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Reducing infection rate among the neonates born at Remera Rukoma Hospital: a report of quality improvement project

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ABSTRACT

INTRODUCTION: Neonatal infection, a leading cause of mortality in lower and middle-income countries, was increasing at Remera Rukoma District Hospital in Rwanda, necessitating the identification of the contributing factors and urgent intervention. Therefore, this study aimed to reduce the neonatal infection rate among neonates born at Remera Rukoma Hospital from 18.53% to 10% within 6 months (from January to June 2024).

METHODS: From January to June 2024, a multidisciplinary team used a Fishbone diagram for root cause analysis to identify factors in healthcare practices, equipment, hospital environment, and patient domains that were contributing to the increased incidence of neonatal infection in the neonatal ward of Remera Rukoma Hospital. Interventions were implemented and monitored through monthly Plan-Do-Study-Act cycles.

RESULTS: Neonatal infection rates decreased from 22.9% in January to 13% in June 2024. While short of the 10% target, this significant improvement resulted from systematic approaches, including regular and targeted staff training and enhanced infection control measures.

CONCLUSION: The quality improvement project demonstrated the effectiveness of a structured, data-driven approach in reducing neonatal infection rates. Key lessons include the role of utilizing comprehensive root cause analysis to learn more about the interconnected elements of disease or health issues, continuous staff engagement in quality improvement initiatives, and ongoing education on infection prevention and control.

Keywords: Neonates, Infections, Quality Improvement, Remera Rukoma

INTRODUCTION

Neonatal sepsis is a primary cause of neonatal mortality and is an urgent global health concern, especially within low-income and middle-income countries (LMICs), where 99% of global neonatal mortality occurs [1]. Without a significant reduction of infection-related neonatal deaths in LMICs, it is unlikely that Sustainable Development Goal 3, which aims to reduce neonatal mortality to at least 12 per 1000 live births by 2030, will be met [2]. Globally, an estimated 22%, 25%, and 34% of under-five deaths resulted from neonatal infections, intrapartum-related conditions, and

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preterm birth complications, respectively, with the highest mortality rates being reported in Sub-Saharan Africa [3,4]

In sub-Saharan Africa alone, an estimated 5.3-8.7 million disability-adjusted life-years (DALYs) were lost in 2014 due to neonatal sepsis and consecutive long-term morbidity [5]. Neonatal infections are also the major causes of death and disability among newborns in Rwanda [6]. In 2022, in Rwanda, the neonatal mortality rate was 17.52 deaths per 1,000 live births in 2022 [7]. Neonatal deaths account for 68% of under-five deaths in Rwanda [2,4]. In Rwanda, nearly 71% of neonatal deaths are preventable, and among these, 10% are due to neonatal sepsis [4]. In 2018, a study which was conducted at Kibungo Referral Hospital found that neonatal sepsis was strongly associated with neonatal age of less than or equal to three days (aOR: 2.769, 95% CI 1.312–5.843; p=0.008); and gestational age less than 37 weeks (aOR: 4.149; CI 1.1878–9.167; p≤0.001) [4].

According to health management and information system (HMIS) data, at Remera Rukoma District Hospital, from January to June 2023, 39 out of 231, which is approximately 16.8% of newborns at Remera Rukoma, have developed infection. This is equivalent to 169 newborns in 1000 newborns. From July to December 2023, 18.53% of neonatal infections were recorded among the neonates born at Remera Rukoma Hospital.

Neonatal infections are a major cause of death and morbidity among neonates, especially in developing countries [8]. Rwanda, and particularly, Remera Rukoma District Hospital in Rwanda, is no exception. From January to June 2023, the neonatal infection rate at the hospital stood at 16.8% (167 live births per 1000 at Remera Rukoma Hospital). From July to December 2023, 18.53% of infection was recorded among the newborns at Remera Rukoma Hospital. Studies indicate several factors contributing to the high neonatal infection rate, including inadequate infection prevention and control practices not limited to contaminated equipment like radiant warmers and continuous positive airway pressure (CPAP), maternal infections, overcrowding, and poor sanitation in neonatal wards [9]. These factors create an environment in which neonates are at high risk of developing infections.

Neonatal infections can lead to several serious complications, including sepsis, pneumonia, and meningitis [10]. These complications can be fatal, and even if neonates survive, they may suffer from long-term health problems. The high neonatal infection rate also puts a significant financial strain on the hospital and families through expensive treatment and long hospital stays. The increasing rate of neonatal infections at Remera Rukoma Hospital was a serious problem that needed to be promptly addressed. An intervention was needed to reduce the number of neonates who develop infections and to improve the outcomes of those who became infected. Therefore, this project was conducted to identify the cause of this infection and reduce the rate of infection at Remera Rukoma District Hospital. It further identified the working spread prevention measures. The broader objective of the project was to reduce the neonatal infection rate among neonates born at Remera Rukoma Hospital from 18.53% to 10% within 6 months (from January to June 2024).

METHODS

Study type

The quality improvement project was conducted from January to June 2024. It was not a traditional study; instead, it employed a systematic methodology centered on the Fishbone (also known as Ishikawa or cause-and-effect) diagram approach. This method was chosen for its effectiveness in visually organizing and analyzing the multiple factors contributing to neonatal infections [1,11]. The project began with a comprehensive root cause analysis, where the quality improvement team identified and categorized potential causes of infections into major branches such as healthcare providers, equipment, hospital environment, processes, and patient factors. Each branch was further explored to identify specific issues. Based on this analysis, targeted interventions were developed and implemented.

The quality improvement (QI) collaboration team at Remera Rukoma Hospital comprises a diverse group of professionals and stakeholders, including neonatology staff, QI officers, maternity and operating room staff, laboratory personnel, cleaners, environmental health officers, hospital management, biomedical technicians, data managers, and pharmacists. This comprehensive team also involves next of kin and external stakeholders, ensuring a holistic approach to

improving neonatal care and reducing infection rates.

The team conducted monthly sessions to track progress, assess the effectiveness of interventions, and make necessary adjustments. These regular check-ins allowed for agile response to emerging challenges and ensured continuous focus on the project's goals. In addition, we tested a range of interventions using multiple Plan Do Study Act cycles [1,12]. To assess the project's impact, monthly data on neonatal infection rates were collected and quantitatively analyzed for six months.

Comprehensive problem analysis

The quality improvement project "Reducing Neonatal Infection Rate at Remera Rukoma Hospital" addressed a critical issue in neonatal care. The initial baseline neonatal infection rate of 18.53% from July to December 2023 was alarmingly high, indicating an urgent need for intervention. With expert recommendation, the project aimed to reduce this rate to 10% within six months, from January to June 2024. While the project did not achieve its ambitious target, it reduced the infection rate to 17.11%, representing progress in the right direction.

The root cause analysis revealed a complex web of factors contributing to the high infection rate [13], spanning multiple domains, including healthcare providers, cleaners, non-clinical staff, equipment, hospital processes and infrastructure, maternal and neonatal factors, and environmental conditions. This comprehensive approach to identifying issues was a strength of the project. Healthcare providers were identified as a key area for improvement, with issues such as ineffective handwashing, poor waste management, and inadequate aseptic techniques. The interventions proposed, including comprehensive training on newborn management, infection prevention and control (IPC), and risk assessment, were well-targeted to address these root causes.

The role of cleaners and non-clinical staff in maintaining a sterile environment was appropriately recognized. Issues such as poor waste management, ineffective cleaning, and unauthorized access to the neonatal ward were identified, and corresponding interventions like IPC training and stricter access controls were proposed. Equipment-related factors, including ineffective cleaning of critical devices and inadequate sterilization, were also addressed. The proposed interventions, such as improved cleaning protocols and advocacy for sufficient equipment, directly tackled these issues.

The analysis also considered broader systemic issues like deliveries occurring in ambulances and poor hospital infrastructure, highlighting the need for improvements beyond the neonatal ward itself. Maternal and neonatal factors, environmental considerations, and the emergence of antimicrobial resistance were all included in the comprehensive approach.

Since no patient was included, the consent was waived. Project conception, data collection, project implementation, and reporting were conducted under the approval and guidance of the ethical committee and hospital leadership of Remera Rukoma Hospital.

RESULTS

Figure 1 shows the progress of the neonatal infection rate reduction project at Remera Rukoma Hospital from January to June 2024. The baseline infection rate from July to December 2023 was 18.53%, and the target was set at 10%. While the project didn't reach its target, there was a consistent downward trend in infection rates over the six months. The rate started high at 22.9% in January but decreased significantly to 13% by June, showing substantial improvement despite falling short of the 10% goal. This trend indicates that the implemented interventions had a positive impact, even though further work is needed to reach the target rate.

DISCUSSION

The study at Remera Rukoma Hospital shows significant progress in reducing the neonatal infection rate from 22.9% in January 2024 to 13% in June, despite not reaching the 10% target. The interventions appear to have had a positive impact, as indicated by the downward trend over the six months. Rwanda's national health strategy targets neonatal mortality reduction, emphasizing the need for systematic hospital interventions, which aligns with the efforts at Remera Rukoma Hospital [14]. Healthcare providers were identified as a key area for improvement, with issues such as ineffective handwashing, poor waste management, and inadequate aseptic techniques. The studies indicate that 50–70% of hospital-

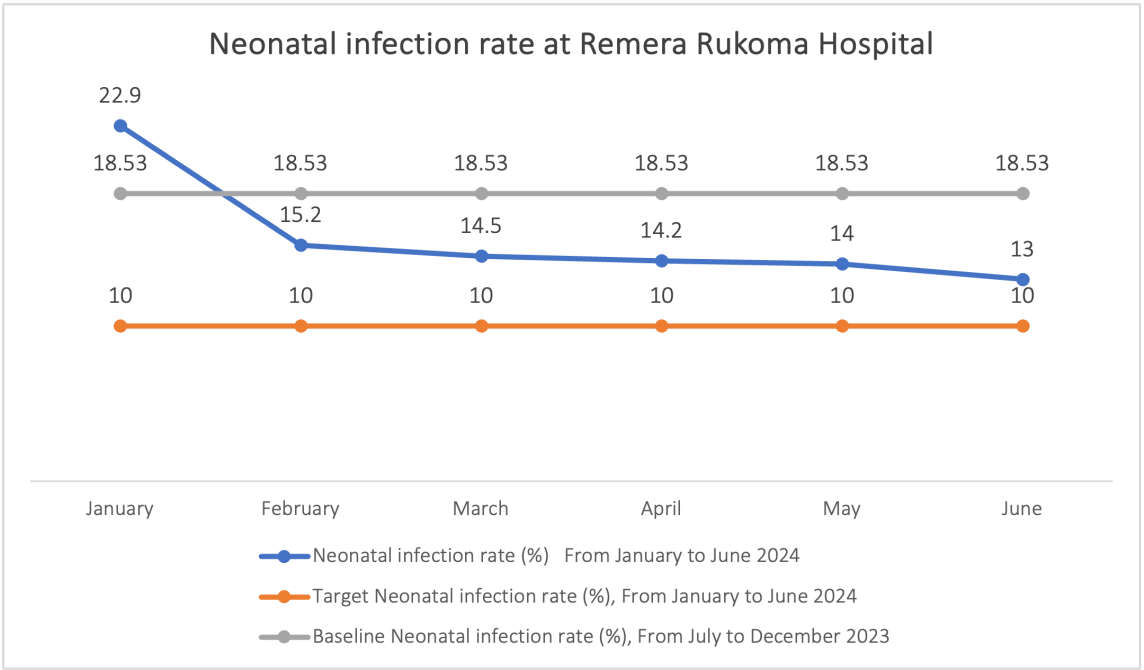

Figure 1: Trends in neonatal infections from January to June 2024.

acquired infections are attributed to poor hand hygiene [15].

Inappropriate sterile environment and related IPC measures were recognized as potential contributors to the rise of infections. Nyantakyi et al. also emphasized the role of uptake and sustainment of IPC programs in neonatal units, though it is limited in many settings [16]. Contrary to a review by Felicity, which failed to show evidence supporting the effectiveness of infection prevention and control interventions in neonatal units from limited-resource countries [17]. The IPC training and stricter access controls were proposed; thus, improved cleaning protocols and advocacy were paramount.

At the end of the six-month duration, the rate of neonatal infection was 17.11%. This rate is below the study by Merab et al., where his review indicated that for 2 years, 23.6% of neonates were admitted for neonatal infections [18]. Encouragingly, this project included a collaboration team at Remera Rukoma Hospital that was comprised of a diverse group of professionals and stakeholders. The evidence argued that the engagement of the hospital's leadership may lead to a reduction of specific mortality and improve maternal, neonatal and child health (MNCH) in resource settings [19]. This underscored the role of Fishbone and PDSA cycle in improving essential newborn care, as well as overall healthcare practice. This aligns with the study in India, which showed that standardizing essential newborn care led to significant improvements in key neonatal care indicators, including infection prevention [11]. The quality improvement project aimed at reducing neonatal infection rates at Remera Rukoma Hospital from January to June 2024 yielded several valuable lessons. Firstly, the use of the Fishbone diagram proved highly effective in identifying and categorizing the multifaceted root causes of neonatal infections, allowing for a comprehensive approach to problem-solving. The monthly monitoring by the quality improvement team was crucial in maintaining focus and allowing for timely adjustments to interventions. A key lesson was the importance of staff engagement and continuous education; improvements in hand hygiene and aseptic techniques were most noticeable when staff fully understood and bought into the importance of these practices. The project also highlighted the interconnectedness of various hospital departments in infection control, emphasizing the need for a hospital-wide approach rather than focusing solely on the neonatal unit.

Infrastructure and resource constraints emerged as significant challenges, underscoring the importance

of creative problem-solving and efficient resource allocation. The modest reduction in infection rates from 18.53% to 17.11% demonstrated that sustainable change takes time and persistent effort. Additionally, the project revealed the value of involving mothers in infection prevention strategies through targeted health education. Lastly, the experience underscored the importance of maintaining detailed records and analyzing data regularly to drive evidence-based decisions and measure the impact of interventions accurately. These lessons provide a solid foundation for future quality improvement initiatives and emphasize the need for ongoing, long-term commitment to infection control practices.

Moving forward, the quality improvement project at Remera Rukoma Hospital should build upon the progress made and lessons learned. The team should continue to use the Fishbone diagram method, refining it based on new insights gained during the initial project phase. Priority should be given to addressing the most impactful root causes identified, with a focus on sustainable, long-term solutions. Enhancing staff training programs, particularly in infection control practices, should remain a key focus. The hospital should consider implementing a more robust monitoring system, potentially incorporating digital tools for real-time data collection and analysis. Strengthening interdepartmental collaboration is crucial, as is developing strategies to overcome resource constraints, possibly through partnerships with NGOs or government initiatives. Engaging mothers and families more deeply in infection prevention strategies could yield significant benefits.

The hospital should also explore the possibility of conducting benchmarking exercises with similar institutions to identify best practices. Additionally, the quality improvement team should set new, realistic targets for further reducing the neonatal infection rate, breaking these down into smaller, achievable milestones. Continuous education and motivation of staff, coupled with regular feedback sessions, will be essential to maintain momentum. Finally, the hospital should consider expanding the scope of the project to address related areas, such as maternal health and overall hospital hygiene, to create a more comprehensive approach to infection control. By maintaining a committed, data-driven approach and fostering a culture of continuous improvement, Remera Rukoma Hospital can continue to make strides in reducing neonatal infection rates and improving overall patient care.

CONCLUSION

The quality improvement project aimed at reducing neonatal infection rates at Remera Rukoma Hospital from January to June 2024 demonstrated the potential for positive change through systematic analysis and targeted interventions. Using the Fishbone diagram method, the project team effectively identified and addressed multiple root causes contributing to neonatal infections. The reduction in infection rates from 18.53% to 17.11%, while modest, represents a significant step in the right direction and lays a foundation for further improvements. The monthly monitoring approach proved valuable in maintaining focus and allowing for timely adjustments. Key successes included enhanced staff awareness of infection control practices, improved interdepartmental collaboration, and the identification of critical areas requiring long-term attention, such as infrastructure and resource allocation. The project highlighted the complexity of addressing neonatal infections and the importance of a holistic, hospital-wide approach. While the initial target of reducing the infection rate to 10% was not met, the progress achieved underscores the potential for continued improvement. This project has not only contributed to better health outcomes for neonates but has also fostered a culture of continuous quality improvement within the hospital. Moving forward, sustaining and building upon these efforts will be crucial in further reducing neonatal infection rates and enhancing overall patient care at Remera Rukoma Hospital.

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