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A Case Control Study on Determinants of Stillbirths and Neonatal Mortality in Select Taluks of Chikkaballapur District, Karnataka

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ABSTRACT

Perinatal and neonatal period forms the crucial part of the baby's life and it needs utmost care to protect the baby from various complications and adverse outcomes. Having knowledge about determinants will likely form the basis for formulation of preventive and interventional strategies thereby avoiding of causative factors of mortality. The present study was undertaken with the objective to study the determinants of stillbirths and neonatal mortality in three taluks of Chikkaballapur district. A case control study design was adopted and was conducted in three taluks of Chikkaballapur district which were Chintamani, Sidlaghatta and Chikkaballapur. Cases were stillbirths and neonatal deaths and controls were live births who survived beyond four weeks of life. A total of 36 cases and 72 controls were enrolled for the study during a period of 6 months. Mothers of cases were interviewed within 4 weeks of occurrence of the event. Study instrument used was adopted from verbal autopsy questionnaire developed by ICMR with few modifications to ascertain the cause of death. The stillbirth rate in the study area was 5.31 (4.51-6.11) per 1000 total births. Neonatal mortality rate was 5.97 (5.13-6.81) per 1000 live births. Multiparity, pre-term birth, low birth weight and solid fuel used for cooking were the independent factors associated with stillbirths and neonatal deaths. The factors determining stillbirths and neonatal deaths are largely preventable. Hence improving the quality of ANC visits to manage high risk pregnancies, improvising on existing immediate new-born care services by enhancing the skills of health workers and doctors, providing intensive awareness to the community regarding exclusive breastfeeding, family planning methods and usage of non-smoke forming fuels are necessary to reduce stillbirths and neonatal deaths.

INTRODUCTION

Perinatal and neonatal period forms the crucial part of the baby's life and it needs utmost care to protect the baby from various complications and adverse outcomes. The major proportion of infant mortality is contributed by neonatal mortality and with declining infant mortality rate more attention is paid to perinatal and neonatal mortality. Various causes of stillbirth and neonatal deaths are quoted in literature. But there is a gap in knowledge about the determinants which lead to these conditions. Having knowledge about the determinants will form the basis for formulation of preventive and interventional strategies thereby avoiding causative factors to occur. International Classification of Diseases (ICD) 10 defines stillbirth or fetal death as death prior to the complete expulsion or extraction from its mother of a product of conception, of fetus weighing 500g or more, when birth weight is not available gestational age of 22 completed weeks or body length (25 cm crown-heel) is considered. The death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles[1].

Neonatal deaths are deaths among live births during the first 28 completed days of life[1]. In 2015, globally for every 1000 total births, 18.4 babies were stillborn, majority of it occurred in low- and middle-income countries. In high income countries Stillbirth rate (SBR) varies from 1.3 to 8 per 1000 total births[2]. According to SRS report 2015, SBR in rural India is 4 per 1000 total births and in rural Karnataka it is 5 per 1000 total births. Neonatal mortality rate in rural India is 29 per 1000 live births and in rural Karnataka it is 24 per 1000 live births[3].

A United Nations report in 2015 also reports that Neonatal Mortality Rate (NMR) in India is 28 per 1000 live births and first day mortality rate is 11 per 1000 live births[4]. Hence the study was conducted with the objective to study the determinants of stillbirths and neonatal mortality in select taluks of Chikkaballapur district.

MATERIALS AND METHODS

A case control study was undertaken in three taluks of Chikkaballapur district (Chintamani, Sidlaghatta and Chikkaballapura taluks) of Karnataka state to study the determinants of stillbirths and neonatal deaths. Cases were stillbirths and neonatal deaths occurring during the study period and controls were live births who have completed four weeks of life. For every case two controls were selected. Data was collected by administering pre-tested semi structured questionnaire adopted from verbal autopsy questionnaire developed by Institute for Research in Medical Statistics, ICMR New Delhi with few modifications[5].

(Source Records obtained from taluk health offices) For this study, 36 cases and 72 controls were enrolled for the period of May 2016 to December 2016. Various sociodemographic and biomedical factors were assessed and its association with stillbirths and neonatal deaths was tested by applying appropriate statistical tests. Sample size was calculated based on a study titled "Perinatal and Neonatal Mortality in Rural Punjab A Community Based Case-Control Study" which was carried out in rural Punjab, India. In this study it was found that one of the risk factors for stillbirths and neonatal mortality was prematurityand the proportion of prematurity was 49% among the cases and 21.67% among controls[6].Considering power of 80% and alpha error of 5% with an estimated risk difference of 27.4% as observed in the above-mentioned study, sample size worked out to be 34 cases and 68 controls with 1:2 allocation ratio.

Analysis was done using SPSS Inc. Released 2009. PASW statistics for windows version 18.0. Quantitative variables such as age, income, parity was summarized as mean and standard deviation, median, interquartile range. Incidence of adverse events such as Stillbirth Rate and Neonatal Mortality Rate were estimated along with 95% confidence interval. Association of various determinants of stillbirths and neonatal deaths in cases and controls were estimated through odds ratio with 95% confidence interval. Chi-square test of significance was used to test the significance of difference in proportions. Independent factors related to stillbirths and neonatal deaths were evaluated by employing forward logistic regression analysis to adjust for confounding factors.

RESULTS

SBR and NMR were estimated. Stillbirth rate in our study area is 5.31 (4.51-6.11) per 1000 total births. Neonatal mortality rate is 5.97 (5.13-6.81) per 1000 live births. Among the neonatal deaths 89.47% were early neonatal deaths (i.e. deaths which occurred within 0-6 days (first week) of life) and 10.53% were late neonatal deaths (i.e. deaths which occurred between 2nd and 4th week of life) (Table 1-2).

Antepartum haemorrhage contributed to 17% of the overall causes, preeclampsia, premature rupture of membranes, obstructed labour and congenital anomaly each contributed to 12% of the causes, accident and bad obstetric history each attributed to 6% of the causes and for the remaining 23% of the stillbirth causes were not determined. Neonatal sepsis and congenital anomaly accounted for 22.1% of the neonatal deaths. Birth asphyxia was the cause for

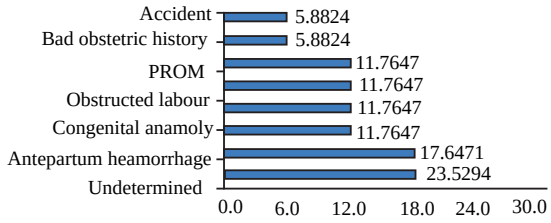

Fig. 1: Causes of stillbirths

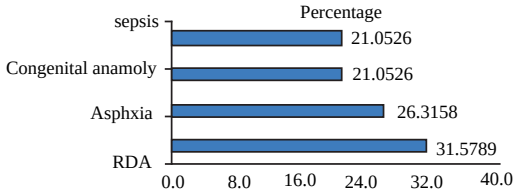

Fig. 2: Causes of neonatal mortality

26.3% of the neonatal deaths. Respiratory Distress Syndrome was the cause for 31.6% of the neonatal deaths. Determinants refer to underlying characteristics that ultimately shape the health of individuals and communities. They can be thought of as the causes of the causes of ill health. Determinants of stillbirths and neonatal mortality were assessed by applying Chi square test and Fisher exact test when the expected value was less than 5. Determinants were classified into two categories namely sociodemographic and biological determinants.

Among sociodemographic determinants, there was no statistically significant association of mother's education and occupation with cases with p = 0.09 and p = 0.33 respectively. There was significant association of father's education and occupation with cases with p = 0.78 and p = 0.40 respectively. Smoke forming fuel was used by 25 (69.4%) of the cases and 34 (47.2%) of the controls and this difference was found to be significant (p<0.001) and OR = 4.63 (1.92-11.12).

Among the biological determinants, there was no statistically significant association between gender of baby and stillbirths and neonatal deaths and mother's age. Multiparous women (≥3) were 8 (22.2%) among cases and 8 (11.1%) were among controls. This difference was found to be statistically not significant. (p = 0.12). Preterm birth was found to be significantly associated [p<0.001, OR = 12.1 (3.63-40.58)] with stillbirths and neonatal deaths. There was a significant association between birth weight and stillbirths and neonatal mortality. [p<0.001, OR = 17.23 (5.48-54.2)] Further analysis was done by applying multiple logistic regression to find out the independent factors associated with stillbirths and neonatal mortality. (Table 3-5). Factors which had p≤0.2 in bivariate analysis were included in multivariate analysis. Multiparity, low birth weight, preterm delivery and smoke forming cooking fuel were found to have significant association (p<0.05) with stillbirths and neonatal deaths.

DISCUSSIONS

The present study was conducted to study the determinants of stillbirths and neonatal deaths. Sociodemographic determinants which were analysed were mother's and father's education, mother's and father's occupation, caste and type of cooking fuel used. In our study, smoke forming fuel was used by 25 (69.4%) of the cases and 34 (47.2%) of the controls and this difference was found to be significant (p = 0.002) and adjusted OR = 6.91 (2.05-23.31). Using solid fuel for cooking will lead to indoor air pollution and known to cause stillbirths and low birth weight of babies.

Similar findings were seen in few other studies. A study done by Mishra *et al.*[7] reported that women who cook with wood, dung, or crop residues are significantly more likely to have experienced a stillbirth than those who cook with electricity, LPG, biogas, or kerosene (OR = 1.44, 95% CI: 1.04, 1.97). Results also indicate that women who cook with biomass fuels are twice as likely to have experienced two or more stillbirths as those who cook with cleaner fuels (OR = 2.01, 95% CI: 1.11, 3.62).

Patel *et al.*[8] conducted a study to examine the association between household pollution and stillbirths and found out that compared to households which used clean fuel (non-smoke forming), there was an increased risk of perinatal mortality among households using polluting fuels (adjusted odds ratio) 1.44, 95% confidence interval (CI) 1.30-1.61).

Multiparity (≥3) was found to be an independent factor associated with stillbirths and neonatal mortality [p = 0.03, adjusted OR = 4.38 (1.10-17.42)]. Parity as a determinant of stillbirths and neonatal mortality has been shown varied results in different studies. In some studies, primiparity is shown to have increased odds and in some multiparity has been shown to have increased odds of stillbirths and neonatal mortality (Fig 1 and 2).

Vishwanath *et al.*[9] conducted a study which showed that the parity >4 was significantly associated with perinatal deaths. [OR 5.75 (1.88-17.54)]. Petridou *et al.*[10] study says that the odds ratio of stillbirth for babies of primiparous mothers increases slightly from 1.39-1.47, whereas the odds ratio for multiparity (4 +) is reduced from 2.06 to 1.51. Our study has showed that, among cases 15 (41.7%) of them had preterm delivery and among controls 4 (5.6%) had preterm birth. Preterm birth was found to be an independent

Table 1: Profile of study area

Taluk	Population	No of PHCs	No of villages
Chintamani	3,10,097	10	400
Sidlaghatta	2,22,521	11	291
Chikkaballapura	2,22,457	6	251
Total	7,55,057	27	942

Table 2: Stillbirth rate and Neonatal mortality rate in three taluks

Taluks	Stillbirth rate per 1000 total births (95% CI)	Neonatal mortality rate per 1000 live births (95% CI)
Chintamani	5.46 (4.34-6.58)	3.66 (2.74-4.58)
Sidlagatta	5.96 (4.32-7.6)	7.20 (5.4-9.0)
Chikkaballapur	4.21 (2.71-5.71)	9.87 (7.63-12.11)

Table 3: Sociodemographic determinants of stillbirths and neonatal mortality

Determinants	Cases n (%)	Controls n (%)	Crude OR (95% CI)	p-value
Mother's education				
Not literate/primary	11 (30.6)	34 (47.2)	0.49 (0.21-1.14)	0.09
Secondary/college	25 (69.4)	38 (52.8)	1	
Mother's occupation				
Working	7 (19.4)	9 (12.5)	1.69 (0.57-4.98)	0.33
Housewife	29 (80.6)	63 (87.5)	1	
Father's education				
Not literate/primary	13 (36.1)	28 (38.9)	0.88 (0.38-2.03)	0.78
Secondary/college	23 (63.9)	44 (61.1)	1	
Father's occupation				
Unskilled	17 (47.2)	28 (38.9)	1.40 (0.62-3.15)	0.40
Skilled/business	19 (52.8)	44 (61.1)	1	
Caste				
SC/ST	25 (69.4)	34 (47.2)	2.54 (1.08-5.92)	0.03
OBC/others	11 (30.6)	38 (52.8)	1	
Type of cooking fuel				
Smoke forming	25 (69.4)	34 (47.2)	4.63 (1.92-11.12)	p<0.001
Smokeless	11 (30.6)	38 (52.8)	1	

Table 4: Biological determinants of stillbirths and neonatal mortality

Determinants	Cases n (%)	Controls n (%)	Crude OR (95% CI)	p-value
Mother's age				
≤20	9 (25.0)	12 (16.7)	1.66 (0.62-4.42)	0.30
≥21	27 (75.0)	60 (83.3)	1	
Parity				
≥3	8 (22.2)	8 (11.1)	2.28 (0.77-6.70)	0.12
≤2	27 (77.8)	60 (88.9)	1	
Gender of baby				
Male	9 (25.0)	12 (16.7)	0.94 (0. 42-2.11)	0.89
Female	27 (75.0)	60 (83.3)	1	
Gestational age at birth				
Preterm	15 (41.7)	4 (5.6)	12.1 (3.63-40.58)	<0.001
Term	21 (58.3)	68 (94.4)	1	
Birth weight				
Low	18 (36.1)	5 (40.3)	17.23 (5.48-54.2)	<0.001
Normal	14 (63.9)	67 (59.7)	1	
Type of delivery				
Caesarean/instrument	7 (19.4)	13 (18.1)	1.09 (0.39-3.04)	0.86
Normal	29 (80.6)	59 (81.9)	1	

Table 5: Multiple logistic regression for identifying independent factors associated with stillbirths and neonatal deaths

	Univariate		Multivariate	
Variables	OR (95% CI)	p-value	OR (95% CI)	p-value
Parity				
≥3	2.28 (0.77-6.70)	0.12	4.38 (1.1-17.42)	0.03
≤2	1		1	
Gestational age				
Preterm	12.14 (3.36-40.5)	<0.001	15.21 (2.14-109.3)	0.002
Term	1		1	
Birth weight				
Low	17.23 (5.48-54.2)	<0.001	34.04 (8.51-136.13)	0.003
Normal	1		1	
Caste				
SC/ST	2.54 (1.08-5.92)	0.03	1.25 (0.89-3.74)	0.22
OBC/others	1		1	
Cooking fuel				

factor associated [p = 0.002, adjusted OR = 15.21 (2.14-109.3)] with stillbirths and neonatal deaths. Similar findings were seen in other studies. Awour *et al.*[11] conducted a study which reported that the risk of neonatal death increased greatly in premature babies than in babies born at term (OR= 13·04, 7·71–22·07, p = 0·0001). A study done by Avachath *et al.*[12] showed in their study that there was significant

association between gestational age and stillbirths (p = 0.001). In the present study, 18 (36.1%) among cases and 5 (40.3%) among controls had low birth weight. [p = 0.003, adjusted OR = 34.04 (8.51-136.13)]. A study done by Badimsuguru *et al.*[13] showed that there is significant association between low birth weight and stillbirths (p<0.001). In Avachath *et al.*[12] study, the proportion of low birth weight babies was 4 (30.8%) among stillbirths and 5 (6.9%) among controls. This difference was found to be significant (p = 0.02). Strengths Some biases are inherent in the case control design. Efforts were made to minimize the bias. Bias due to confounding was minimized by matching of the cases and controls for geographical area and also by multiple logistic regression analysis (adjusted odds ratio) for the determinants studied. To minimize recall bias, interview of mothers of cases was done within 4 weeks of occurrence of event. A local events calendar was developed with various festivals and other events which were common in that particular community to correlate with events that happened during pregnancy and neonatal period. By allocating same duration for interview of both cases and controls, efforts were taken to reduce interviewer's bias. Information elicited from the mothers was cross checked with the hospital records wherever possible to minimize information bias.

Limitations: For the present study, as 36 cases were enrolled the exposure factors were observed in a smaller number of study subjects. This has led to wide confidence interval of the odds ratios thereby reducing the precision of the study. Cases were reported as and when it occurred in the study area. But there might have been chances of missing cases if it was not reported to the health authorities, especially stillbirths. For this study, data was collected for a period of 6 months. There can be seasonal variation in occurrence of stillbirths and neonatal deaths, which might have affected the estimation of stillbirth and neonatal mortality rate.

CONCLUSION

In spite of the availability of antenatal care and delivery care in the health care facilities, stillbirths and neonatal mortality continues be a challenge in maternal and child health care. Improving quality of the existing services and formulating novice effective interventions can be a way forward to attain the goal of single digit mortality by 2030. Antenatal care to be made more efficient and build the capacity of health care facilities to manage preterm and small for preterm babies by providing efficient neonatal intensive care unit. Encouraging small family norm, educating about the consequences of multiparity and providing adequate antenatal care for multiparous women. Smokeless form of fuel for cooking needs to be promoted and practiced by the community.

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