



Study on Prevalence and Etiology of Early Neonatal Deaths in Jasin district, Melaka from 2014-2017

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Abstract: Background: Neonatal mortality rate is in the range of 3.2- 4.2 since 2013 in Melaka state but records of Jasin district which is a part of this state, had shown higher early neonatal deaths. Hence, this study was conducted to find out prevalence of early neonatal deaths and its causes from 2014-17. **Material and methods:** This cross-sectional study was done in Jasin district using universal sampling method from 1st January 2018 to 30th June 2018. Initially records of all perinatal deaths from 2014-17 were checked and proforma was filled in and later early neonatal deaths were segregated from the main excel sheet and analyzed for prevalence and etiology. **Results:** We found prevalence of early neonatal mortality rate of 5.56/1000. Forty-one percent deaths occurred in 24 hours of life followed by 22% on day 2. Preterm birth accounted for ¾ of the total deaths and 63.44% deaths seen in low birth weight (<2500grams). Fifty-one of all deaths had congenital malformation, 17.8% had infection, 15.5 % each died due to asphyxia and immaturity. **Conclusion:** Prematurity, low birth weight and congenital malformation are the main causes during 0-6 days of life. Hence provision of good obstetric care, educating pregnant women on nutritious diet, vaccination and follow up is necessary. Apart from this there is a need to have upgradation of neonatal resuscitation services.

Keywords: Early neonatal deaths, Immaturity, Low birth weight, Congenital malformation, Asphyxia.

INTRODUCTION

Early neonatal mortality is death of a newborn baby within one week of life and constitute about 73% of all postnatal deaths worldwide [Lehtonen L. *et al.*, 2017].¹ Globally 2.8 million neonates died in 2013 and nearly ¾ of them were early neonates. Of these early neonatal deaths, 36.3% occur on the day of birth [Oza S. *et al.*, 2014].² Around 98-99% neonatal deaths occur in low- and middle-income countries and 1-2% in developed countries. Countries of Sub-Saharan Africa and South-Central Asia and South American and Caribbean countries contributes 1/3 of neonatal deaths each. There are estimated 1.1 million neonatal deaths in Sub Saharan Africa, 1.2 million in South Asia, and 107000 in South America and Caribbean islands [Anna C Seale *et al.*, [2013].³ Under Millennium Development Goals countries have made significant progress. Global neonatal mortality decreased from 35.5-37.8 /1000 live births in 1990 to 17.0-19.9/1000 live births in 2017. Though there is considerable reduction in NMR across the world but is still very high in West and Central Africa and South Asia [Lucia Hug MA *et al.*, 2019].⁴ Prematurity and congenital malformation are major causes of deaths in early neonates in high income countries whereas asphyxia, infections and immaturity constitute bulk of deaths in Africa, East Asia, and Latin America.^{1,2}

A prospective observational study in Guatemala, Democratic Republic of Congo, Zambia and Pakistan observed 45% deaths on day 1, 19% on day 2 and 16% on day 3 after birth and causes of death were infection 49%, birth asphyxia 26%, prematurity 17% and congenital malformations 3% [Engmann C. *et al.*, 2012].⁵ A Chinese study observed reduction in neonatal mortality 5.9 in 2014 to 3.9/1000 live births in 2018 and major causes of neonatal deaths were preventable causes such as prematurity, intrapartum complications and pneumonia [Yuxi Liu *et al.*,].⁶ Abdullah Al-Taia [2012] in their study on 963 neonatal sepsis cases observed 0.62/1000 deaths in early neonatal sepsis (<3 days) and 4.91/1000 in late neonatal sepsis (>3days) in China, Malaysia, Hong Kong and Thailand.⁷ Thong *et al.*, [2009] screened 17720 births in Kinta district of Perak state of Malaysia and found 253 babies having major birth defects giving incidence of 14.3/1000 live births. Eighty of them had multiple birth defects and 173 had isolated birth defects. Over 25% children died due to congenital anomalies.⁸ Though 50% of these do not have known causes but race, ethnicity, inheritance, old age pregnancy, consanguineous marriages, malaria afflicted, sickle cell disease patients, thalassemia, G₆PD deficiency and exposure to harmful environment during pregnancy have been associated with birth defects and can be prevented [SSM Mutalip *et al.*, 2017].⁹ Observational Study on 45277 deliveries between 2004-2010, in UKMMC Kuala Lumpur found 44994 live births and 241 early neonatal deaths giving mortality rate of 5.35/1000 live births. The leading causes of death were prematurity followed by congenital abnormality and birth asphyxia.¹⁰ Anne CC Lee *et al.*, [2011] observed that deaths due to intrapartum related causes and prematurity can be prevented significantly by immediate newborn assessment and stimulation and by facilities based resuscitation.¹¹ We conducted this retrospective cross-sectional study in Jasin district to find out prevalence of early neonatal deaths and its etiology so that effective preventive measures can be taken.

MATERIALS AND METHODS:

Place and Period: Study was conducted in Jasin district health office which keeps the record of neonatal deaths and for this study we covered the period from 1st January 2018 to 30th June 2018.
Study design: Cross sectional study using secondary data.

This study found 45 neonatal deaths from 2014-2017. Data collected and entered in the study format by Public health nurses posted in Jasin. They were trained and were given the responsibility to collect information from data available at DHO office.

Inclusion criteria:

Newborns completing 22 weeks and above gestational period and born alive were included in the study. Determination of gestational period was on basis of last menstrual period (LMP) and if the patient did not remember LMP, then first ultrasonography (USG) was taken for determining gestation. The neonatal deaths were classified on basis of age of death from 1-7days.

Exclusion criteria:

Children born with gestational period less than 22 weeks and Infant death occurring after 7 days of birth were excluded. Also, all neonates borne outside the jurisdiction of Jasin district and women with missing information on LMP and first USG.

Ethics and consent:

All standard ethical process was observed. Permission was taken from medical Research Ethic Committee, Ministry of health, Malaysia, and other concerned authorities.

Format for study/interview:

The format developed by ministry of health on reporting of stillbirths and neonatal deaths with slight modification was used for this study which included information on individual parameters, ethnicity, socioeconomic status, demography, lifestyle characteristics, reproductive and obstetrics history, pregnancy complications, characteristics of delivery and early neonatal period, initiation of breast-feeding practice etc.

Following variables were included in study proforma:

Maternal related

Age of mother, Mother's education, Occupation of mother, Marital status, Family Income, Short stature of mother, Obesity of mother, Systemic diseases- diabetes, Hypertension, heart diseases, CKD, STDs, Pregnancy details, Place of antenatal care, Place of delivery, type of delivery, Number of fetuses, Twins, Complications of pregnancy—preterm, post-dated, transverse lie, obstructed labour, Placenta praevia, abruptio placentae, cord prolapse.

Infant Related

Gender, Prematurity, low birthweight, asphyxia, infections, birth trauma

Socio economic and cultural:

Poverty, illiteracy, income, and social customs

Medical and health care facilities

Long distance of clinic from home, Too much rush in hospital/clinics and indifferent staff or poorly managed hospitals/clinics, Lack of transportation facilities, Lack of essential obstetrics care facility

Statistical Analysis

Processing and analysis were done using Epi-Info statistical tools.

Results and Analysis

Jasin district had 8141 registered cases but 8081 women delivered in this region during 2014-2017. The district health office showed the record of 49 early neonatal deaths of this 1 was home delivery and 1 in private hospital by caesarean, all others were in

government hospitals. All deliveries were managed either by medical officer having more than 6 months experience as house officer or by specialist doctor. Of the total 49 hospital deliveries, 4 were excluded due to (a) having no record of time of death (cause: hydrops fetalis 2 cases), (b) medical termination of pregnancy due to meningomyelocele (1 case), (3) severe congenital anomaly incompatible with life (1 case). So, we had 45 early neonatal deaths.

Table 1: No. of live births and early neonatal deaths 2014-2017 in Jasin District

Year	Registered cases	No. of deliveries	Total no. of deaths	Proportion of deaths in Male[M]	Proportion of deaths in female[F]	Mortality per 1000
2014	1897	1882	9	4	5	5.31
2015	2082	2066	6	4	2	2.9
2016	2045	2028	19	11	8	8.38
2017	2117	2105	11	5	6	5.7
Total	8141	8081	45	24	21	5.56 (Av)

Total number of early neonatal deaths were 9/1882 (2014), 6/2066 (2015), 19/2028 (2016), 11/2105 (2017). Relatively high early neonatal deaths were seen in

2016. Of the 45 deaths 24 were male and 21 were female babies giving M:F ratio of 1.14:1.

Table 1 chart

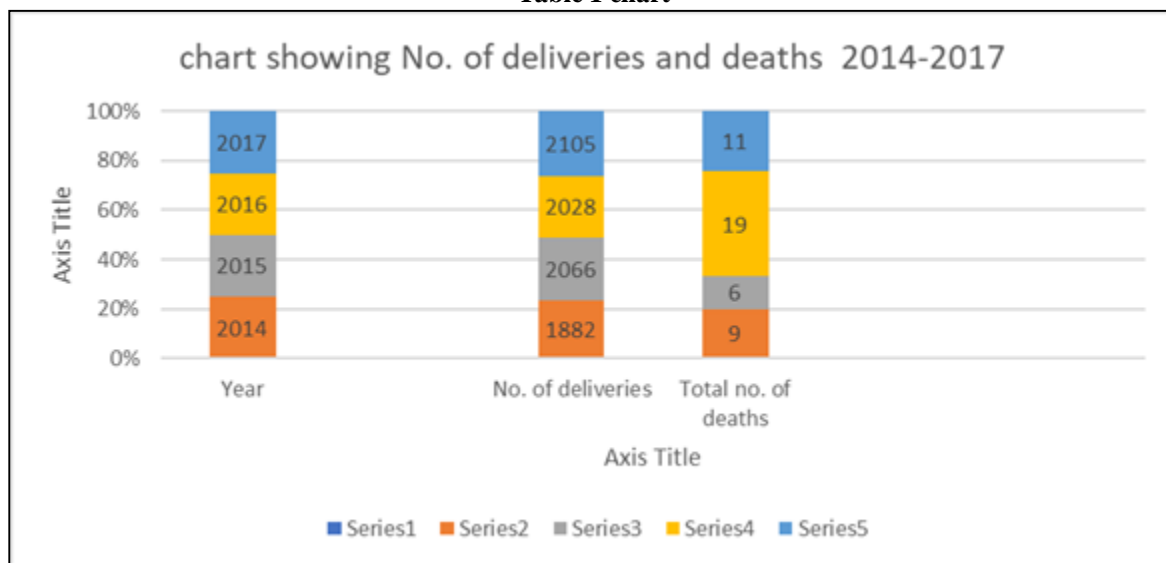


Table 2: Number of newborns and their age at the time of death

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Number	19	8	5	2	4	7	0
Percentage	42.4	17.8	11.11	4.44	8.88	15.55	0

Maximum deaths of 19 were seen on 24 hours followed by 8 in 48 hours. Thus 60% deaths took place in 48 hours. From 3rd -6th day deaths were 5, 2, 4, and 7 respectively.

Table 2 chart

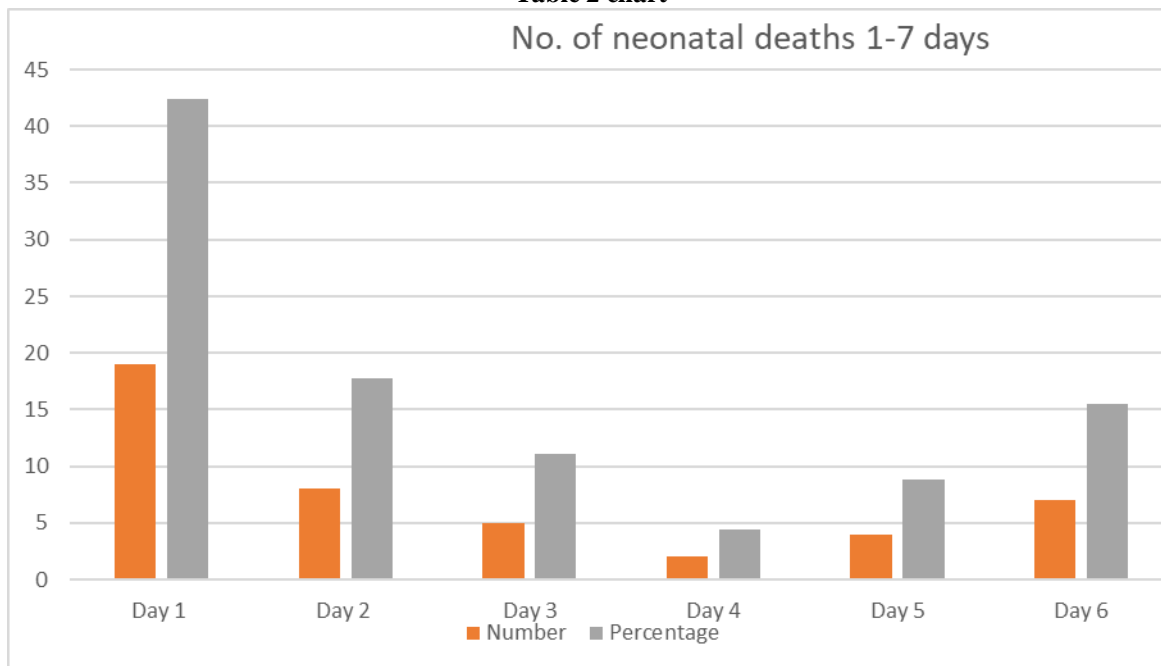


Table 3: Correlation between early neonatal deaths and birth weight

2500 grams or above (Normal)	1500-2499 grams	1000-1499 grams	<1000 Grams	No records	Wt.	Total
14	11	6	12	2		45
31.1%	24.4%	13.3%	26.6%	4.6%		100%

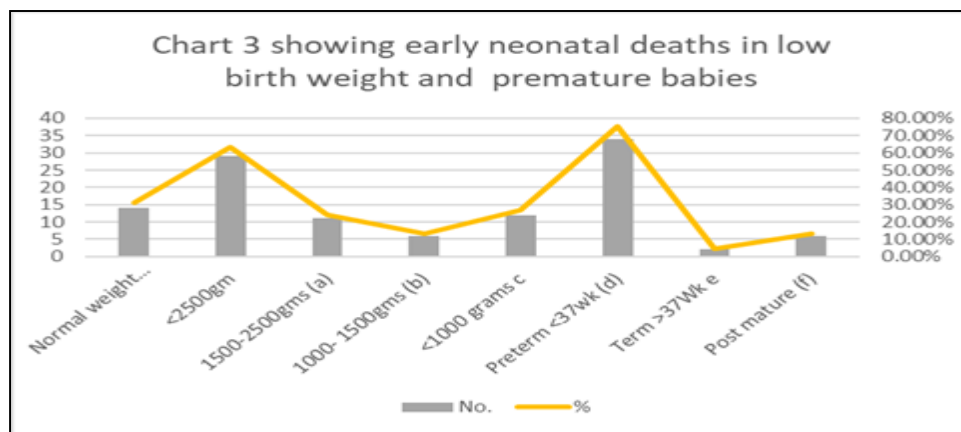
Twenty-nine (63.44%) deaths were seen among low Birth weight (<2500gms) against 14 (31.1%) in normal birth weight (>2500gms) babies ($p < 0.001$) Two infants had no birth weight records. Of the low-birth-weight

babies, 26.6% were extremely low birth weight, 13.3% were very low birth weight and 24.4% were low birth weight.

Table 4: Correlation between early neonatal deaths and prematurity

Death among full term	Deaths among Preterm	Deaths among post mature	Unknown gestational period	Total
2	34	6	3	45
4.4%	75.55%	13.3%	6.75%	100%

Thirty-four (75.55%) deaths were observed in premature babies compared to 2 (4.4%) in term and 6 (13.3%) in post-mature babies ($p < 0.0001$).



In chart 3 we observe high mortality among early neonates in low birth weight and premature babies.

Table 5: Percentage occurrence of early newborns deaths due to specific causes

	Asphyxia	Immaturity	Infections	Congenital Malformation	Total
Number	7 / 45	7 / 45	8 / 45	23 / 45	45
Percentage	15.55%	15.55%	17.8%	51.1%	100

Congenital malformations were the main causes of death in early neonatal period (51.1%). Other causes of

deaths were infection (17.8 %), asphyxia (15.5%) and immaturity (15.5%).

Percentage of deaths due to various neonatal period

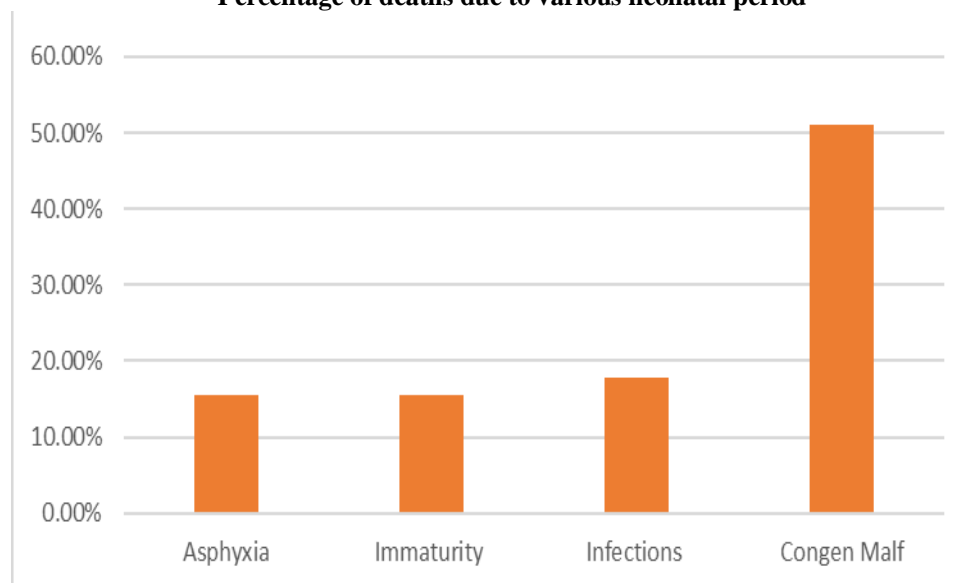


Table 6: Major causes of deaths in early neonatal period

Asphyxia	Immaturity	Infections	Congenital diseases
Severe meconium aspiration syndrome, Severe hypoxia, severe neonatal encephalitis	most of the babies were less than 32 weeks of gestation, prematurity and low birth weight were causes of death.	Sepsis, Pulmonary Hemorrhage, Necrotizing enterocolitis, Pneumonia	Bilateral Polycystic Kidney Disease, Severe persistent pulmonary hypertension, Severe congenital diaphragmatic hernia, Myelo-encephalocele, Potter syndrome/Potter sequence, Anencephaly, Edwards Syndrome (trisomy 18) with trachea-oesophageal fistula and Dandy Walker Malformation, Hydrops fetalis, hypoplastic left heart syndrome, Dysmorphism. Three cases were associated with Asphyxia and 2 with congenital Pneumonia.

DISCUSSION

The ENNMR in Malaysia is in the range of 3-3.4 per 1000 live births from 2010 to 2018.^{12,13} A study by University Kebangsaan Malaysia Medical Centre found ENNMR of 5.35/1000.¹⁰ Developing countries have high burden of neonatal mortality. Zambia had ENMR of 11.2/1000 live births which later got reduced to 6.2/1000 after implementation of essential neonatal care training programme for midwives under WHO.¹⁴ India has NMR of 27.8, Nigeria 7.2, Pakistan 6.9, Brazil 7.36

and China 6.4 per thousand live births.¹⁵ In developed countries such as Denmark NMR ranges from 0.47-1.04/1000 live births.² The Russian Federation has NMR of 1.03/1000.¹⁷ Report from Euro Peristat project [2004] showed ENNMR for 29 participating countries of Europe in the range of 1.6-5.7/1000 live births.¹⁸ We found ENNMR of 5.56/1000 live births [table 1] which is higher than national average but much lower than developing countries.

Various studies observed maximum Early neonatal deaths in 48 hours of life. Systemic review by M J Shankar [2016] observed 66% of the deaths occurring on 1st day of life and maximum deaths were seen during the three days of life.¹⁹ Studies in Russian federation and Denmark observed maximum deaths in 24 hours of life.¹⁸ However, Georgian study found maximum deaths on second day [Manjavidze T *et al.*, 2019].²⁰ A review and surveillance study in Bangladesh observed 46.1% deaths in 24 hours of life and 83.6% in 7 days [Abdul Halim *et al.*, 2016].²¹ We observed maximum deaths (42.2%) in 24th hours of life. Of this nearly 50% were in first 3 hours and approximately $\frac{3}{4}$ ENNM was observed within 3 days [table 2].

Hannah *et al.*, [2015], observed poor outcome for extremely premature babies (<28 weeks) and extremely low birth weight babies (<1000 grams).²² Zahraa Mohamed Ezz-Eldin *et al.*, [2015] in their prospective cohort study observed increased mortality (34.5%) in children having CRIB II (Clinical Risk Index for babies scoring system) score of >11, gestational age less than 28 weeks and birth weight <1100 grams.²³ We observed 63.44% deaths in low-birth-weight babies compared to 31.1 % in term babies [table 3]. The mortality rate was twice in extremely low birth weight babies as that of very low birth weight. A study in England observed increase in IMR in 2014 which was mostly contributed by rise in early neonatal deaths. the ENNM was high in premature babies with gestational age of 24 weeks.²⁴ In our study, high mortality (75.5%) was seen in premature babies. However, post-mature babies showed mortality rate of 13.3% [table 4].

Chances of survival improve with advancing gestational age. Pierre- Yves Ancel *et al.*, [2015] from France in their prospective cohort study observed survival rate of 0.7% at less than 24 weeks, 31.2% at 24 weeks, 59.1% at 25 weeks, 75.3% at 26 weeks, 93.6% at 27-31 weeks, and 98.9% at 32-34 weeks.²⁵ Female babies have better outcome than male babies which could be due to hormonal, genetic and immunological differences.²⁶ We observed higher survival rate in female compared to male. The early neonatal mortality ratio for M:F was 1.14:1 during the period of 2014-2017 [table 1].

Neonatal mortality can be reduced in developing and emerging countries if these countries provide good neonatal services. Malaysia being emerging economy, is providing good health services through its network of maternal and child health centres, family health centres and hospital services with good network of referral services. Rate of antenatal coverage is >90%, pregnancy being considered as risk hence all pregnant women are booked for deliveries in hospital and 99.5% deliveries are attended by health care personnel, $\frac{3}{4}$ in public hospital and $\frac{1}{4}$ in private hospital (2016).²⁷ In our study, of the total registered cases, 99.26% deliveries

took place in hospital and health centres under supervision of health personnel [table 1].

Asphyxia, birth trauma, infection, and prematurity are the major causes of early neonatal deaths in developing countries of Sub-Saharan Africa, Asia, and Latin America.¹ UKMMC, Kuala Lumpur study observed deaths due to prematurity (50%) followed by congenital malformations (35%) and birth asphyxia (10%).¹⁰ In Georgia, prematurity (58%) and congenital anomalies (23%) were the main causes of early neonatal deaths.²⁰ In this study, the causes of death during early neonatal period were Meconium aspiration syndrome, severe Hypoxia, --- mostly babies born less than 32 weeks of gestation, Prematurity and Low Birth Weight, Sepsis, Pulmonary Hemorrhage, Necrotizing Enterocolitis, Pneumonia, Bilateral Polycystic Kidney Disease, Severe Persistent Pulmonary Hypertension, Severe Congenital Diaphragmatic Hernia, Myelo-encephalocele, Potter Syndrome, Anencephaly, Edwards Syndrome (trisomy 18) with trachea-esophageal fistula and Dandy Walker Malformation, Hydrops fetalis, Hypoplastic left heart syndrome, and Dysmorphism [table 6]. Immaturity was mainly associated as a cause of death (75%) in early neonatal period. Of all cause deaths congenital malformation was leading cause of death (51.1%), followed by asphyxia (18%) and infection [Table 5].

CONCLUSION

1. Early neonatal mortality rates in Jasin for the period of 2014- to 2017 is 5.56/1000 live births.
2. Sixty-three percent deaths occurred in 48 hours of birth with maximum within 24 hours.
3. Prematurity, low birth weight and congenital malformations are found to be most common causes of early neonatal deaths.

What can be done? (Lee, A. C. *et al.*, 2011)

Early neonatal deaths can be prevented by following measures.

- a) Provision of good antenatal, intra-natal and post-natal care.
- b) Delivery in hospitals, assessing new-born immediately and stimulating to breathe and resuscitate immediately.
- c) Provision of high standard of neonatal resuscitation facilities and neonatal care in all hospitals level (district and general).
- d) Training of health care staff / nurses and midwives on neonatal care, essential new-born care.
- e) Promoting training in helping babies breathe and essential care for every baby programme.
- f) Educating pregnant women on hygiene and nutrition, spacing, contraceptives, vaccinations, breast feeding, skin-skin care.
- g) Supplementation of micronutrients to pregnant women.

- h) Early detection of genetic disorders and congenital malformation and termination of pregnancies.
- i) Early neonatal death audit

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