Original Research Article

Perinatal mortality audit in a tertiary healthcare center in Uttar Pradesh: a retrospective study

Bandana Sharma, Himani Malviya*, Anchal Malik, Neha Swayam

Department of Obstetrics and Gynecology, Ganesh Shankar Vidyarthi Memorial Medical College, Kanpur, Uttar Pradesh, India

Received: 30 July 2024
Accepted: 02 September 2024

*Correspondence:
Dr. Himani Malviya,
E-mail: himanimalviya@gmail.com

ABSTRACT

Background: Perinatal mortality remains a significant global health issue, reflecting the quality of maternal and neonatal care. In Uttar Pradesh, India, where healthcare challenges are pronounced, understanding the specific factors contributing to perinatal mortality is crucial. This study aims to analyse and evaluate the patterns, causes, and contributing factors of perinatal mortality in a tertiary healthcare center in Kanpur.
Methods: This retrospective observational study was conducted at GSVM Medical College, Kanpur, from April 1, 2023, to March 31, 2024. Data on maternal and fetal characteristics were collected from hospital files and neonatal outcomes from the NICU. Inclusion criteria included stillborn babies born after 28 weeks of gestation and newborns who died within the first 7 days of life. Cases were excluded if they were preterm, of low birth weight, or delivered outside the hospital. Descriptive statistics were used to analyze the data.
Results: Among 6,123 deliveries, 212 perinatal deaths were recorded, yielding a perinatal mortality rate of 3.46%. The mean maternal age was 27.67 years. A majority of perinatal deaths (75.5%) involved women with no antenatal care. The leading causes of death were prematurity (23.5%), asphyxia (15.6%), and respiratory distress syndrome (11.8%). Hypertensive disorders, antepartum haemorrhage, and severe anemia were the most common maternal complications. The study revealed significant risks associated with multiparity, lack of prenatal care, and low birth weight.
Conclusions: Reducing perinatal mortality in Uttar Pradesh requires a comprehensive approach, including improved access to antenatal care, strengthened healthcare infrastructure, and community education. Addressing these factors is essential for enhancing maternal and neonatal health outcomes and reducing perinatal mortality rates.

Keywords: Antenatal care, Perinatal mortality, Retrospective study, Stillbirths, Tertiary care center

INTRODUCTION

Perinatal mortality continues to be a pressing global health issue, serving as a reflection of both maternal and neonatal well-being and the effectiveness of healthcare systems.[1] As a key indicator of newborn care quality, it directly reflects the standard of care provided during pregnancy, childbirth, and the newborn period. In India, especially in states like Uttar Pradesh where maternal and neonatal healthcare faces significant challenges, identifying the specific factors driving perinatal mortality is essential to drive improvements in healthcare outcomes and save lives.

The Perinatal Mortality Rate (PMR) is a key indicator of a society's overall health status. Although India has seen a decline in PMR, it remains significantly higher compared to global standards.[2] The World Health Organization (WHO) defines perinatal mortality as the death of a baby between 28 weeks of gestation and the first 7 days of life.[3] The PMR is calculated by dividing the total number of stillbirths and early neonatal deaths within a specified period by the total number of births, then multiplying by 1,000. This metric provides valuable insights into the quality of maternal and newborn care.[4]

In 2019, the global average was 14 stillbirths and 17 neonatal deaths per 1,000 births. However, low- and middle-income countries (LMICs) faced significantly higher mortality rates, with 19 stillbirths and 25 neonatal deaths per 1,000 births.[5,6] To address this, the UN set a target to reduce neonatal mortality to 12 per 1,000 live births by 2030, while the WHO aims to lower stillbirth rates to less than 12 per 1,000 births through every newborn action plan (ENAP).[7] India has adopted the Indian Newborn Action Plan (INAP) to achieve a single-digit stillbirth rate by 2030.[8] Notably, while developed countries have seen a 2% annual decline in stillbirth rates, India's progress in reducing stillbirths and neonatal mortality has been slower compared to its progress in reducing maternal mortality.[9]

The quality of care provided to the mother and the newborn baby throughout pregnancy, delivery, and the postpartum period has a significant impact on the likelihood that the baby will survive.[10] A history of stillbirth, smoking, and alcohol use, as well as multiple pregnancies, obesity, hypertension, diabetes, HIV, and fetal growth restriction, are all risk factors for stillbirth.[11] Furthermore, a short interval between pregnancies, low socioeconomic status, limited educational attainment, and lack of prenatal care also increase the risk of stillbirth. These factors underscore the importance of comprehensive and quality healthcare throughout the reproductive journey to minimize the risk of stillbirth and ensure optimal outcomes for mothers and newborns.

In high-income countries, the link between maternal complications and perinatal death has been well-documented, and these nations have the resources to diagnose, treat, and prevent obstetric complications.[12] However, these findings may not be applicable to low- and middle-income countries (LMICs) due to limitations in human resources, diagnostic capabilities, and access to obstetric interventions. Despite bearing 98% of the global burden of perinatal mortality, studies in LMICs have been limited in scope and power, often focusing on single facilities and neglecting to include stillbirths and early neonatal deaths as separate outcomes.[13] Furthermore, previous large-scale epidemiological surveys of neonatal deaths in LMICs have not collected data on maternal complications.[14] This study aims to address these gaps by investigating the causes of perinatal death and associated maternal problems in Kanpur city, Uttar Pradesh, India.

Tertiary healthcare centers are crucial for managing high-risk pregnancies and providing specialized care to mothers and newborns. Auditing perinatal mortality in these settings is essential to identify areas for improvement and enhance the quality of care. This retrospective review aims to analyse and evaluate the patterns, causes, and contributing factors of perinatal mortality in a tertiary healthcare center in Uttar Pradesh. By examining a comprehensive dataset of clinical records, this study seeks to provide insights into the epidemiological profile of perinatal mortality cases, ultimately informing strategies to reduce mortality rates and improve maternal and neonatal outcomes. The results of this audit will provide valuable insights to inform evidence-based interventions and strategies, ultimately reducing perinatal mortality rates in similar healthcare settings. By shedding light on the factors contributing to perinatal mortality in Uttar Pradesh, this study will contribute to the development of targeted healthcare policies and practices tailored to improve maternal and neonatal health outcomes. This research has the potential to make a meaningful impact on the lives of mothers and newborns, helping to create a safer and more supportive healthcare environment for vulnerable populations.

This retrospective review aims to provide a deeper understanding of the intricate factors surrounding perinatal mortality in a tertiary healthcare setting, highlighting the need for ongoing quality improvement initiatives and patient-centered care approaches. By examining the magnitude of the issues within our hospital, this study seeks to inform the development of targeted preventive strategies, ultimately enhancing the quality of care and improving outcomes for mothers and newborns. Through this research, we strive to identify areas for improvement and implement effective solutions to reduce perinatal mortality and enhance patient care.

This study aimed to determine the main causes and underlying factors contributing to perinatal mortality in the healthcare center, providing a comprehensive understanding of the issues at hand. Also, to benchmark the audit findings against established clinical guidelines and standards of care, identifying gaps and areas for improvement, and subsequently proposing evidence-based recommendations to enhance perinatal healthcare practices and improve patient outcomes.

METHODS

This retrospective observational study was conducted at the Department of Obstetrics and Gynecology and the Department of Pediatrics at GSVM Medical College, Kanpur, spanning a one-year period from April 1, 2023, to March 31, 2024. The study collected data on maternal and fetal demographic characteristics, as well as the mother's clinical and obstetric conditions, from hospital files in the Department of Obstetrics and Gynecology. Additionally, data regarding neonatal outcomes were obtained from the Neonatal Intensive Care Unit (NICU) in the Department of Pediatrics. This comprehensive data collection aimed to provide a thorough understanding of perinatal mortality factors and associated maternal and neonatal characteristics.

Inclusion criteria

All stillborn babies born after 28 weeks of gestation and weighing more than 1000 grams. Also, all newborns born in the hospital during the study period who died within the first 7 days of life were included.

Exclusion criteria

The following cases were excluded from the study: 1) Preterm births with a gestational age of less than 28 completed weeks; 2) Low birth weight cases with a birth weight of less than 1000 grams; 3) Neonatal deaths occurring more than 7 days after birth; 4) Babies delivered outside of GSVM Medical College.

The various causes of perinatal mortality were determined and effect of various factors like status of antenatal care, socioeconomic status, maternal age, parity, birthweight, obstetrical complications on perinatal mortality rate were studied.

Statistical analysis

Data analysis was performed using simple descriptive statistics and percentage calculations to summarize and describe the characteristics of the data. This included calculating frequencies, percentages, and summary measures (such as means and medians) to provide an overview of the perinatal mortality cases and associated factors. This approach enabled the identification of patterns, trends, and correlations within the data, providing a foundation for understanding the causes and contributing factors of perinatal mortality.

RESULTS

Over a 12-month period, a total of 6,123 deliveries were recorded, resulting in 212 perinatal deaths. This corresponds to a perinatal mortality rate of 3.46%, indicating that approximately 3.5 perinatal deaths occurred per 100 deliveries. This statistic highlights the significance of perinatal mortality as a critical healthcare concern, warranting further investigation and targeted interventions to reduce this rate and improve maternal and neonatal outcomes.

The mean age of participants was 27.67 years, with a standard deviation of 3.94 years. Among them, 72 participants (34.0%) were aged 20-25 years, 91 participants (42.9%) were aged 26-30 years, 43 participants (20.3%) were aged 31-35 years, and 6 participants (2.8%) were over 35 years old. More than half of the perinatal deaths (52.8%) involved male babies. Most mothers who experienced perinatal deaths (69.4%) were multiparous, while about one-third were primigravida. Over three-quarters (75.5%) of the women who had stillbirths or neonatal deaths were unbooked for antenatal care. Nearly half (44.8%) of the perinatal deaths occurred in term pregnancies. The majority (77%) went into spontaneous labor, and 80% delivered vaginally, either cephalic or breech. Only 20% underwent emergency caesarean sections. Approximately three-quarters of the mothers (75.4%) were referred from Primary Health Centers (PHC) and Community Health Centers (CHC), where the quality of care was considered suboptimal. A total of 26 perinatal deaths (12.6%) occurred in neonates

weighing less than 1,000 grams, 56 deaths (26.4%) in neonates weighing between 1,000 and 1,499 grams, 46.2% of deaths in neonates weighing between 1,500 and 2,499 grams, and 15.1% in neonates weighing more than 2,500 grams (Table 1).

Table 1: Distribution of maternal characteristics by baby conditions.

Characteristics	Number	Percentage
Mean age- 27.67±3.94 (years)		
20-25	72	34
26-30	91	42.9
31-35	43	20.3
>35	6	2.8
Parity		
Primi	65	30.6
Multipara	147	69.4
Gender		
Male	114	52.8
Female	104	47.2
Attendance in ANC		
Booked	52	24.5
Unbooked	160	75.5
History of still birth	6	2.83
History of neonatal death	14	6.6
Type of pregnancy		
Singleton	206	97.1
Twins	6	2.9
Gestational age (weeks)		
<28	17	8
28-31^{+6}	34	16
32-33^{+6}	22	10.4
34-36^{+6}	44	20.8
>37	95	44.8
Birth weight (gm)		
<1000	26	12.3
1,000-1499	56	26.4
1500-2499	98	46.2
>2500	32	15.1
Onset of labor		
Spontaneous	165	77.8
Induced	42	19.8
Elective LSCS	5	2.4
Mode of delivery		
Cephalic vaginal delivery	143	67.5
Breech vaginal delivery	25	11.8
Caesarean	44	20.7
Referred from PHC/CHC		
Yes	160	75.4
NO	52	24.6

The most common complications identified during pregnancy were hypertensive disorders (36.3%), antepartum haemorrhage (17.4%), and severe anemia (16.5%). These three conditions were more prevalent than

other maternal complications, underscoring the need for close surveillance and timely intervention to mitigate risks (Table 2).

Table 2: Obstetric complications associated with perinatal mortality.

Obstetric complication	Frequency	Percentage
Severe pre- eclampsia	56	26.4
Eclampsia	21	9.9
APH	37	17.4
Severe anaemia	35	16.5
No complication	24	11.3
Uterine rupture	20	9.4
GDM	10	4.7
IHCP	3	1.4
Rh negative pregnancy	3	1.4
Cardiac disease	3	1.4

A total of 50 neonatal deaths (23.5%) were attributed to prematurity, while 33 deaths (15.6%) were caused by asphyxia. Additionally, 25 deaths (11.8%) resulted from respiratory distress syndrome, and 24 deaths (11.3%) were due to meconium aspiration syndrome. Prematurity was the most common cause of neonatal death, whereas haemorrhagic disease of the newborn was the least common. Notably, the cause of 32 perinatal mortality cases (15%) remained unexplained, highlighting the need for further investigation into these cases (Table 3).

Table 3: Factors associated with perinatal mortality.

Cause of mortality	Number	Percentage
Preterm	50	23.5
Intrapartum asphyxia	33	15.6
Respiratory distress syndrome	25	11.8
Meconium aspiration syndrome	24	11.3
Early onset neonatal sepsis	17	8.0
Hypoxic ischaemic encephalopathy	15	7.1
Nuchal cord around neck	6	2.8
Congenital anomalies	5	2.4
Haemorrhagic disease of new born	5	2.3
Unexplained	32	15

DISCUSSION

Perinatal mortality audits play a vital role in reducing perinatal mortality and reflect the quality of health services provided at healthcare centers. Determining the causes of perinatal mortality is crucial for developing health care programs to reduce the perinatal mortality rate and setting priorities for health interventions. This study highlights that perinatal mortality remains a significant problem in healthcare facilities. In India, as in many other countries,

perinatal death audits are not routinely conducted in all health facilities due to various reasons. These reasons include health workers' fear of being personally identified and blamed for deaths, lack of participation from health facility managers, and failure to implement actions to correct system weaknesses. Without implementing actions and changing the practice environment, health workers may lose morale, become burned out, and feel frustrated by identifying the same issues without seeing any improvements. This study demonstrates that addressing all elements of perinatal death audits contributes to sustaining the practice.

Over a 12-month period, monthly perinatal death audits were conducted. In our study, the stillbirth rate was 13 per 1,000 live births, and the neonatal mortality rate was 21 per 1,000 live births. Globally, in 2019, an estimated 14 stillbirths per 1,000 births and 17 neonatal deaths per 1,000 live births were reported.[5,6] Compared to developed countries, our study's stillbirth and neonatal mortality rates are still higher. This disparity can be attributed to limited access to quality healthcare, malnutrition, poor maternal health, inadequate prenatal and postnatal care, and socioeconomic disparities. Efforts to improve these outcomes often focus on enhancing healthcare infrastructure, increasing awareness, and ensuring better nutrition and maternal care. Mortality rates in low-income and middle-income countries (LMICs) were considerably higher, with estimates of 19 stillbirths per 1,000 births and 25 neonatal deaths per 1,000 live births. [5,6] Our study found that stillbirth and neonatal mortality rates are lower than those in LMICs. This improvement is due to significant investments in healthcare infrastructure in India, including the establishment of numerous public and private healthcare facilities. Initiatives such as the National Health Mission and Janani Suraksha Yojana aim to improve maternal and child health by promoting institutional deliveries and providing financial incentives for expectant mothers. Additionally, India has a robust immunization program that helps prevent common infections leading to neonatal mortality, and increased awareness and education about maternity health practices have contributed to better healthcare outcomes. Despite these improvements, challenges remain. Continuous efforts are needed to further reduce stillbirth and neonatal mortality rates.

In this study, the perinatal mortality rate is higher in multiparous women with male babies, similar to findings from a study conducted in Tanzania.[15] This higher mortality rate can be attributed to multiparous women having an increased risk of developing gestational diabetes mellitus (GDM), hypertensive disorders of pregnancy, and placental issues. Additionally, women who do not attend regular antenatal visits may experience complications like GDM and preeclampsia that are often detected late, reducing the chances of timely and effective interventions. Perinatal mortality is also higher among women who had no antenatal visits. This observation aligns with findings from other studies conducted in different parts of the world. [16-20]

The study reveals a strong link between lack of prenatal care and increased risk of stillbirths and newborn deaths. A staggering 75.5% of women who experienced these tragic outcomes had not received proper prenatal care, echoing findings from previous research. This highlights the critical importance of regular antenatal check-ups in preventing pregnancy complications and ensuring the health and well-being of both mothers and babies.[21-23]

In this particular study, 55.2% of the women delivered before 37 weeks of gestation. India is estimated to account for 23.4% of all preterm births worldwide, making it the country with the highest number of preterm births globally.[24] Previous research [25]has shown that preterm labor is a significant source of perinatal morbidity and mortality in both developed and developing nations, affecting 5-10% of pregnancies and being a leading cause of perinatal complications. The incidence of premature birth in this study was 5.52%, which is comparable to research conducted in Europe.[26] An Indian multicentric study found the preterm birth rate to be 8.6%, which is similar to the results of our study.[27] Another large longitudinal cohort study found that preterm births occurred more frequently (14.9%) in India.[28]

In this study, low birth weight (LBW) babies had 5.6 times more risk of neonatal death than babies weighing more than 2,500 grams. Similarly, a study conducted in Central Nepal (Chitwan district) observed that the risk of neonatal deaths was increased by more than 8 times in LBW newborns compared to those with normal or higher birth weights. Leach et al and Ngoc et al found similar observations.[29,30] Findings from studies in Zimbabwe (4.67 times higher risk, 95% CI: 3.92-5.57) and Iran (7.68 times higher risk, 95% CI: 1.49-39.55) align with these results.[31,32] A study conducted in Nigeria reported that LBW babies are approximately 4.7 times more likely to die during the neonatal period compared to neonates with a birth weight of 2.5 kg or more.[33] LBW babies are at increased risk of hypothermia, poor immunological function, and infections, which heighten the risk of neonatal deaths. Therefore, it is crucial to give LBW babies extra attention to ensure they lead healthy lives.[34]

The risk of perinatal mortality is 3.5 times higher in women who experienced spontaneous onset of labor and 20 times higher for infants born in a breech presentation. Similar increases in risk have been observed in other studies.[35-37]

Approximately two-thirds of patients in this study were referred from Primary Health Centers (PHCs) or Community Health Centers (CHCs), due to various challenges such as limited specialized care, patient preferences, transportation barriers, strict audit criteria, and systemic issues. To enhance the referral process and improve perinatal outcomes, it's crucial to address these factors. This can be achieved by upgrading the capabilities of PHCs and CHCs, enhancing communication and coordination, and establishing clear referral guidelines,

ensuring that patients receive suitable care at the appropriate facility level.

In this study, the most common obstetric complication associated with perinatal mortality was hypertensive disorder of pregnancy (36.3%), followed by antepartum haemorrhage (17.4%) and severe anemia (16.5%). However, other studies conducted by Singhal et al and Adekanle et al showed very high maternal and perinatal morbidity and mortality in cases of antepartum haemorrhage (APH).[38,39] Hypertensive disorders, including preeclampsia and eclampsia, and APH can lead to significant complications for both the mother and the fetus, such as placental insufficiency, fetal hypoxia, and preterm births. Severe anemia can exacerbate the effects of hypertensive disorders and APH by further compromising oxygen delivery and increasing the risk of preterm birth and fetal distress. The causes of anemia during pregnancy in developing countries are multifactorial, including micronutrient deficiencies of iron, folate, and vitamins A and B12, as well as anemia due to parasitic infections.

In this study, the three most common causes of perinatal mortality were prematurity, asphyxia, and respiratory distress syndrome. A total of 50 deaths (23.5%) were due to prematurity, 33 deaths (15.6%) were due to asphyxia, and 25 deaths (11.8%) were due to respiratory distress syndrome. The three most common causes of early neonatal deaths (ENDs) were asphyxia, low birth weight (LBW)/prematurity, and infection. These causes are frequently identified in low- and middle-income countries (LMICs), although their relative frequencies differ among studies. For instance, a household survey in rural Tanzania found that the most important causes of perinatal deaths, in order of frequency, were infections, asphyxia, and LBW/prematurity.[40] In contrast, a retrospective hospital-based study in North Kivu, DRC, identified LBW as the predominant cause of death.[41] The variability in the relative frequency of individual causes may depend on environmental features, the demography of the population, and the healthcare system.

CONCLUSION

The persistence of high perinatal mortality rates in a tertiary healthcare center in Uttar Pradesh, India, is a pressing concern that requires immediate attention. Despite efforts to improve healthcare outcomes, the leading causes of death remain prematurity, asphyxia, and respiratory distress syndrome. These critical issues highlight the need for comprehensive interventions to address the complex factors contributing to perinatal mortality.

Improving access to quality antenatal care is a crucial step towards reducing perinatal mortality rates. Expectant mothers must receive regular check-ups, proper nutrition, and timely interventions to prevent complications. Moreover, strengthening healthcare infrastructure is essential, including upgrading facilities, equipment, and

personnel, to provide high-quality care during delivery and postpartum periods.

Promoting awareness and education about best practices for maternal and child health is also vital. Empowering communities to make informed decisions and adopt healthy behaviors can significantly impact perinatal outcomes. Targeted interventions, such as implementing evidence-based guidelines for antenatal and intrapartum care, enhancing neonatal care, and encouraging community-based initiatives, can further minimize the risk of perinatal mortality.

By addressing these critical issues and implementing effective solutions, it is possible to ensure a healthier future for mothers and newborns in India. Reducing perinatal mortality rates requires a multifaceted approach that involves improving healthcare infrastructure, promoting awareness, and providing high-quality care. With concerted efforts, it is possible to make significant progress in this critical area of healthcare.

Recommendations

Doppler parameters and clubbed it with all adverse outcomes including perinatal deaths and nursery admissions. Martinez et al studied small-for-gestational-age group and concluded that middle cerebral artery vasodilation was associated with the highest risk of cesarean delivery ($p<0.001$) and cesarean delivery for nonreassuring fetal status ($p<0.001$) and also increased risk of neonatal acidosis (odds ratio, 9.0).

ACKNOWLEDGEMENTS

REFERENCES

1. Mukherjee SB, Bandhopadhyay T. Perinatal mortality what has changed. Indian Pediatr. 2016;153(3):242-3.
2. International Institute for Population Sciences (IIPS) and ICF. National Family Health Survey (NFHS-4), 2015-2016, 2017. Available at: https://dhsprogram.com/pubs/pdf/FR339/FR339.pdf. Accessed 01 June 2024.
3. World Health Organization. Child Health: Health Topics, 2016. Available at: https://www.who.int/health-topics/child-health. Accessed 01 June 2024.
4. World Health Organization. World Preeclampsia Day Report, 2017.
5. World Health Organization. UN Inter-agency Group for Child Mortality Estimation neglected tragedy: the global burden of stillbirths, 2022. Available at: https://www.who.int/publications/m/item/a-neglected-tragedy-the-global-burden-of-stillbirths#:~:text=This%20means%20that%20every%20year,term%20economic%20repercussions%20for%20society. Accessed 01 June 2024.
6. World Health Organization. Newborns: improving survival and well-being. Available at: https://www.who.int/news-room/fact-sheets/detail/newborns-reducing-mortality. Accessed 01 June 2024.
7. World Health Organization. Sustainable Development Goals (SDG). Available at: https://www.who.int/health-topics/sustainable-development-goals#tab=tab. Accessed 01 June 2024.
8. Roy MP. Mitigating the stillbirth challenge in India. The Lancet. 2016;387(10032):1995.
9. Lawn JE, Blencowe H, Waiswe P. And for the Lancet ending preventable stillbirths series study group with the Lancet stillbirth epidemiology investigator group. Stillbirths: rates, risk factors, and acceleration towards 2030. Lancet. 2016;387(10018):587-603.
10. Flenady V, Koopmans L, Middleton P, Frøen JF, Smith GC, Gibbons K, et al. Major risk factors for stillbirth in high-income countries: a systematic review and meta-analysis. Lancet. 2011;377(9774):1331-40.
11. Gardosi J, Madurasinghe V, Williams M, Malik A, Francis A. Maternal and fetal risk factors for stillbirth: population based study. BMJ. 2013;346:f108.
12. Olagbuji BN, Ezeanochie MC, Igbaruma S, Okoigi SO, Ande AB. Stillbirth in cases of severe acute maternal morbidity. Int J Gynaecol Obstet. 2012;119(1):53-6.
13. Bayou G, Berhan Y. Perinatal mortality and associated risk factors: a case control study. Ethiop J Health Sci. 2012;22(3):153-62.
14. McClure EM, Pasha O, Goudar SS, Chomba E, Garces A, Tshefu A, et al. Epidemiology of stillbirth in low-middle income countries: a Global Network Study. Acta Obstet Gynecol Scand. 2011;90(12):1379-85.
15. Pascal M, Sifaeli K, Godfrey G, Vickfarajaeli D et al Perinatal mortality audit in a rural referral hospital in Tanzania to inform future interventions: A descriptive study PLoS One. 2022;17(3):e0264904.
16. Aragaw YA. Perinatal mortality and associated factor in Jimma University Specialized Hospital, South West Ethiopia. Gynecol Obstet (Sunnyvale). 2016;6(11):409.

17. Goba GK, Tsegay H, Gebregergs GB, Mitiku M, Kim KA, Alemayehu M. A facility-based study of factors associated with perinatal mortality in Tigray, northern Ethiopia. Int J Gynaecol Obstet. 2018;141(1):113-9.

18. Fawole AO, Shah A, Tongo O, Dara K, El-Ladan AM, Umezulike AC, et al. Determinants of perinatal mortality in Nigeria. Int J Gynaecol Obstet. 2011;114(1):37-42.

19. Feresu SA, Harlow SD, Welch K, Gillespie BW. Incidence of stillbirth and perinatal mortality and their associated factors among women delivering at Harare Maternity Hospital, Zimbabwe: a cross-sectional retrospective analysis. BMC Pregn Childbir. 2005;5:1-2.

20. Diallo AH, Meda N, Zabsonré E, Sommerfelt H, Cousens S, Tylleskär T, PROMISE-EBF study group adi044@ cih. uib. no. Perinatal mortality in rural Burkina Faso: a prospective community-based cohort study. BMC Pregn Childb. 2010;10:1-9.

21. Tekelab T, Chojenta C, Smith R, Loxton D. The impact of antenatal care on neonatal mortality in sub-Saharan Africa: A systematic review and meta-analysis. PLoS One. 2019;14(9):e0222566.

22. Arunda M, Emmelin A, Asamoah BO. Effectiveness of antenatal care services in reducing neonatal mortality in Kenya: analysis of national survey data. Glob Health Action. 2017;10(1).

23. Tuladhar H, Dhakal N. Impact of antenatal care on maternal and perinatal outcome: a study at Nepal Medical College Teaching Hospital. NJOG. 2011.;6(2):37-43.

24. Devi TC, Singh HS. Prevalence and associated risk factors of preterm birth in India: a review. J Public Health Dev. 2021;2:209-26.

25. Reddy KM, Ravula SR, Palakollu S, Betha K. Prevalence of preterm birth and perinatal outcome: A rural tertiary teaching hospital-based study. J Fam Med Prim Care. 2022;11(7):3909-14.

26. van der Ven AJ, Schaaf JM, van Os MA, de Groot CJ, Haak MC, Pajkrt E, et al. Comparison of perinatal outcome of preterm births starting in primary care versus secondary care in Netherlands: a retrospective analysis of nationwide collected data. Obstet Gynecol Int. 2014;2014(1):423575.

27. Pusdekar YV, Patel AB, Kurhe KG, Bhargav SR, Thorsten V, Garces A, et al. Rates and risk factors for preterm birth and low birthweight in the global network sites in six low- and low middle-income countries. Reprod Health. 2020;17(Suppl 3):187.

28. Bhatnagar S, Majumder PP, Salunke DM, Interdisciplinary Group for Advanced Research on Birth Outcomes-DBT India Initiative (GARBH-Ini). A pregnancy cohort to study multidimensional correlates of preterm birth in India: study design, implementation, and baseline characteristics of the participants. Am J Epidemiol. 2019;188(4):621-31.

29. Leach A, McArdle TF, Banya WA, Krubally O, Greenwood BM, Rands C, et al. Neonatal mortality in a rural area of the Gambia. Ann Trop Paediatr 1999;19(1):33-43.

30. Ngoc NT, Merialdi M, Abdel-Aleem H, Carroli G, Purwar M, Zavaleta N, et al. Causes of stillbirths and early neonatal deaths: data from 7993 pregnancies in six developing countries. Bull World Health Organ 2006;84(9):699-705.

31. Kambarami R, Matibe P, Pirie D. Risk factors for neonatal mortality: Harare Central Hospital Neonatal Unit-Zimbabwe. Cent Afr J Med. 1999;45(7):169-73.

32. Chaman R, Naieni KH, Golestan B, et al. Neonatal mortality risk factors in a rural part of Iran: A nested case-control study. Iran J Publ Heal. 2009;38(1):48-52.

33. Lawoyin TO, Onadeko MO, Asekun-Olarinmoye EO. Neonatal mortality and perinatal risk factors in rural southwestern Nigeria: A community-based prospective study. West Afr J Med. 2010;29(1):19-23.

34. Sines E, Syed U, Wall S, Worley H. Postnatal care: A critical opportunity to save mothers and newborns. Policy Perspectives on Newborn Health. 2007;1(7).

35. Feresu SA, Harlow SD, Welch K, Gillespie BW. Incidence of stillbirth and perinatal mortality and their associated factors among women delivering at Harare Maternity Hospital, Zimbabwe: a cross-sectional retrospective analysis. BMC Pregn Child. 2005;5:1-12.

36. Wildschut HI, Tutein Nolthenius-Puylaert MC, Wiedijk V, Treffers PE, Hubert J. Fetal and neonatal mortality: a matter of care? Report of a survey in Curaçao, Netherlands Antilles. Br Med J 1987;295(6603):894-97.

37. Mavalankar DV, Trivedi CR, Gray RH. Levels and risks for perinatal mortality in Ahmedabad, India. Bull World Health Organ. 1991;69(4):435-42.

38. Singhal S, Nymphaea, Nanda S. Maternal and perinatal outcome in antepartum hemorrhage: a study at a tertiary care referral institute. Intern J Gynecol Obstet. 2007;9(2):1-6.

39. Adekanle DA, Adeyemi AS, Fadero FF. Ante-partum hemorrhage and pregnancy outcome in LAUTECH teaching hospital, southwestern Nigeria. J Med Med Sci. 2011;2(12):1243-7.

40. Hinderaker SG, Olsen BE, Bergsjo PB, Gasheka P, Lie RT, Havnen J, et al. Avoidable stillbirths and neonatal deaths in rural Tanzania. BJOG. 2003;110(6):616-23.

41. Mugisho E, Dramaix M, Porignon D, Musubao E, Hennart P. Analysis of data routinely collected in the maternity ward of Rutshuru in the Democratic Republic of the Congo between 1980 and 1998. II. New-born deaths and low birth weights. Sante. 2002;12(2):252-5.