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Perinatal mortality trend and classification of causes at a tertiary care centre of western Nepal

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Abstract

Background: Identifying causes of perinatal death is important to reduce perinatal mortality rate.

Objectives: To determine trend of perinatal mortality rate (PMR), ascertain causes, and find out changes in causes of death over period of seven years.

Methods: This retrospective study, conducted after ethical approval, included stillbirths and early neonatal deaths at Manipal teaching hospital from April 2014 to April 2021, after 28 weeks of gestation or of foetuses weighing more than 1000 grams. Perinatal mortality rate of each year was calculated. Cause of death was assigned according to International Classification of Disease – Perinatal Mortality classification. Data analysis was done to find out trends and causes of perinatal mortality using SPSS v.21. Frequency and percentages were used to calculate causes of deaths.

Results: Perinatal mortality rate decreased from 35.5 to 21.1 per 1000 births over seven years. Antepartum hypoxia (103, 45%) was commonest cause of antepartum deaths, commonly associated with maternal medical conditions. This remained as main cause of antepartum death over years. Acute intrapartum events resulted in three-fourths of intrapartum deaths; were associated with complications of labour and delivery. Decline in this has resulted in overall decrease in intrapartum deaths. Low birth weight and prematurity (73, 42.2%) was the common cause of neonatal deaths and has remained same over years.

Conclusion: Perinatal mortality has decreased over years. Antepartum hypoxia as cause of antepartum deaths and prematurity as cause of neonatal deaths remained same over years. There is decrease in intrapartum deaths due to declining acute intrapartum events.

Key words: Classification; International classification of diseases; Perinatal death; Stillbirth.

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INTRODUCTION

Worldwide, there are over 6.3 million perinatal deaths a year, mostly in developing countries.[1] Despite decline in childhood mortality rates over a period of years, there is no significant decrease in perinatal deaths.[2] Perinatal mortality contributes greatly to infant and neonatal mortality - 40% of infant mortality and 75% of neonatal mortality occurring because of perinatal deaths.[3] Stillbirths account for over half of all perinatal deaths.[1]

Identifying causes of perinatal death helps the clinicians and policy makers to develop strategies and to implement programmes that address preventable factors. Knowledge about the trend of perinatal deaths and its causes helps in adapting and recommending interventions to ensure further decline.

The Perinatal Mortality Rate (PMR) of Nepal has declined from 49 to 31 per 1000 births from 2001 to 2016.[4] Still more needs to be done to accomplish the Sustainable Development Goal target of neonatal mortality less than 12 per 1000 births by 2030. Determining trends of perinatal deaths and ascertaining causes may be the first step to reduce mortality. Hence, this study was conducted with the aim to determine trends of PMR, ascertain their causes, and see change in causes over a period of seven years.

METHODOLOGY

This was a retrospective chart review analysing the trends of perinatal deaths and the cause of the perinatal deaths. The perinatal deaths that occurred in the department of Obstetrics and Gynaecology and department of Paediatrics of Manipal Teaching Hospital, Pokhara, Kaski, Nepal were included. All perinatal deaths from 1st Baisakh 2071 Bikram Sambat (BS) to 31st Chaitra 2077 BS (14th April 2014 to 13th April 2021) were taken. Data collection was done from 1st June 2021 to 30th June 2021 for a period of one month after taking ethical clearance from institutional review committee (Ref. MEMG/452/IRC).

The study included all stillbirths, antenatal, or intrapartum occurring after 28 weeks of gestation. It also included neonatal deaths within the first seven days of life, after 28 weeks of gestation. If the gestational age was not known, then foetuses weighing more than 1000 grams were included. Stillbirths and early neonatal deaths less than 28 weeks of gestation were excluded from the study.

After identifying the deaths, data were collected from the Maternal and Perinatal Death Review (MPDR) forms, from the records and Registers in "Labour Room" and Neonatal Intensive Care Unit (NICU). Charts from the Medical Record Section were also retrieved for collection of data.

Each of the MPDR forms or charts of patients was studied in detail by the principal investigator and the cause of death was determined using International Classification of Disease – Perinatal Mortality (ICD-PM) classification system. There are over 80 classification systems for perinatal mortality.[5] In response to which, World Health Organization (WHO) in 2016 has adapted International Classification of Disease (ICD 10) for use in perinatal mortality – the ICD-PM classification.[6] This classification system categorises deaths first according to the timing of death: antepartum, intrapartum, or neonatal death, and further links them with maternal condition.[5] This classification has been known to be globally applicable and its use is advocated to make international comparison uniform and standard.[7] The ICD-PM classification system seems to be promising even in the low-income countries[8] and hence was used in this study.

First the timing of death, whether antenatal or intrapartum or neonatal, was determined and then associated maternal condition was determined. The ICD-PM classification is presented in Table 1.

Total number of births each year during the study period was noted and PMR was calculated for each year. The trend of PMR over seven years was analysed. The PMR was calculated as:

$$\text{PMR} = \frac{\text{Stillbirths} + \text{Early neonatal deaths}}{\text{Total births}} \times 1000 \text{ births}$$

The socio-demographic characteristics like age and address were noted for each perinatal death. Obstetric characteristics like status of booking, parity of mothers, gestational age, birth weight of the foetus and neonate, gender, and the mode of delivery were noted. The cause of each perinatal death was identified according to the ICD-PM classification system and recorded.

Data were entered in the Microsoft Excel sheet. IBM Statistical Package for Social Sciences (SPSS) Statistics for Windows, version 21 (IBM Corp., Armonk, N.Y., USA) was used for data analysis. Frequency and percentage were used to calculate the socio-demographic and obstetric variables. Chi-square test was used to calculate the significance of difference of different categorical variables. Frequency and percentage were used to calculate the different causes of perinatal deaths; p-value less than 0.05 was considered to be statistically significant.

RESULTS

There were total 461 perinatal deaths during the study period of seven years. Of these, 288 (62.5%) were stillbirths (SB) and 173 (37.5%) were early neonatal deaths (END). The trend of the PMR over period of years is shown in the Figure 1.

There is a falling trend of the PMR from 2071 BS (April 2014-2015) to 2077 BS (April 2020-2021); the decline was from 35.5 per 1000 births in 2071 (Apr 2014 - Apr 2015) to 21.1 per 1000 births in 2077 BS. A slight rise was noted in 2073 BS nearing the same rate as in 2071 BS. The PMR has remained static over the last three years. The year-wise distribution of the antepartum, intrapartum, and neonatal deaths is presented in Table 2.

Stillbirths were more common than intrapartum or neonatal deaths in all years. The antepartum deaths and intrapartum have shown decline but not much change was noted in the neonatal deaths.

The socio-demographic and obstetric characteristics of perinatal deaths according to the time of death are presented in Table 3.

The causes of the perinatal death according to the ICD-PM classification system is given in Table 4.

The most common cause of antepartum deaths was antepartum hypoxia (A3). Antepartum hypoxia was commonly associated with maternal medical disorders (M4). The common maternal condition associated with antepartum deaths was maternal medical disorders, especially hypertensive disorders in pregnancy. Antepartum deaths due to unspecified cause was noted in 54 (23.6%) of antepartum deaths; no maternal medical condition was associated in almost all of these cases; 50 out of 54 antepartum deaths due to unspecified cause also did not have any maternal condition associated with it.

Acute intrapartum events (I3) were the cause of fresh stillbirths in almost three-fourth of the deaths. These were associated with the complications of labour and delivery (M3).

In case of neonatal deaths, the commonest cause was low birth weight and prematurity as seen in 73 (42.2%) deaths followed by respiratory and cardiovascular disorders in 40 (23%) cases. Common maternal conditions associated with death due to low birth weight and prematurity were maternal complications of pregnancy (M2).

Trends in the causes of antepartum, intrapartum, neonatal, and maternal conditions associated are presented in Figures 2 to 5.

Antepartum hypoxia was the common cause of death throughout the years (Figure 2). Though slight decline was noted in the last three years, there is a spike lately in antepartum hypoxia being the cause of death. Unspecified cause of antepartum deaths has decreased over years.

Intrapartum hypoxia was the commonest cause of fresh stillbirths in all years but has declined (Figure 3). There have been few deaths due to infection and due to disorders related to growth mostly intrauterine growth restriction.

Low birth weight and prematurity were the commonest causes of neonatal deaths throughout the years and there was no change in that. The other causes like neonatal infection and respiratory and cardiovascular disorders as causes of death show slight decline in the recent years as compared to previous years (Figure 4).

No maternal condition was associated in many of the cases. This cause has shown decline over the years. Maternal complications of pregnancy like prelabour rupture of membranes, malpresentation, multiple births, etc., remained static. Dramatic decline was noted in other complications of labour and delivery over the period of years (Figure 5).

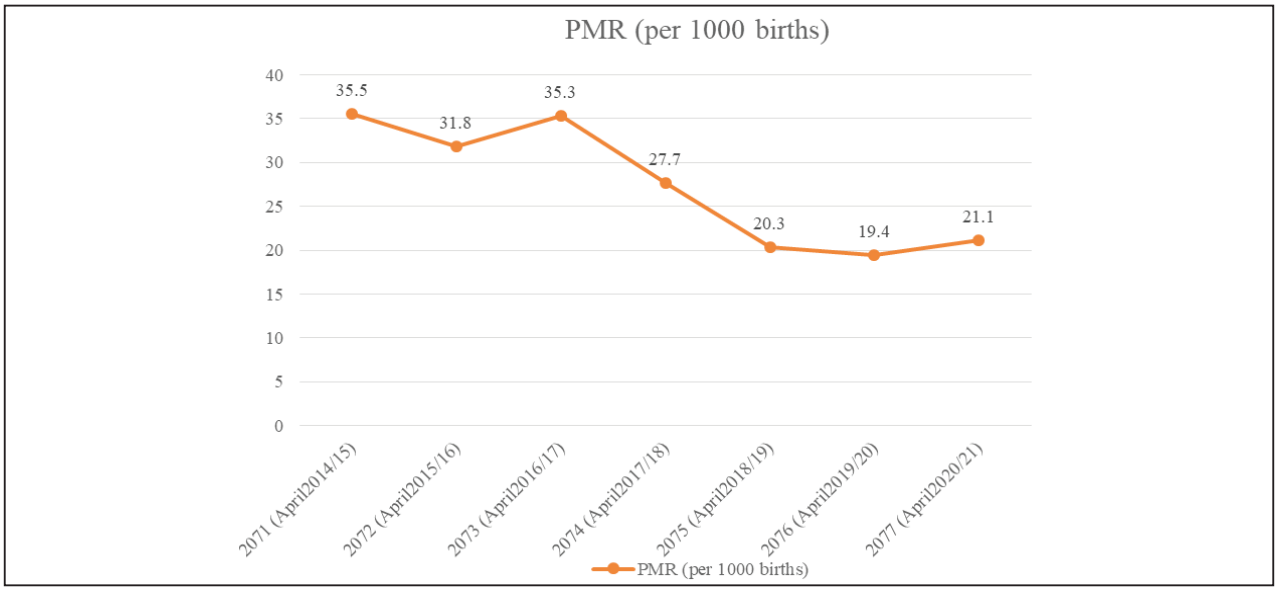

Figure 1: Trend of perinatal mortality rate

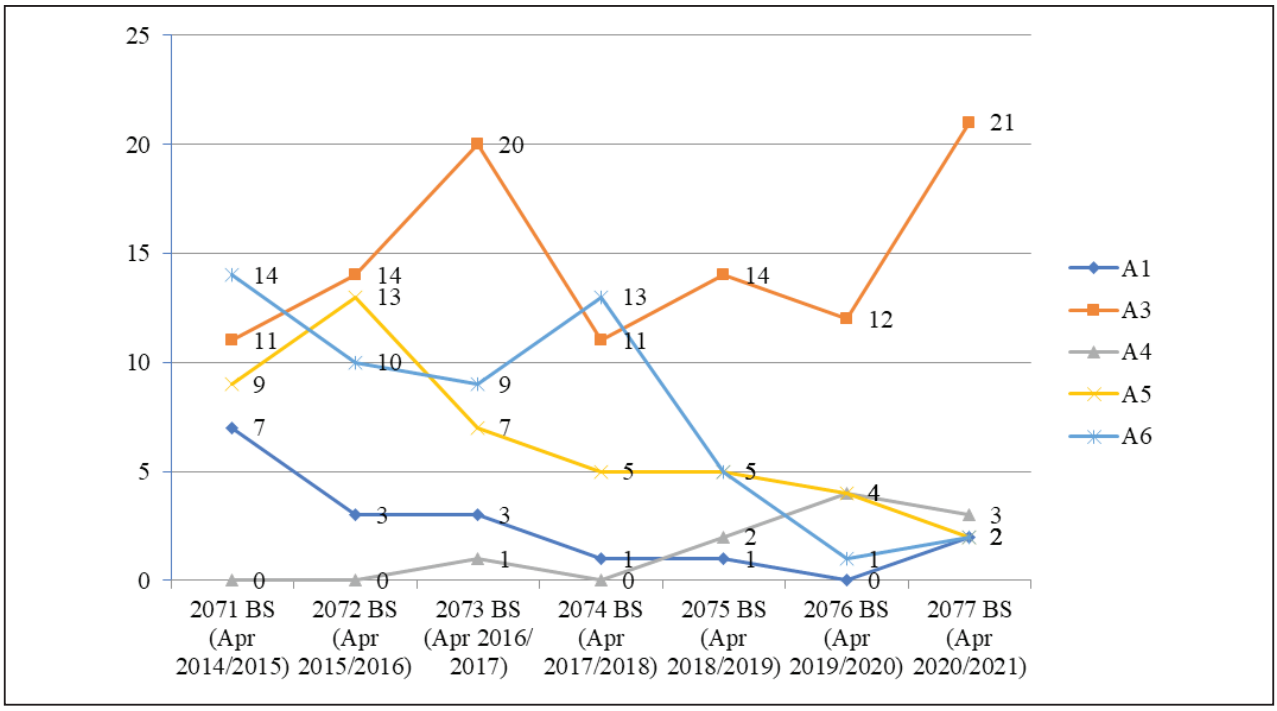

Figure 2: **Trend in the causes of antepartum deaths**

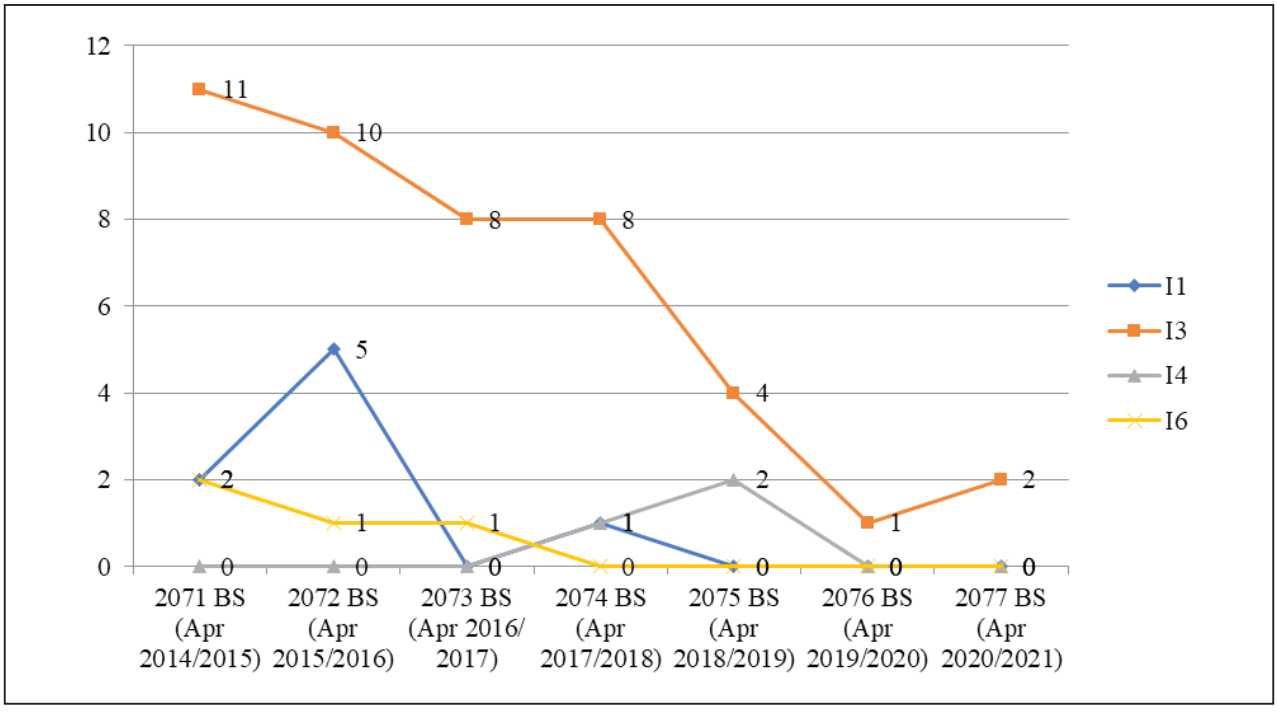

Figure 3: **Trend in the causes of intrapartum deaths**

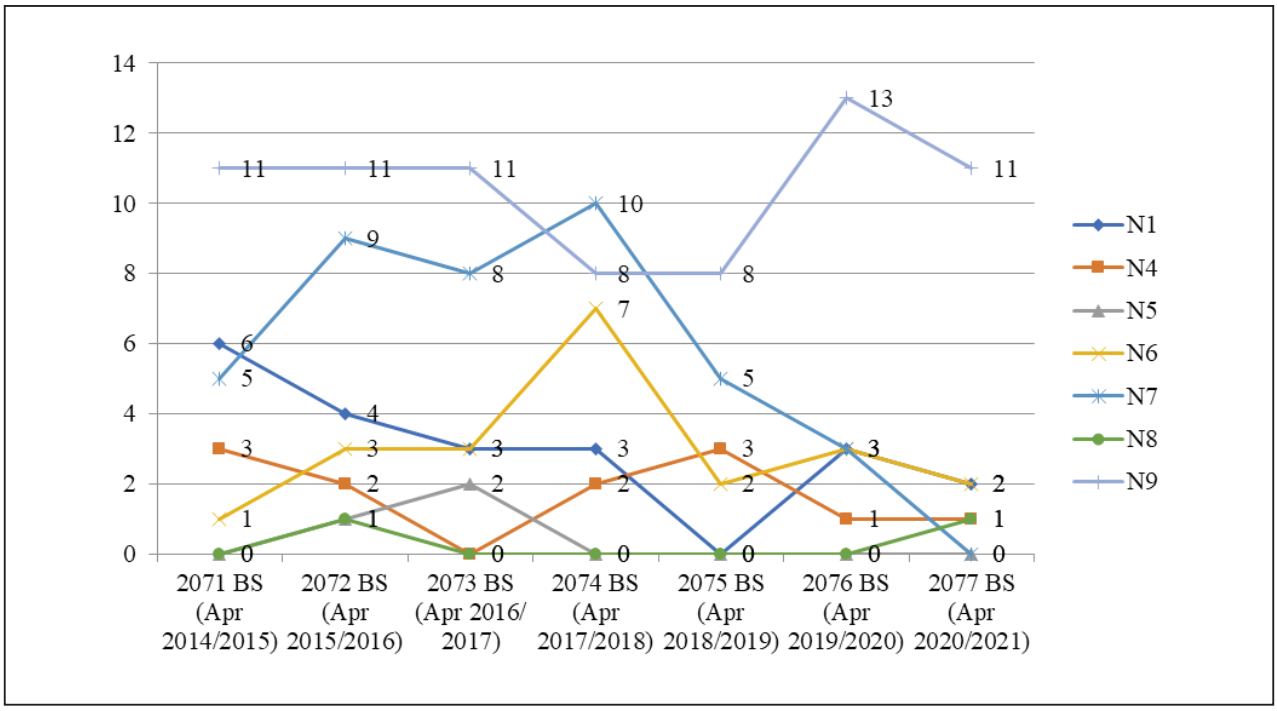

Figure 4: **Trend in the causes of neonatal death**

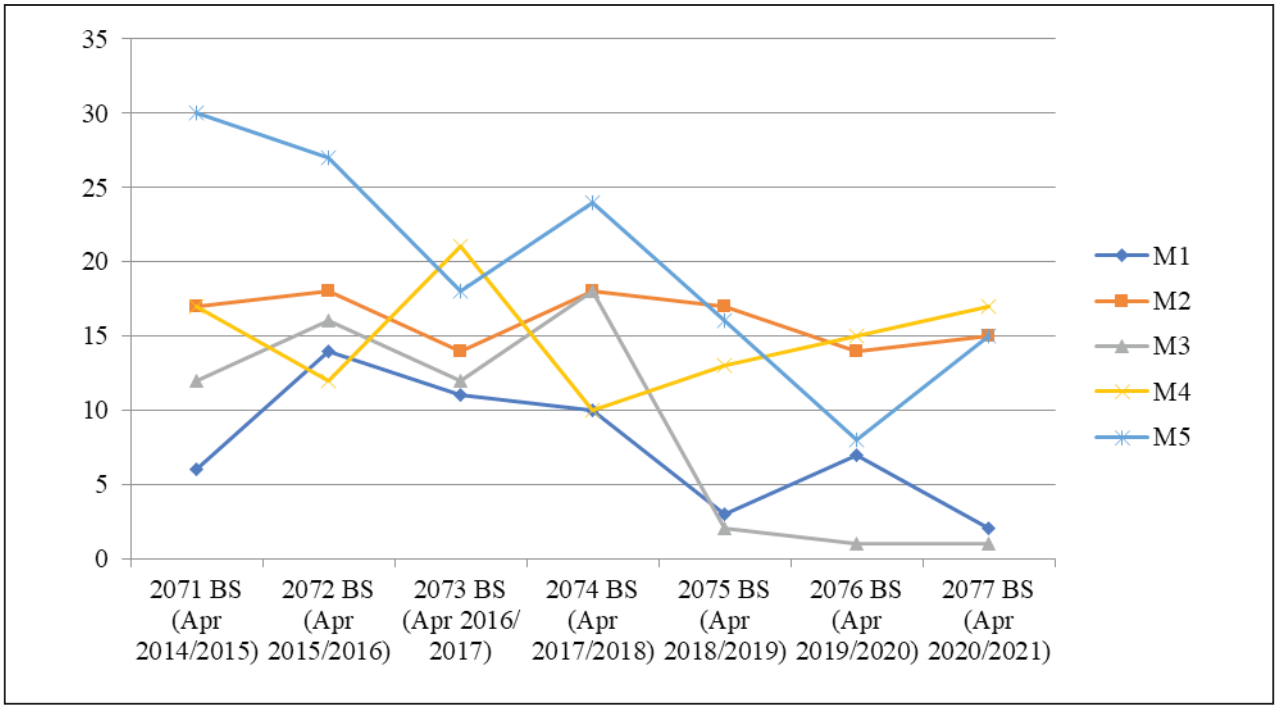

Figure 5: **Trend in maternal condition associated with perinatal deaths**

Table 1: International classification of disease - perinatal mortality

Time of death	Category	Description
Antepartum	A1	Congenital malformation and chromosomal defects
	A2	Infection
	A3	Antepartum hypoxia
	A4	Other specified antepartum disorders
	A5	Disorders related to growth
	A6	Antepartum death of unspecified cause
Intrapartum	I1	Congenital malformation and chromosomal defects
	I2	Birth trauma
	I3	Acute intrapartum event
	I4	Infection
	I5	Other specified intrapartum disorder
	I6	Disorders related to foetal growth
	I7	Intrapartum death of unspecified cause
Neonatal death	N1	Congenital malformation and chromosomal defects
	N2	Disorders related to foetal growth
	N3	Birth trauma
	N4	Complications related to intrapartum events
	N5	Convulsions and disorders of cerebral status
	N6	Infection
	N7	Respiratory and cardiovascular disorders
	N8	Other neonatal conditions
	N9	Low birth weight and prematurity
	N10	Miscellaneous
	N11	Neonatal death of unspecified cause
Maternal condition	M1	Complications of placenta, cord, and membrane
	M2	Maternal complications of pregnancy
	M3	Other complications of labour and delivery
	M4	Maternal medical and surgical conditions
	M5	No maternal conditions

Table 2: Trends of antepartum, intrapartum, and neonatal deaths over period of years, n (%)

Year	Antepartum deaths	Intrapartum deaths	Neonatal deaths	Total number of perinatal deaths
2071 BS (April 2014/2015)	41 (50)	15 (18.3)	26 (31.7)	82 (100)
2072 BS (April 2015/2016)	40 (46)	16 (18.4)	31 (35.6)	87 (100)
2073 BS (April 2016/ 2017)	40 (52.6)	9 (11.8)	27 (35.5)	76 (100)
2074 BS (April 2017/2018)	30 (42.8)	10 (14.3)	30 (42.8)	70 (100)
2075 BS (April 2018/2019)	27 (52.9)	6 (11.8)	18 (35.3)	51 (100)
2076 BS (April 2019/2020)	21 (46.7)	1(2.2)	23 (51.1)	45 (100)
2077 BS (April 2020/2021)	30 (60)	2 (4)	18 (36)	50 (100)
Total	**229 (49.7)**	**59 (12.8)**	**173 (37.5)**	**461 (100)**

Table 3: Socio-demographic and obstetric characteristics of the perinatal deaths according to timing of death, n (%)

Categories	Antepartum death	Intrapartum death	Neonatal death	Total	p-value
Age group (in years)					
≤19	15 (6.6)	2 (3.4)	12 (6.9)	29 (6.3)	0.084
20-35	203 (88.6)	50 (84.7)	156 (90.2)	409 (88.7)	
>35	11 (4.8)	7 (11.9)	5 (2.9)	23 (5.0)	
Address					
Rural	148 (64.6)	37 (62.7)	90 (52.0)	275 (59.7)	0.034
Urban	81 (35.4)	22 (37.3)	83 (48.0)	186 (40.3)	
Antenatal status					
Unbooked	11 (4.8)	2 (3.4)	13 (7.5)	26 (5.6)	0.001
Manipal	33 (14.4)	8(13.6)	43 (24.9)	84 (18.2)	
Outside in tertiary centre	68 (29.7)	17(28.8)	64 (37.0)	149 (32.3)	
Outside in primary centre	117 (51.1)	32 (54.2)	53 (30.6)	202 (43.8)	
Parity					
Para 1	98 (42.8)	23 (39.0)	93 (53.8)	214 (46.4)	0.050
Para 2-4	128 (55.9)	33 (55.9)	76 (43.9)	237 (51.4)	
Para ≥5	3 (1.3)	3 (5.1)	4 (2.3)	10 (2.2)	
Period of gestation					
28-36 weeks 6 days	163 (71.2)	34 (57.6)	132 (76.3)	329 (71.4)	0.077
37 – 40 weeks 6 days	56 (24.5)	20 (33.9)	36 (20.8)	112 (24.3)	
≥41 weeks	10 (4.4)	5 (8.5)	5 (2.9)	20 (4.3)	
Birth weight (grams)					
<1000	17 (7.4)	4(6.8)	16 (9.2)	37 (8.0)	0.037
1000-1500	65 (28.4)	13 (22.0)	48 (27.7)	126 (27.3)	
1500-2500	89 (38.9)	16 (27.1)	76 (43.9)	181 (39.3)	
2500-4000	57 (24.9)	26 (44.1)	33 (19.1)	116 (25.2)	
>4000	1 (0.4)	-	-	1 (0.2)	
Sex					
Male	124 (54.1)	35 (59.3)	108 (62.4)	267 (57.9)	0.459
Female	103 (45.0)	24 (40.7)	63 (36.4)	190 (41.2)	
Indeterminate	2 (0.9)	-	2 (1.2)	4 (0.9)	
Mode of delivery					
Vaginal delivery	200 (87.3)	37 (62.7)	100 (57.8)	337 (73.1)	<0.001
Instrumental delivery	-	2 (3.4)	-	2 (0.4)	
Caesarean section	29 (12.7)	20 (33.9)	73 (42.2)	122 (26.5)	
Total	**229**	**59**	**173**	**461**	

Table 4: Identification of perinatal deaths according to ICD-PM and their association with the maternal conditions

Time of Death		Category	M1 Complications of placenta, cord and membranes	M2 Maternal complications of pregnancy	M3 Other Complications of labour and delivery	M4 Maternal medical conditions	M5 No maternal conditions	Total (%)
Antepartum	A1	Congenital malformations and chromosomal abnormalities	-	1	-	2	14	17 (7.4)
	A2	Infection	-	-	-	-	-	-
	A3	Antepartum hypoxia	17	20	2	47	17	103 (45.0)
	A4	Other specified antepartum disorder	3	1	-	2	4	10 (4.4)
	A5	Disorders related to foetal growth	4	12	-	14	15	45 (19.7)
	A6	Antepartum deaths of unspecified cause	-	2	-	2	50	54 (23.6)
	Total		**24 (10.5)**	**36 (15.7)**	**2 (0.9)**	**67 (29.3)**	**100 (43.7)**	**229 (100)**
Intrapartum	I1	Congenital malformations and Chromosomal abnormalities	-	1	-	-	7	8 (13.6)
	I2	Birth trauma	-	-	-	-	-	-
	I3	Acute intrapartum event	6	12	19	3	4	44 (74.6)
	I4	Infection	-	-	2	-	1	3 (5.1)
	I5	Other specified intrapartum disorder	-	-	-	-	-	-
	I6	Disorders related to foetal growth	1	2	1	-	-	4 (6.8)
	I7	Intrapartum death of unspecified cause	-	-	-	-	-	-
	Total		**7 (11.9)**	**15 (25.4)**	**22 (37.3)**	**3 (5.1)**	**12 (20.3)**	**59 (100)**
Neonatal	N1	Congenital malformations and chromosomal abnormalities	-	5	1	4	11	21 (12.1)
	N2	Disorders related to foetal growth	1	-	-	-	-	1 (0.6)
	N3	Birth trauma	-	-	-	-	-	-
	N4	Complications of intrapartum events	5	1	3	1	2	12 (6.9)
	N5	Convulsions and disorders of cerebral status	-	-	1	1	1	3 (1.7)
	N6	Infection	3	9	2	4	3	21 (12.1)
	N7	Respiratory and cardiovascular disorders	3	13	12	6	6	40 (23.1)
	N8	Other neonatal conditions	-	2	-	-	-	2 (1.2)
	N9	LBW prematurity	10	32	9	19	3	73 (42.2)
	N10	Miscellaneous	-	-	-	-	-	-
	N11	Neonatal death of unspecified cause	-	-	-	-	-	-
	Total		**22 (12.7)**	**62 (35.8)**	**28 (16.2)**	**35 (20.2)**	**26 (15.1)**	**173 (100)**
	Grand Total		**53 (11.5)**	**113 (24.5)**	**52 (11.3)**	**105 (22.8)**	**138 (29.9)**	**461 (100)**

DISCUSSION

Perinatal period is the period between gestational ages after viability to the first seven days of life. In a country like ours, where the survival of very preterm and extremely low birth weight foetuses is poor, it is justifiable to consider perinatal period after 28 weeks of gestation though WHO includes gestational age after 22 weeks in the perinatal period. In this study, only deaths occurring after 28 weeks of gestation were included taking this fact into account.

There were 461 perinatal deaths in a seven-year period. The number of perinatal deaths and the PMR has decreased in these seven years from 35.5 per 1000 births in 2071 BS (Apr 2014/2015) to 21.1 per 1000 births in 2077 BS (Apr 2020/2021). Though there has been decline over the period of seven years, this has remained static in the last three years in this study. Other studies analysing the trend of the perinatal deaths have also shown decline as in present study.[9,10] The latest PMR in this study ranged from 20 to 21.1 per 1000 births. This rate was high when compared to the other studies conducted in Nepal.[9-12] This might be due to different study settings in these studies. There were many participants in this study who were not booked and had presented only for termination of pregnancy after intrauterine death was diagnosed. This might have led to higher PMR in this study.

In the present study, the ICD-PM classification system was used to classify the perinatal deaths according to the timing of death. There were 229 (49.7%) antepartum deaths, 59 (12.8%) intrapartum deaths, and 173 (37.5%) neonatal deaths. These deaths were linked with the maternal condition associated with deaths. There were not any studies on perinatal deaths using ICD-PM classification in Nepal, making comparisons challenging. In present study, there were no deaths whose classification could not be done.

Stillbirths were more common compared to neonatal deaths as in other studies.[12-15] Analysing the antepartum and intrapartum deaths, antepartum deaths were more common than the intrapartum deaths in the current study, similar was the finding in a study conducted in Sri Lanka.[14] Other studies reported either higher or similar rate of intrapartum deaths compared to antenatal deaths.[15-17] The reason for decreasing trend in the perinatal deaths over the years in this study especially in case of intrapartum deaths can be attributed to improved intrapartum care, involvement of stillbirths attendants for delivery, and increase in institutional deliveries.

Perinatal deaths were more common in the age group 20-34 years of age as in the other studies. [11,12,16,17] Most of the women were from rural areas suggesting that access to health care could be one factor in such women leading to poor outcomes. Most of the women who had perinatal deaths had antenatal supervision. However, the majority of women with antepartum deaths were booked at primary level antenatal care with limited resources. Hence, though they had antenatal visits as recommended by WHO, quality of care might not have been good enough to identify the risk factors to prevent these intrauterine deaths. In case of neonatal deaths, most of the participants had been supervised at tertiary level care. Lack of antenatal care was reported in perinatal deaths in other studies as well.[16,17]

It was found in this study that most of the perinatal deaths, 329 (71%) occurred in preterm gestation; most of the early neonatal deaths occurred before 37 weeks of gestation. Likewise, the weight of most of the babies was less than 2500 grams. So, the perinatal deaths were more likely at earlier gestation. Other studies also reported preterm gestation and low birth weight babies to be more in perinatal deaths.[12,16] Higher number of term and post-term babies compared to preterm babies were reported in perinatal deaths in another study.[17] In this study, intrapartum deaths were more common than the antepartum deaths.

Antepartum hypoxia was the commonest cause of antepartum death in the present study. This was found to be associated commonly with maternal medical conditions, especially hypertensive disorders in pregnancy. Antepartum hypoxia was the commonest cause of antepartum deaths in other studies.[14,15] Disorders related to the foetal growth was more common in another study and this was associated with maternal medical and surgical conditions especially hypertensive disorders.[17] In this study, no specified cause of antepartum deaths could be found in 54 (23.6%) of cases. In most of these cases, there was no maternal condition associated with the antepartum death. Such types of unspecified antepartum death ranged from 17.2% to 88.9% in different studies.[14-17] Congenital anomaly as a cause of antepartum death was noted in 17 (7.4%) of cases in the present study. Congenital anomaly as the cause of death was more common in antepartum deaths (14%) in another study where postmortem of the dead foetuses was done.[14] This defines the importance of postmortem examination to ascertain the causes and to decrease number of deaths due to unspecified cause.

While analysing the trend of causes of antenatal death, there was not much decline in the deaths due to antepartum hypoxia, which was the commonest cause of antepartum deaths. These deaths were linked mostly with the maternal medical conditions, maternal complications of pregnancy and complications of placenta, cord, and membranes. In order to reduce the antepartum deaths, preventive measures have to be focussed to improve these aspects of maternal health.

The common cause of intrapartum deaths was acute intrapartum events, nearly three-fourth (44, 74.6%) of all cases. These were mostly associated with the complications of labour and delivery. However, there was a steep decline in the intrapartum deaths, especially because of acute intrapartum events, over the period of years. This indicates that there has been improvement in the intrapartum care leading to reduction in the fresh stillbirths from intrapartum deaths. Acute intrapartum events were the commonest cause of intrapartum deaths in other studies as well.[15,16] Intrapartum deaths due to unspecified cause were reported in high proportion of cases in some studies.[15-17] Congenital anomaly was diagnosed in almost 71% of cases of intrapartum deaths where postmortem was performed in all foetuses.[14] This indicates that postmortem could be an answer to determine the exact cause of perinatal deaths and reducing the number of deaths due to unspecified cause.

Low birth weight and prematurity were the commonest cause of neonatal deaths (73, 42.2%), followed by respiratory distress syndrome (40, 23.1%), and neonatal sepsis (21, 12.1%). However, in another study, complications of intrapartum events were more common.[15] Again, congenital anomaly was the leading cause of neonatal deaths when postmortem was performed.[14] On analysing the trend of the cause of neonatal death, there was not much decline in low birth weight and prematurity but slight decrease in infection and respiratory disorder as cause of death over the years. Other studies showed a decrease in the low birth weight over the period of years.[10] Hence, preventing preterm births by screening and timely treatment of preterm labour during antenatal care needs to be boosted to reduce neonatal deaths in the days to come. Likewise, improvement in the neonatal care also needs to be improved to make more low birth weight babies survive.

The commonest maternal condition associated with perinatal deaths was maternal complications of pregnancy observed in 62 (35.8%) cases followed by maternal medical condition in 35 (20.2%) cases. Not much change was noted in these conditions over the period of years. Therefore, preventing measures should emphasise on these maternal conditions to improve perinatal outcome. In the current study, the changes in the maternal condition have not been observed because most of the women are referred at the last minute. No maternal condition was identified in a considerable number of cases in another study.[15] Other different maternal conditions were identified in other studies which project the area that needs to be focussed to lessen the number of perinatal deaths. This study was a single centred study and conducted at a tertiary care centre. A multicentred study involving primary care as well as tertiary care centres would give robust results that can be used to provide appropriate recommendations.

CONCLUSION

The Perinatal Mortality Rate has decreased over the years. Antepartum deaths and neonatal deaths were more common than intrapartum deaths. Antepartum hypoxia was the commonest cause of antepartum death which has not changed over years. This was commonly associated with maternal medical disorders. Acute intrapartum event was the commonest intrapartum cause associated with maternal complications of labour and delivery. There has been a decline in acute intrapartum events over the years indicating improved intrapartum care and this has led to the decline in the intrapartum deaths over years. Low birth weight and prematurity were the common causes of neonatal deaths over the years and this was mainly due to maternal complications of pregnancy.

Hence, in order to reduce perinatal mortality further, strategies should be developed to improve antepartum hypoxia and prevent preterm deliveries and low birth weights. This could be made possible by improving the quality of the antenatal care. Focus should not just be in increasing the number of antenatal visits but on proper supervision and care during antenatal checkups making timely diagnosis and management of pregnancy complications possible.

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