

Determinants of Infant Mortality in Samdrup Jongkhar District, Bhutan

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Abstract

Samdrup Jongkhar district has reported an increasing trend in infant mortality rates over the recent years. This study aimed to identify its determinants. A population based case-control study was conducted in May 2018. Case group comprised of 79 infants who died between 1st January 2015-30th April 2018 while 158 living children born during the same period and residing closest to the home where infant mortality occurred were recruited as controls. Premature new-borns and those with low birth weight were 5.9 times and 4.1 times more likely to die respectively. New-borns whose mother received better ante-natal and post-natal care were more likely to survive. Over 50% of the deaths occurred at home and around two-thirds of deaths occurred during the post-natal period. Implementing a multi-stakeholder collaborative approach including local leaders, village health workers and religious leaders would be useful in reassuring parents to seek early medical care during childhood illness.

Keywords: *Determinants, Infant mortality, Samdrup Jongkhar, Bhutan*

Background

Infant mortality is an important indicator of health and well-being of the population.^[1] Globally 4.5 million infant deaths were reported in 2015 and it accounts for 75% of all under-five deaths. Close to 1 million children died on the first day of their life in 2016. Majority of these deaths occur in developing countries where accessibility to healthcare is low.^[2] Over the past one and a half decade, Bhutan has made substantial progress in reduction of under-five deaths which reduced from 84.0 per 1000 live births in 2000 to 37.3 in 2016. Significant proportion of these under-five deaths are contributed by infant deaths as infant mortality rate was 30.0 per 1000 live births in 2016,^[3] and similar trends have been reported globally.^[4] Samdrup Jongkhar district has reported an increasing trend in infant and under-five mortality rates over the recent years.^[5] Similar findings were reported by the Population and Housing Census of Bhutan 2017.^[6] Preventing newborn deaths contributes to healthier and more prosperous societies.^[7] The United Nations Sustainable Development Goal calls upon member states to end all preventable deaths of newborns and children under-five with all countries aiming to reduce neo-natal mortality to 12 per 1000 live births and under-five mortality to 25 per 1000 live births by 2030.^[8] Reliable information on the magnitude,

trends and causes of death of children helps decision-makers to assess programmatic needs, prioritize interventions and monitor progress. It is crucial for planning and evaluating effectiveness of health services and interventions.^[9] However, no studies have been conducted at the moment to address this situation. This study aimed to identify the determinants of infant mortality in Samdrup Jongkhar.

Methodology

A population based case-control study matched for place, month and year of birth was conducted in May 2018. Records of infant deaths were obtained from data maintained at the district health office. Infants who died in the district but whose parents were not recorded as resident of the district in any of the annual household surveys between 2014-2017 were excluded from the study. Case group comprised of 79 infants (96.3% of the case population) who died between 1st January 2015-30th April 2018 while 158 living children born during the same period and living closest to the home where infant mortality occurred were recruited as controls. Data collection was done by trained health assistants using a validated and pre-tested structured questionnaire. Socio-demographic data were collected from the mothers by personal interview at their

homes while health services related data were extracted from the maternal and child (MCH) hand books and MCH registers maintained at various health facilities in the district. Data entry was done using Epi Data version 3.1 and analyzed using SPSS version 22. Descriptive were presented as frequencies, means and percentages. Chi-Square test was done to assess the associations between independent and dependent variables keeping p-value of <0.05 as statistically significant. Univariate analysis was done to estimate crude odds ratio (OR) and 95% confidence interval (95% CI) for all the significant variables. Ethical approval was granted by the Research Ethics Board of Health, Ministry of Health, Bhutan (Ref. No. REBH/Approval/2017/082). Participation in this study was voluntary and data was collected only after obtaining written consent.

Results

Over three-fourths (77.8%) of the mothers in the control group had education compared to 58.2% in the case group. Less than one-thirds (30.4%) of the mothers in case group availed over eight ante-natal care (ANC) services compared to 41.1% in the control group. One-fifths (21.4%) of the infants in the case group were born before 37 weeks of gestation and around a quarter (25.3%) of them were underweight. Over one-fifth (21.5%) of the infants in the case group were born at home. Mothers availing subsequent post-natal care (PNC) services declined gradually in both the groups with over half (57.0%) of the mothers in the case group not availing the fourth post-natal care (table 1).

Table 1: Maternal and infant history (n=237)

Variables	Total	Case (79)		Control (158)	
		n	%	n	%
Maternal age at birth of the child					
≤ 30	161	46	58.2	115	72.8
≥ 31	76	33	41.8	43	27.2
Mean, SD		28.4, 6.4		26.8, 5.6	
Maternal education					
No education	68	33	41.8	35	22.2
Educated	169	46	58.2	123	77.8
Maternal occupation					
HW/Farmer	187	66	83.5	121	76.6
Private	26	9	11.4	17	10.8
Government	24	4	5.1	20	12.7
Type of family					
Nuclear	169	56	70.9	113	71.5
Extended	68	23	29.1	45	28.5
Monthly family income					
less than 5000	64	26	32.9	38	24.1
5001-10000	68	23	29.1	45	28.5
100001-20000	65	19	24.1	46	29.1
20001 and above	40	11	13.9	29	18.4
History of chronic Disease					
Yes	21	8	10.1	13	8.2
No	216	71	89.9	145	91.8
Complications during pregnancy					
Yes	18	10	12.7	8	5.1
No	219	69	87.3	150	94.9
Trimester of ANC booking (n=236)					
1st Trimester	108	36	45.6	72	45.9
2nd Trimester	115	38	48.1	77	49
3 rd	13	5	6.3	8	5.1
Number of ANC visits					
1-3	19	9	11.4	10	6.3
4-7	129	46	58.2	83	52.5
8 and above	89	24	30.4	65	41.1
Gestational Age					
< 37 weeks	24	17	21.5	7	4.4
37-42 weeks	213	62	78.5	151	95.6
Intrapartum complications					
Yes	30	8	10.1	22	13.9
No	207	71	89.9	136	86.1
Place of birth					
District Hospital	107	33	41.8	74	46.8
Basic Health Unit	62	19	24.1	43	27.2
Tertiary Hospitals	33	6	7.6	27	17.1
Home	31	17	21.5	14	8.9
Ambulance/ En-route to HF	4	4	5.0	0	0.0
Type of delivery					
Normal	198	67	84.8	131	82.9
Caesarean	39	12	15.2	27	17.1
Gender					
Female	120	37	46.8	83	52.5

Male	117	42	53.2	75	47.5
Birth Weight (grams)					
< 2500	32	20	25.3	12	7.6
2500-4499	205	59	74.7	146	92.4
Birth Order					
1 and 2	132	35	44.3	97	61.4
≤ 3	105	44	55.7	61	38.6
New born complications					
Yes	54	22	27.8	32	20.3
No	183	57	72.2	126	79.7
History of Post Natal Care (PNC)					
PNC 1					
Yes	188	51	64.6	137	86.7
No	49	28	35.4	21	13.3
PNC 2					
Yes	185	49	62	136	86.1
No	52	30	38	22	13.9
PNC 3					
Yes	167	41	51.9	126	79.7
No	70	38	48.1	32	20.3
PNC 4					
Yes	135	34	43.0	101	63.9
No	102	45	57.0	57	36.1

Around two-thirds (65.8%) of the deaths occurred during the post-neonatal period. Over half of the deaths occurred at home (26.6%) and district hospital (25.3%). The cause of death was not known for 43.0% of the infants (Table 2).

Table 2: Descriptive of cases (n=79)

Variables	n	%
Gender		
Male	42	53.2
Female	37	46.8
Age at death		
within 24 hours	15	19.0
1-7 days	7	8.9
8-28 days	5	6.3
more than 28 days	52	65.8
Place of death		
Home	21	26.6
District Hospital	20	25.3
Ambulance	18	22.8
Tertiary Hospitals	15	19.0
Basic Health Units	5	6.3
Cause of death		
Unknown	34	43.0
Pneumonia	8	10.1
Preterm	8	10.1
Sudden death	5	6.3
Unknown fever	4	5.1
Aspiration	4	5.1
Meningitis	3	3.8
Others	13	16.5

Over one-fourths (30.8%) of the post-neonatal deaths occurred at home followed by 26.9% in ambulance. 40% of the deaths occurring during the first 24 hours of life occurred at the district hospital (table 3).

Table 3: Age at death by place of death (n=79)

Place of Death	Total		Within 24 hours		1-7 days		8-28 days		Post-Neonatal	
	N	%	n	%	N	%	n	%	n	%
Home	21	26.6	3	20	1	14.3	1	20	16	30.8
District Hospital	20	25.3	6	40	2	28.6	2	40	10	19.2
Ambulance	18	22.8	2	13.3	2	28.6	0	0	14	26.9
Tertiary Hospitals	15	19	3	20	2	28.6	1	20	9	17.3
BHU	5	6.3	1	6.7	0	0	1	20	3	5.8
Total	79	100	15	100	7	100	5	100	52	100

Crude estimates show that infants born before 37 weeks were 5.9 times more likely to die compared to those infants born after 37 weeks. Infants with a birth weight less than 2500 grams were 4.1 times more likely to die. Infants who were not born in health facilities were 3.7 times more likely to die (Table 4).

Table 4: Association between the independent and dependent variable (n=237)

Variables		Total	Case (79)		Control (158)		Crude Estimates			
			n	%	n	%	p-value	OR	95% CI	
Maternal age at birth										
	≤ 30	161	46	58.2	115	72.8	0.025	1		
	≥ 31	76	33	41.8	43	27.2		1.9	1.1	3.4
Education of the mother										
	Educated	169	46	58.2	123	77.8	0.002	1		
	No education	68	33	41.8	35	22.2		2.5	1.4	4.5
Number of ANC visits										
	≥ 7	123	33	41.8	90	57	0.028	1		
	≤ 6	114	46	58.2	68	43		1.8	1.1	3.2
Complications during pregnancy										
	No	219	69	87.3	150	94.9	0.044	1		
	Yes	18	10	12.7	8	5.1		2.7	1	7.2
Gestational Age										
	37-42	216	64	81	152	96.2	0.000	1		
	< 37 weeks	21	15	19	6	3.8		5.9	2.2	16
Place of delivery										
	Health facility	202	58	73.4	144	91.1	0.001	1		
	Outside health facility	35	21	26.6	14	8.9		3.7	1.8	7.8
Birth weight										
	Normal	205	59	74.7	146	92.4	0.000	1		
	Low birth weight	32	20	25.3	12	7.6		4.1	1.9	9
Birth order										
	≤ 2	132	35	44.3	97	61.4	0.013	1		
	≤ 3	105	44	55.7	61	38.6		2	1.2	3.5
History of availing post-natal care services										
PNC 1										
	Yes	188	51	64.6	137	86.7	0.000	1		
	No	49	28	35.4	21	13.3		3.6	1.9	6.9
PNC 2										
	Yes	185	49	62	136	86.1	0.000	1		
	No	52	30	38	22	13.9		3.8	2	7.2
PNC 3										
	Yes	167	41	51.9	126	79.7	0.000	1		
	No	70	38	48.1	32	20.3		3.6	2	6.6
PNC 4										
	Yes	135	34	43	101	63.9	0.002	1		
	No	102	45	57	57	36.1		2.3	1.4	4.1

Only significant variables at p-value 0.05 presented

Discussion

Preterm births and low birth weight had the highest influence on survival of an infant. Children born before 37 weeks of pregnancy are defined as preterm children.^[10] The study found that infants born before 37 weeks of gestation were 5.9 times more likely to die compared to those born after 37 weeks of gestation. The World Health Organization reports that around one million children die due to complications arising from preterm birth.^[11] Common causes of preterm births include multiple pregnancies, infections and chronic diseases like hypertension and diabetes.^[10] Birth weight of less than 2500 grams is classified as low birth weight.^[12] The data suggest that infants with low birth weight were 4.1 times

more likely to die compared to infants with normal birth weight. A cohort study conducted in Ghana reported that low birth weight children had higher rates of illnesses and had higher mortality rates compared to other children. The risk of death increased with the increase in severity of underweight.^[13] The World Health Organization points out that the main causes of newborn deaths are prematurity, low birth-weight, infections, birth asphyxia and birth trauma which accounts for around 80% of the total newborn deaths.^[14]

Infants born to mothers who had complications during pregnancy were 2.7 times more likely to die. Quality ante-natal care is important in identifying and managing complications during

pregnancy. A cohort study conducted in India reported that complications during pregnancy leads to still births, low birth weight and neonatal deaths.^[15] The study found that availing ante-natal, intra-natal and post-natal care services were positively associated with infant survival. Infants whose mother availed 6 or more number of ante-natal care services were 1.8 times more likely to survive and infants born in health facilities were 3.7 times more likely to survive. A study conducted in Iran reported that home delivery and less than four ante-natal visits significantly increased the chance of death.^[16] Quality ante-natal care, care at the time of birth and post-natal care for newborns and their mothers are vital to combating newborn deaths.^[17]

Children born to women who were over 31 years of age during birth were 1.8 times more likely to die. Mothers giving birth at an advanced age can lead to reduced quality of care due to poor birth spacing. This is intricately connected with higher birth order infants being less likely to survive as reported in this study. The WHO recommends at-least 24 months' interval after a live birth.^[18] Infants whose mothers had no education were 2.5 times more likely to die compared to those born to an educated mother. Maternal education can affect the quality care and feeding practices which is crucial for the survival of an infant during the early days of life. Literature show that many infants do not receive optimal feeding.^[19] Pre-lacteal feeding and sub-optimal infant and young child feeding practices (IYCF) were reported by the national nutrition survey of Bhutan 2015^[20] which was confirmed during the in-depth analysis.^[21] Inadequate knowledge on breastfeeding^[22] and mothers expelling out colostrum^[23] have been reported by earlier studies conducted in other parts of Bhutan.

The study found that over 50% deaths occurred at home (26.6%) and district hospital (25.3%). Educating parents on the need to seek medical care even during mild illnesses could help reduce preventable deaths. Shortage of skilled medical professionals such as pediatrician and pediatric nurses in the district can partly explain the high proportion of deaths at the district hospital. Studies have shown that access to medicines and skilled health professionals can help reduce preventable deaths.^[4] A child's risk of dying is highest in the first 28 days of life which is called as the neonatal period.^[17] The national annual health bulletin reports that around 56% of the under-five deaths are newborn deaths.^[3] However, this study found that around two-thirds of the deaths occurred during the post-neonatal period. Over half of these post-neonatal deaths occurred either at home or in ambulance during transit the health facilities. Although literature suggest that undernutrition, non-breastfed children, low-birth weight, poor hygiene practices, unsafe drinking water and food as major risk factors of death in post-neonatal children^[17] this trend also suggests of delayed health seeking behavior in the community. Religious rituals and local healers are first preference of rural population in Bhutan over health services. A prospective study conducted in Bangladesh reported of delayed health seeking behavior among parents who lost their children.^[24] Poor health care seeking for febrile conditions in children under-five was found among many African countries.^[25] The cause of death could not be ascertained for 43% of the cases. Ascertaining the cause of death is crucial for planning and targeted interventions.^[9] Small sample size was a major limitation in this study (n case = 79). Because of the sparseness of the samples in some strata multivariate regression could not be done. Recall bias can also be a major shortcoming in a case-control study. However, this was addressed by retrieving all the health services related

information from the maternal and child handbooks and records maintained at various health facilities across the district.

Conclusion

The study found that prematurity and low birth weight had the highest influence on survival of an infant. The study observed higher rates of survival in infants who received better ante-natal, intra-natal and post-natal care services. Almost two-thirds of the deaths occurred during the post-natal period. The study recommends to strengthen ante-natal and post-natal care services at all health facilities across the district. Implementing a multi-stakeholder collaborative approach including local leaders, village health workers and religious leaders would be useful in reassuring parents to seek early medical care during childhood illness. Further study is required to understand the causes of highest proportion of deaths during the post neonatal period.

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Conflict of interest

The authors have no conflict of interest.

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