Factors associated with neonatal deaths among the tribal community in Lanjigarh block, Kalahandi, Orissa, India, 2008

By

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CERTIFICATION

This is to certify that this dissertation entitled **"Factors associated with neonatal deaths among the tribal community in Lanjigarh block, Kalahandi, Orissa, India, 2008"** submitted by Dr. Tapas Kumar Patra in partial fulfillment of the requirements for the degree of Master of Applied Epidemiology is the original work done by him.

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CONTENTS

List of Tables and Figure

Abbreviations

AFP	Attributable Fraction in the population
ASHA	Accredited Social Health Activist
AWC	Anganwadi Center
ANC	Antenatal Care
CDC	Center for Disease Control
IMNCI	Integrated Management of Neonatal and Childhood Illnesses
IMR	Infant Mortality Rate
ICMR	Indian Council of Medical Research
JSY	Janani Suraksha Yojana
MDG	Millennium development Goal
NIE	National Institute of Epidemiology
NRHM	National Rural Health Mission
NNMR	Neonatal Mortality Rate
SEA	South-East Asia
UNICEF	United Nations Children's Emergency Fund
U5MR	Under Five Mortality Rate

SECTION: I

DISSERTATION

Abstract

Factors associated with neonatal deaths among the tribal population in Lanjigarh block, Kalahandi, Orissa, India, 2008

Introduction

Lanjigarh, a tribal block of Orissa, Eastern India reports high neonatal deaths despite the availability of good health infrastructure. We conducted case-control study to identify factors associated with neonatal deaths and recommend preventive measures.

Methods

We defined cases as babies born alive and died within four weeks of birth and controls as babies completed four weeks of life. We collected information about maternal, newborn care practices. We calculated adjusted odds ratios (AOR), 95% confidence intervals (CI) and attributable fractions in the population (AFP) for the risk factors.

Results

We recruited 102 cases and 250 controls. Of the cases, 25% were from low socioeconomic status, 75% of mothers illiterate, 30% died on first day, 88% died at home. Cases were more likely to have registered late for antenatal care (ANC) [AOR: 4.9, 95% CI: 1.7 – 14.1, AFP 65%], failed to feed colostrum [AOR: 10.5, 95% CI: 5 – 21.6, AFP 54%] and had pre-term [AOR: 3.6, 95% CI: 1.9 – 7, AFP 43%] or twin

[AOR: 13.3, 95% CI: 2.8 – 64.1, AFP 9%] or male babies [AOR: 2.5, 95% CI: 1.3 – 4.8, AFP 34%].

Conclusions

Neonatal deaths were associated with late ANC registration, high-risk pregnancy, male babies and unhealthy neonatal practices. We suggested to (1) promote early ANC registration, colostrum feeding and pre-term baby care (2) train health workers to identify and refer pre-term and twin babies early (3) conduct studies to identify gender preferences.

Key words: Antenatal care, Neonatal mortality rate, Pre-term baby, Twin babies

Factors associated with neonatal death among tribal population, Lanjigarh block, Kalahandi, Orissa, India, 2008

Introduction

Neonatal survival is a very sensitive indicator of population growth and socio-economic development of a nation. The World Health Organization (WHO) estimated that in 2004, globally, the neonatal mortality rate (NNMR) was 28 per 1000 live births.[1] Every year, globally, an estimated 4 million babies die in the first four weeks of life (the neonatal period), among these, more than three millions die in their first week and up to half die in their first 24 hours.[2,3] Almost all (99%) neonatal deaths are reported in low and middle-income countries.[3] The countries of the South-East Asia (SEA) Region contribute more than 40% of the global burden.[3] WHO estimated that in 2004, in SEA region, the NNMR was 35 per 1000 live birth.[1]

About 1 million neonates die annually in India alone, amounting to almost one-fourth of all global newborn deaths.[4] WHO estimated that in 2004, in India, the NNMR was 39 per 1000 live births.[1] About two - third infant mortality rate is being contributed by NNMR in India.[3] In Orissa, in 2005, the neonatal mortality rate was 53 per 1000 live births, of which two-third died during early neonatal period.[5]

Globally, the main direct causes of neonatal deaths are severe infections (36%), preterm birth (28%), and asphyxia (23%).[2] Low birth weight is an important indirect cause of death.[2] Studies in India showed that, low birth weight, sepsis, respiratory

distress syndrome, asphyxia, prematurity and hypothermia were causes of neonatal death. [7, 8] In addition, economic status is a strong determinant of neonatal deaths in India.[3]

The fourth Millennium Development Goal (MDG 4) calls for a two-third reduction in death rates for children under five years (U5MR) by 2015.[9] In India, according to UNICEF estimates half of the under five deaths occur during neonatal period.[10] The average annual rate of reduction in U5MR was 2.6% between 1990 to 2006.[10] India has to reduce U5MR by 7.6% every year to reach the 4th MDG.[10] To achieve the MDG 4, India's National Rural Health Mission (NRHM) initiated Integrated Management of Neonatal and Childhood Illnesses (IMNCI) programme in every state to take care new born and under five children. NRHM also initiated Janani Surksha Yojana (JSY) to provide care to mother during pregnancy. NRHM recommends early registration of mothers for antenatal care, which will provide opportunity to screen for complication and manage it appropriately. Early registration also provides opportunity to the health care provider to educate the mother on basic health care like antenatal care, birth preparedness, benefits of institutional delivery, new born care and breast feeding practices.[11]

Orissa, in eastern part of India, has largest numbers of tribal community (n=62) including 13 primitive tribes. Orissa's one-fifth population constitutes tribal people. (Census 2001). In Orissa, the U5MR among the tribal was 126/ 1000 live birth.[12]. Lanjigarh in Kalahandi district of Orissa is one of the tribal block with predominance of Kutia kandha tribes (population: 75, 042, 2001 Census). The Lanjigarh block has well developed health infrastructure and adequate man power. However, there are few pockets of inaccessible and outreach areas in the block. According to district annual

reports, antenatal registration in the block was 99% during 2006-07. [13] However, in 2007, the infant mortality rate (IMR) and NNMR in the block were 124 and 51 per 1000 live births respectively.[13] As compared to the general community, there could be number of special factors operating in the tribal areas that contribute this high level of neonatal death and low maternal care during pregnancy. The possible contributing factors of neonatal death in Lanjigarh could be due to illiteracy, low socioeconomic status, cultural differences, poor living condition, inaccessibility to health facility and unsafe delivery practices.

Despite availability of health infrastructure and manpower in Lanjigarh, increased number of neonatal death was a concern of district health managers. Therefore, we conducted a study with the objectives to (1) estimate the factors associated with neonatal deaths (2) propose recommendations for reducing them.

Methods

Study population

We defined the study population as the babies born alive during June 2007 to May 2008 in a tribal community of Lanjigarh block, Kalahandi district to mothers who stayed in the area during the pregnancy period and also one month after delivery. We excluded babies (1) born outside the block (2) whose mother stayed outside the block during the pregnancy period (3) not belonging to tribal family (4) still born. We conducted an unmatched case control study.

Definition of cases and controls

We defined cases as neonates who were born alive and died within 28 days of birth. We defined controls as babies completed 28 days of life and living. We recruited cases and controls, who were born during June 2007 and May 2008.

Sampling procedure

We collected information on live births from the registers of health sub-centres and Anganwadi centres. We line-listed all cases and controls based on birth and death records. We recruited all neonatal death cases and selected controls by simple random sampling from the line list.

Sample size

Based the district annual report, 2006-07, we assumed that the proportion of low birth weight would be 30% among the general population. [13] Hence we needed to recruit 125 cases and 250 controls for detecting odds ratio of at least two with a 95% confidence interval (95% CI), 80% power, case control ratio of 1:2 and 10% non-response.

Data collection

We interviewed parents of the selected cases and controls and collected information on demographic characteristics, socioeconomic status, antenatal and perinatal care availed by the mother and new-born care of the baby. We also collected detailed history related to death. We trained health personnel to conduct interview using the questionnaire written in local language. The trained field supervisors cross-checked 20% of questionnaires to identify any discrepancies in data collection. The principal investigator validated 10% of data collection form for quality assurance and consistency.

We verified the records available at the health sub-centres and Anganwadi centres to minimize recall bias. We involved the health workers from outside the study area in the investigation team to minimize the interviewer bias

Data analysis

We described the characteristics of households of neonatal death cases. We defined socioeconomic status as low if both the parents were illiterate, monthly family income less than 1500 rupees, no landed property and living in either hut or kutcha house. We described characteristics of neonatal death cases in terms of time and place of death, sign, symptoms and treatment history prior to death. We calculated the frequency and proportion of maternal care during antenatal, perinatal period and new born care practices. We compared the proportion of different characteristics among cases with controls by calculating odds ratio (OR) with 95% CI to identify risk factors contributing to neonatal deaths.

We used Chi-square (χ^2) for trend for dose-response analysis. We stratified to eliminate confounding and identify effect modifiers. We examined the multi-collinearity for the variables that were significant in the univariate analysis. We included those variables that were not highly correlated with each other in the unconditional logistic regression model for assessing the independent association of risk factors with the neonatal death. We calculated adjusted odds ratio (AOR) and 95% CI. We also calculated the attributable fractions in the population (AFP) for the risk factors [AFP = incidence among cases X {(OR – 1)/OR}].

We double entered the data in Epi info – 3.3.2 version (Centre for Disease Control, Atlanta, USA) software for analysis.

Protection of human subjects

We explained the objectives, methods, benefits and risk of study to our participants and took written informed consent. We used codes for each participant and

administered the questionnaire in local language in same manner among cases and controls. The Ethics committee of the National Institute of Epidemiology (Indian council of Medical Research), Chennai approved the study.

Results

Of the 110 neonatal deaths reported in the Lanjigarh block during June 2007 to May 2008, five were unavailable and three did not give consent for the interview. Finally, we recruited 102 cases and 250 controls as participants in our study. Mostly we collected information from mothers (97%) and in others we interviewed fathers.

Household characteristics of cases

Of the 102 neonatal deaths, 93% of family's monthly income was less than 1500 rupees, two-third of mothers were illiterate, 10% mothers were below 20 years age, half of families lived in hut, 42% stayed beyond 10 km from the nearest health facility and one-fourth belonged to low socioeconomic status (Table 1).

Characteristics of neonatal deaths

Of the 102 neonatal deaths, 68% were male babies. Of these deaths, 30% died on first day of birth, 26% between 2^{nd} to 3^{rd} day, 16% between 4^{th} to 7^{th} day and the rest died between 8^{th} to 28^{th} day. Most of the neonates died at home and 80% did not receive any treatment prior to death. Of those who received treatment, 15% admitted in hospital before death and two-third treated within 24 hours of illness. Almost half of these neonates had illness within 24 hours of birth (Table 2). Low birth weight was predominantly present (38%) as compared to other signs and symptoms such as fast breathing (28%) or low body temperature (16%) at the time of death (Figure 1).

Univariate analysis

Of the household characteristics, babies born to family with low socioeconomic status were three times more likely to die during neonatal period as compared to babies born in a family with high socioeconomic status.

Of the antenatal care factors, the odds of neonatal death was five times higher among mothers who did not register for ANC. The proportion of mother who registered late was higher among cases (93%) as compared to controls (79%). The mothers who attended less than three ANC were two times more likely to have neonatal death as compared to who attended adequate ANC.

Babies born to primigravida mothers were two times more likely to die as compared multigravida. Inadequate chemoprophylaxis against anaemia and malaria were also associated with neonatal death. Mothers who had previous history of neonatal death, abortion, still birth or pregnancy related complication were more likely to have neonatal death. Other factors like antenatal care by paramedical staff, mothers weight less than 45 Kg, no supplemental feeding from Anangwadi centre and not using mosquito nets were also associated with neonatal death. (Table 3)

Of the perinatal factors, preterm babies were at five times more likely to die in neonatal period as compared to full- term babies. Of the 102 cases, 79% delivered at home as compared to 68% among controls. Odds of neonatal death was nine times higher among twin babies as compared to singleton. Other factors such as delivery by unskilled personnel and no home visit by health workers during first seven days of birth were also associated with neonatal death. (Table 3)

Of the neonatal factors, odds of neonatal death was two times higher among male babies as compared to females. Birth weight was not measured in 75% of cases and 39% of controls. Babies whose birth weights were measured, the proportion with low birth weight was slightly lower among controls (16%) than the cases (23%). Of all cases, 59% mother did not feed their baby with colostrum, as compared to 11% among the controls. The odds neonatal deaths was 11 times higher among babies who were not fed with colostrum as compared babies who were fed. Compared to controls, the cases were more likely to have inappropriate breast-feeding practices such as late initiation, not exclusively breast-fed and inadequately fed. (Table 3)

In dose response analysis, we observed that the odds of neonatal death increased with delay in time of ANC registration [AOR: 4.9; 95% CI 1.7 – 14.1]. Similarly, the odds of neonatal death increased with decrease with number of antenatal visit. (Table 4)
In stratified analysis, we identified that proximity of residence from the health facility was an effect modifier for the association between place of delivery and neonatal death. Mother's who delivered at home and staying at > 10 km from the nearest health facility had six times more likely to had neonatal death and the mothers who were staying within 10 km had only 1.2 times more likely to had neonatal death. (Table 5)

Multivariate analysis

In univariate analysis, we identified several components of antenatal, perinatal and neonatal care practices were significantly associated with neonatal death. We selected twelve statistically significant variables, which were not highly correlated with each other for the unconditional logistic regression model. The model indicated that some of the variables that were significantly associated with neonatal death in univariate analysis were no longer significant when adjusted simultaneously for the other

variables. In unconditional logistic regression model, late registration [AOR: 4.9, 95% CI 1.7 – 14.1, AFP: 65%], preterm baby [AOR: 3.6, 95% CI 1.9 – 6.9, AFP: 43%], birth of male baby [AOR: 2.5, 95% CI 1.3 – 4.8, AFP: 34%], twin babies [AOR: 13.2, 95% CI 2.8 – 62.7, AFP: 9%], no colostrum feeding [AOR: 10.4, 95% CI 5 – 21.4, AFP: 54%] were independently associated with neonatal death after adjustment (Table 6).

Discussion

In a case-control study among the tribal community, we identified late registration for antenatal care, preterm baby, twin babies, no colostrum feeding, and birth of male baby as associated with neonatal death.

We identified that those women with late registration for antenatal care were likely to have higher risk for neonatal death. Further, we identified that more the delay in time of ANC registration, there were more likely to have neonatal death. In the tribal area, low socioeconomic status of the family, mother's illiteracy, traditional believes and inaccessibility to the nearest health facility could be barriers for early registration for ANC. At the district level, in Kalahandi, 41% of mothers had their first antenatal care visit with twelve weeks of pregnancy.[14] However in the tribal block, only 7.3% of cases registered within 12 weeks. Study in Rural Western Kenya showed that 9 out of 10 women reported at least one ANC visit during their last pregnancy; however, two-thirds of these women began attending the ANC in the third trimester[15]. Among the tribal population, 65% of all neonatal deaths could have been prevented if the mothers of babies would have register earlier for ANC.

Preterm babies were more likely to die during the neonatal period than the term babies. Earlier study showed that low birth weight arises through preterm birth or in-utero growth restriction, or both and also estimated that 28% of all neonatal deaths globally are directly attributable to preterm birth.[2] Study conducted rural part of India also showed that preterm babies are at higher risk of death.[16] Further, we identified that 43% of deaths among preterm babies could have been prevented if proper care would have been taken and timely referral to higher centres would have been done early during the neonatal period.

Twin babies were more likely to die during neonatal period. We also identified that 9% of deaths among twin babies could have been prevented if early detection of twin pregnancy during ANC and proper care would have done during the neonatal period. Twin pregnancy is one of the criteria for selection of high-risk pregnancy during ANC. The possibility of preterm birth is common in twin pregnancy and the babies usually have low birth weight. Study conducted in Nepal showed that during neonatal period, twin babies were nine times more likely to die as compared to singleton.[17]

Neonates, who were not fed with colostrum, were more likely to die during neonatal period. Mother's illiteracy, social belief and cultural practices could be the reason for not feeding the baby with colostrum among the tribal community. In Kalahandi, 44% of mother did not initiate breast feeding within two hours and 49% squeeze out the first milk (colostrum).[18] Study in India showed that in rural and tribal communities withhold early breast feeding and do not feed colostrum early.[19] Among the tribal population, 54% of total number of neonatal deaths could have been prevented if we would have educated the mothers on at the time of antenatal care on benefits of breast

feeding practices and also if the neonates would have been fed with colostrum after birth.

Male neonates were more likely to die during the neonatal period as compared female. In India, neonatal mortality is higher among male as compared to female (37).[20] However, Girls have a well described biological survival advantage in the neonatal period as compared to males.[2] Where as study conducted in Nepal showed that male neonates were at higher risk of dying as compared to females.[21]

Our study could suffer from limitations of information bias and failure to recruit desired number cases as per the protocol. Information bias could result during recall by respondents or from the interviewers while collecting data. Our study participants were from tribal community and most of the mothers were illiterate. Hence, one would suspect inaccurate recall for some of the selected exposures. However, we minimized recall bias by cross-checking the interview data for both cases and control with that of information available in the records of health sub-centres and Anganwadi centres (AWC). In this process, we identified 5% errors in information given by study participants like number of antenatal visit, weight of baby at birth, weight of mother at first ANC. The interviewers were also health service providers; there were possibilities of under reporting of information. To minimize the bias, we did not involve the health workers from the same area in our investigation team. Further, we cross-checked 10% of all data collection instruments and compared with records at sub centre and AWC and identified only 2% errors in few information like weight of baby, weight of mother. We minimized the errors by cross-checking the records at sub-centres to avoid this bias.

We interviewed 97% mothers hence, even if misclassification of some of the exposures have occurred, it would have equally occurred among cases and controls. Hence, this would have amounted to non-differential misclassification. This error would only lead to an underestimation of the strength of the association, which would not prevent us from concluding.

Secondly, we could not recruit cases as per our sample size calculation. We used low birth weight as the main criteria for calculating sample size. Further the data suggest that in 74% of cases and 39% of controls birth weight was not measured. Of the babies, whose birth weight was measured only 16% of controls had low birth weight as against the assumption of 30%. The power of the study to detect low birth weight as a risk factor was 31%, way below the stipulated 80% power. Nonetheless, despite low power of the study, we identified five key factors to be independently associated with neonatal death. If we could have recruited more number of cases, possibly, we could have identified other significant exposures as well. However, even with the limited sample size, we identified key factors of public health importance i.e., late registration for antenatal care, preterm baby, twin babies, no colostrum feeding and birth of male baby. Our results would have not been very different in terms of practical recommendations to reduce neonatal death in the tribal community despite our limitation to recruit desired number of cases.

In conclusion, late registration for antenatal care, preterm birth, twin babies, no colostrum feeding, male baby are risk factors associated with neonatal death among the tribal community in Lanjigarh block, Kalahandi.

These findings have direct relevance to the national policies for the tribal community in India. The Government of India recommends to improve basic health and reproductive and child health services in the tribal areas.[22] India's NRHM deployed Accredited Social Health Activist (ASHA) at village level as a link between community and health sector for assisting in the Reproductive child health programme.[23] Basic job of the ASHA's is to identifying pregnant women and register for ANC and ensure complete ANC, counsel and escort mother for institutional delivery, counsel on safe breast feeding practices, arrange immunization of new born.[22]

Our findings have direct relevance to issues that need immediate attention for improving neonatal survival and maternal care during pregnancy among the tribal community. Based on evidence from this study, in order to prevent neonatal deaths in the tribal community, first, we need to educate mothers about registering for antenatal care early in their pregnancy, benefits of colostrum feeding and practices to protect preterm babies. Secondly, we recommend to train health workers and ASHAs to identify and register pregnant women early and also to identify and refer preterm neonates and twin pregnancies. This will augment NRHM's objective to reduce the neonatal mortality and to provide better maternal care. Thirdly, we suggest further studies to identify role of gender-specific new born care practices that may be prevalent in the community.

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Annexure 1

Table1. Characteristics of households with a neonatal death (n = 102), Lanjigarh block, Kalahandi, Orissa, India, 2008

Characteristics		Cases	%
Family income per month	Less than 1500 rupees	95	93
	More than 1500 rupees	7	7
Education status of mother	Illiterate	74	72
	Literate	28	27
Education status of father	Illiterate	39	38
	Literate	63	62
Occupation of mother	House wife	37	36
	Daily Labour	23	22
	Part time labour	33	32
	any other work	9	9
Occupation of father	Not working	1	1
	Part time labour	61	60
	Full time labour	9	9
	Government/Private job	4	4
	Others	27	26
Age of the mother	Less than 20 years	10	10
	20 to 34 years	79	77
	35 years and above	13	13
Ownership of land property	No land	56	55
	Less than one acre	23	22
	One to two acre	10	10
	More than 2 acre	13	13
Type of house	Hut	55	54
	Kutcha/mixed	47	46
	Mixed	5	5
Distance from nearest health facility	Less than 10 kilometers	59	58
	10 Kilometers or more	43	42
Socioeconomic status*	Low	25	24
	High	77	75

* Low socioeconomic status - Mother and father illiterate, family income less than 1500 rupees/month, no landed property and living in either hut or kacha house

Table2. Characteristics of neonatal deaths (n = 102), Lanjigarh block, Kalahandi, Orissa, India, 2008

Characteristics		#	%
Sex of neonates	Male	69	68
	Female	33	32
Time of death of neonates	First day	31	30
	2^{nd} to 3^{rd} day	26	25
	4^{th} to 7^{th} day	16	16
	Late neonatal period (8^{th} to 28^{th} day)	29	28
Place of death of neonates	Hospital	12	12
	Home	90	88
Treatment received by neonate before death	Yes	20	20
	No	82	80
Illness of neonate	Fever	5	5
	Loose motion	2	2
	Bloody dysentery	1	1
	Cough	3	3
	Fast breathing (> 60/minute)	29	28
	Vomiting	1	1
	Low body temperature	16	16
	Redness/discharge from cord	0	0
	Yellow palms/soles	1	1
	Body weight < 2500 g	39	38
	Fits	2	2
	Malformation	1	1
	Others	2	2
Total period of illness before death of neonate	Within 24 hours	47	46
	24 to 48 hours	20	20
	More than 48 hours	35	34
Hospitalization of neonate before death	Yes	15	15
	No	87	85

Table 3. Frequency of selected exposure among neonatal death cases and controls, Lanjigarh block, Kalahandi, Orissa, India, 2008

	Frequency of exposure						Odds Ratio	95% CI
	Cases			Controls				
	#	Total	%	#	Total	%		
Socio-demographic characteristics								
Low socio-demographic status	25	102	24	28	250	11	2.6	1.4 – 4.7
Mother illiterate	74	102	72	169	250	68	1.3	0.8 – 2.1
Father illiterate	39	102	38	70	250	28	1.6	0.9 – 2.6
Family income less than 1500 rupees/month	95	102	93	223	250	89	1.6	0.7 – 3.9
Mother's age less than 20 years	10	102	10	12	250	5	2.2	0.9 – 5.2
Mother's age more than 35 years	13	102	13	26	250	10	1.3	0.6 – 2.6
Residing at a distance of more than 10 km from nearest health facility	59	102	58	160	250	64	0.8	0.5 – 1.2
Antenatal factors								
Not registered for Antenatal check up (ANC)	6	102	6	3	250	1	5.1	1.3 – 21
Delayed registration for ANC (more than 12 weeks)	89	96	93	195	247	79	3.4	1.5 – 7.8
Inadequate ANC (less than 3 ANC)	58	96	60	111	247	45	1.9	1.2 – 3
ANC by peripheral health workers	94	96	98	226	247	91	4.4	1 – 19
Mother's weight less than 45 kg	61	96	63	126	247	51	1.7	1 – 2.7
Mother's height less than 145 cm	21	102	21	61	250	24	0.8	0.5 – 1.4
No supplemental feeding from Aganwadi centre	6	96	6	2	247	1	8.2	1.6 – 41.2
Inadequate immunization (less than two doses of Inj TT)	27	96	28	74	247	30	0.9	0.5 – 1.5
Primigravida	36	102	35	49	250	20	2.2	1.3 – 3.7
Birth spacing less than two years	32	66	48	90	201	45	1.2	0.66 – 2
Previous history of neonatal death/still birth/abortion	23	66	35	34	201	17	2.6	1.4 – 4.9
Previous history of pregnancy related complication	26	66	39	36	201	18	3	1.6 – 5.5
Inadequate chemoprophylaxis against Anaemia (consumed < 100 tables of Iron folic acid)	38	96	40	46	247	19	2.9	1.7 – 4.8
Inadequate chemoprophylaxis against Malaria (consumed < 60 of Chloroquine tablets)	74	96	77	117	247	47	3.7	2.2 – 6.4
Not used Mosquito net daily	91	102	89	189	250	76	2.7	1.3 – 5.3

Table 3. Frequency of selected exposure among neonatal death cases and controls, Lanjigarh block, Kalahandi, Orissa, India, 2008 (continued)

	Frequency of exposure						Odds Ratio	95% CI
	Cases			Controls				
	#	Total	%	#	Total	%		
Perinatal factors								
Preterm delivery (< 37 weeks)	55	102	54	49	250	20	4.8	2.9 – 7.9
Home delivery	81	102	79	171	250	68	1.8	1 – 3
Delivered by unskilled personnels (Dhai/Relatives/self)	62	102	61	116	250	47	1.8	1.1 – 2.9
Twin baby birth	10	102	10	3	250	1	8.9	2.4 – 33.2
No health worker visit in early neonatal period	59	102	58	105	250	42	1.9	1.2 – 3
Neonatal factors								
Male baby	69	102	68	128	250	51	2	1.2 – 3.2
Birth weight not measured	76	102	74	98	250	39	4.5	2.7 – 7.6
Low birth weight (weight < 2500g)	6	26	23	24	152	16	1.6	0.6 – 4.4
Bathing of baby in early neonatal period	65	102	64	178	250	71	0.7	0.4 – 1.2
Delayed initiation of breast feeding (More than two hours)	41	102	40	32	250	13	4.6	2.7 – 7.9
No colostrum feeding	60	102	59	28	250	11	11.3	6.5 – 19.8
No exclusive breast feeding	31	102	30	24	250	10	4.1	2.3 – 7.5
Inadequate breast feeding (< eight times/day)	49	71	69	76	226	34	4.4	2.5 – 7.8
Inadequate visit by trained birth attendant (< 5 times in 28 days)	96	102	94	223	250	89	1.9	0.8 – 4.8
No zero Polio vaccination	100	102	98	230	250	92	4.3	1 – 18.9
No zero BCG vaccination	100	102	98	239	250	96	2.3	0.5 – 10

Table 4. Neonatal death according to increasing gradients of exposure, Lanjigarh block, Kalahandi, Orissa, India, 2008

Characteristics		Cases		Controls		Odds Ratio	95% CI
		#	%	#	%		
ANC Registration	Within 12 weeks	7	7	52	21	Reference	
	13 to 24 weeks	81	84	185	75	3.3	1.4 – 8.2
	24 weeks and above	8	8	10	4	5.9	1.5 – 24.2
Number of antenatal check ups	Three and above	38	37	136	54	Reference	
	One to two	58	57	111	44	1.9	1.1 – 3.1
	No ANC	6	6	3	1	7.2	1.5 – 38.2

Table 5. Stratified analysis of selected exposure neonatal death cases and controls, Lanjigarh block, Kalahandi, Orissa, India, 2008

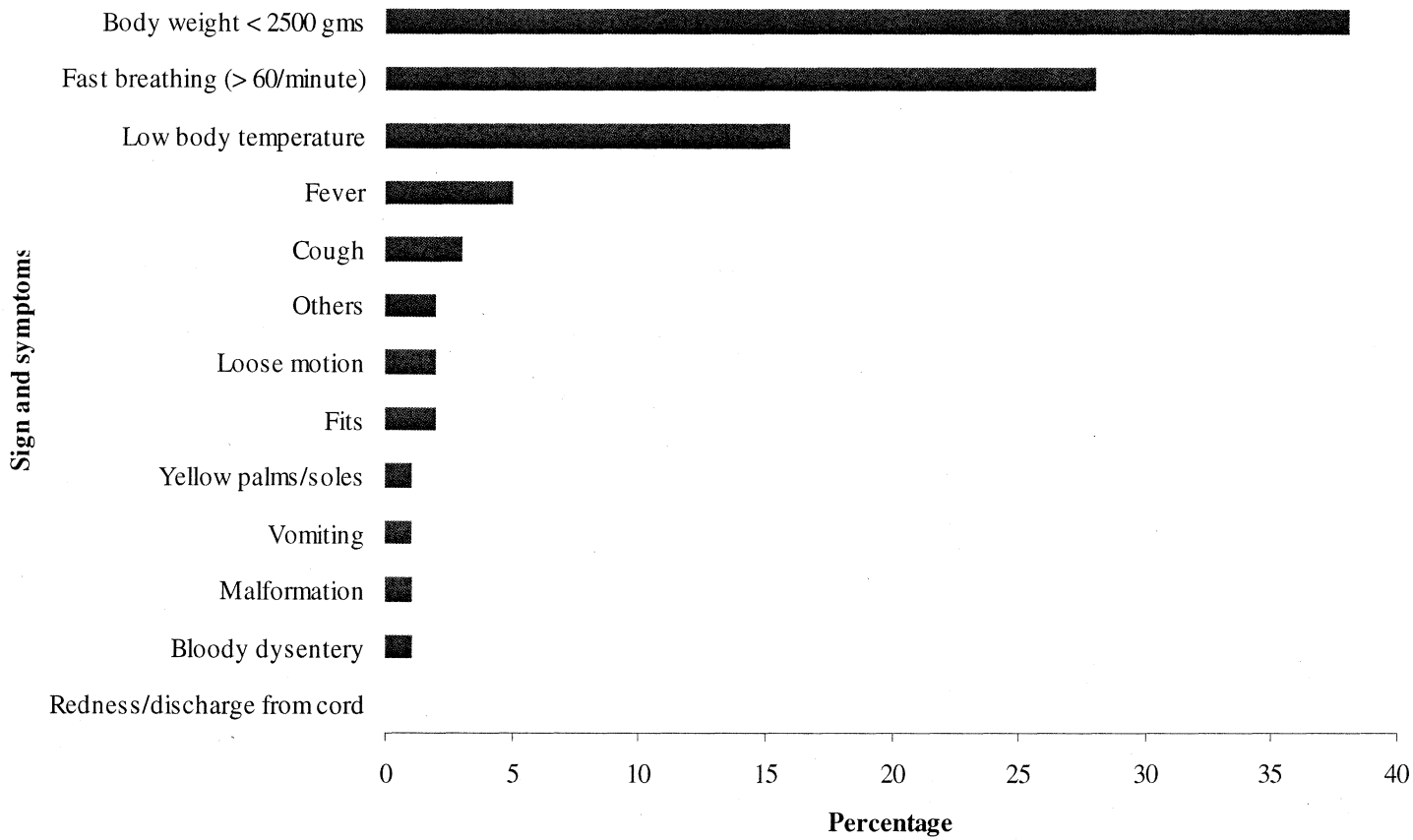
Characteristics	Strata	Exposure	Cases (n = 102)		Controls (n = 250)		Odds Ratio	95% CI
			#	%	#	%		
Place of delivery	All	Home	81	79.4	171	68.4	1.8	1 – 3
		Institutional	21	20.6	79	31.6		
	Distance > 10 Km	Home	41	95.3	69	82.7	6.2	1.4 – 28
		Institutional	2	4.7	21	23.3		
	Distance < 10 Km	Home	40	67.8	102	63.8	1.2	0.6 – 2.2
		Institutional	19	32.2	58	36.3		

Chi square for trend – 3.9, P value – 0.047

Table 6. Logistic regression analysis of selected exposure neonatal death cases and controls, Lanjigarh block, Kalahandi, Orissa, India, 2008

Characteristics	Crude odds ratio	Adjusted odd ratio	95% CI
Household characteristics			
Low Socio-demographic status	2.6	2	0.9 – 4.6
Family income less than 1500 rupees/month	1.6	1.5	0.5 – 4.3
Residing at a distance of more than 10 km from nearest health facility	0.8	0.9	0.4 – 1.6
Antenatal factors			
Delayed registration for ANC (> 12 weeks)	3.4	4.9	1.7 – 14.1
Inadequate ANC (< 3 ANC)	1.9	1.5	0.4 – 5.1
Primigravida	2.2	1.7	0.9 – 3.4
Perinatal factors			
Home delivery	1.8	1.5	0.6 – 3.6
Delivery by unskilled personnel	1.8	0.6	0.2 – 1.3
Preterm delivery	4.8	3.6	1.9 – 7
Neonatal factors			
Had male baby	2	2.5	1.3 – 4.8
Had twin neonates	8.9	13.3	2.8 – 64.1
Did not feed colostrum	11.3	10.5	5 – 21.6

Figure 1: Sign and symptoms of neonatal death cases prior to death among the tribal community, Lanjigarh block, Kalahandi, Orissa, India, 2008



Annexure 1

Consent form for

Factors associated with neonatal death among the tribal community, Lanjigarh block, Kalahandi, Orissa, India June 2007 – May 2008

Information sheet:

Namaskar,

We, _____ and _____ are working at Upgraded primary health center, Biswanthpur. Dr Tapas Kumar Patra is working at Chief district medical office, Bhawanipatna is doing research on **"factors associated with neonatal deaths among tribal population in Lanjigarh block 2008".** We are part of his research team. The National institute of epidemiology, Chennai and District health administration, Kalahandi are also working with us. As you know, there are four hospitals and 24 health sub centers in your block. There are doctors and other health staffs in these hospitals to take care of your health problem. Also at your Panchayat level there is one health worker female whose main responsibility is to take care of pregnant women and infants. There is also provision of Rupees 1400 for delivery in hospitals and Rupees 250 for transportation of the pregnant woman. Despite availability of all these facilities, people are not coming forward for better health care in your block. During 2006 – 07, though the antenatal registration of pregnant women was 99%, only 12% of women delivered their babies in the hospitals. We are doing this research as a response to 109 deaths of new born babies in your block during 2007. Since new born death is a public health problem your area, it is essential for us and for you also to know the reasons of new born death. We are looking into the factors that put the new born baby at risk of dying

within 28 days of life. By knowing these factors, the health department will take care of these factors to reduce deaths.

To find out why there are neonatal deaths, we need to ask questions to mother whose baby died and also mother of baby whose baby didn't die during June 2007 to May 2008. We would like to confidentially ask these few questions to you once. We will also collect data from the records of health worker (female) with your permission. Answering these questions will take about 30- 45 minutes of your time. We will interview the mother at her residence.

Taking part in this survey is voluntary. No compensation will be paid to you for taking part in this study. You can choose not to take part. You can choose not to answer a specific question. You can also stop answering these questions at any time without having to provide a reason. This will not affect your rights to health care in the Upgraded primary health center, Biswanthpur, or any other rights. There is no specific benefit for you if you take part in the survey. However, taking part in the survey may be of benefit to the community, as it may help us to understand the problem, its causes and potential solutions. When the results will have been analyzed, a report will be shared with all the participants by focus group discussion at the village and the local health officials, so that the right measures can be taken to prevent and control new born death among the tribal population.

The information we will collect in this survey will remain between you and the investigation team. We will not write your name on this form. We will only use a code instead. Only the principal investigator will know the key to this code. It will be kept under lock and key. It will be destroyed after the project is over.

If you wish to find out more about this survey before taking part, you can ask me all the questions you want. You can also contact Dr. Tapas Kumar Patra, MAE-FETP Scholar (VIIth Cohort) and principal investigator of this survey attached to the National Institute of Epidemiology, Chennai, at the Chief district medical office, Kalahandi who will be happy to give you more details. You can call to his mobile phone (9437224520) or office phone (06670 – 233761). You can also contact the authority of National institute of epidemiology (ICMR), Chennai over phone (044 – 26821156) to know more about the research. If you are agreeing to take part, we will go ahead now.

Certificate of consent:

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have asked have been answered to my satisfaction. I consent voluntarily to participate as a participant in this study and understand that I have the right to withdraw from the study at any time without in any way it affecting my further medical care.

Name of the study participant

Signature/thumb impression
of the study participant
Date:

(If the participant is illiterate, literate witness selected by the participant must sign. The witness should not have any relationship with the research team.)

I have witnessed the accurate reading of the consent form to the potential participant and the individual has had opportunity to ask questions. I confirm that the individual has given consent freely.

Name of the witness

Signature/thumb impression of the witness

Name of the interviewer

Signature of the interviewer

Date:

(One copy to be given to the participant after signature of participant, witness and investigator)

Annexure 2

Identifiers collection form

(To ensure confidentiality, identifiers will not be collected in the paper questionnaires but on this separate identifier log to be kept under lock and key)

ID NUMBER: | | | |

Respondent: **Mother / Father**
(Encircle which is applicable)

(Put this ID No in every page of data collection form)

Status: 1.**Case / 2. Control**

Date of interview: ____/____/ _____

(Encircle which is applicable)

Name of the mother:

_____

(write in capital letter)

Name of the father: _____

Detail address

Name of the village/Hamlet _____

Name of the Sub-center _____

Name of the Gram panchayat:_____

Number of investigation team:_____

Name of Investigator: 1 _____, Health worker (Male)

2. _____, Health worker (Female)

(Detach the this Identifier collection form the data collection after putting the ID No in every page of data collection form)

Annexure – 3

Data collection instrument on "Factors associated with neonatal death among the tribal community of Lanjigarh block in Kalahandi district, Orissa, India, 2007 – 08"

ID No:				Team No _____	Date_____
Status: 1.Case / 2. Control (Encircle which is applicale)					
I will ask you few question about your family and also about you					
Questionnaire items				**Options**	**Coding**
1. What is your age (in years)?				_____ Year	
2. What is your educational status?				1. Non educated	2. 1st to 5th class
				3. 6th to 10th class	11th and above
3. What is your husband educational status?				1. Non educated	2. 1st to 5th class
				3. 6th to 10th class	11th and above
4. What is your occupation?				1. House wife	2. Daily Labour
				3. Part time labour	4. any other work Specify_____
5. What is your husband occupation?				1. Not working	2. Part time labour
				3. Full time labour	4. Private job
				5. Government job	6. Others specify _____
6. Can you tell me, what is your family average monthly income (in Rupees)?				1. < 500	2. 500 to 1499
				3. 1500 to 2999	4. 3000 +
7. Type of house (Observe)				1. Hut	2. Kutcha
				3. Mixed	4. Pucca
8. Do you have any land property?				1. No	2. < 1 acre
				3. 1- 2 acre	4. > 2 acre
9. What is the distance from nearest health facility (in Kilometers)?				..... KM	

ID No _____			
Questionnaire items		**Options**	**Coding**
Now, I will ask you some questions regarding various health services you received during the antenatal period.			
10. Did you register your name for antenatal check up (ANC) at the sub-center?	1. Yes	2. No	
If Q. 10 is No, Skip 11 to 20			
11. When did you register your name for antenatal check up (in weeks)?	..... Weeks		
12. How many ANC was done during the pregnancy period (Write number)?		_____	
13. Who did the antenatal check up?	1. Doctor	2. Staff nurse	
	3. Health worker (F)	4. Trained dhai	
	5. Others		
14. How many inj TT you had received?	1. No	2. One	
	3. Two		
15. Did you receive any supplemental feeding from the Anganwadi center?	1. Yes	2. No	
16. What was your weight at the time of first ANC (in kg)? (verify Health worker record)	_____		
17. Was your blood tested for Hemoglobin level?	1. Yes	2. No	
If Q. 17 is No, Skip Q. 18			
18. What was the hemoglobin level (in g %)?	_____		
19. Had you taken complete dose (62 Tab) Chloroquine chemoprophylaxis after 3 months of pregnancy?	1. Yes	2. No	
20. Had you taken full course IFA tablet (100 tablets) as chemoprophylaxis after 3 months of pregnancy?	1. Yes	2. No	

ID No _____			
Questionnaire items		**Options**	**Coding**
21. Do you use medicated mosquito net everyday?	1. Yes	2. No	
22. What was your age at the time of pregnancy (in years)?	_____		
23. Height of mother in cm (Measure by tape)	_____		
24. What was the gravida of last pregnancy (write number)	_____		
If Q 24 is FIRST, Skip Q. 25 and 27			
25.What was the duration of gap from the previous pregnancy (in years)?	_____		
26. Was there any history of pregnancy related complications during your last pregnancy?	1. Yes	2. No	
27. Was there any history of neonatal death/ still birth/abortion during earlier pregnancy?	1. Yes	2. No	
Now, I will ask you some questions regarding various health services you received during the perinatal period (from 28 weeks of pregnancy to 7 days after birth of baby).			
28. What was total period of pregnancy at the time of delivery (Write in weeks)?	_____		
29. In which place did you deliver the baby?	1. Government hospital	2. Private hospital	
	3. Sub – center	4. Home	
	5. Outside Home		
30. Who conducted the delivery?	1. Doctor	2. Staff nurse	
	3. Health worker	4. Trained Dhai	
	5. Untrained personnel	6. Relative	
	7. Self		

ID No _____			
Questionnaire items		**Options**	**Coding**
31. What type of delivery procedure was done?	1. Normal vagina	2. C.S.	
	3. Forceps	4. Ventose	
32.Was the baby a single birth?	1. Yes	2. No	
33. Who visited your home within 24 hours after delivery for check up?	1. Doctor	2. Health worker (F)	
	3. Trained dhai	4. ASHA	
34. How many times the health worker visited your home within 7 days of delivery (No of time)?	_____		
Now, I will ask you some questions about the new born baby (from birth to 28 days of life)			
35. What was/is the sex of the baby?	1. Male	2. Female	
36. Was the baby's weight measured after birth?	1. Yes	2. No	
If Q No. 36 is NO, Skip Q. 37			
37. What was the weight of baby at the time of birth (in g)?	_____		
38. How many times did the trained dhai visited your house to check the neonate (Number)?	_____		
39. How many times baby was bath everyday within 7 days after birth?	1. No bath	2. One time	
	3. Two times	4. More than 2 times	
40. Did you apply any substance on stump of cord within 28 days of birth?	1. Yes	2. Yes	
If Q. 40 is No, go to Q. 43			
41. On what day after birth did you apply?	_____		
42. What did you applied on stump of cord?	1. Antiseptic ointment	2. Ghee	
	3. Mud	4. Ash	
	5. Cow dunk	6. Turmeric powder	
	7. Others Specify _____		
43. When the new born was started on breast feeding?	1. Within 30 minutes	2. 31 minutes to 1 hours	
	3. 1 hour to 2 hours	4. more than 2 hours	
44. Was the baby fed with colostrums?	1. Yes	2. No	

ID No _____			
Questionnaire items		**Options**	**Coding**
45. Was the baby was on exclusive breast feeding?	1. Yes	2. No	
If Q. 45 is No , Skip Q. 46			
46. How many times in a day (Write number)?	_____		
47. What extra food was given to the baby?	1. Water	2. Cows milk	
	3. Pre-prepared food	4. Honey	
	5.Others specify___		
48. Was the new born given Polio vaccine on the first day of birth?	1. Yes	2. No	
49. Was the new born given BCG vaccine on the first day of birth?	1. Yes	2. No	
50. Did the baby complete 28 days of life and living?	1. No	2. Yes	
If Q. 50 is No, go to next Questionnaire, if Yes Stop here, and thank the family for participation			
Now I will ask you some questions regarding details of death of baby			
51. When did the baby die after birth (Write in days)?		_____	
52. Where did the baby die?	1. Home	2. Hospital	
	3. Other place, Specify_____		
53. Did the baby receive any treatment before death?	1. Yes	2. No	
If Q 53 No then skip Q 54			
54. Who treated the baby for illness?	1. Doctor	2. Pharmacist	
	3. health worker	4. Trained dhai	
	5. traditional healer		

ID No _____			
Questionnaire items		**Options**	**Coding**
55. What was the main signs and symptoms/illness prior to death? (multiple response is allowed; circle what ever is applicable)	1. fever	2. Loose motion	
	3. Bloody dysentery	4. Cough	
	5. Fast breathing	6. Vomiting	
	7.Redness/ discharge from cord	8. Yellow palms/soles	
	9. Hypothermia	10. Weight less than 2500g	
	11. Fits	12. Malformation	
	13. Other specify	_____	
56. What was the duration of illness (in days)?	_____		
57. On what day of illness the baby was started on treatment	1. Within 24 hours	2. 25 hours to 48 hours	
	3. 49 hours to 72 hours	4. More than 72 hours	
58. Was the baby admitted in hospital?	1. Yes	2. No	

Thank You

SECTION: II
LITERATURE REVIEW

Factors associated with neonatal death among tribal community in Lanjigarh block, Kalahandi, Orissa, India, 2008: Review of literature

Introduction

Neonatal survival is a sensitive indicator of population and socio economic development of a nation. Neonatal deaths include deaths between first day of life to 28th completed days. Neonatal deaths may be sub-divided into early neonatal deaths (occurring during the first seven days of life) and late neonatal deaths (occurring after the seventh day but before 28 completed days of life).

Newborn mortality is one of the world's most neglected health problems. While there has been significant progress in reducing deaths among children under age 5 over the past decade, mortality rates among babies during the first month of life have remained relatively constant.[1] Every year an estimated 4 million babies die in the first 4 weeks of life (the neonatal period).[2] Three-quarters of neonatal deaths happen in the first week, the highest risk of death is on the first day of life. Almost all (99%) neonatal deaths arise in low and middle-income countries. The highest numbers of neonatal deaths are in south-central Asian countries and the highest rates are generally in sub-Saharan Africa. [2] The fourth Millennium Development goal calls for a two-third reduction of under five death by 2015.[3] Globally new born deaths account for 40 percent of all deaths among under five children.[1] The proportion of child deaths that occurs in the neonatal period is increasing, and the MDG for child survival cannot be met without substantial reductions in neonatal mortality.

The countries of the South-East Asia (SEA) Region contribute more than 40% of the global burden.[1] WHO estimates that in the 2004, in SEA region, the NNMR was 35 per 1000 live birth.[4]

About 1 million neonates die annually in India alone, amounting to almost one-fourth of all global newborn deaths[3]. WHO estimates that in 2004, in India, the NNMR was 39 per 1000 live births.[1] About two - third infant mortality rate is being contributed by NNMR in India.[1] In Orissa, during 2005, the neonatal mortality rate was 53 per 1000 live births, of which two-third died during early neonatal period.[5]

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Causes of Neonatal Mortality

Globally, the main direct causes of neonatal death are preterm birth (28%), severe infections (26%), and asphyxia (23%).[2] Neonatal tetanus accounts for a smaller proportion of deaths (7%), but are easily preventable. Low birth weight is an important indirect of neonatal death. [2] Maternal complications in labour carry a high risk of neonatal death, and poverty is strongly associated with an increased risk.[1, 2]

Factors associated with neonatal mortality

Maternal Factors

Antenatal care

Effective antenatal care (ANC) can improve the health of the mother and give her a chance to deliver a healthy baby. Regular monitoring during pregnancy can help detect complications at an early stage before they become life-threatening

emergencies. However, one must realize that even with the most effective screening tools currently available, one cannot predict which woman will develop pregnancy related complications. Hence, every pregnant woman needs special care.

Time of ANC registration

The first visit or registration of a pregnant woman for ANC should take place as soon as the pregnancy is suspected. Every married woman in the reproductive age group should be encouraged to visit her health provider if she believes herself to be pregnant. Ideally, the first visit should take place in the first trimester (first three months of pregnancy), before or at the 12th week of pregnancy.[6]

Importance of early registration

Early registration is required to:

- Assess the health status of the mother and to obtain baseline information on blood pressure (BP), weight, etc.
- Screen for complications early and manage them appropriately by referral as and where required.
- Give the woman the first dose of tetanus toxoid injection (Inj. TT) well within time (after 12 weeks of pregnancy).[6]
- Build a good rapport with the pregnant woman and provides plenty of time to counsel the woman and her family.
- Start the woman on a regular dose of folic acid during the first trimester. [6]

Number of ANC visit

- Ensure that every pregnant woman makes at least 4 visits for ANC, including the first visit/ registration. [6]

- The first visit is recommended as soon as the pregnancy is suspected. This is meant for registration of the pregnancy and the first antenatal check-up. The second visit should be scheduled between the 4th and 6th month (around 26 weeks). The third one should be planned in the 8th month (32 weeks), and the fourth one in the 9th month (36 weeks). [6]

Study conducted rural western part of Kenya on "use of antenatal care services and delivery among women showed that 90% of women visited antenatal care clinic at least once during their last pregnancy and most women (64%) visited in the last trimester.[7]

Maternal age

Maternal age plays an important role in determining the fate of newborn. Women below the age of 16 years or above 40 years have greater chances of having pregnancy-related complications. [6]

Order of the pregnancy

Primigravida's and those who have had 4 or more pregnancies are at higher risk of developing complications during pregnancy and labour. [6]

Birth spacing

A newborn's health is affected to a great extent by the timing and frequency of the mother's pregnancies. Women who give birth when they are too young or too old, or who have babies spaced too closely together, place themselves and their newborns at increased risk of complications. Research clearly shows the association between newborn and infant mortality and birth intervals. For example, a child who is born less than two years after the next oldest sibling is 2.2 times more likely to die than a newborn who arrives after three years.[8] In addition, women who have borne many children are at a higher risk of maternal mortality, and their newborns are at increased

risk of death as well. Effective use of family planning methods can contribute to improved maternal and newborn health by helping women to space their births at intervals that are healthy for them and their babies.

Previous pregnancies

It is essential to ask a woman about her previous pregnancies or obstetric history, especially if she had suffered from any complications. This is important as some complications may recur during the present pregnancy. [6]

It is essential to refer a woman to the nearest health facility if her obstetric history reveals any of the following:

- previous stillbirth or neonatal loss
- history of three or more spontaneous consecutive abortions
- birth weight of the previous baby <2500 g
- birth weight of the previous baby >4500 g
- hospital admission for hypertension or pre-eclampsia/eclampsia in the previous pregnancy
- previous surgery on the reproductive tract
- iso-immunization (Rh .ve) in the previous pregnancy

Multiple birth

This must be suspected if the following are present on examination:

- .An unexpectedly large uterus for the estimated gestational age
- Multiple foetal parts are felt on abdominal palpation

If a multiple pregnancy is suspected, refer the woman to the nearest health facility for confirmation, and arrange for delivery in an institution. [6] Study conducted in Rural Nepal showed that the twining rate was 16 per 1000 pregnancies and twining rate is

higher among women of higher parity. The twin babies were nine times more likely to die than the singletons during neonatal period.[9]

Folic acid supplementation

If the woman is registered within the first trimester of pregnancy, she should be given folic acid supplementation for improving the growth of the foetal neural tissue. [6] It is recommended that the woman be given 5 mg of folic acid once a day, till 12 weeks of pregnancy. [6] After that, she is to be advised a combination of iron and folic acid (IFA). All pregnant women need to be given one tablet of IFA (100 mg elemental iron and 0.5 mg folic acid) every day for at least 100 days, starting after the first trimester. [6] This is the dose of IFA given to prevent anaemia (prophylactic dose). If a woman is anaemic (Hb <11 g/dl) or she has pallor, two IFA tablets per day is given for three months. [6] This is the dose of IFA needed to correct anaemia (therapeutic dose). Many women do not take IFA regularly due to some common side-effects. The necessity of taking IFA and the dangers associated with anaemia should be explained to the mother.

Counselling

Four out of ten pregnant or postpartum women will experience some complication related to their pregnancy; for about 15% of these women, the complication will be potentially life-threatening and will require immediate emergency obstetric care. [6] Since most of these complications cannot be predicted, every pregnancy necessitates preparation for a possible emergency.

Birth preparedness

All pregnant women should be helped to reach a decision regarding the health provider they want for conducting their delivery. An skilled attendant at birth should be preferred over an unskilled one. Other factors such as the condition of the

pregnancy (complicated or uncomplicated), the distance to the provider, transport facilities, financial situation, etc. all need to be kept in mind before finally reaching a decision about the choice of birth attendant. All pregnant women must be encouraged to opt for an institutional delivery. [6]

Diet and rest

The woman should be advised to eat more than her normal diet throughout her pregnancy. A pregnant woman needs about 300 extra kcal per day compared to her usual diet. [6] She should be told that she needs these extra calories for maintenance of her health as a mother, the needs of the growing foetus and for successful lactation. The woman should be advised to sleep for 8 hours at night and rest for another 2 hours during the day. [6] She should be told refrain from doing heavy work, especially lifting heavy weights, as it can adversely affect the birth weight of the baby. The other members of the household should be taken into confidence and advised to help the woman in carrying out her routine household chores. All pregnant women should be told to avoid the supine position, especially in late pregnancy, as it affects both the maternal and the foetal physiology. During pregnancy, the pressure exerted by the pregnant uterus on the main pelvic veins results in a reduced quantity of circulating blood reaching the right side of the heart. This causes a reduced supply of oxygen to the brain and can therefore lead to a fainting attack, a condition referred to as the supine hypotension syndrome. It can also result in abnormal foetal heart rate patterns, and may also cause a reduction in the placental blood flow. If the supine position is necessary, a small pillow under the lower back at the level of the pelvis is recommended.

Maternal weight

A pregnant woman's weight should be taken at each ANC visit. [6] The weight taken during the first visit/ registration should be treated as the baseline weight. Normally, a woman should gain 9 - 11 kg during her pregnancy.[6] After the first trimester, a pregnant woman gains around 2 kg every month. [6] If the diet is not enough, with less than the required amount of calories, the woman might gain only 5 - 6 kg during her pregnancy. An inadequate dietary intake can be suspected if the woman has gained less than 2 kg per month. She needs to be put on food supplementation. A low weight gain usually points towards intrauterine growth retardation (IUGR) and results in a low birth-weight baby. Excessive weight gain (more than 3 kg in a month) should arouse the suspicion of pre-eclampsia / twins (multiple pregnancies). [6]

Perinatal factors

Complications of Childbirth

Complications of childbirth also have a significant impact on newborns. Almost 25 percent of newborn deaths are the result of problems occurring during delivery.[10] Asphyxia, for example, occurs when a newborn receives an inadequate supply of oxygen immediately before, during or just after delivery. It is often caused by obstructed labor, a complication that also causes 8 percent of maternal deaths and many uncounted stillbirths. An estimated 4 million to 5 million newborns suffer from birth asphyxia and more than 1 million die from it each year.[11] Obstructed labor and asphyxia may go unrecognized and untreated because only about half of deliveries in less-developed countries take place with the assistance of skilled health personnel who can detect, treat or ensure referral care for complications that develop during labor or for an asphyxiated newborn. Mothers and families can also be empowered

through health education and birth preparedness to recognize danger signs (in both the mother and newborn) and seek professional help. But this type of health education is often unavailable in the poor, remote areas where so many mothers and newborns die. Child marriage exacerbates this problem. In developing countries, many girls marry and begin having children when their bodies are not physically mature enough to deliver a baby without complications. Girls in their teens are twice as likely to die from pregnancy and childbirth related causes compared with older women, and their babies face a risk of dying before age 1 that is 50 percent higher than babies born to women in their 20s.[12] Fistula – perhaps the most devastating of pregnancy related disabilities – most often occurs in the poorest countries where child marriage is common and trained doctors and well-equipped hospitals are scarce. Fistula occurs as a result of obstructed labor that is not dealt with in a timely and appropriate manner. The prolonged pressure of the baby's head against a young mother's pelvis cuts off blood supply to the soft tissue surrounding the bladder, rectum and vagina, which can then rot away leaving a hole (fistula) that impairs control of the bladder or bowels. The condition causes great pain, both physical and emotional, and victims are often shunned by their family and community.

Neonatal factors

Low birth weight

Low birth weight has been defined by the World Health Organization (WHO) as weight at birth of less than 2,500 grams.[13] This practical cut-off for international comparison is based on epidemiological observations that infants weighing less than 2,500 g are approximately 20 times more likely to die than heavier babies.[14] More common in developing than developed countries, a birth weight below 2,500 g contributes to a range of poor health outcomes.

A baby's low weight at birth is either the result of preterm birth (before 37 weeks of gestation) or of restricted foetal (intrauterine) growth.[15] Low birth weight is closely associated with foetal and neonatal mortality and morbidity, inhibited growth and cognitive development, and chronic diseases later in life.[16] Many factors affect the duration of gestation and of foetal growth, and thus, the birth weight. They relate to the infant, the mother or the physical environment and play an important role in determining the infant's birth weight and future health.[17]

• For the same gestational age, girls weigh less than boys, firstborn infants are lighter than subsequent infants, and twins weigh less than singletons;

• Birth weight is affected to a great extent by the mother's own foetal growth and her diet from birth to pregnancy, and thus, her body composition at conception;

• Women of short stature, women living at high altitudes, and young women have smaller babies.

Small Babies and Mothers' Health

Of the 4 million newborns who die every year, between 60 and 80 percent are smaller than normal and weigh less than 2,500 grams.[10] Worldwide, 18 million babies are born with low birth weight each year.[18] Most of these babies are born too early – before the full nine months of pregnancy – and are called pre-term. Some are full term, but they are small because of poor growth in the mother's womb, which may have been caused by infections such as malaria, untreated high blood pressure or poor nutrition.

Feeding practices

Pregnancy is the ideal time to counsel the mother regarding the benefits of breastfeeding her baby. Though breastfeeding is almost universal in India, a few points need to be emphasized to the would-be mother.[6]

Initiation of breastfeeding: Counsel the mother that breastfeeding should ideally be initiated within half-an-hour of a normal delivery or within two hours of a caesarean section. [6] It is common practice in India to delay initiation. [6] Colostrum (the first milk) is thrown away, and prelacteal feeds are given instead.[6] This has obvious disadvantages. First, the pre-lacteal feed may not be hygienic and can cause an intestinal infection in the baby. [6] Second, the baby is deprived of colostrum which is very rich in protective antibodies. [6] Most importantly, the sucking and rooting reflex in the child, which are essential for the baby to successfully start breastfeeding, are the strongest immediately after delivery, making the process of initiation much easier for the mother and the baby. These reflexes gradually become weaker over the span of a few hours, thus making breastfeeding difficult later on. Study conducted among tribals of Madhya Pradesh showed that the tribal delayed the breast feeding and give pre-lacteal feeding with honey and water.

Exclusive breastfeeding for 6 months: It should be emphasized to the mother that only breast milk and nothing but breast milk should be given to the baby for the first 6 months, not even water. [6] The mother should be assured that breast milk has enough water to quench the baby's thirst (even in the peak of summer) and satisfy its hunger for the first 6 months. [6] Take special care in the case of a female child to ensure that she is adequately breastfed and not discriminated against because of her sex. [6]

Demand feeding: This refers to the practice of breastfeeding the child whenever he/she .demands. it, as can be made out by the child crying. The practice of feeding the child by the clock should be actively discouraged. After a few days of birth, most children will develop their own .hunger cycle. and will feed every 24 hours. Each child is different as far as the feeding requirements and timings are concerned. The practice of giving night feeds should be actively encouraged. Often, there is a

misconception that breastfeeding the baby at night disturbs the mother.s sleep, thus depriving her of adequate rest. Inform the woman and her husband that this is not so. Night feeds help the baby to sleep more soundly.

Rooming in: This refers to the practice of keeping the mother and baby in the same room and preferably on the same bed. [6] This is usually practiced in the Indian setting. This practice should be encouraged as it has certain advantages.

Complementary feeding at 6 months: The mother should be told that after 6 months of age, breast milk alone does not meet the baby's nutritional requirements.[6] The baby needs supplementary food, in addition to breast milk. Advise the mother to begin with semi-solid soft food devoid of spices, supplemented with a small amount of ghee/butter/oil.[6] The frequency of feeds and the quantity of each feed should be increased gradually. Over a period of time the baby may be given solid foods. A one-year-old child should start eating from the family pot, and should have an intake that is about half the adult diet. Feeding bottles should be strictly discouraged.

Body temperature maintenance

Newborns may be hypothermic at birth. Hypothermia is a body temperature of <36 °C.[6] Hypothermia results in increased oxygen consumption and hypoxaemia, increased glucose consumption, and hypoglycaemia and metabolic acidosis. Hypoxaemia and hypoglycaemia can result in death of the newborn. Among survivors, it can lead to permanent impairment of the brain resulting in developmental handicaps.

Heat loss at birth can be prevented by the following simple interventions:

Receive the baby in a dry, warm, clean towel. Dry the baby well. While drying, make sure that the head is in a neutral position, neither too flexed nor too extended. Discard the wet towel immediately and wrap/cover the baby (except for the face and upper

chest), in a fresh, clean dry towel. The baby should be kept wrapped during the assessment, and suction ventilation applied (if required) to prevent heat loss. Wrap the baby in loose multiple layers of light but warm cloth. Blood, meconium and some of the vernix will have been wiped off during drying at birth. The remaining vernix does not need to be removed as it is harmless, may reduce heat loss and is reabsorbed through the skin during the first few days of life. Place the baby near a source of warmth. A normal baby, who is crying well after birth, can be placed in skin-to-skin contact with the mother's abdomen and covered with a dry cloth. The maternal body heat will provide the extra warmth required. It is also an additional assurance to the mother of the baby's well-being. In a PHC setting, additional heat can be provided by placing the baby under a source of heat such as a lamp with a 200 Watt bulb or under a radiant warmer. Ensure that during and after the delivery, no fans are running in the delivery room, and no windows are open through which air currents blow into the room.

Cord care and infections

Many stillbirths and newborn deaths from infection could be prevented by better health care for mothers before and during pregnancy, and during and immediately after childbirth. Hygienic practices such as clean delivery, cutting the umbilical cord with a clean blade, proper cord care, long with early and exclusive breastfeeding, can prevent most of the infections that kill newborns. Birth preparedness – including educating mothers and families to recognize danger signs and plan for emergency transport – can ensure proper treatment and management of complications when they do occur. Tetanus is another easily preventable illness that can lead to death for both a mother and her baby. Infants are at increased risk of contracting the disease when their umbilical cords are cut with unclean instruments or treated with unhygienic

traditional applications such as cow dung. Neonatal tetanus kills more than 200,000 infants each year.[19] Mothers get tetanus from injuries suffered during unclean deliveries. It is estimated that tetanus is responsible for at least 5 percent of maternal deaths, approximately 30,000 per year.[20]

Maternal diseases

Mothers may pass sexually transmitted infections to their newborns during pregnancy, delivery or breastfeeding. More than one-third of mothers who are infected with HIV and go untreated pass the virus on to their infants during the perinatal period (between 22 weeks of pregnancy and the first week of life). Mother to- child transmission of HIV resulted in nearly half a million child deaths in 1999 alone.[25] Other sexually transmitted infections can lead to infant blindness, and still others are associated with stillbirth, low birth weight and a variety of other complications after birth.[26] These risks can be greatly reduced through prevention of mother-to-child transmission of HIV, syphilis screening and treatment and other preventive measures. For example, a pregnant woman in a developing country who is HIV-positive has a 20 to 45 percent chance of transmitting the virus to her baby during pregnancy, delivery or subsequent breastfeeding. This risk can be reduced by about 50 percent through a short course of antiretroviral drugs, Indonesia and by an even greater percentage if the mother receives longer-term antiretroviral therapy.[27] In countries where malaria is endemic, women are more likely to have it during pregnancy than at any other time. Infected women are more apt to have low-birth weight infants, a major risk factor for newborn death. Malaria an cause up to 30 percent of preventable low birth weight and as much as 5 percent of newborn deaths.[28] malaria is also associated with miscarriages and stillbirths, and women who develop severe anemia from malaria re at increased risk of maternal death.[29] In addition, regnant mothers who have malaria and are HIV-positive

re more likely to pass HIV on to their unborn child.[30] treatment for malaria in endemic areas, administered during the prenatal period, can reduce the incidence of prematurity and low birth weight by 40 percent.[31]

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