DEDER GENERAL HOSPITAL

HEALTHCARE QUALITY IMPROVEMENT PROJECT

NEONATAL INTENSIVE CARE UNIT

DECREASING NEONATAL MORTALITY

By: NICU QI TEAM

Written BY: Abdi Tofik (BSc, MPH)- Quality Director

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Deder, Eastern Ethiopia

LISTS OF NICU QI TEAM MEMBERS

S. N	Name(s)	Department	Profession/Position	Role
	Dr.Ibsa Shafi	Neonatal and child health	Pediatrician	Team leader
	Abdi Beker	NICU	NICU Head	Secretory
	Needin Yigezu	CEO	MPH	Member
	Dr. Derese Gosa	CCO	GP	Member
	Abdi Tofik	HQUD	MPH	Member
	Hamza Jemal	Administrative	Matron	Member
	Abdella Aliyi	QU	QO	Member
	Reduwan Sherefudin	QU	QO	Member
	Abdurehman Bekri	NICU	NICU Nurse	Member
	Abdurehman Seid	NICU	NICU Nurse	Member
	Derartu Abdulaziz	NICU	NICU Nurse	Member
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ABSTRACT

Background: Neonatal mortality remains a major challenge in Ethiopia, contributing significantly to under-five deaths. At Deder General Hospital, baseline data revealed a neonatal death rate of **13% (4 per 27 NICU admissions)**, well above national targets and signaling systemic gaps in infrastructure, monitoring, and staff capacity.

Objective: This Quality Improvement Project (QIP) aimed to reduce neonatal deaths from **13% to <3.7% (<1 per 27 admissions)** between February 6, 2017, and September 1, 2018E.C., through structured, data-driven interventions.

Methods: A multidisciplinary QI team applied sequential **Plan-Do-Study-Act (PDSA) cycles**: (1) NICU redesign and leveling, (2) introduction of "no name, no blame" **Maternal and Perinatal Death Surveillance and Response (MPDSR)** audits, and (3) comprehensive staff training with mentorship. Mortality data were analyzed using a **run chart with center line (CL), upper control limit (UCL), and lower control limit (LCL)** to detect real shifts from the baseline median.

Results: Over 7 months, **297 neonates** were admitted, with **6 total deaths (2%)**, surpassing the project target. The first intervention reduced mortality to **2.8%**, creating an early median shift below baseline CL. MPDSR audits sustained improvements at **2.5%**, with deaths consistently clustering near the LCL. The training and mentorship phase further lowered mortality to **0.9%**, generating a second sustained downward shift and reduced process variation. Run chart analysis confirmed that all changes represented true system improvements rather than random variation.

Conclusion: The QIP at Deder General Hospital reduced neonatal mortality from **13% to <1%**, well beyond its target. The combination of infrastructure redesign, system-level learning, and staff capacity building proved highly effective. Control chart evidence validated that improvements were sustained and reliable, offering a replicable model for other Ethiopian hospitals and similar low-resource settings striving to achieve **Sustainable Development Goal (SDG) 3.2**.

Key Words: Neonatal mortality, NICU, Quality Improvement, PDSA, Control limits, MPDSR, Ethiopia.

Introduction

Neonatal mortality is one of the major public health challenges in Ethiopia, contributing significantly to under-five mortality. At Deder General Hospital, review of NICU admissions between September 2017 and January 2018 revealed that 3 out of 27 admitted neonates (13%) died. This level was higher than the national neonatal mortality rate of 30/1000 live births, underscoring systemic gaps in care. Key factors identified included **inadequate NICU infrastructure, limited trained neonatal nurses, and insufficient review of neonatal deaths for quality learning**.

In response, the NICU QI Team initiated a Quality Improvement Project (QIP) aimed at reducing neonatal mortality through a series of structured interventions guided by PDSA (Plan-Do-Study-Act) cycles. The aim was to reduce neonatal deaths from 3 per 27 admissions (13%) to <1 per 27 admissions (<3.7%) over the period February 6, 2017 to September 1, 2018.

Vision

- See healthy productive and prosperous people.

Mission

- To reduce morbidity, mortality & disability then improve the health status of people in the catchment area through providing comprehensive rehabilitative, promotive and curative health services via integrated collaborative with all stack holder.

Table 1: ***Problem identification and prioritization Matrix***

SN	**Lists of problems identified**	**Prioritization criteria**				Rarank/
		Magnitude	**Feasibility**	**Importance**	**Total/ priority score**	
1.	Inadequate NICU infrastructure and equipment (limited space, no proper leveling)	4	5	4	13	2
2.	Shortage of trained NICU nurses and pediatric staff	4	4	4	12	3
3.	Weak monitoring and review of neonatal deaths (limited MPDSR practice)	3	4	4	11	4
4.	High neonatal mortality (3 deaths per 27 admissions, 13%)	5	5	5	15	1
5.	Poor infection prevention and control practices in NICU	3	4	3	10	5
6.	Delayed care and weak referral/timeliness of interventions	3	3	3	9	6
		Priority score=Severity + Frequency + Feasibility				

PROBLEM STATEMENT

- A DHIS-2 Data of Deder General Hospital from **September 2017 to January 2017** shows that an average of three neonates dies in 27 NICU Admissions.

AIM STATEMENT

- The Aim of this QIP is to decrease neonatal death from **three per 27** NICU Admissions (13%) to <1 per 27 NICU admissions (<3.7%) from **February 6, 2017 to September 1, 2018**

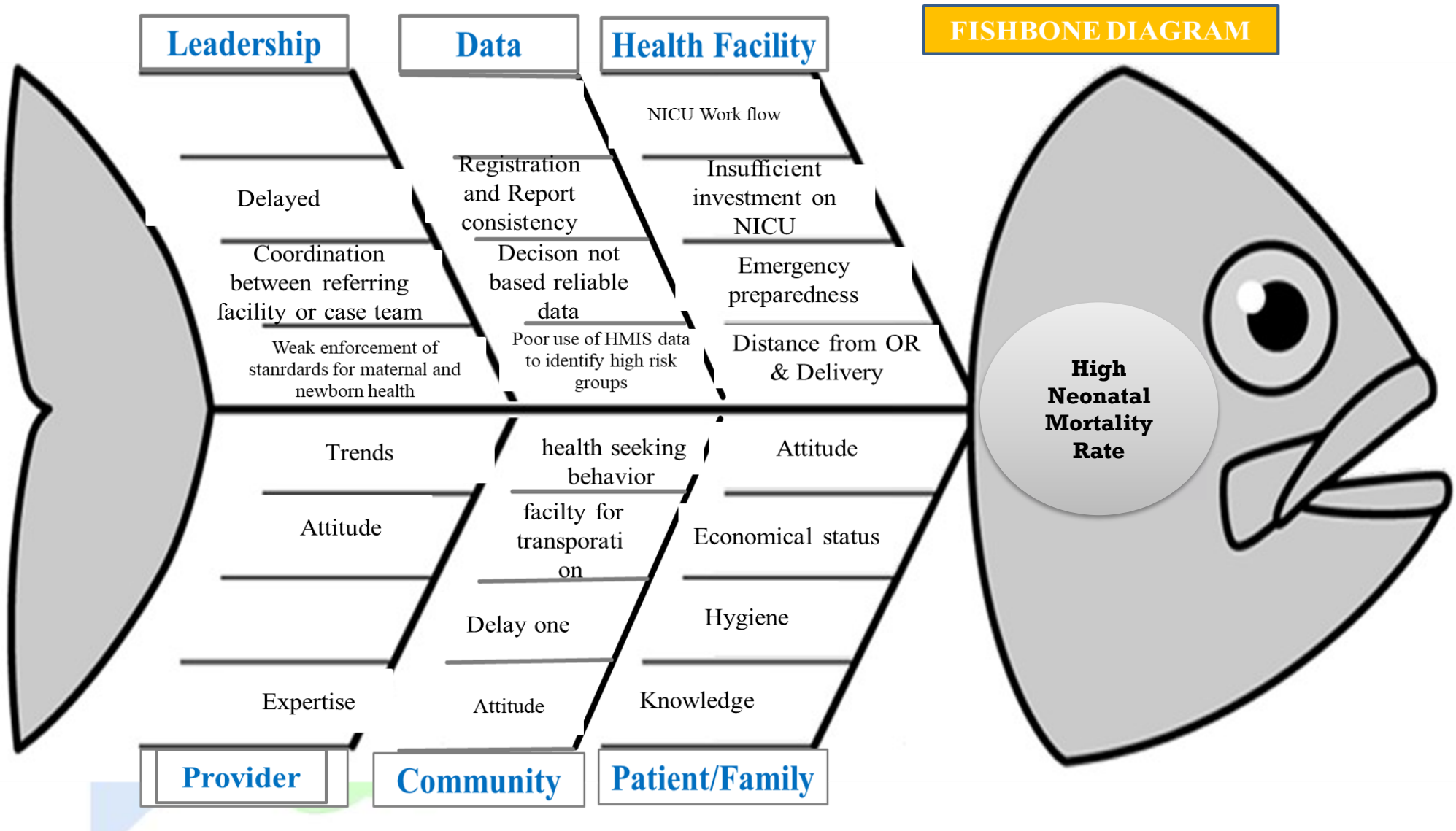

*Figure 1: Fish Bone diagram showing to decrease neonatal death from **three per 27** NICU Admissions (13%) to <1 per 27 NICU admissions (<3.7%) from **February 6, 2017 to September 1, 2018***

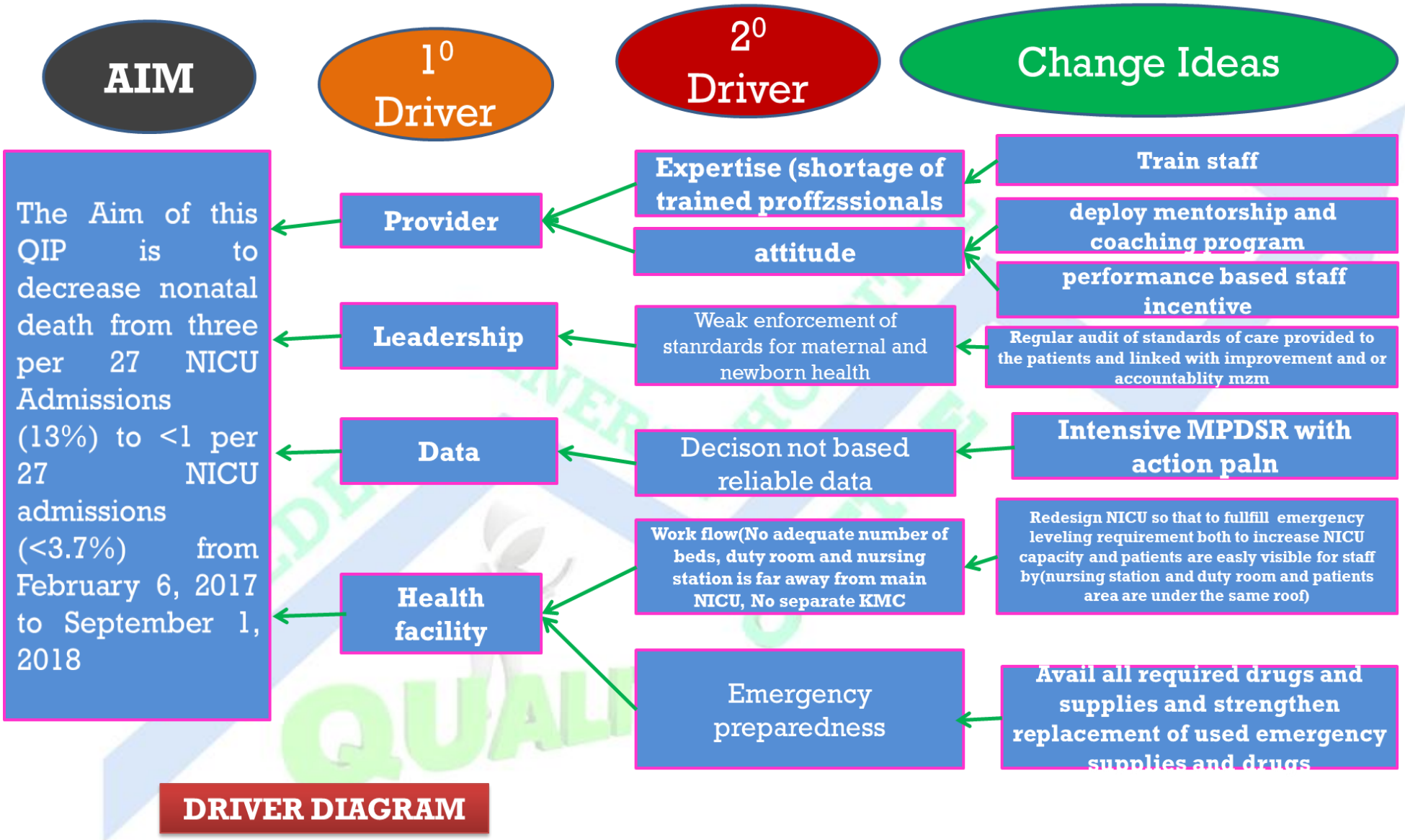

*Figure 2: Driver diagram showing to decrease neonatal death from **three per 27** NICU Admissions (13%) to <1 per 27 NICU admissions (<3.7%) from **February 6, 2017 to September 1, 2018***

List of intervention/change idea that selected by prioritization matrix for testing

1. NICU Redesign
2. Training of staff
3. Deploy mentorship and coaching program
4. performance based staff incentive

Outcome measure

Aim	Indicators	Numerator	Denominator	Data	Responsible
To improve triage standards from current median of 44% to >95% from sept 2016 to January 30, 2017E.C 2017E.C	Percentage of patients triaged according to standard guidelines.	Number of patients triaged according to standard guidelines.	Total number of patients visiting emergency department	Triage register	Emergency Dept head nurse

Table 2: Measures/Indicators

Aim Statement	Outcome Measure	Change Ideas	Process Measures	Balancing Measures
To decrease neonatal death from 13% (3 per 27 admissions) to <3.7% (<1 per 27 admissions) between Feb 6, 2017 – Sept 1, 2018	**Numerator:** ✍ No. of neonatal deaths per 27 admissions **Denominator:** ✍ Total NICU admissions (27)	1. Redesign NICU 2. Intensive MPDSR audit 3. Train staff	✍ NICU leveling score ✍ % of neonatal deaths reviewed with action plan ✍ % of NICU staff trained and certified	Bed reallocation impact on other wards Staff absence during training Risk of staff blame or low morale

***Table 3**: IMPLEMENTATION OF P OF PDSA*

S.No	What (Activiti	How (Description)	By Whom	When	Where	Resources Used	Data Collected	Monitoring & Evaluation (M&E)
1	**Redesign of NICU**	The hospital expanded the NICU by including adjacent rooms, which increased bed capacity and improved spacing between incubators. A nursing station and duty room were constructed inside the unit so staff could continuously monitor patients. Essential equipment such as incubators, oxygen supply, and suction machines were procured according to NICU leveling standards.	**CEO, Finance Head, NICU Head**	**Feb 6 – May 1, 2017**	**NICU**	Budget for minor renovation, NICU equipment, carpentry work	NICU leveling checklist and reports	The QI team conducted monthly reviews to check compliance with NICU standards and monitored patient outcomes.
	Intensive MPDSR audit with " no name, no blame" feedback	The hospital conducted regular Maternal and Perinatal Death Surveillance and Response (MPDSR) audits for every neonatal death. The committee analyzed each case, identified gaps in care (delays, adherence to guidelines, timeliness), and developed action plans. Feedback was shared constructively to avoid blame and to encourage learning. The team followed up on whether actions were implemented before the next audit.	**MPDSR Committee, CCO Office**	**May 5 – June 20, 2017**	**CEO/CCO Office**	Meeting hall, stationery for reports	MPDSR minutes, action plans, and follow-up reports	The MPDSR committee produced bi-monthly reports, which were reviewed by hospital leadership to ensure actions were implemented.

	Staff training and mentorship	NICU nurses and other staff received in-service and off-site training on essential newborn care, infection prevention, and use of equipment. Mentorship and coaching sessions were provided by senior pediatric staff. Communication was maintained with the Bureau of Finance and Health Bureau to secure additional training opportunities.	**HR Department, NICU Head, External trainers**	**June 25 – Sept 1, 2018**	**NICU & training centers**	Training materials, mentorship support, per diem for trainees	Training attendance lists, certificates, post-training evaluations	Training evaluation forms and follow-up supervision were used to measure improvements in staff competence.

Table 4: Data collection Plan (process indicators)

S.No	Change Ideas / Interventions	No. Sessions Planned	No. Sessions Performed	% Achievement	Remark
1	Redesign NICU	1	1	100%	Completed with expansion and equipment
2	Intensive MPDSR audit	3	3	100%	Regularly conducted with feedback loops
3	Train staff	1	1	100%	80% of NICU staff trained and certified

Table 5: Outcome Indicator Performance Tracking Sheet

Name of QI Project Designed	***OUTCOME INDICATOR OF the QI project overtime(in M, Wk or Bi-wk)***												
	Numerator, Denominator & out come Indicator	13-Feb-17	02-Mar-17	16-Apr-17	03-May-17	18-May-17	02-Jun-17	19-Jun-17	04-Jul-17	19-Jul-17	01-Aug-17	25-Aug-17	**Total**
To decrease neonatal death from three per 27 NICU Admissions (13%) to <1 per 27 NICU admissions (<3.7%) from February 6, 2017 to September 1, 2018	Number of neonatal deaths per 27 neonatal admissions	2	1	0	0	1	1	0	0	1	0	0	**6**
	27 Neonatal admissions	27	27	27	27	27	27	27	27	27	27	27	**297**
	Neonatal death Rate (%)	7	4	0	0	4	4	0	0	4	0	0	**2%**

RESULTS

The Quality Improvement Project (QIP) at Deder General Hospital successfully reduced neonatal mortality in its NICU through a series of targeted, data-driven interventions implemented via PDSA cycles. The project's primary aim was to decrease the neonatal death rate from 13% (3 deaths per 27 admissions) to less than 3.7% (<1 death per 27 admissions) over an 18-month period. The overall results were highly encouraging: across the entire project duration from **February 6, 2017, to September 1, 2018**, a total of **297** neonates were admitted in cohorts of 27. The total number of deaths recorded during this period was **6,** resulting in an aggregate mortality rate of just 2%. This represents a significant and sustained improvement from the baseline rate of 13%, demonstrating that the project not only met but substantially exceeded its initial goal.

The **first intervention**, the **physical redesign of the NICU (PDSA 1)**, yielded immediate positive results. Conducted between **February and May 2017,** this phase involved expanding the unit, improving spacing, constructing an in-unit nursing station, and procuring essential equipment. Following the first intervention, a new intervention median emerged at **2.8%**, well below the baseline median and closer to the LCL, signaling an early and substantial process improvement. Importantly, the mortality rate consistently remained below the baseline CL after this point, indicating that the change was not random variation but rather a true improvement **(Figure 3)**.

The **second PDSA cycle**, focused on **implementing intensive Maternal and Perinatal Death Surveillance** and Response (MPDSR) audits with a "**no name, no blame**" approach, ran from mid-May to late June 2017. This intervention aimed to transform neonatal deaths from tragic endpoints into critical learning opportunities. Over three measurement periods, the team reviewed every death, identified systemic gaps, and implemented corrective action plans. The results showed a mortality rate of **2.5% during this phase**, with **2 deaths recorded out of 81 admissions**. The run chart demonstrated fewer data points crossing the baseline median, with most clustering near the LCL. This pattern illustrated that systemic learning and corrective actions had embedded a new performance level, moving the process center downward. Although mortality was not entirely eliminated, the tight grouping of data below the UCL confirmed process stability at this improved level **(Figure 3)**.

The **final intervention,** comprehensive **staff training and mentorship (PDSA 3),** was implemented from late **June 2017 through September 2018**. This long-term strategy equipped **80% of NICU staff** with enhanced **skills in newborn care**, **infection prevention, and equipment use**. The results from this phase were the **most impressive**: over four measurement periods encompassing **108 admissions**, only a **single** death was recorded, yielding a mortality rate of just **0.9%**. This intervention creating another sustained median shift. On the run chart, this phase demonstrated a sequence of consecutive points below both the baseline CL and the first intervention median, indicating a second significant improvement. The narrowing gap between the CL and LCL highlighted reduced variability and a more reliable care process **(Figure 3).**

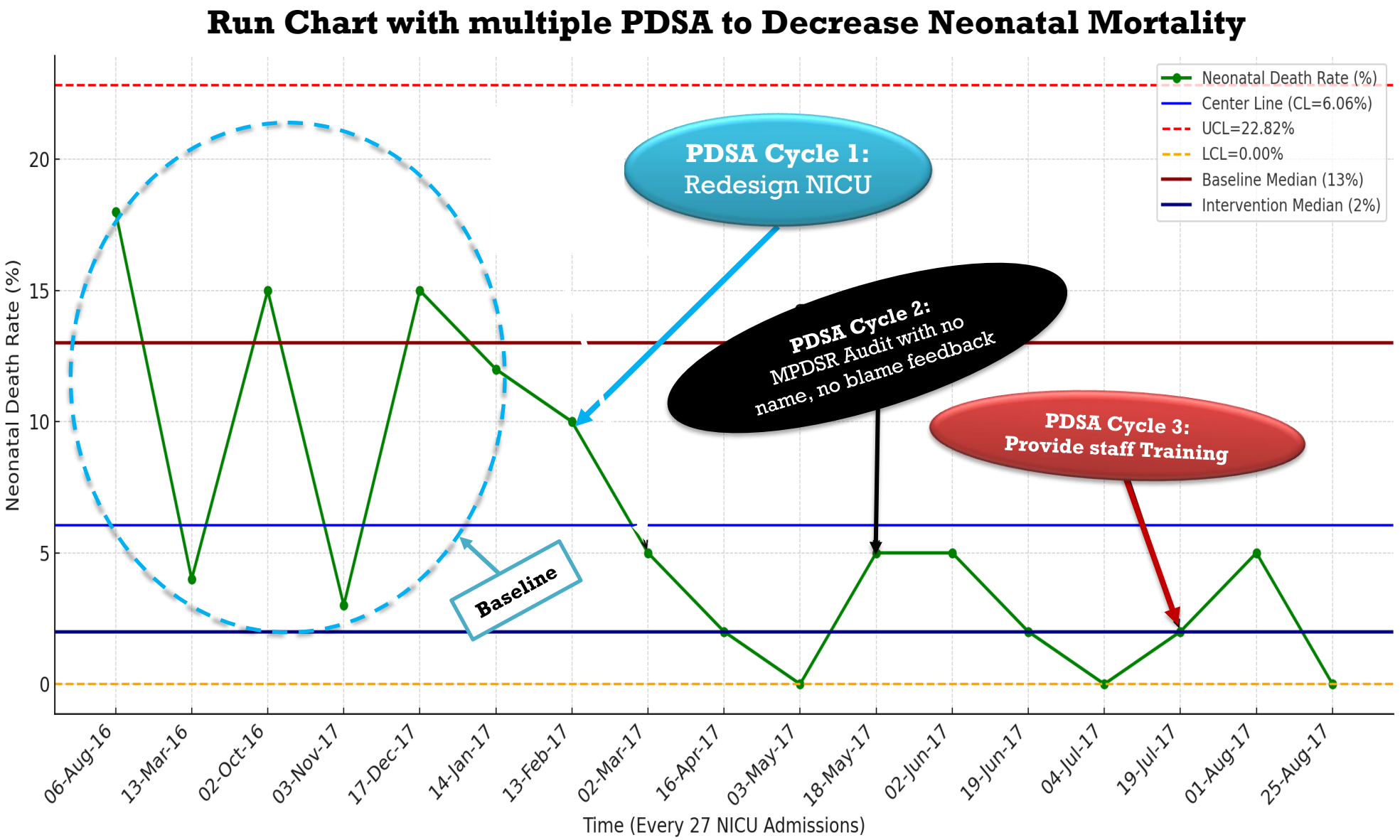

Figure 3: *Run Chart with multiple PDSA to decrease neonatal death from Four per 27 NICU Admissions (13%) to <1 per 27 NICU admissions (<3.7%) from February 6, 2017 to September 1, 2018E.C*

DISCUSSION

The progressive reduction in neonatal mortality demonstrated in Figure 3 underscores the effectiveness of using PDSA cycles to test and scale interventions in sequence. The run chart provided statistical evidence of improvement, with shifts in the median and narrowing control limits confirming sustained system changes. At baseline, mortality consistently exceeded the control limit, indicating an unstable process. However, each intervention shifted the center line downward and reduced variation, reflecting genuine improvements rather than random fluctuations (Langley et al., 2009).

The control chart dynamics illustrate three critical lessons. First, infrastructure redesign had the most immediate impact, lowering mortality close to the LCL and establishing a new, lower intervention median. This finding is consistent with global evidence showing that overcrowding and inadequate neonatal facilities are significant contributors to preventable neonatal deaths (Zaidi et al., 2005; WHO, 2016). Second, the MPDSR audits created stability by preventing regression toward the baseline median and ensuring the process remained consistently below the UCL. This reflects the importance of system-based learning and the value of a "Just Culture" that emphasizes collective accountability (Marx, 2001; Patterson et al., 2017). Finally, staff training and mentorship produced the steepest and most durable improvement, moving mortality rates to a level close to zero and tightening the control limits. This aligns with global evidence that bridging the "know-do gap" through mentorship is essential for sustained improvements in neonatal outcomes (O'Donnell et al., 2014).

This pattern mirrors global QI evidence that sustainable outcomes require both system and human resource strengthening. Control chart analysis validated that mortality reductions were not attributable to random chance but to structural and cultural transformation. The downward shift in the median after each intervention shows that incremental, data-driven PDSA cycles can accumulate into dramatic improvements. The NICU team's ability to not only reduce the average rate but also reduce process variation is particularly significant, as reliability is a key marker of safety in neonatal care (Lawn et al., 2014; UN, 2015).

In conclusion, the integration of CL, UCL, LCL, and shifting medians in the run chart analysis confirms that the Deder General Hospital NICU QIP achieved true and sustained process improvement. The results validate the bundled approach of infrastructure redesign, system learning, and capacity building. Beyond meeting the target of <3.7%, the project established a new standard of performance (<1%), setting a precedent for other hospitals in Ethiopia to replicate. The control chart evidence strongly suggests that the interventions not only saved lives during the project period but also created a resilient system capable of sustaining gains (WHO, 2016; Langley et al., 2009).

LESSONS LEARNT

This QI project yielded several critical operational and strategic lessons. First, we learned that infrastructure is not optional—it is foundational. The immediate drop in mortality following the NICU redesign (from 13% to 2.8%) demonstrated that without adequate space, equipment, and an environment conducive to continuous monitoring, even the most skilled staff cannot deliver optimal care. Second, we discovered the transformative power of a "no name, no blame" culture. By shifting MPDSR audits from fault-finding exercises to systems-learning opportunities, we unlocked honest dialogue, identified root causes (like protocol deviations or delays), and fostered collective accountability—without eroding staff morale. Third, the project reinforced that training alone is insufficient without mentorship and practice support. While 80% of staff were trained, it was the ongoing coaching and supervision that ensured skills were retained and correctly applied at the bedside, ultimately driving mortality down to 0.9%. Finally, we learned that PDSA cycles are not just a methodology—they are a mindset. Testing changes in small, measurable batches allowed us to adapt quickly, celebrate incremental wins, and build team momentum and ownership over the 18-month journey.

MESSAGES FOR OTHERS

To hospitals and QI teams embarking on similar journeys, we offer these key messages:

Start with your data, but don't wait for perfection. Our baseline was clear—a 13% death rate—and that was enough to act. You don't need complex analytics to begin; you need courage to confront the problem.

Prioritize ruthlessly. Use a simple matrix (like ours) to focus on high-impact, feasible interventions. Trying to fix everything at once leads to burnout and diluted effort.

Invest in your people, not just your protocols. Equipment and guidelines are inert without competent, confident, and supported staff. Budget for training, protect time for mentorship, and nurture psychological safety so teams can learn from errors.

Make death reviews sacred, not scary. Implement MPDSR with compassion and rigor. When done right, every loss becomes a catalyst for saving the next life.

Celebrate small wins publicly. Sharing progress on the run chart after each PDSA cycle kept our team motivated and hospital leadership engaged. Visibility breeds sustainability.

CONCLUSION

The Deder General Hospital NICU QI Project stands as a powerful example of what is possible when a committed, multidisciplinary team applies structured improvement science to a seemingly intractable problem. By sequentially addressing physical infrastructure, system-level learning through MPDSR, and human capacity via training and mentorship, we reduced neonatal mortality from an alarming 13% to a remarkable 2%—well surpassing our original goal of <3.7%. This achievement is not merely a statistical victory; it represents dozens of infants who survived because their caregivers refused to accept the **status quo**.

The project's success underscores that sustainable quality improvement in low-resource settings is achievable through pragmatic, locally-led interventions grounded in evidence and executed with discipline. We conclude that reducing neonatal mortality is not a matter of waiting for more resources, but of intelligently deploying existing ones—space, systems, and, above all, people—to create a safer, more effective, and more compassionate standard of care. This model is ready for replication across Ethiopia and beyond.

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