
Reduction of Neonatal Hypothermia by PDSA: A Quality Improvement Initiative in Neonatal Practice

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Abstract

Background: Neonatal hypothermia is a commonly encountered problem in newborns and can eventually leads to death if not recognized and managed timely. In a resource limited country like Bangladesh where most of the hospitals are overburdened, hypothermia in newborn is often a missed issue.

Objective: Before the study in Phulbari Upazilla Health complex, 39% of babies were found hypothermic after 1 hour of life which can be detrimental for newborn health. so we aimed to reduce this hypothermia from a baseline of 39% to 0% among all live newborns at first one hour of life.

Method: PDSA (Plan-do-study-act) a four staged quality improvement approach was undertaken for the first time to solve this problem. We oriented the working staffs about PDSA and used concept of warm chain (covering the baby, providing skin to skin contact, delayed weight

measurement etc.) to reduce hypothermia; one by one interventions after identifying the gaps and testing the changes.

Results: During the study period 42 newborns were born. By implementing PDSA, the incidence of neonatal hypothermia was reduced to 0% from baseline.

Conclusion: Small Quality improvement projects can bring big changes in practice and can reduce incidence of serious neonatal conditions like hypothermia in first one hour of life.

Keywords: neonatal hypothermia reduction by PDSA, plan-do-study-act cycle, plan-do-check-act cycle

1. Problem:

Phulbari Upazilla is one of the remote areas of rural Bangladesh where the Upazilla Health complex serve around 140392 population. Labor room is well equipped with specific neonatal resuscitation corner and 40-50 normal deliveries are conducted per month. There is a newborn stabilization unit in the center which has facilities to provide essential and emergency care for the newly born babies including thermal and initial respiratory support. Despite having baseline infrastructure and sub-optimal manpower, babies who were born in Phulbari UHC in March 2018 were found hypothermic. Data collected in that time revealed that, among 41 delivered newborns at the UHC, 16 were hypothermic (temperature below 36.5°C). Further analysis showed that among these 16 newborns, 11 (69%) were in cold stress (36°C–36.4°C), 4 (25%) were having moderate hypothermia (32°C–35.9°C) and 1 (6%) was in severe hypothermia. We designed a quality improvement project for the first time in the hospital to reduce the incidence of any degree of hypothermia to 0%. We also aimed to see how the team used quality improvement method to solve their problem which had not tried before.

2. Background: Hypothermia in newborn is a significant contributor to neonatal morbidity and mortality. According to World Health Organization, neonatal hypothermia is defined as body temperature below the normal range from 36.5°C to 37.5°C¹. Newborns are prone to develop hypothermia due to large body surface area and reduced amount of subcutaneous as well as brown fat². After birth, however, the baby is exposed to an environment that is often substantially cooler, and is subject to the four basic mechanisms through which all humans will start to lose heat. These processes are evaporation, conduction (direct transfer of heat from baby to contact surface), convection (loss of heat to cooler surrounding air), and radiation (indirect transfer of heat to nearby lower temperature objects)^{2,3}. Provision of warmth to prevent hypothermia is one of the cardinal principles of newborn care. Although hypothermia is rarely a direct cause of death, it can lead to hypoglycemia, bleeding diathesis, pulmonary hemorrhage, acidosis, apnea, respiratory failure and shock if not addressed timely. A study in Ethiopia revealed that 67% of high-risk infants who were born outside of the hospital were hypothermic. AWHO-supported study in Nepal showed that 80% of infants born in hospital became hypothermic soon after birth⁴. Evidence from 36 observational studies has revealed that there is also an increased risk of mortality associated with hypothermia at NICU admission⁵. Bangladesh is one of the rapidly developing countries in the South Asia region where many improvements

have been made in child and newborn health care with time. But neonatal mortality is still high which contributes to 60% of all deaths of children under five years of age⁶. Like other countries hypothermia also continues to be a very important cause of neonatal deaths here due to lack of attention by health care providers. It is not well addressed after birth in labour room, in post-natal ward and even in neonatal care unit. In the other hand, due to huge patient load and limited resource, health care providers are not always motivated. But some simple cost effective measures of 'warm chain concept' like drying thoroughly after birth, covering head, initiating breast feeding and skin to skin contact, warm transportation etc. can decrease this hypothermia and its adverse outcome^{7,8}. Quality improvement project is a new concept in Bangladesh especially in clinical field. Simple low-cost measures and team effort can make things easier. Considering the high incidence of hypothermia in Phulbari UHC, we aimed to initiate a quality improvement project for reducing this condition. This study might also provide background information and serve as platform for future study on quality.

2. Methodology:

This study was conducted over eight weeks from 1st April to 31st May, 2018 in Phulbari Upazilla Health Complex which is a 50- bedded hospital under Rangpur division and serves 140,392 population⁹. The center provides comprehensive care to both mothers and newborns including antenatal care, safe delivery, post natal care and with a well- equipped newborn stabilization unit for sick newborns. This is also a piloting area for establishing Every Mother Every Newborn (EMEN) standards by the Government and is supported by UNICEF.

2.1. Baseline measurement: After birth, all babies received routine newborn care. Within 1 hour of life, temperature was measured by using digital thermometer in axilla for 3 minutes. Then temperature was recorded in admission registry by the staff nurse on duty. Data were reviewed by team members weekly.

2.2. Design: We undertook a quality improvement approach named PDSA (Plan-do-study-act) to reduce incidence of hypothermia in neonates. PDSA is an iterative, four-stage approach for continually improving processes and for resolving problems. The method is widely accepted in healthcare improvement. It involves systematically testing possible solutions, assessing the results and implementing the ones that are shown to work. Four basic steps are used in this process which includes (Figure 1); Plan: first to identify and analyze the problem, Do: to test the potential solution in a small scale and to measure the results, Study: to study the results and measure its effectiveness and finally Act: if the solution is successful, implement it^{10,11}.

We started this project with the following stepwise actions.

2.3. Team Formation: For execution of this project, we formed a team of five members including two doctors and three nurses who received training on PDSA and who were motivated. Among them one senior staff nurse was selected as team leader who was responsible for coordinating activities of other team members. We had national and international experts who guided us throughout our project activity.

2.4. Measures: (test the changes)

The team used process flow chart to see the gaps in existing work flow. After birth of baby, they used to put baby on mother's abdomen and drying wrapping was done. Then umbilical cord was cut and 7.1% Chlorhexidine was applied. Vitamin K injection and weight recording were done thereafter (Figure-2). After all these, baby was handed over to family members until mother was transferred from labour ward to post-natal ward. They also used fish bone diagram to identify the problems in different areas like process, people, place and policy (Figure-3).

Team found that most of the staffs were not aware of the importance of neonatal hypothermia and its consequences. There were also some points in the workflow which leads neonates to become hypothermic (Figure 2 and 3).

A short training was given to all the staffs who were involved in labour room management and discussed about the detrimental effect of hypothermia in neonates. Team identified that after birth newborns were put on mother's abdomen followed by drying and wrapping. But afterwards, baby was unwrapped for cutting of umbilical cord for a while which made babies hypothermic. (Figure-2) So team planned to cut cord within 1-3 minutes of birth with adequate covering of the baby.

But on second week, it was noticed that newborns were still becoming cold. On detailed observation, it was found that babies were partially un-wrapped during administration of vitamin K injection and later for weight recording. So they tried for delaying these two interventions at least for 90 minutes of birth.

At the end of third week, hypothermia slightly reduced but not to expectation level. Then a health care provider was asked about this. She told that, after ensuring these services, babies were handed over to family members for long time until mothers were shifted to the post natal ward (Figure -2).

On query, another nurse on duty told that vitamin K and weight machines were available in labour room only. So they used to ensure those soon after birth. As family members kept the newborn babies with them, there was also delay in providing skin to skin contact. Hospital had no instructions regarding stepwise management of newborns for reducing hypothermia. (Figure-3)

So the team brought new changes in their action plan from week 3-4. They started to give inj. Vitamin K and take weight in post natal ward later by shifting the weight machine from labour room to post natal ward. They reviewed their steps and modified chart was displayed in labour room. They counseled mothers along with family members about importance of skin to skin contact (STS) and after birth they provided STS for one hour to all babies before mother-baby pair shifted to post natal ward.

2. Results:

There were three PDSA undertaken to get the desired outcome.

- (1) PDSA Cycle -1: First change was to ensure warmth to the babies immediately after birth. So they trained labour room nurses and doctors about adequate covering and delayed cord cutting. After these measures, hypothermia reduced to 25% from 39% which was not satisfactory. So they took another PDSA.
- (2) PDSA Cycle-2: The team observed that for vitamin K injection and weight recording, babies were un-wrapped partially which made them hypothermic despite covering and delayed cord cutting after birth. So in second PDSA cycle they aimed to delay vitamin K injection and weight recording but within first 90 minutes of birth as per EMEN standards. So they started implementing that. But weight machine was only available in labour room. Therefore they re-arranged the weighing machine in post natal ward. Despite all efforts, desired reduction was not achieved. Still 18% babies were having hypothermia.
- (3) PDSA-3: As the results were not reaching the targets, suggestions from other staff helped to detect the most important gap and to start the third PDSA. Team started providing skin to skin contact between mother and baby for at least 1 hour after birth. As a result un-necessary handling of baby by family members and risk of becoming hypothermic decreased. At the end of 6th week, all babies were found normothermic (temperature 36.5°C to 37.5°C) with 0 incidence of any degree of hypothermia.

3. Discussion:

Neonatal hypothermia is often detrimental to newborn health if not identified and managed timely. Especially after birth, babies can lose heat due to many unwanted tasks like un-wrapping, keeping in contact with cold object such as weighing machine, delaying skin to skin contact etc. It does not require expertise but requires regular practice and improvisation of routine work. In that situation, PDSA is very much beneficial to reach the targets by using the limited resources and by incorporating the new ideas into routine practice. Similar study was done in India by using PDSA cycle, where they were able to reduce hypothermia in newborns admitted to neonatal care unit of a large hospital. Their identified problems were lack of staff awareness, supply issues and transferring of sick babies which they solved by small initiatives through PDSA approach¹². Behavioral factors appear to play a central role in risk of hypothermia and are high-lighted by the WHO's guidelines to optimize thermal care, described as a warm chain. The warm-chain consists of 10 steps to minimize risk of exposure and includes the following: keeping the delivery room warm, drying immediately, skin-to-skin contact, breastfeeding, delayed bathing, appropriate clothing, warm transport (if necessary), keeping mother and baby together, warm resuscitation, and improved awareness and recognition of hypothermia risk^{4,13}. There are few similar studies which have used PDSA to reduce neonatal hypothermia by ensuring warm chain in their respective working areas where it was found effective^{14,15}.

In this study, we were able to use PDSA to protect newborns from hypothermia though it was our first quality improvement project. We tried to involve the health care providers in depth of the issue and to solve the problems by their own. But to motivate the people was the most

challenging part as they were overburdened. Our team tried to overcome that by regular communicating with people, on sight problem solving skills and good co-ordination which finally helped us to achieve the targets.

4. Limitations:

This was the first quality project that was undertaken in Phulbari UHC. We trained health care providers who were directly related to groundwork. But only knowledge did not help in this real situation. When process was analyzed in detail, staff were able to identify the gaps. When they started making change, success did not come all together but one by one. Moreover, keeping patience of team members was another challenging issue which we sorted out by weekly meeting and by appreciating every member's idea of solving the problem. Finally, we learned from this project that team effort and motivation to work can help to solve the problems which we face daily in our workplace and it can be applicable in any clinical area within the available resources.

5. Conclusion:

Neonatal hypothermia was reduced in all delivered live newborns at labour room by using simple quality improvement initiative. Furthermore, this work has also improved the practice of warm chain indirectly which needs to be ensued in every newborn service care point. It can be also concluded that plan-do-study-act; is an effective quality improvement initiative that can help any facility to reduce their neonatal hypothermia rate by exploring theirs' own situation.

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Conflicts of interest: The authors have no conflicts of interest.

Ethical Approval: This project was under the quality improvement activities of Government of Bangladesh and no ethical approval was required to implement this.

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Figures



Figure 1: PDSA cycle for quality improvement project

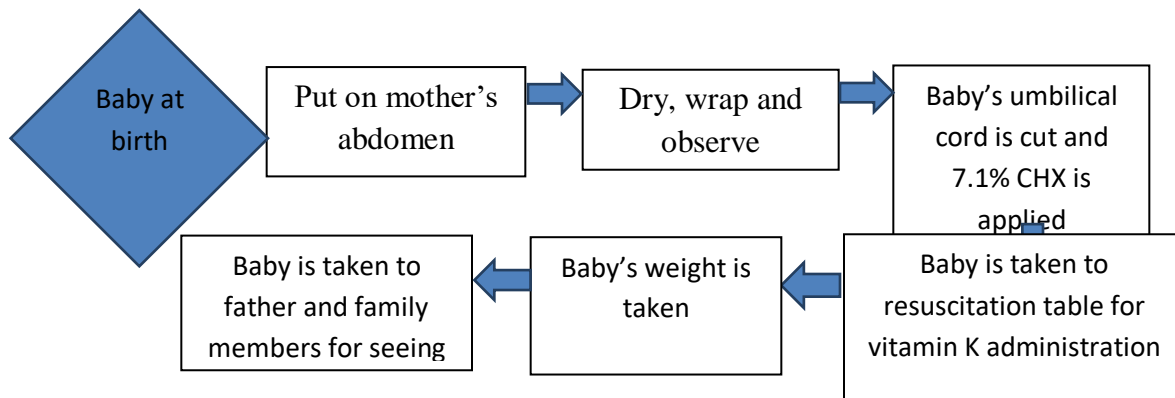


Figure 2: Process flow chart

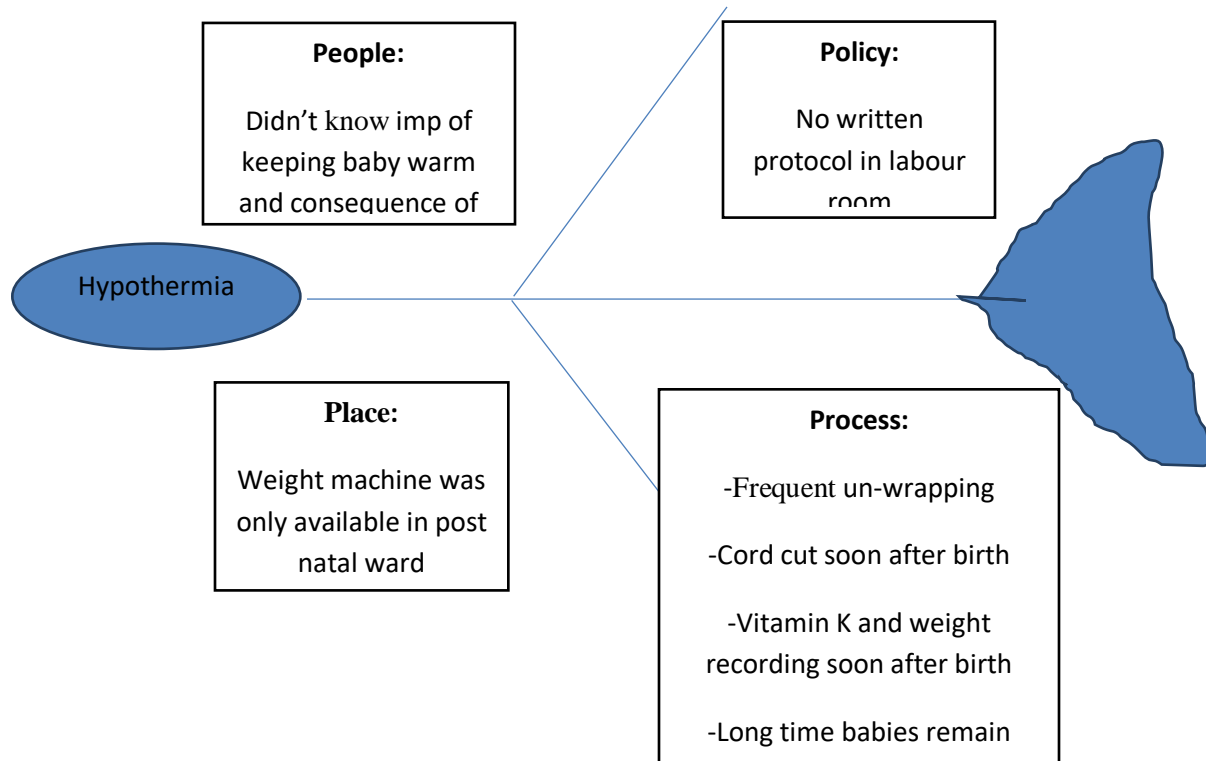
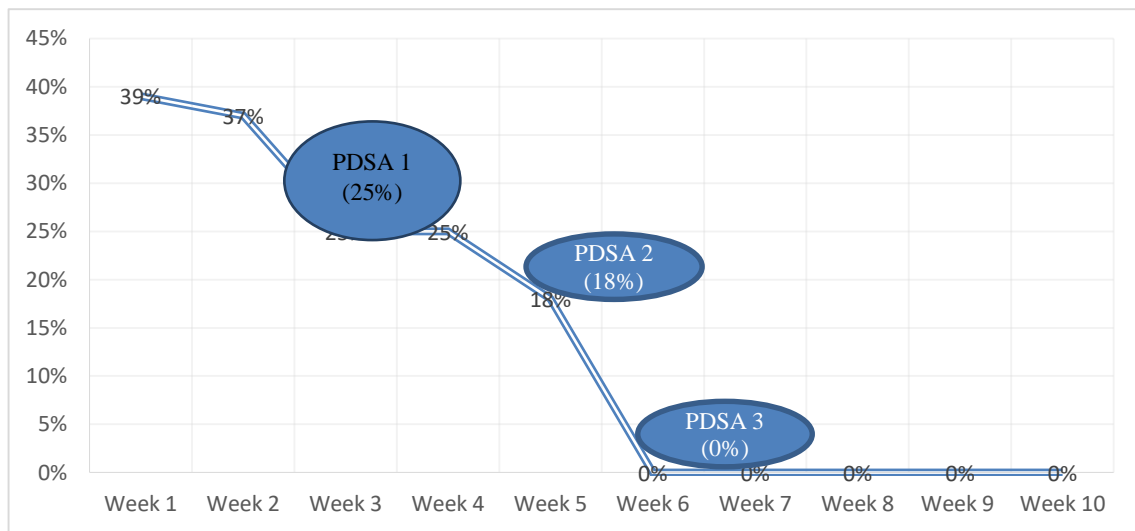


Figure-3: Fish Bone analysis of the problem



Hypothermia at 1 hour after birth, UHC Kurigram, Bangladesh

Figure-4: Incidence of neonatal hypothermia in Phulbari UHC