹, Vikram Bedi², Parul Bedi³, Ramneek Singh Bedi⁴, Gulpreet Kaur Bedi⁵, Raveena Bedi⁶, Ravi Sahota⁷, Akshdeep Kaur⁸, Navjot Puri⁹, Shivani¹⁰

¹Consultant, Department of Neonatology, Bedi Hospital, Chandigarh, India.

²MD, FNNF Head, Department of Neonatology Bedi Hospital, Chandigarh, India.

³Consultant, Department of Gynecology & Obstetrics, Bedi Hospital, Chandigarh, India.

⁴DCH, MD Head, Department of Pediatrics, Bedi Hospital, Chandigarh, India.

⁵MBBS, DGO Head, Department of Gynecology & Obstetrics, Bedi Hospital, Chandigarh, India.

⁶Consultant Radiologist ASL Scans & Diagnostic Center Chandigarh, India.

⁷MBBS DCh Fellowship in Neonatology IPPC FRSPH Head, Department of Pediatrics, Sahota Superspeciality Hospital, Kashipur, Uttarakhand, India.

⁸Senior Resident, Department of Neonatology, Bedi Hospital, Chandigarh, India.

⁹Consultant, Department of Neonatology, Bedi Hospital, Chandigarh, India.

¹⁰Department of Pediatrics, Sahota Superspeciality Hospital, Kashipur, Uttarakhand, India.

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Corresponding Author:

Dr. Vikram Bedi

MD, FNNF Head, Department of Neonatology Bedi Hospital, Chandigarh, India.
Email: dr.vsbedi@gmail.com

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ABSTRACT

Background: Diaper Dermatitis (DD) is a significant problem in newborns and infants. Newborns admitted to the NICU are at significant risk of skin barrier damage due to various factors. Generally, it is mild, but sometimes, it can be more aggressive, leading to secondary infections. It is one of the significant stress creators for parents and caregivers. Diaper dermatitis can be prevented by raising awareness and implementing simple measures such as hand hygiene, gentle skin care, frequent diaper care and educating staff and parents. **Objective:** To decrease the percentage of diaper dermatitis from 30% to 15% over a period of 6 months in newborns admitted to the NICU.

Materials and Methods: A quality improvement (QI) study was conducted in the level-3 NICU of a mother and child hospital. In the baseline phase from June 24 to November 24, all newborns admitted to the NICU, who developed diaper dermatitis were recorded. Root cause analysis was done, and various modifiable factors were identified and dealt with in the intervention phase lasting from December 24 to May 25 by multiple plan-do-study-act (PDSA) cycles. These PDSA cycles included raising awareness about the increasing number of diaper dermatitis cases in NICU, focused diaper and skin care routine, frequent diaper and position changing, and using a mnemonic. The total number of admissions and diaper dermatitis cases in each month was noted and entered in excel sheets and analyzed over run charts. The sustenance phase was conducted in June 25 to see the effectiveness of the PDSA cycles.

Results: The percentage of diaper dermatitis was 31.90% (68/213) in the observation phase, which declined to 15.90% (27/169) in the intervention phase. Reduction in the sustenance phase was 6.66% (2/30).

Conclusion: Educating parents and nursing staff regarding diaper dermatitis and training sessions on proper diaper and skin care led to a significant reduction in diaper dermatitis cases in the NICU.

Keywords: Diaper dermatitis, Skin Care, Diaper Care, NICU, Prevention.

INTRODUCTION

Problem description

Diaper dermatitis (DD), also known as napkin dermatitis, nappy rash, or diaper rash, is a nonspecific term used to describe any inflammatory reaction of the skin in the diaper area.

It is one of the most common skin conditions that neonates and infants face in their first few days of life.^[1,2] Infants in the neonatal intensive care unit (NICU) are more prone to skin barrier damage due to various factors related to their condition, like prematurity, sepsis, and the medical interventions they receive.^[3] It is one of the significant causes of discomfort and emotional distress to parents and creates possible sources of infection among newborn intensive care unit infants.^[4]

Within the literature, there is a wide variation in the reported frequency of diaper dermatitis cases. Estimates range from 25% of infants to the majority of children being affected to some degree before the age of 2 years.^[5-9] A US survey of 482 neonatal units looking at extremely low birthweight babies found that an average of 21% suffered skin breakdown during the first week of life.^[10,11]

Though the direct etiology of DD is unknown, some multifactorial factors have been identified, which include moisture, warmth, friction, urine, faeces, microbes, and chemicals that cause a complex interplay in causing DD. Skin contact with urine and faeces plays an integral role as moisture trapped against the skin causes changes in pH, increased permeability and susceptibility to damage from friction.^[12] Once the stratum corneum is damaged, microbes are more likely to cause inflammation and can lead to the development of a secondary infection.^[13] Neonatal skin is highly fragile, especially in the critically ill. Many factors affect the skin, specifically the diaper region, causing dermatitis, skin breakdown that can lead to open, bleeding ulcers.^[14]

The stratum corneum is thinner and is less protective in premature infants when compared to full-term infants, making them more prone to infection.^[15] In infants born between 30 and 32 weeks of gestational age, the full barrier function develops only 2–4 weeks after birth, indicating that premature infants are particularly sensitive to the development of diaper dermatitis.^[16,17]

Most common types of diaper dermatitis are chaffing dermatitis, irritant contact dermatitis, and diaper candidiasis.^[18,19] Amongst them, irritant contact dermatitis is the most predominant form of diaper dermatitis.^[19]

DD can be prevented with optimum skin care. Evidence-based care standards using tools and algorithms promote optimal skin care and positive patient outcomes.^[14] Management of diaper dermatitis focuses on two major objectives: acceleration of healing of the damaged skin and prevention of a recurring rash. Diaper dermatitis can

be prevented and treated by providing parental support and educating parents, care givers, and health care workers.^[16]

Various studies have been done to prevent the occurrence of diaper dermatitis in infants, but this QI study was conducted to specifically reduce the number of DD cases in newborns admitted to a tertiary-level NICU.

Specific Aim: The specific objective of this Quality Improvement study was to decrease the percentage of Diaper Dermatitis cases in NICU from baseline 30% in the last 6 months (June 24–Nov 24) to 15% in the next 6 months (December 24–May 25).

MATERIALS AND METHODS

Context

This quality improvement study was conducted in a private tertiary-level mother and child Hospital with a level III NICU in north India over a period of 6 months from December 2024 to May 2025. The unit comprises of 13-bedded NICU. It was based on the WHO point of care quality improvement (POCQI) model.^[20]

To tackle the identified problem, a QI team was formed. It consisted of one consultant Neonatologist, two Medical Officers, and staff nurses of the NICU. Consultant Neonatologist worked as team leader, who supervised and coordinated various changes and activities, taken decisions about PDSA cycles, and did one to one meetings to achieve the targeted goals. Other team members also performed the directed activities to achieve targets.

The study was conducted in three phases

Initial observation phase (June 2024 to November 2024), in which the total number of diaper dermatitis cases in admitted newborns in NICU was taken into account. The total number of admissions was recorded from the NICU admission register. This served as the baseline data. Almost 30% of admitted newborns (68/213) suffered from Diaper dermatitis. Further root cause analysis was done by the fish-bone diagram (Figure 1), to find out the possible contributing factors of the increased number of DD cases in NICU. The QI team then identified various causes for the increased number of DD cases in NICU, like less frequent diaper changes, more contact time between perineal skin and urine and faeces, less frequent position changes of newborns, joining of some new nursing staff, lack of knowledge and awareness, and lack of in-house guidelines.

In the implementation phase, from December 2024 to May 2025, the QI team decided to perform multiple plan-do-study act (PDSA) cycles to tackle these identified problems. The elements of these PDSA cycles were education and raising awareness regarding DD in staff nurses and mothers taking care of the newborns, training of newly joined health care workers, more frequent positioning and diaper

changes in newborns, more focus on breast milk use, and less use of antibiotics. Clinical observation was done daily by the senior nurse allocated to each shift and the Medical Officer. These changes were tested and modified as part of PDSA cycles. Changed ideas

were then adopted or discarded depending on the feasibility and results. Data was collected daily and reviewed weekly. The final outcome was recorded at the end of each month. A summary of these PDSA cycles is described in Table-1.

Table 1: Summary of PDSA cycles

PDSA Cycle&Timeline	Plan	Do	Study	Act
PDSA-1 1st - 31st Dec 2024	Raising awareness regarding increased number of DD cases in NICU	1) Team meeting between Consultant Neonatologist, Medical officers and Senior Staff Nurses. 2) Explanation of problem with pictorial diagrams. 3) Training of newly joined staff members and mothers regarding hand washing and cleaning of diaper area and change of diapers. 4) More frequent hand washing by care givers.	DD cases decreased from 12 in Nov 24 to 07 in Dec 24. Total admissions in Dec - 32 Incidence - 21.8 %	Adopt the PDSA cycle and continue with it. - To improve the diaper care routine in next PDSA.
PDSA-2 1st - 31st Jan 2025	Improvement in diaper care Routine	1) Gentle cleaning with alcohol free wipes 2) more frequent assessment for soiling of diapers 3) Change of diapers every 2 hours 4) correct method of application - not too tight diapers	DD cases decreased from 07 in Dec 24 to 06 in Jan 25. Total admissions in Jan - 34 Incidence - 17.64 %	PDSA cycle adopted and continued with some other changes - Plan to improve skin care routine
PDSA-3 1st - 28th Feb 2025	Improvement in skin care routine along with diaper care	1) more frequent oiling of the diaper area every hourly. 2) Air Drying for 5 minutes after cleaning and before diaper change. 3) More frequent position change of ventilated babies, every hourly instead 2 hourly	DD cases decreased from 06 in Jan 25 to 03 in Feb 25 Total admissions in Feb - 22 Incidence - 13.60%	Adopt the PDSA cycle and continue with it. - To identify early signs of DD and halts its progression
PDSA-4 1st - 31st March 2025	To identify early signs of DD and halts its progression	Early use of barrier creams and Emollients to avoid progression.	DD cases increased from 03 in Feb 25 to 05 in March 25.	Adopt the PDSA cycle and continue with it. Problem with the
	- More use of breast milk and breast feeding	- early stoppage of antibiotics	Total admissions in March - 34 Incidence - 14.70%	remembrance of steps amongst staff members Reinforcement of new practices by using mnemonic
PDSA-5 1st - 30th April 2025	Use of mnemonic for better remembrance and reinforcement of practices	"HOPE" H - Hand washing, Gentle cleaning of Diaper area. O - Oiling more frequent, occlusive barrier. Air drying. P - position change every hourly. E - examine more frequently	DD cases decreased from 05 in March 25 to 03 in April 25. Total admissions in April - 21 Incidence - 14.28%	Adopt the PDSA cycle and continue with it. Continued counselling of staff nurses and mothers. Use of pamphlets using mnemonic in NICU and giving handouts to mothers.
PDSA-6 1st - 31st May 2025	Use of pamphlets using mnemonic in NICU and giving handouts to mothers.	Pamphlets given to care providers	DD cases remained same 03 in April 25 to 03 in May 25. Total admissions in May - 26 Incidence - 11.50%	Adopt the PDSA cycle and continue with it.

Post Implementation phase:

This was done to check the sustainability of the QI project. Data from June 2025 was collected to see the sustenance of the QI project.

Study of the intervention

The intervention team performed monthly meetings and reviewed the number of DD cases in the NICU. Also, in each meeting, more emphasis was given on the training of newly joined staff members and adherence to the specified protocols. Any

shortcoming during any PDSA cycle was also discussed.

Data analysis

Baseline data was collected from the admission register of the NICU and the Nursing care plans for each baby. At the end of each month, the total number of admissions and the number of DD cases were recorded and entered in Excel sheets, percentages calculated, and analyzed over a run chart to evaluate the trend of increase/decrease in the incidence of DD cases.

RESULTS

The study included all newborns (169) admitted to the NICU during the study period and 213 newborns in the baseline period. Gestational age of babies varied from 28 weeks to 41+5 weeks in both groups. The birth weight of newborns varied from 850 grams to 4400 grams, with a mean weight of 2300 grams in the study group, and 780 grams to 3800 grams, with a mean weight of 2436 grams in the baseline group.

The total number of males was 94 and females were 71 in the study group, and 120 males and 82 females in the baseline group.

The study included 28 outborn newborns and 141 inborn newborns in the study period, and 40 outborn and 173 inborn newborns in the baseline group.

The total number of term and preterm newborns in the study group was 138 and 31, respectively, whereas the numbers in the baseline group were 154 and 59, respectively.

In the observation and implementation phase, the percentage of DD cases was calculated by dividing the total number of diaper dermatitis cases by the total number of admissions. Month wise total admissions, cases of diaper dermatitis and incidence is depicted in table 2.

Baseline data was collected from the NICU admission register, from where the incidence of DD was calculated over the last 6 months (June 24 to Nov 24) by dividing the sum of total number of DD cases in each month by the total number of admissions in those months. This was identified as 31.92% (68/213).

A change of practices was initiated during the first PDSA cycle in December by educating staff about diaper dermatitis and reinforcing hand hygiene. This led to a reduction in incidence to 21.8% (7/32).

Building on this, further interventions were implemented through PDSA cycles 2 and 3, focusing on improvement in diaper care and skincare routines in January and February, respectively. These changes led to a further decrease in incidence to 17% in January (6/34) and 13% in February (3/22).

During PDSA cycle 4 in March, a slight increase in incidence was observed at 14.7% (5/34). This was attributed to challenges in consistently following diaper care steps and late identification of early DD signs, which were subsequently addressed in the following PDSA cycles.

During PDSA cycles 5 and 6, the incidence was again reduced to 14.28% in April 2025 (3/21), and then progressively declined to 11.50% in May 2025 (3/26). Overall, the incidence was reduced to 15.90% (27/169) during the study period. The percentages of diaper dermatitis in baseline and intervention phase are depicted in run chart in figure 2. The decline in sustenance phase- June 25 was 6.66% (2/30).

A two-tailed p-test was used to compare the baseline and intervention phase proportions, i.e., 0.3192 (68/213) and 0.1598 (27/169). The p-value was found to be 0.00032, which was statistically significant ($p < 0.05$). The 95% Confidence Interval was (0.076, 0.243).

Upper Control Limit (UCL) and Lower Control Limit (LCL) were calculated for each month and depicted in the run chart, along with the centre (average) line in figure 3.

Table 2: Total Number of Admissions and Diaper Dermatitis Cases in Each Month

S. No	Baseline Phase Month	Total Admission	Number Of Diaper Dermatitis Cases	Incidence
1	JUN 24	26	10	38.46%
2	JUL 24	34	12	35.29%
3	AUG 24	42	12	28.57%
4	SEP 24	32	09	28.12%
5	OCT 24	43	13	30.23%
6	NOV 24	36	12	33.33%
Total		213	68	31.92%
S.No	Intervention Phase Month	Total Admission	Number Of Diaper Dermatitis Cases	Incidence
1	DEC 24	32	07	21.80%
2	JAN 25	34	06	17.64%
3	FEB 25	22	03	13.60%
4	MAR 25	34	05	14.70%
5	APR 25	21	03	14.28%
6	MAY 25	26	03	11.50%
Total		169	27	15.90%

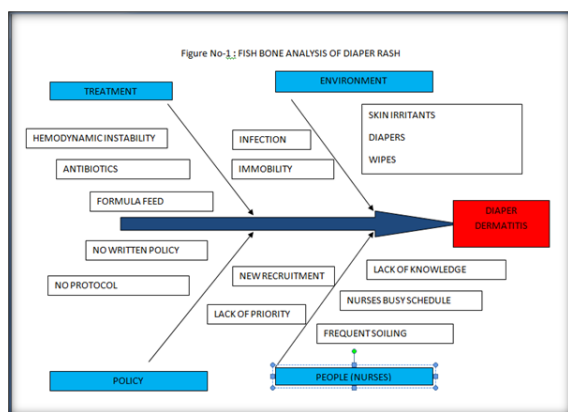


Figure 1: Root Cause Analysis Using Fish Bone Diagram

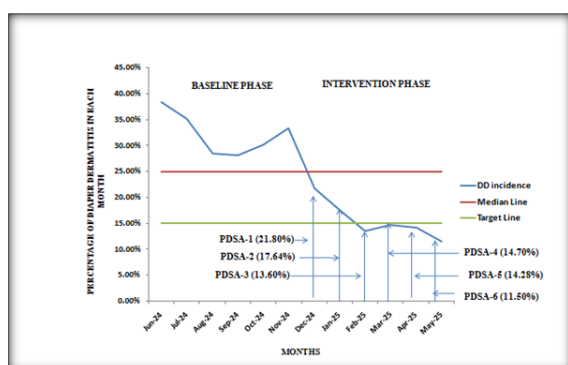


Figure 2: Run Chart Showing Diaper Dermatitis Percentages in Baseline and Intervention Phase in Each Month

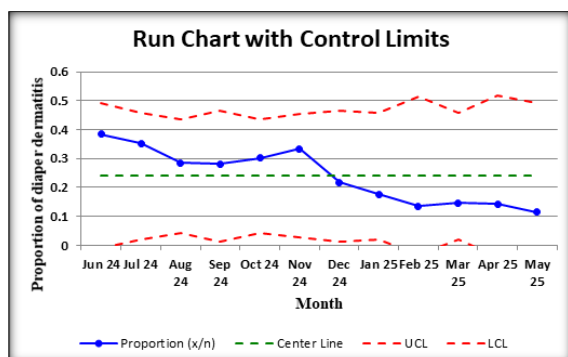


Figure 3: Run Chart and Control Chart Showing Proportion of Diaper Dermatitis Cases in Baseline and Intervention Phase

DISCUSSION

Diaper dermatitis is a well-recognized and frequent problem encountered in neonates and infants, particularly those admitted to intensive care settings. Repeated interventions and frequent exposure to irritants, moisture, friction, and occasional secondary infections predispose newborns to the development of this condition. Several studies have emphasized not only the incidence but also the significant morbidity and discomfort it causes in neonates, along with the additional burden it places on nursing care and healthcare resources.

In the present study, the initial step was directed towards improving awareness among healthcare workers and nursing staff regarding the seriousness of diaper dermatitis. Structured teaching sessions were organized to sensitize the staff about the risk factors, early recognition, and simple preventive measures. This educational intervention was pivotal, as most studies highlight that awareness and adherence to evidence-based nursing practices significantly reduce the incidence of diaper dermatitis.

Following the awareness drive, simple yet effective measures were implemented in routine neonatal care. These included frequent diaper changes, gentle cleansing of the perineal area with lukewarm water or mild cleansers instead of harsh wipes, ensuring adequate drying before re-diapering, and the use of barrier creams where indicated. The role of minimizing unnecessary antibiotic or antifungal usage and preventing occlusive, moisture-retaining environments was also stressed.

The results of this quality improvement initiative demonstrated a noticeable reduction in diaper dermatitis incidence among NICU newborns. These findings align with previous studies where structured educational interventions and protocol-based care significantly decreased the rates of diaper dermatitis in high-risk neonatal populations. The improvement underscores that even low-cost, simple, and evidence-based interventions can bring about measurable positive outcomes in neonatal health.

Discussing the simple practices we usually follow in our routine care, such as hand washing. More frequent handwashing and training of newly joined staff about the diaper routine of newborns led to a reduction in the number of DD cases, as was shown after our 1st PDSA cycle.

Many studies have also found that improving handwashing rates and staff education can significantly reduce the number of DD cases in newborns and infants.^[21,22]

In the present study, changes in diaper care routine and improvements in skincare for newborns in our 2nd and 3rd PDSA cycles also led to further reduction in DD cases. Gentle cleaning of the diaper area, more frequent assessment for soiling, and more frequent diaper changes brought about significant improvement. Frequent position changes in ventilated babies and more frequent oiling helped in reducing pressure injuries and distress to the baby. Similar protocols were suggested by the Indian Academy of Paediatrics (Neonatology Chapter) in June 2025 for evidence-based neonatal skin care of hospitalized newborns.^[3]

Similarly, other studies found that the inclusion of superabsorbent gel diapers and better-fitted diapers (not too tight) led to a reduction in erythema and severity of diaper dermatitis.^[23]

In our 4th PDSA cycle, we also tried to switch to breast milk as early as possible, along with early discontinuation of antibiotics once the newborn was

hemodynamically stable and blood cultures were sterile. This also led to a reduction in DD cases. Early prevention with the use of emollients at the first appearance of redness also helped reduce severe DD cases.

Similar factors were identified in previous studies, like Merrill (2015) and Stamatas and Tierney (2014) documented that breastfed infants are less likely to develop severe DD in comparison with those who are fed formula. Stools from breastfed individuals have been found to have a lower pH and be less irritating to the skin.^[24,25]

In the 4th PDSA cycle of the present study, it was found that nursing staff were slightly forgetful of the diaper care and skincare routine. To tackle this problem, a mnemonic was adopted to help remember the basic steps and to bring uniformity in the care plan. The mnemonic 'HOPE' was designed as follows:

- H – Stands for Hand Washing (more frequent) and gentle cleaning of the diaper area
- O- Stands for Oiling (more frequent), Occlusive barrier creams, and Air drying
- P – Stands for Position change every hour
- E – Stands for Examination (more frequent) and Education

After the adoption of this mnemonic, it became easier for staff nurses to remember the basic steps, leading to a further reduction in DD cases. Pamphlets were distributed to mothers and also posted in the NICU for easy reference.

Several studies in infants and newborns have also used mnemonics to reduce diaper dermatitis. Study done by L Merrill in 2015 for prevention, treatment, and Education for Diaper Dermatitis adopted the 'ABCDE' approach as practical solutions for prevention and treatment of diaper dermatitis, given by Susan Boiko.^[24,26]

One quality improvement study was also conducted in infants, including sensitization of nurses and mothers/caregivers through clinical teaching, and provided informational handouts on proper diaper care and rash prevention, along with the use of a mnemonic: 'CARE-P'. They also observed a reduction in the incidence of diaper rash from baseline data of 7% to 3% after the 1st PDSA and to 1% after the 2nd PDSA over a 3-week period.^[27]

However, no QI is sustainable without regular reinforcement practices. In June 2025, sensitization and education about Diaper Dermatitis were continued among the nursing staff and mothers/caregivers in the NICU. Pamphlets and handouts with the mnemonic were used, leading to a further reduction in the number of DD cases in the NICU (6.66%).

This study highlights the importance of continuous education, supervision, and reinforcement of good nursing practices. Regular audits and feedback mechanisms can ensure sustained improvement and compliance. It also reinforces the need for a multidisciplinary approach where neonatologists,

nurses, and parents work collaboratively to maintain skin integrity in newborns.

However, certain limitations need to be acknowledged. The study was conducted in a single-centre NICU setting with a relatively small sample size, which may limit the generalization of findings. Long-term follow-up and replication of the protocol across diverse NICU settings would strengthen the evidence. Additionally, while the reduction in incidence is promising.

CONCLUSION

Diaper Dermatitis is a significant problem in newborns and infants, leading to considerable stress among healthcare workers as well as parents. The WHO POCQI model is effective in reducing the number of cases by adopting very simple measures in an organized way that aligns with our daily practices. Adherence to the guidelines and continued sensitization and education are crucial in reducing the incidence of DD and keeping the bottoms of our newborns free from rashes.

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