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Sustaining immediate newborn care processes (delayed cord clamping and early breastfeeding initiation) in the delivery room: a quality improvement study

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ABSTRACT

Background Immediate newborn care processes like delayed cord clamping (DCC) and early breastfeeding initiation (EBFI) in the delivery room have several benefits including survival. Despite the evidence, the practices have not been widely adopted. We used a point-of-care quality improvement (QI) to implement and sustain these two immediate newborn care processes in our delivery room over a period of 2 years through a series of plan–do–study–act (PDSA) cycles.

Methods All neonates above 30 weeks of gestation irrespective of the need for resuscitation except Rh-isoimmunisation were eligible for DCC. Neonates >35 weeks not requiring respiratory support or resuscitation were eligible for EBFI. The root causes of gaps in the quality were analysed by fishbone analysis. The key quantitative outcome measure was the percentage of eligible deliveries in which DCC and EBFI were done. Duration of DCC was also recorded in the sustenance phase. This implementation was done through three PDSA cycles and the practices were sustained for 2 years.

Results A total of 770 deliveries were part of this QI study from October 2018 to December 2020. There was a significant improvement in DCC (median) from a baseline of 25% to 96% over a 2-year period. Sensitisation, making DCC part of pre-birth checklist and recording outcomes on a dashboard daily helped to implement and sustain the processes over 2 years. As a co-process, EBFI improved (median) from a baseline of 50% to 97% without any major intervention in the system.

Conclusions Immediate newborn care processes could be sustained by making them part of pre-birth preparation and dashboard recording by a QI initiative without any additional resources.

INTRODUCTION

Problem description

Before the early 1950s, the term early clamping was defined as umbilical cord clamping within 1 min of birth, and late clamping was defined as umbilical cord clamping more than 5 min after birth.[1 2] Immediate clamping of the umbilical cord has traditionally been recommended as part of active management of the third stage of labour, together with a prophylactic uterotonic drug and controlled cord traction, to reduce postpartum haemorrhage. The timing of cord clamping does not appear to have a major impact on blood loss at the time of birth.[3] Thus, at the time of birth, immediate cord clamping is more of an ingrained practice.[4] Moreover, mother's care takes priority at the time of delivery and simpler interventions like delayed cord clamping (DCC) and early breastfeeding initiation (EBFI) are ignored many times. Apart from these challenges, lack of awareness of best practices, lack of formal training and poor coherence within the working team contribute to poor compliance.[5]

Context

Ovum Woman and Child Speciality Hospital is a tertiary care hospital in Bangalore rural district, India. It is a referral hospital catering to close to 400–500 high-risk annual deliveries. The obstetric unit is well supported by level III neonatal intensive care unit (NICU). The unit has one each of operation theatre (OT) and delivery room. The obstetric wing of Ovum Hospitals has two obstetric consultants and two nurses per shift (6-hour shift) supporting deliveries. The resuscitation and essential care of the newborn at birth are supported by three paediatric consultants and one nurse per shift from the NICU. The information flow in the hospital was that an expectant mother was admitted and prepared for delivery by labour room nurses. NICU nurses were informed few minutes prior to delivery to prepare for resuscitation along with a paediatrician.

Available knowledge and rationale

Evidence from a meta-analysis has shown DCC in healthy term neonates is known to

have higher early haemoglobin concentration and iron stores by 3–6 months. The meta-analysis has also shown no difference of APGAR <7 at 5 min of life and severe postpartum haemorrhage in the mother.[6] In preterms between 24 and $36^{6/7}$, a meta-analysis has shown DCC to reduce mortality and requirement of blood transfusions.[7] There was a slight increase in the risk of jaundice requiring phototherapy.[6] Considering the overall beneficial effect of DCC, having access to monitor and treat jaundice, the slight risk should not be a concern.[8] Various professional bodies including the WHO, American College of Obstetrics and Gynecology, American Academy of Pediatrics, and Royal College of Obstetrics and Gynecology have recommended the practice of DCC.[8–12] Despite evidence and recommendations, the practice of DCC is variable. Several studies have looked into barriers and have attempted various strategies to implement DCC in their settings.[13] Lack of awareness, professional resistance to change, obstetric concerns (postpartum haemorrhage) and paediatric-specific concerns (jaundice, polycythaemia, intraventricular bleed in preterms) on safety despite evidence and lack of written policy are few of the important barriers. Limited data exist regarding the sustenance of DCC.[14]

Similar to DCC, EBFI is a simpler intervention. Compared with early initiation (<1 hour), late initiation of breast feeding increases the risk of mortality by 33%.[15] Despite the evidence, globally, the rates of EBFI are at an average of only 57%.[16] Evidence-based interventions exist for improving the initiation of breastfeeding rates.[17] Few studies have attempted addressing the barriers using quality improvement (QI) methodology and improved the EBFI rates in their setting.[18 19] Both DCC and EBFI are proven interventions. But this evidence has variably translated into bedside practice. The QI methodology helps in getting the multidisciplinary team together, analyses the problem systematically and the change ideas are tested by the frontline staff, thereby enhancing the success of the intervention. Overall, studies have implemented immediate newborn care processes separately. We aimed to implement both the interventions one after the other and also planned to sustain them in our setting.

Specific aim

We aimed to implement immediate newborn care processes—DCC (baseline 25%) and EBFI (baseline 50%)—in the eligible deliveries taking place at our hospital to above 80% over a period of 6 months.

METHODS

Design

We formed a multidisciplinary QI team consisting of two nurses, one obstetrician and two neonatologists. The study was conducted in the delivery room of the hospital from October 2018 to December 2020. The three nursing officers were given the responsibility of supervising the implementation and data collection. These two nursing officers along with an obstetric consultant and neonatologist led the QI initiative for the entire period.

Patient involvement

Patients were not directly involved in the design or conduct of the study.

Measurements

All term and preterm deliveries beyond 30 weeks' gestation without Rh-isoimmunisation were eligible for assessing compliance to DCC. While all babies beyond 35 weeks without any respiratory distress and/or need for resuscitation were eligible for EBFI. DCC was practised by either of the two methods. The first method involved delaying clamping of the cord by the obstetrician for certain duration (at least 30 s or until placental separation) on the OT/delivery table. The second method involved cut cord milking and was practised if there was excessive maternal bleeding or if the baby required resuscitation. The time interval between the delivery of the baby to clamping of the cord was recorded with a timer present on the warmer. The total number of DCC done in the given period was taken as the numerator. The total number of deliveries (>30 weeks) that happened in the given time period was taken as the denominator. We assessed safety by assessing the number of babies requiring partial exchange or fluid relaxation due to polycythaemia. EBFI was taken as feeding the newborn within 30 min (vaginal delivery) or 60 min (caesarean) after delivery. Total deliveries >35 weeks was taken as the denominator. Audits were done by two nursing officers who were the project leads. Initially, data were recorded in an Excel sheet in the implementation phase. During the sustenance phase, data were recorded in the delivery register and updated on the dashboard at the entry of the delivery room. The babies receiving phototherapy or formula feed during the stay were not recorded. Descriptive statistics were used to describe demographic variables. We obtained 4 weeks of baseline data to calculate the median. Monthly compliance rates were collected thereafter and displayed using run charts from Microsoft Excel software. We defined a shift according to evidence-based rules.[20] When we identified a shift, we recalculated the new median using the points that made up the shift and compared new data with this new median. We followed the Standards for Quality Improvement Reporting Excellence 2.0 guidelines for reporting.[21]

STRATEGY

Baseline period (1–31 October 2018)

The QI team led by the nursing officers collected baseline data on DCC and EBFI. A group meeting was conducted involving 2 obstetric consultants, 2 paediatric consultants, 4 nurses from the delivery room and 10 NICU nurses. The challenges in the implementation of these two birth practices were analysed on a fishbone analysis (online supplemental figure 1) in the meeting. After the baseline period, DCC was planned to be implemented first

followed by EBFI. The results of each plan–do–study–act (PDSA) cycle informed the strategy change for the next cycle. Both the immediate newborn care processes were implemented in three PDSA cycles and were sustained for 2 years.

PDSA cycles

PDSA cycle #1 (1–30 November 2018)

The QI lead nursing officers sensitised the nurses of the delivery room and NICU on the importance of DCC and EBFI through teaching sessions every alternate day for a week. Low-intensity frequent training lasting around 15 min was conducted in the afternoon shifts during shift handover to reach maximum nurses on alternate days. A pictorial poster depicting the importance of DCC was displayed to remind staff in the delivery room. The poster was located at the entry door of OT-labour room complex. It was decided to send WhatsApp messages by NICU nurses to do DCC as a reminder in the nursing group before each delivery. The data on compliance to DCC and EBFI were collected on an Excel sheet.

PDSA cycle #2 (1–31 December 2018)

The sensitisation sessions were adapted as part of the weekly team huddle. The huddle had briefing on need and improvements in compliance to both DCC and EBFI. Lack of communication about the admission of waiting mothers led to inconsistency in WhatsApp reminders. Just prior to delivery, pre-birth briefing was done regarding maternal risk factors, Nonstress test (NST), gestation, estimated fetal weight and liquor. A DCC plan was added to this pre-birth checklist as a reminder. The data on compliance to DCC and EBFI were collected on an Excel sheet. Qualitative experiences of nurses were collected as an anonymous response to a questionnaire.

PDSA cycle #3 (1–31 January 2019)

Based on concerns raised in qualitative experience from nursing officers, it was decided to have a simpler system of data collection. The unit had a delivery register in which the baby's gestation, weight, APGARs and mode of delivery were documented. Two extra columns to record compliance of DCC and EBFI were added in the same register and were updated after each delivery. The total numbers were updated on the dashboard on a daily basis.

Sustenance phase (1 January 2019–31 December 2020)

Based on learning from the previous cycle, reminders during pre-birth preparation led to improvement in compliance. Data collection was also made an easier process. The unit has a QI time dedicated on Tuesday afternoon between 14:00 and 14:15 to discuss the progress of QI projects. Monthly results were displayed as run charts on the hospital notice board. In the monthly perinatal statistics meeting, compliance to these two processes was presented as part of quality indicators to sustain motivation. Celebrations and incentives to QI champions led to sustained motivation with the team. From August 2019, based on inputs from the perinatal team, data on quality

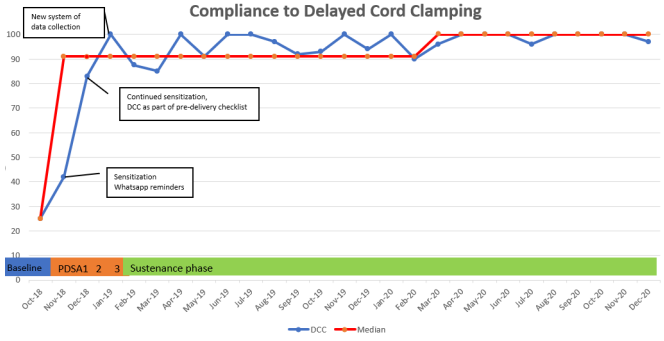

Figure 1 Run chart showing compliance to DCC during the study period. DCC, delayed cord clamping; PDSA, plan–do–study–act.

of DCC, that is, various duration of DCC like cord milking, 30–60 s and >60 s, were also recorded and displayed in the daily dashboard.

RESULTS

A total of 757 deliveries were part of the implementation and sustenance phase. The majority of babies were born by caesarean section (70%) and 18% of the babies were born preterm. None of the babies required a partial exchange transfusion. The demographic features of enrolled deliveries are depicted in online supplemental table 1.

Our baseline data showed median compliance of DCC of 25% over 4 weeks (figure 1). We identified a shift of 9 data points from November 2018 to July 2019 after the baseline period. We recalculated the median based on this and found the new median of 91%. We identified an additional shift from March 2020 to December 2020 data points after the initial shift. We recalculated the new median using these points and found a median of 100%. This shift suggested continued improvement during the sustenance phase. Our baseline data showed median compliance of EBFI of 50% over a period of 4 weeks (figure 2). We identified a shift of 9 data points from November 2018 to July 2019 after the baseline period. We recalculated the median based on this and found the new median of 96%. We identified an additional shift from January 2020 to December 2020 data points after the

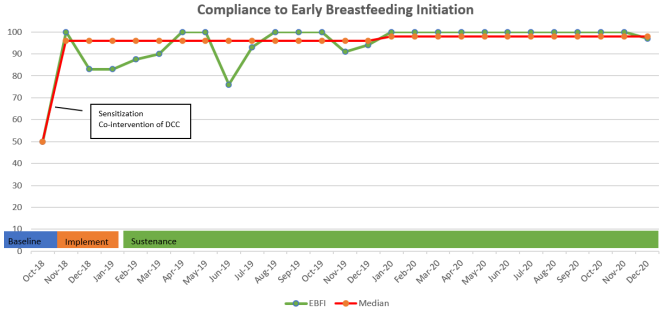

Figure 2 Run chart showing compliance to early breastfeeding initiation (EBFI) during the study period. DCC, delayed cord clamping.

Table 1 Details of the PDSA cycles

PDSA	1 (n=20)	2 (n=15)	3 (n=18)	Sustenance (n=694)
When	1 Nov 2018–30 Nov 2018	1 Dec 2018–31 Dec 2018	1 Jan 2019–31 Jan 2019	1 Jan 2019–31 Dec 2020
Plan	Sensitisation & reminders at workplace	**Reminder** of DCC **prior to delivery**	Simpler system of data collection	Sustain improvement
Do	**Teaching sessions** thrice weekly with the nurses. **WhatsApp reminder** after each admission. **Pictorial poster** display in resuscitation area reminder	Continue **sensitisation sessions** weekly as part of team huddle. **Reminder** of DCC as part of **pre-delivery** checklist. Continue recording EBFI rates. Qualitative experience of nurses on DCC	**Data entry in delivery register and updated on daily dashboard**	Pre-delivery reminder. Data collection in delivery register and dashboard. **Monthly display** of results. **Celebrations and incentivise QI champions**
Study	Compliance DCC=42%, EBFI=100%, WhatsApp reminders=26%. Lack of communication at admission of probable delivery cases to the resuscitation team	Compliance DCC=83%, EBFI=83%. Pre-delivery reminders helped in improving DCC. EBFI improved as a co-intervention without any specific strategy. Qualitative experience revealed challenges in data collection	Compliance DCC=100%, EBFI=83%. New system of data collection was well accepted	Compliance DCC=96%, EBFI=97%. Quality of DCC was also recorded from August 2019. DCC and EBFI part of monthly quality indicators
Act	EBFI improved with teaching. Instead of a reminder of DCC at admission, try reminding just before delivery. **Abandon WhatsApp reminder**	**Adopt pre-delivery reminder and weekly team huddle**. Continue recording and displaying data. Try data collection in an easier way	**Adopt the new system of data collection**. Sustain changes	**Pre-delivery reminder and display of results** sustained the change

DCC, delayed cord clamping; EBFI, early breastfeeding initiation; PDSA, plan–do–study–act; QI, quality improvement.

initial shift. We recalculated the new median using these points and found a median of 98%. This shift suggested continued improvement during the sustenance phase.

Qualitative experiences were collected from 10 randomly selected nurses attending deliveries during PDSA #2 (table 1). A total of 6 of 10 nurses raised concerns about data collection. They felt entering data in an Excel sheet in the NICU computer was time-consuming. All 10 nurses felt happy in assisting mothers for EBFI.

Lessons and limitations

Anaemia, especially due to iron deficiency, is an important public health problem in developing countries.[22] DCC in term neonates is known to transfer approximately 80 mL of blood from the placenta. This additional blood provides 40–50 mg/kg of extra iron.[23] The impact of early initiation of breast feeding on both mother and child is huge. Apart from nutrition, breast feeding is known to reduce mortality and risk of acquiring infection and has an impact on duration of breast feeding.[24 25] Simple interventions in the delivery room like DCC in the first minute and ensuring EBFI in the first hour can mitigate mortality to a larger extent. Overall, we could implement and sustain immediate newborn care processes (DCC and EBFI) above 80% over a period of 2 years with no additional resources or no increase in balancing measure, that is, symptomatic polycythaemia.

To implement and sustain the above-mentioned immediate newborn care processes, we used many specific strategies. The strategies like having a multidisciplinary team, sensitisation and pre-delivery reminder led by nurses as part of pre-birth briefing helped us for smooth implementation of DCC. In the first PDSA, sensitisation was ensured by low-intensity high-frequency sessions during the shift handover lasting around 15 min. From the second PDSA onwards, sensitisation was sustained by making DCC and EBFI part of a team huddle weekly using a daily dashboard. In the first PDSA, the team tested many change ideas as a bundled approach to ensure sensitisation (training session) and reminder (poster and WhatsApp reminder) at workplace. Although the compliance improved to 42%, individual impact of either poster or training could not be judged. As a combined effect, these change ideas helped in implementation along with pre-delivery checklist, while simpler data collection on the daily dashboard and delivery room register also aided in sustaining the progress. Surprisingly, EBFI improved as a co-process with sensitisation and data collection with DCC. It did not take us any extra effort for EBFI. Celebration of success of persistent compliance to the processes ensured motivation among the team. Making both the process part of our quality indicators and discussion every month in perinatal meetings helped us to

reduce professional resistance and thus we could sustain immediate newborn care processes over 2 years. Overall, the project did not require any additional resources for sustaining the evidence-based best practices. These strategies should serve as a framework for multimodal strategies for future QI projects on DCC and EBFI.

We also started recording the quality of DCC, that is, duration of DCC (online supplemental figure 2). Approximately 20% of cases of DCC could not be done above 30 s. Cut cord milking had to be done in them as there was either professional resistance in the initial period, placental separation or maternal bleeding in a few cases. The exact reason in each case was not documented. In nearly 30% of cases, DCC could be done even beyond a minute. We also recorded babies requiring partial exchange due to polycythaemia as a balancing measure after the concern was raised by the team despite the evidence. Haematocrit was measured only in symptomatic babies. None of them required fluid relaxation or partial exchange during the study period.

In this initiative, we could not formally involve mothers in the design and conduct of the study. This limitation can be addressed in similar projects in future. There are several other concerns of DCC like severe postpartum haemorrhage, jaundice requiring phototherapy and increased need for resuscitation at birth. Except for jaundice, evidence from meta-analysis has shown other two concerns as not different from DCC.[6 7] The data of babies requiring phototherapy were not collected, which was a limitation. Jaundice was not a concern for the practice of DCC as systems were in place for monitoring and management of jaundice. Another limitation was we did not specifically address the value of intervention with outcomes like mortality, blood transfusion, iron stores and exclusive breastfeeding rates at discharge. The goal of the study was not to prove or refute already established evidence on these immediate newborn care processes.

Conclusions

We were able to implement and sustain immediate newborn care processes—DCC and EBFI—in eligible babies by focusing on sensitisation, pre-birth checklist as a reminder, simpler data collection on the dashboard and making them part of the quality indicators. These simpler multimodal strategies will serve as a framework for similar scenarios across the developing world. Making mothers part of these initiatives in reducing the barriers in resource-limited settings needs to be studied further.

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Contributors PN assisted in designing the data collection tool, collected data, made data analysis and drafted the initial manuscript. AM designed the data collection tool, made data collection, assisted in data analysis and approved the final manuscript. ASA conceptualised the study, supervised data collection and data analysis, made critical inputs to the manuscript, approved the final manuscript and is the overall guarantor of the article. RNS assisted in data collection and data analysis, and approved the final manuscript. PV supervised data collection, made critical inputs to the manuscript and approved the final manuscript.

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Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not required.

Ethics approval The mothers were explained about the intervention upon entry to the delivery room and verbal consent was obtained. We implemented the intervention based on sound evidence and objectively monitored for any safety issues. Hence, IRB approval was deferred based on hospital policy.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplemental information.

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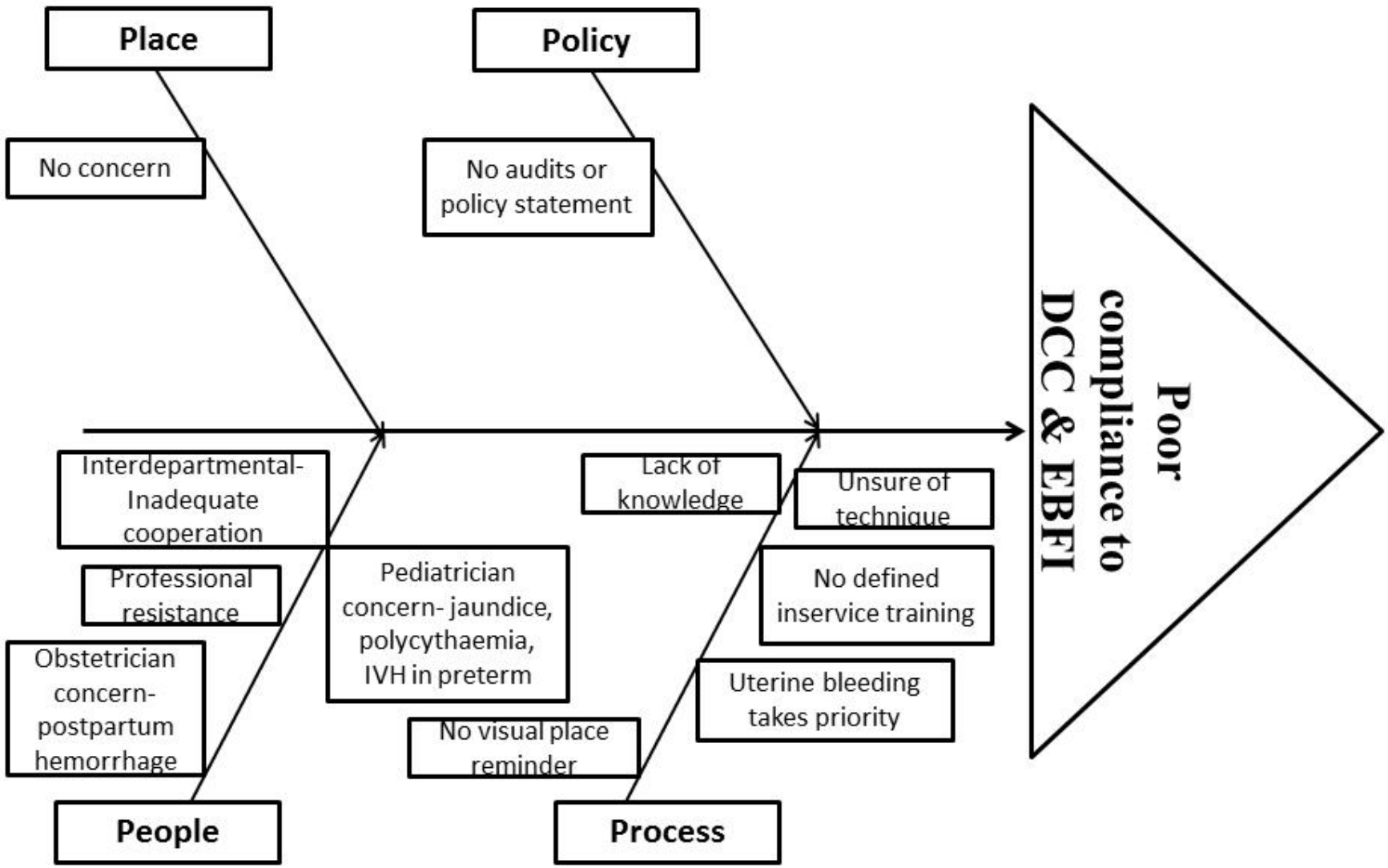
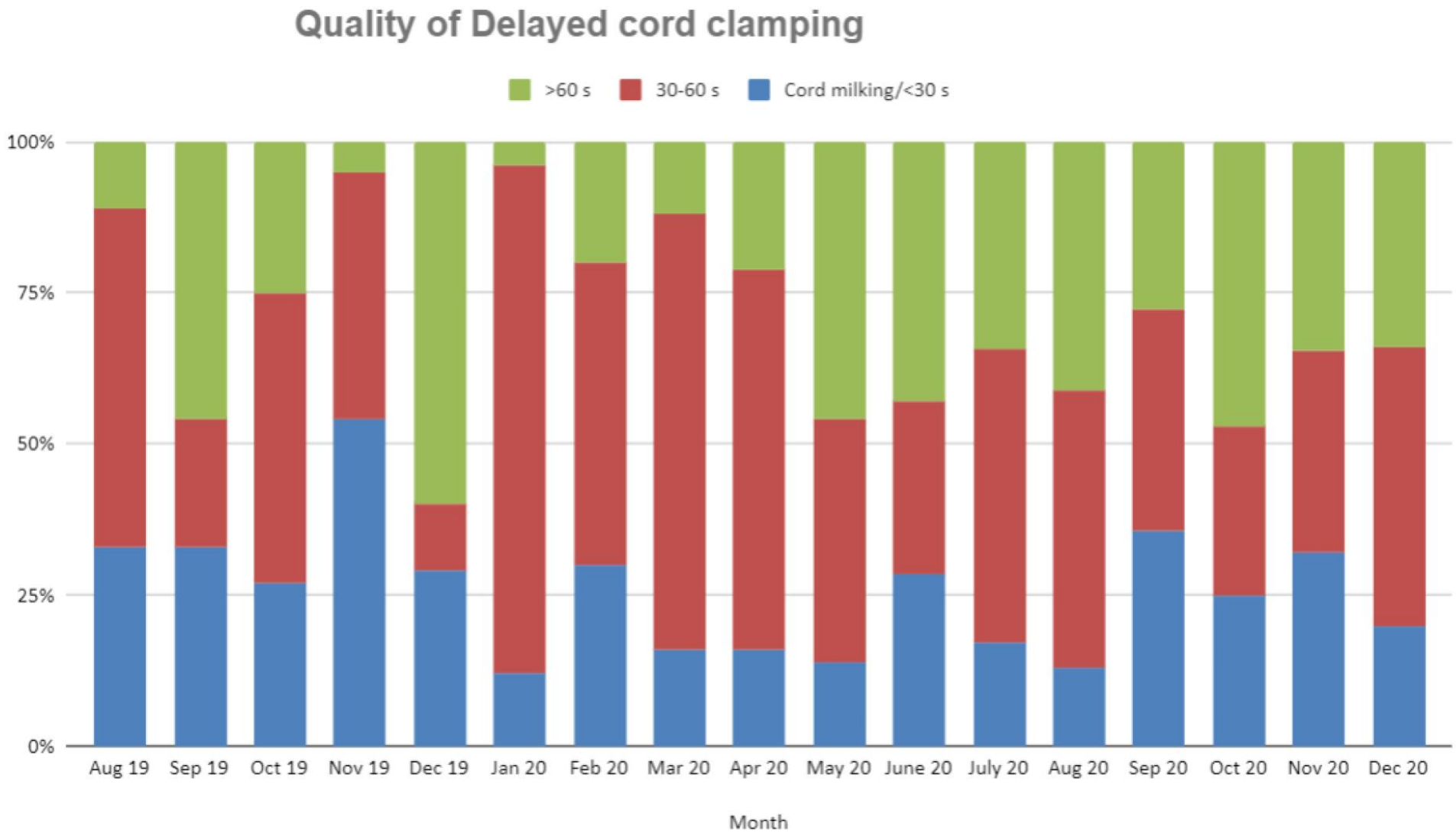

Place
Policy
No concern
No audits or policy statement
Poor compliance to DCC & EBFI
Interdepartmental-Inadequate cooperation
Lack of knowledge
Unsure of technique
Professional resistance
Pediatrician concern- jaundice, polycythaemia, IVH in preterm
No defined inservice training
Obstetrician concern- postpartum hemorrhage
Uterine bleeding takes priority
No visual place reminder
People
Process

Supplemental table 1: Demographic features of enrolled neonates

Phases	**Baseline**	**PDSA 1**	**PDSA 2**	**PDSA 3**	**Sustenance**
Duration	1.10.2018 to 31.10.2018	1.11.2018 to 30.11.2018	1.12.2018 to 31.12.2018	1.1.2019 to 31.1.2019	1.2.2019 to 31.12.2020
Total deliveries	23	20	15	18	694
Term gestation (%)	19 (82)	14 (70)	11 (74)	14 (77)	571 (82)
Preterm (%)	4 (18)	6 (30)	4 (26)	4 (23)	123 (18)
LBW (%)	4 (18)	4 (20)	4 (26)	4 (23)	121 (17)
Males (%)	13 (56)	14 (70)	10 (66)	11 (61)	344 (49)
Twin gestation (%)	0	1 (5)	1 (7)	1 (5)	12 (1)
Cesarean (%)	22 (95)	17 (85)	14 (93)	12 (66)	490 (70)
No. requiring partial exchange-polycythemia	0	0	0	0	0

Abbreviations: LBW- Low Birth Weight, PDSA- Plan Do Study Act


Quality of Delayed cord clamping
>60 s
30-60 s
Cord milking/<30 s
100%
75%
50%
25%
0%
Aug 19
Sep 19
Oct 19
Nov 19
Dec 19
Jan 20
Feb 20
Mar 20
Apr 20
May 20
June 20
July 20
Aug 20
Sep 20
Oct 20
Nov 20
Dec 20
Month