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Reducing Neonatal Infection Rate Among the Neonates Born at Remera Rukoma Hospital: A Report of Quality Improvement Project

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Abstract

Background

Neonatal infection is one of the leading causes of neonatal mortality globally, significantly higher mortality rates are observed in Lower and middle-income countries, where Rwanda is located. Remera Rukoma District Hospital reported an increasing rate of neonatal infection necessitating assessment of the contributing causes and urgent intervention.

Methods

The project was conducted from January to June 2024. The Fishbone diagram was adopted to conduct a comprehensive root cause analysis. A multidisciplinary team of a quality improvement officer, clinicians, and different stakeholders identified contributing factors across multiple domains were categorized into healthcare practices, equipment, hospital environment, and patient factors. Interventions were implemented and monitored using monthly Plan-Do-Study-Act (PDSA) cycles to track progress and make necessary adjustments.

Results

There was a downward trend from a high rate of neonatal infection of 22.9% in January to 13% in June 2024. Despite not meeting the ambitious target of 10%, the results indicated a significant improvement. The systematic approach, involving targeted training of all hospital personnel, and fostering infection control measures, contributed to this progress.

Conclusion

The project demonstrated that a structured, data-driven approach to quality improvement can reduce neonatal infection rates. Key lessons include the effectiveness of comprehensive root cause analysis and the importance of continuous staff engagement and education. While the initial target was not met, the reduction achieved lays a foundation for continued efforts to improve neonatal outcomes at Remera Rukoma Hospital. Sustained commitment and further refinement of strategies are essential for ongoing progress in infection control and overall patient care. Lessons learned include the value of staff engagement, continuous education, and data-driven decision-making in infection control efforts.

Background

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[12]. 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 livebirths by 2030 will be met[3]. Globally, an estimate of 22, 25 and 34% of under-five deaths resulted from neonatal infections, intrapartum-related conditions and preterm birth complications respectively, with the highest mortality rates being reported in Sub-Saharan Africa[4,5].

In sub-Saharan Africa alone, an estimated 5.3–8.7 million disability-adjusted life-years have been lost in 2014 due to neonatal sepsis and consecutive long-term morbidity[6]. Neonatal infections are also the major causes of death and disability among newborns in Rwanda[7]. In 2021, in Rwanda, the neonatal mortality rate was 17.52 deaths per 1,000 live births in 2021[7].. Neonatal deaths account for 68% of under-five deaths in Rwanda[2,5]. In Rwanda, nearly 71% of neonatal deaths are preventable and among these, 10% are due to neonatal sepsis[5]. 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; $p \leq 0.001$)[5].

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% newborns at Remera Rukoma have developed infection, this is equivalent to 169 newborns in 1000 newborns. From July to December 2023, 18.53% neonatal infection was recorded among the neonate born at Remera Rukoma Hospital. Therefore, this project was conducted to reduce this infection rate at Remera Rukoma District Hospital, and to identify the working interventions for neonatal infection prevention.

Problem statement

Neonatal infections are a major cause of death and morbidity among neonates, especially in developing countries[8]. Remera Rukoma District Hospital in Rwanda is no exception. In January to June 2023, the neonatal infection rate at the hospital was 16.8% (167 live birth per 1000 at Remera Rukoma Hospital). From July to December 2023, 18.53% neonatal infection was recorded among the neonate born at Remera Rukoma Hospital. There are a number of factors that could contribute to the high neonatal infection rate including inadequate infection prevention and control practices not limited to contaminated equipment like radiant warmer and continuous positive airway pressure (CPAP), High rates of maternal infections, and overcrowding and poor sanitation in the neonatal ward[9]. These factors create an environment in which neonates are at high risk of developing infections. The high neonatal infection rate at Remera Rukoma Hospital has a significant impact on the health and well-being of neonates and their families.

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 has a significant financial impact on the hospital. Neonatal infections require expensive treatment, and they can also lead to prolonged hospital stays. This can put a strain on the hospital's resources and make it difficult to provide quality care to all

patients. The high neonatal infection rate at Remera Rukoma Hospital is a serious problem that needs to be addressed. An intervention is needed to reduce the number of neonates who develop infections and to improve the outcomes of those who do become infected. Therefore, this project was conducted to address those issues.

Objectives

To reduce the neonatal infection rate among the neonate born at Remera Rukoma Hospital from 18.53–10% within 6 months (from January to June 2024).

Methodology

The quality improvement project "Reducing Neonatal Infection Rate at Remera Rukoma Hospital" from January to June 2024 employed a systematic methodology centered on the Fishbone (also known as Ishikawa or cause-and-effect) diagram approach[11,12]. This method was chosen for its effectiveness in visually organizing and analyzing the multiple factors contributing to neonatal infections. 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 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 monitoring 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 [12,13]. Data on neonatal infection rates were collected and analyzed monthly, providing quantitative evidence of the project's impact. This multi-faceted, data-driven approach allowed for ongoing refinement of strategies throughout the six-month project period, contributing to the observed reduction in neonatal infection rates from 18.53–17.11%.

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. 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 did result in a reduction of the infection rate to 17.11%, which represents progress in the right direction.

The root cause analysis revealed a complex web of factors contributing to the high infection rate[12], 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, with corresponding interventions like IPC training and stricter access controls 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.

Results

This data in graph 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.

Graph I: Trends in neonatal infections from January to June 2024.

Lessons Learned from Reducing Neonatal Infection Rates at Remera Rukoma Hospital

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 18.53–17.11% 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.

Way forward in reducing neonatal infection at Remera Rukoma Hospital.

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 18.53–17.11%, 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.

Abbreviations

AOR: Adjusted Odd Ratio

CPAP: Continuous Positive Airway Pressure

IPC: Infection Prevention and Control

LMICs: low-income and middle-income countries

WHO: World Health Organization

QI: Quality Improvement

Declarations

Ethical Approval

Since there was 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.

Consent for Publication

Not applicable. This quality improvement project on reducing surgical site infections at Remera Rukoma Hospital does not contain any individual person's data in any form (including individual details, images or videos), and all data used in the analysis were aggregated and anonymized.

Availability of data and material

The datasets generated and analyzed during the current quality improvement project on reducing surgical site infections at Remera Rukoma Hospital are available from the corresponding author upon reasonable request, as they contain no individual personal data and consist only of aggregated statistics and anonymized quality improvement metrics.

Competing of interest

The authors declare that they have no competing interests in relation to this project on reducing surgical site infections at Remera Rukoma Hospital, and have no financial or non-financial interests that could potentially influence the interpretation of the study results or conclusions drawn.

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Graph 1

Graph 1 is available in the Supplementary Files section.

Supplementary Files

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- GraphI.jpg