The Efficacy of Community Based Intervention in Newborn Care Practices and Neonatal Illness Management in Morang District of Nepal

Sirjana Khanal[1], Weidong Zhang[1], Sudhir Khanal[2]

1. Department of Biostatistics & Epidemiology, College of Public Health, Zhengzhou University, Zhengzhou, China
2. Project Director of Morang Innovative Neonatal Intervention Program, JSI R & T, Nepal Family Health Program, Nepal. P.O. Box – 1600.

Abstract: Background: In developing countries like Nepal, most of the births take place in the home, where high-risk care practices are common. This study is focused to find the efficacy of a community based intervention in newborn care practices and neonatal illness management in Morang district of Nepal. **Methods**: In Morang district of Nepal, intervention (base line & follow on) and non intervention (control) area were randomly selected. A community based program was launched in intervention area. The program mobilized the female community health volunteer (FCHV) to provide antenatal service (ANC), essential newborn care (ENC) and identify, assess and basic management of sick newborn. The survey included 624, 620 and 613 eligible married women of reproductive age (MWRA) in baseline (BSL), follow on (FON) and non intervention (NI) group respectively. During the survey, data regarding ANC services, clean and safe delivery, implementing ENC practices and managing ill babies were collected. The data, thus collected were analyzed using SPSS for windows. **Results**: The population characteristics of all the three groups; BSL, FON and NI were similar. The number of women receiving ANC service increased from 85.4% to 89% after intervention. The practice of home delivery was low in FON (64.8%) than BSL (69.6%) and NI (70.1%). In case of home delivery, presence of skilled and trained attendant increased to 60.6% with introduction of intervention program. The total illness rate in BSL, FON and NI groups were 41.2%, 38.2% & 29.7% respectively. The most commonly observed danger sign was respiratory problem 38.1%, 41.8% and 30.2% respectively in three groups. A significant improvement was seen in ENC practices of early breastfeeding, cord care, warming baby and delay in bathing practices in FON group ($p<0.005$). The fatality rate in FON group was low (3.2%) than BSL (14.1%) and NI (15.6%). **Conclusion**: Neonatal illness can be diagnosed and managed earlier if proper training is given to grass root level health worker. The intervention in Morang district showed the reduced neonatal fatality rate and this program can be extended in other rural areas of Nepal. [Life Science Journal. 2009; 6(4): 34 - 40] (ISSN: 1097 – 8135)

Key words: Essential Newborn Care, Neonatal illness, Community Based Intervention

1. Introduction

Globally, each year around 10 million young children in low and middle income countries die and about 4 million children die within the first 28 days of life. Reduction of child mortality by two third between 1990 and 2015 is one of goal of MDG. During this period (1990-2006), children under 5 mortality rates in Nepal has been reduced from 117 to 82 and infant mortality rate from 82 to 48. [1] In the last 15 years, Nepal has observed a significant decline in the under 5 mortality. Nepal is one of those six countries who are on the track to achieve the MDG 4 for child health. [2].

Nepal's estimated neonatal mortality rate is 33/per 1000 lives birth. [1] Over 90% of births occur at home unattended by skilled health professionals. [3] Therefore there should be an effective intervention program to create awareness in rural areas regarding new born care practices at home to reduce neonatal morbidity and mortality. A large proportion of the babies who die could be saved with low tech and low cost interventions. MINI is one of such project which launched a community based program giving emphasis on ENC along with identification and management of the illness in babies in Morang district of Eastern Terai region of Nepal.

Corresponding Author:
Sirjana Khanal, Department of Biostatistics & Epidemiology, Zhengzhou University, China
khanalsirju@yahoo.com

The Project has been approved by Government of Nepal and is supported by Saving Newborn Lives Program (SNL-1) through Save the Children/US with support from the Bill & Melinda Gates Foundation, NFHP/USAID.

This study is a part of the MINI intervention program to describe the efficacy of the intervention for essential newborn care practices and management of neonatal illness.

2. Material and Methods

2.1 Location and population

Nepal is a developing country with a population of 23.2 million. [4] Morang is densely populated district of Eastern Terai region of Nepal with a population of 914,000 living in 65 VDCs and one municipality, smallest administrative units.

2.2 Study design

The intervention area included 21 VDCs and NI areas included 44 VDCs and were selected by randomization. However, 8 VDCs were excluded from intervention area because of political instability. MINI conducted a BSL survey in 2004 and then intervention program (mentioned below in 1.3) was launched. After 30 months of intervention, a FON survey was conducted. At the same time, FON survey was conducted in NI area as control group. During the study, the information was collected from all eligible MWRA giving birth in the last one year. The information collected was about mothers' age, her first pregnancy age,

literacy and no. of live child. Similarly, mothers were also interviewed about ANC service, delivery related practice, new born care practice and the problem seen in babies. A same proforma was developed to collect the information from all the three groups – BSL, FON and NI.

2.3 Intervention

A specific training was given to existing health workers to manage neonatal infections. FCHVs were specially trained to provide ANC counseling or health education to new mothers; weigh all newborns to identify those at higher-risk; use a simple clinical algorithm to assess sick newborns (based on an algorithm tested in other countries); manage local bacterial infections (ophthalmic, umbilical, skin); initiate treatment for PSBI with cotrim; facilitate treatment with injectable gentamicin by VHWs; follow up and record outcomes; and conduct simple birth and death recording.

2.4 Statistics

The data were analyzed using SPSS 16 for windows. The data were expressed in mean $\pm$ standard deviation or median and range. Chi square test was used for qualitative data and t- test was used for numerical variable. P value less than 0.05 was considered as significant.

3 Results
3.1 Population Characteristics

A total of 624, 620 and 613 of eligible mothers were interviewed in BSL, FON and NI group respectively. Population characteristics with maternal age, first pregnancy age, no of live child and mother's literacy are presented in table 1

3.2 Antenatal care service and delivery

ANC practice, home delivery and delivery attendant are presented in table 2.

Table 1. Population Characteristics

	INT_BSL		INT_FON		NON_INT		Pvalue
	No.of MWRA	%	No.of MWRA	%	No.of MWRA	%	
No. of House hold visited	5449		4411		4309		
Mothers	624		620		613		
Mothers' Age (years)							**0.929#**
15~	124	19.9	120	19.4	106	17.3	
21~	322	51.6	324	52.3	334	54.5	
27~	114	18.3	120	19.4	125	20.4	
33~	45	7.2	39	6.3	37	6.0	
39~	11	1.8	17	2.7	11	1.8	
45~	2	0.3	0	0.0	0	0.0	
Don't know*	6	1.0	0	0.0	0	0.0	
Mean $\pm$ Std. deviation	25 $\pm$ 5		25 $\pm$5		25$\pm$5	0.0	
Mothers' Literacy							**0.090 ^**
Literate (can read easily)	227	36.4	287	46.3	245	40.0	
Semi Literate (read with difficulty)	68	10.9	58	9.4	66	10.8	
Iliterate (can't read)	329	52.7	275	44.4	302	49.3	
First Pregnancy age (years)							**0.067#**
<15	4	0.6	8	1.3	13	2.1	
15~	412	66.0	431	69.5	448	73.1	
21~	186	29.8	161	26.0	137	22.3	
27~	12	1.9	17	2.7	12	2.0	
33~	3	0.5	2	0.3	2	0.3	
39~	0	0.0	0	0.0	1	0.2	
45~	0	0.0	0	0.0	0	0.0	
Don't know*	7	1.1	1	0.2	0	0.0	
Mean $\pm$ std. deviation	19.6$\pm$3		19.4$\pm$3		19.2$\pm$3.1		
No of live child							**0.239 ^**
1~2	427	68.4	450	72.5	436	71.1	
3~4	167	26.8	139	22.5	157	25.6	
>4	30	4.8	31	5.0	20	3.3	

* Without considering missing value (don't know)
^ chi square test, # ANOVA test

Table 2. ANC and delivery

	INT_BSL		INT_FON		NON_INT		χ^2	P value
	NO. of MWRA	%	NO. of MWRA	%	NO. of MWRA	%		
ANC received	533	85.4	552	89.0	550	89.7	6.3	**0.043**
Median month	4		4		4			
First ANC visit at							25.1	**0.001**
1st Trimester	185	29.6	212	34.2	211	34.4		
2nd Trimester	275	44.1	305	49.2	305	49.8		
3rd Trimester	73	11.7	35	5.6	34	5.5		
Place of Delivery							19.7	**0.001**
Home	434	69.6	402	64.8	430	70.1		
Hospital	110	17.6	110	17.7	127	20.7		
Others	80	12.8	108	17.4	56	9.1		
Delivery assisted by							13.0	**0.001**
Skilled & trained Attendant	315	50.4	376	60.6	332	54.2		
Untrained Attendant	293	47.0	236	38.1	276	45.0		
No Attendant at all	16	2.6	8	1.3	5	0.8		

Table 3. ENC Practices

	INT_BSL		INT_FON		NON_INT		χ^2	P value
	No.of MWRA	%	No. of MWRA	%	No. of MWRA	%		
Cord care	177	28.4	375	60.5	261	42.6	130.8	0.001
Breastfeeding (within 1st hour of birth)	181	29	270	43.5	264	43	35.8	0.001
First colostrums fed	473	75.8	545	87.9	508	82.8	31.4	0.001
Baby wiped	367	58.8	394	63.5	328	53.5	12.8	0.002
Baby wrapped	433	69.3	446	71.9	381	62.1	14.5	0.001
Baby bathing (>24 hrs)	109	17.5	261	42	215	35	69.8	0.001
Weighing of baby (within 24 hrs)	178	28.5	313	50.4	209	34	68.9	0.001

In BSL, 533 (85.4%) women received ANC service and 552 (89%) and 550(89.7%) in FON and NI group. Most of the women seek first ANC service in 2nd trimester 44.1%, 49.2% and 49.8% respectively in BSL, FON and NI group. In BSL 434 (69.6%) women delivered the baby at home. Similarly in FON and NI group home delivery were 402 (64.8%) and 430 (70.1%) respectively. The skilled & trained attendant conducted 50.4%, 60.6% & 54.2% of the deliveries while untrained assisted in 47%, 38.1% and 45% cases respectively in the BSL, FON and NI group. In this study, birth attendant were grouped into skilled and trained attendant (doctor/Nurse/paramedics/Trained TBA) and untrained attendant (Family members, neighbours, relatives, untrained dais). There is a significant different in antenatal service and delivery practices among the groups. (ANC received χ^2= 6.3; $p<0.05$; home delivery χ^2= 19.7; $p<0.001$; delivery assistance by skilled χ^2 = 13.1; $p<0.001$).

3.3 Essential Newborn Care Practices

There was a significant improvement in cord care among the groups (χ^2 = 130.8, $p<0.001$). The practice of breastfeeding to babies within 1st hour of birth and feeding of colostrums was significant different among the groups (χ^2 = 35.8, $p<0.001$ and χ^2 = 31.4, $p<0.001$). Newborn was wiped immediately after birth. Babies were dried and wrapped in clothes. Both the practices were significantly improved after intervention (χ^2 = 12.8; $p<0.005$ and χ^2 =14.5; $p<0.001$). The practice of delay to bath the babies were reported more after intervention. (χ^2 =69.8; $p<0.001$). The significant improvement in taking weight of babies after birth was seen (χ^2 = 68.9; $p <0.001$) The newborn care practices are in table 3.

3.4 Status of Ill Babies

FCHVs had assessed ill babies in their villages using a standard algorithm. The danger signs of the newborn identified are listed in Table 4.

Table 4   Danger Signs Identified

	INT_BSL		INT_FON		NON_INT		χ^2	P value
	No.of MWRA	%	No. of MWRA	%	No.of MWRA	%		
Unable to suck milk	46	18	51	21.5	30	16.5	1.9	0.382
Difficulty in breathing	98	38.1	101	42.6	55	30.2	6.0	**0.050**
Lethargic	8	3	9	3.8	4	2.2	0.8	0.646
Redness around cord	5	2	18	7.6	5	2.7	11.1	**0.004**
Fever	164	64	157	66.2	123	67.6	0.7	0.697
Cold body	0	0	0	0.0	4	2.2	10.9	**0.004**
Watery + bloody stools	20	8	14	5.9	14	7.7	0.78	0.674
Yellow in eyes, skin	24	9	13	5.5	11	6.0	3.19	0.202
Failed to pass urine	3	1	3	1.3	4	2.2	0.89	0.641
Skin problem	9	4	32	13.5	15	8.2	16.2	**0.001**
Red eyes with discharge	14	5	11	4.6	8	4.4	0.29	0.861
Others	127	49	37	15.6	39	21.4	75.8	**0.001**
Total ill babies	257	41.2	237	38.2	182	29.7	18.9	0.001

Table 5   Effect Of Treatment In Neonatal Illness

	INT_BSL		INT_FON		NON_INT		χ^2	P value
	NO. of MWRA	%	NO. of MWRA	%	NO. of MWRA	%		
PSBI cases	99	38.5	157	66.2	64	35.2	52.8	0.001
Babies receiving cotrim	-	-	78	32.9	33	18.1	11.5	0.001
Babies receiving gentamicin	0	0	73	30.8	21	11.5	21.9	0.001
Death	14	5.4	5	2.1	10	5.5	215.6	0.001
Case Fatality Rate of PSBI		14.1		3.2		15.6		

In BSL, 257 babies were ill within 60 days of their life with illness rate of 41.2%. In FON, 237 were ill and illness rate was 38.2%. In NI group, 182 were ill with illness rate of 29.7%. The most commonly observed danger sign was respiratory problem 38.1%, 41.8% and 30.2% respectively. Other illness includes the danger sign like unable to feed, bluish palm and sole, excess cry or no cry, no urine, convulsion, abnormal movement and other unclassified illness. Two or more danger signs were seen in 66.2% of babies in FON group. They were considered as possible severe bacterial infection. The symptoms of difficulty in breathing, redness around cord, skin problem were significantly different among the groups ($p<0.005$) where as non specific symptoms or danger sign had significantly decreased ($p<0.001$).

3.5 Outcome

A total of 14, 5 and 10 babies died in BSL, FON and NI groups respectively. Case fatality rate of PSBI was 14.1%, 3.2% and 15.6% in BSL, FON and NI group, respectively. The treatment and its outcome are in table 5. The PSBI cases of 99(38.5%), 157 (66.2%) and 64 (35.2%) were seen in BSL, FON and NI groups. There is a significant difference in PSBI cases among the group (χ^2 = 52.8; $p<0.001$). There was no any information about the treatment of ill babies in BSL. In FON group ill babies were treated by FCHV and VHW with cotrim and gentamicin. Cotrim was given to 78 (32.9%) ill babies

and 73 (30.8%) of babies received gentamicin in FON group. In NI, babies treated with cotrim and gentamicin were 33 (18.1%) and 21 (11.5%) respectively. These were also found to be significantly different. (χ^2 = 11.5; $p<0.001$ and χ^2 = 21.9; $p<0.001$). Total death of ill babies were 14 (5.4% of total ill babies), 5 (2.1%) and 10 (5.5%) in BSL, FON and NI group. The total case fatality rate of PSBI are high in BSL (14.1%) and NI group (15.6%) compared to FON (3.2%).

4. Discussions

The infants who are born at home are almost all exposed to substantial infectious challenge during their neonatal period. The study shows illness is associated with the care taking practices. [5] In our study, we had taken three groups – BSL, FON and NI, to find the efficacy of intervention in the essential new born care practices and management of neonatal illness in Morang district of Nepal. ANC receiving practice has been increased from BSL to FON but no difference in NI group. In NI group, MWRA received ANC from the regular government health services but intervention was not done. In all the three groups, it has been seen that pregnant women went for first antenatal service mostly in 2nd trimester only. However, the new mothers should be encouraged for first ANC within first trimester. The previous findings show that home delivery is a common practice in rural part of Nepal. [1, 6] After intervention, in the FON group, home delivery was low

(64.8%). David O et al had reported 90% of home delivery in rural part of Nepal [3] In rural part of India also, home delivery is quite common. [7] Though the delivery attendant by untrained has been decreased, the skilled and trained health workers need to increase their coverage more during home delivery. In the study by David O et al, there were 11% of women who gave birth alone [3], we found a much lower rate of 1.3%.

Cord cutting practices have been identified as risk factors for neonatal infection. [8-12] During the delivery, in FON group, 60.5% of women had proper care of cord. This shows the increment in the use of clean and safe instruments. A.H. Baqui et al suggested a low coverage of clean cord care among home deliveries in South Asia. [3, 13, 14] The application of the material on the cord especially oil is a risk factor for the infection. [15-17] There is no any additional benefit of topical substances on the cord. [18,19] So MINI's recommendation of keeping cord dry as per World Health Organisation guidelines of ENC were followed widely in FON group. However, ointment/dettol/powder was commonly used in FON group and oil in NI group. Other case control studies suggested that the use of antiseptics may reduce the risk of neonatal sepsis. [20-22] In our study in FON group, the practice of applying substances on the cord has been decreased than that of BSL and NI group.

Breastfeeding is one of the most important contributors to neonatal health, growth and development. Several studies have demonstrated effective reduction of mortality rate in neonate with early and exclusive breastfeeding. [23-29] However, there are few studies that have evaluated the breastfeeding in neonatal outcome. Huffman et all concluded that early & exclusive breastfeeding played an important role in reducing neonatal mortality. [30] The benefits are enhanced if breastfeeding starts within one hour after birth. Many neonatal health problems can be avoided or reduced by such a pattern of breastfeeding. However many women are not aware of the benefits of early breastfeeding. Our study shows that 29%, 43.5% & 43% of babies were breastfed within 1 hour of birth in BSL, FON and NI group respectively which is very lower compare to previous studies of 63%.[31] Though early breastfeeding was lower, all most all the women practiced breastfeeding (including breastfeeding within 1 hour and after 1 hour). Though the constant effort by the health workers to promote breastfeeding has resulted positive findings but it is not up to the mark. So health worker should promote for the early breastfeeding. In other studies [32,33], the first colostrum was commonly given to babies in our report. The breastfed babies have less risk to the infection. The practices of wiping, drying & wrapping babies were increased in FON group than BSL and NI group showing the positive effect of intervention.

As per WHO guidelines, bathing of neonate should be postpone [34], but there is a trend to bathe the babies soon after birth. After intervention, the practice of delay bathing (>24hrs.) increased. Birth weight is an important indicator of child survival but this is difficult in developing countries since most of the deliveries are conducted at home where adequate facilities to weigh a new born does not exist. [35] So in many rural part of Nepal, it is difficult to take the weight of babies immediately after birth mainly in home delivery. In our study, FCHV has weighed the baby using spring balance and identified the low weight baby during intervention. Early identification of low birth weight babies (<2500 gms) is vital in preventing neonatal deaths. Low birth weight is one of the risk factor for the illness of baby which is consistent with previous studies of community based new born care practices and might be improved through appropriate behaviors change intervention. [9, 13, 36] Our study also focused in identification and management of neonatal illness by FCHV and its outcome. The term "illness" includes all the danger sign identified by other studies. [36] The danger sign includes no suckling, lethargic, cold or warm body, respiratory problem (grunting or chest drawing), skin pustules, red eyes with discharge, redness around cord, yellow in skin and eyes and others (blue palm & sole, no urine, weak/excess cry, abnormal movement, convulsion etc) The presence of more than two of these danger sign was considered as PSBI. Breathing problem was most frequently reported in FON group (42.6%). The incidence of breathing problem (pneumonia or ARIs) in community level is not known. However, significant proportion of newborn diagnosed with sepsis or severe infections may have associated with pneumonia. [37] For the treatment of this severe problem in developing countries in health care facility, WHO recommended administration of antibiotics. Majority of neonatal death are in rural part/in home and families are reluctant to seek care outside the home for neonatal illness. [36] Therefore, grass root health worker should be trained for the treatment of neonatal illness. MINI project focused on this and trained FCHV for the treatment and management of neonatal illness. Before intervention, danger sign of neonatal illness was not known to the community health worker. After intervention, FCHV has identified these danger sign as per the approved algorithm due to which danger signs were more identified in FON group compared to BSL and control groups. After identification of illness FCHV initiated for treatment after obtaining consent from family. If any of the sign of PSBI seen, FCHV initiated treatment with cotrim and facilitate referral to higher level of health worker for injectable gentamicin. The babies receiving cotrim and gentamicin in FON group were 33% & 30.8% respectively. It seems that the illness rate in babies in FON is higher than BSL and NI; however, the total outcome or the fatality rate is low in FON compared to BSL and NI which reveals the effectiveness in intervention. The case fatality rate for PSBI was 14.1% in BSL which reduced to 3.2% in FON while in NI it is still high (15.6%). In India (Gadchiroli) the trained health workers could identify sick newborns in their home and were able to treat with antibiotics (cotrim & gentamicin) reducing neonatal mortality. [38] Our study also confirms the findings that if health workers are trained to identify the danger sign then the infection in neonate will be reduced. Infection being one of the major cause of neonatal death [39,40], lives of newborn can be saved by preventing it on the home setting too for which health workers and mothers should also be trained to identify the danger sign.

4. Conclusion & Recommendation

Our study suggested that neonatal infection and death are preventable through interventions. The intervention should focus on training to grass root level health worker. The proper and effective training may lead to change in knowledge, attitude and practice in community. The trained

health workers are need of rural areas in Nepal where hospitals are not easily accessible. The intervention should focus on antenatal counseling, safe and hygienic delivery, implement essential newborn care practices, identify the danger sign, assess them and treat with prescribed antibiotics. Apart from these, it is also recommended to provide training to all mothers to identify the danger sign so that early treatment can be started.

References
1. Nepal Demographic and Health Survey 2006, Population Division - Ministry of Health and Population, Government of Nepal, New ERA and Macro International Inc.
2. Bryce J, Terreri N, Victora CG et al. Countdown to 2015: tracking intervention coverage for child survival. Lancet 2006；368:1067-76.
3. David O, Kirti MT，Dej S et al。 Cross sectional community based study of care of newborn infants in Nepal. BMJ 2002； 325:1063
4. Fact Sheets of Nepal, Ministry of Health and Population, Government of Nepal.
5. Luke CM, Darmstadt GL, Joanne K et al. Risk Factors for Umbilical Cord Infection among Newborns of Southern Nepal. American Journal of Epidemiology 2007；165(2):203-11.
6. Pradhan A, Aryal R, Regmi G et al。 Nepal family health survey 1996. Kathmandu and Calverton: Ministry of Health, Nepal; New ERA; Macro International, 1997.
7. Baqui AH, Williams EK, Darmstadt GL et al。 Newborn care in rural Uttar Pradesh. Indian J Pediatr 2007；74 (3):241-7.
8. Moss W, Darmstadt GL, Marsh DR et al. Research priorities for the reduction of perinatal and neonatal morbidity and mortality in developing country communities. J Perinatol. 2002；22(6):484-95.
9. Darmstadt GL, Bhutta ZA, Cousens S et al. Evidence-based, cost-effective interventions: how many newborn babies can we save? The Lancet 2005; 365 (9463): 977-88.
10. WHO. Care of the umbilical cord: A review of the evidence. Geneva: World Health Organization:1998.
11. Bhutta ZA, Darmstadt GL, Ransom E . Using evidence to save newborn lives. Policy brief. Washington, D.C: Population Reference Bureau, 2003
12. Costello A, Manandhar D. eds. Improving newborn infant health in developing countries. London: Imperial College Press. 2000; 289 – 308.
13. Manandhar DS, David O, Shrestha BP et al. Effect of a participatory intervention with women's groups on birth outcomes in Nepal. Cluster-randomised controlled trial. Lancet 2004; 364 (9438): 970-9.
14. Nandan D, Mishra S. Delivery Practices in West Uttar Pradesh. Indian J Public Health 1996; 40(1): 20-21. 24.
15. Bennett J, Azhar N, Rahim F et al. Further observations on ghee as a risk factor for neonatal tetanus. Int J Epidemiol 1995; 24 (3): 643-7.
16. Hectar T, John B, Kahn AJ et al. Ghee applications to the umbilical cord: a risk factor for neonatal tetanus. Lancet 1989; 4;1 (8636):486-8.
17. John B, Cindy Ma, Hectar T et al. Neonatal tetanus associated with topical umbilical ghee: covert role of cow dung. International Journal of Epidemiology 1999; 28: 1172-5.
18. Zupan J, Garner P, Omari AA. Topical umbilical cord care at birth. The Cochrane Database Systematic Reviews 2004；(3):CD001057
19. Bourke E. Cord care: too much or too little. Aust J Adv Nursing 1990; 7:19-22.
20. Abhay TB, Rani AB, Reddy HM et al., Reduced incidence of neonatal morbidities: Effect of home-based neonatal care in rural Gadchiroli, India. J Perinatol 2005; 25: S 51-61.
21. Kulathilaka T, Jayakuru W. Development of epidemiological services in Sri Lanka and future challenges. J commun Phys Sri Lanka 2001; Millennium suppl:21-8.
22. Vittoz JP, Labarère J, Castell M et al. Effect of a training program for maternity ward professionals on duration of breastfeeding. Birth 2004;31 : 302- 7.
23. Lopez A, Villalpando S, Fajardo A. Breast-feeding lowers the frequency and duration of acute respiratory infection and diarrhea in infants under six months of age. J Nutr. 1997;127:436–443
24. Zaman K, Baqui A, Yunus M et al. Acute respiratory infections in children: a community-based longitudinal study in rural Bangladesh. J Trop Pediatr. 1997;43:133–137
25. Leach A, McArdle T, Banya W et al. Neonatal mortality in a rural area of the Gambia. Ann Trop Paediatr. 1999;19:33–43
26. Raisler J, Alexander C, O'Compo P. Breastfeeding and infant illness: a dose-response relationship? Am J Public Health. 1999;89:25–30
27. Perera B, Ganesan S, Jayarasa J et al. The impact of breastfeeding practices on respiratory and diarrhoeal disease in infancy: a study from Sri Lanka. J Trop Pediatr. 1999;45:115–118
28. Cesar J, Victora C, Barros F et al. Impact of breastfeeding on admission for pneumonia during postnatal period in Brazil: nested case-control study. BMJ. 1999;318:1316–1320
29. Arifeen S, Black RE, Antelman G et al. Exclusive breastfeeding reduces acute respiratory infection and diarrhea deaths among infants in Dhaka slums. Pediatrics. 2001; 108(4). Available at: www.pediatrics.org/cgi/content/full/108/4/e67
30. Huffman S, Zehner E, Victora C. Can improvements in breast-feeding practices reduce neonatal mortality in developing countries? Midwifery 2001;17:80–92
31. Upul S, Dulitha NF, Ishani R. Newborn care practices at home: effect of a hospital-base intervention in Sri

Lanka. Journal of Tropical Pediatrics 2006; 53 (2); 113-8.

32. Singh MB, Haldiya KR, Lakshminarayana J. Infant feeding and weaning practice in some semi-arid rural areas of Rajasthan. J Indian Med Assoc 1997; 95:576-8.

33. Srivastava SP, Sharma VK, Kumar V. Breast feeding pattern in neonates. Indian Pediatr 1994;31:1079-82.

34. Promoting Effective Perinatal Care, Essential Newborn Care and Breastfeeding, Training modules, WHO Regional Office for Europe, 2002.

35. Fazlui H, AMZ Hussain. Detection of Low Birth-Weight New Born Babies by Anthropometric Measurements in Bangladesh. Indian J Pediatr 1991; 58 : 223-231.

36. Abhay TB, Rani AB, Baitule S et al. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. Lancet 1999; 354: 1955–61.

37. Bhutta ZA, Darmstadt GL, Babara JS. Et al. Outcomes in Developing Countries: A Review of the Evidence Community-Based Interventions for Improving Perinatal and Neonatal Health. Pediatrics 2005;115;519-617

38. Abhay TB, Rani AB, Barbara JS et al. Is Home-Based Diagnosis and Treatment of Neonatal Sepsis Feasible and Effective? Seven Years of Intervention in the Gadchiroli Field Trial (1996 to 2003). Journal of Perinatology; 2005；25:S62–S71.

39. Save the children. State of the World's Newborn. Save the Children, Washington DC; 2001

40. Barbara JS. Neonatal infections: a global perspective in: Remington JS, Klein JO, editors. Infectious Diseases of the Fetus and Newborn Infant. 6th ed. Philadelphia: WB Saunders Company (in press).

Corresponding Author:

Sirjana Khanal, Department of Biostatistics & Epidemiology, College of Public Health, Zhengzhou University, 100 Kexue Avenue, Zhengzhou, Henan 450001, China.
Telephone # +86 371 65257125
Email: khanalsirju@yahoo.com

Other Authors' Information:

Weidong Zhang, Professor & Director, Department of Biostatistics & Epidemiology, College of Public Health, Zhengzhou University, 100 Kexue Avenue, Zhengzhou, Henan 450001, China.
Email1: imooni@zzu.edu.cn
Email2: imooni@163.com

Sudhir Khanal, Project Director of Morang Innovative Neonatal Intervention Program, JSI R & T, Nepal Family Health Program, Nepal. P.O. Box – 1600.
Email: sudhirkhanal@hotmail.com