

## Determinants of Delivery Complications in Rural Bangladesh

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**Abstract:** The maternal morbidity data in Bangladesh is scanty. In this paper an attempt is made to identify the possible risks of occurring delivery complications among the rural women of Bangladesh in relation to their selected delivery characteristics. Longitudinal data on Maternal Morbidity in rural Bangladesh, conducted by the Bangladesh Institute of Research for Promotion of Essential and Reproductive Health and Technologies (BIRPERHT) were employed in this study. A total of 1020 pregnant women (pregnancy less than 6 months) were interviewed. It was observed that women who had a higher risk of assisted deliveries had no formal education during delivery period compared to those who had formal education. Deliveries attended by untrained personnel reduced risk of having assisted delivery compared to those deliveries attended by trained personnel. The place of delivery is significantly associated with the nature of delivery. The duration of labor seems to have an association with the nature of delivery as well. Similarly, complications at the time of deliveries significantly increase subsequent complications during the postpartum period.

**Keywords:** Logistic regression model; Odds ratio; Delivery complications; Postpartum complications; Assisted delivery

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### INTRODUCTION

Though the safe motherhood initiative has been given priority in recent years, maternal morbidity and mortality still remain a major public health issue in most developing countries<sup>[1]</sup>. It is estimated that 1600 women die worldwide each day as a result of problems during pregnancy or childbirth and the greater proportions of these deaths occur in developing countries<sup>[2,3]</sup>. A large proportion of these deaths are preventable by appropriate measures through the periods of antenatal, delivery and postnatal care<sup>[4]</sup>. Complications of pregnancy and childbirth are still the leading causes of death and disability among women of reproductive age in developing countries<sup>[5]</sup>. Researchers emphasized more on the maternal morbidity and mortality that occur during ante partum and intrapartum periods. However, as a consequence of morbidities during ante partum and intrapartum period, there is an increased risk of occurrence of various morbidities during the postpartum period. Care during the puerperium receives less attention from researchers than ante partum and intrapartum care in many developing countries, even though it is the period during which most maternal mortality occur<sup>[6]</sup>. Danel *et. al.*, reported that in El Salvador the incidence of significant morbidity during delivery was hemorrhage, fever,

prolonged labor (over 24 hours), loss of consciousness, possible preeclampsia, and convulsions<sup>[7]</sup>. From a study in Nepal, it was reported that delivery-related problems included labor exceeding 18 hours, heavy bleeding, and fainting<sup>[8]</sup>. Bhatia showed that in India, 18 % of the women reported problems during antenatal period and an equal proportion during delivery<sup>[9]</sup>. In another study, conducted in South India, it was found that 33 % of women reported at least one problem; the most common were weakness, anemia, and lower abdominal pain<sup>[10]</sup>. According to Prual *et. al.*, the main direct causes of severe maternal morbidity in West Africa were hemorrhage, obstructed labor, eclampsia, and sepsis<sup>[11]</sup>.

Various studies were undertaken on maternal morbidities in different countries including Bangladesh. The information on maternal morbidities at the community level in Bangladesh is scanty. The studies published in this field are hospital-based or cross-sectional, and most of these focused on maternal mortality<sup>[12-17]</sup>. Hospital-based case reviews included only women who sought the kind of treatment that did not permit speculation about the nature and magnitude of the untreated segment, while hospital discharge surveys measure the incidence of serious conditions that require hospitalization<sup>[18,19]</sup>. Long-term pregnancy-related morbidity was reported to be 28.6% in

Bangladesh, 25.5% in Egypt, 19.7% in Indonesia, and 8.2% in India. The percentage of respondents with at least one complication during the index pregnancy and puerperium ranged from 58.3% in India to 79.9% in Bangladesh<sup>[20]</sup>. According to Akhter et al., the major causes of morbidity, in relation to pregnancy, were reported to be, urinary complaints (29 %), edema during ante partum period (23 %), excessive bleeding (20 %), prolonged labor for >18 hours during intrapartum period (7 %), lower abdominal pain (49 %), urinary problems (19 %), and fever for more than 3 days during postpartum period (17 %)<sup>[17]</sup>.

Several studies demonstrated that the most important causes of maternal deaths in rural Bangladesh were eclampsia, septic abortion, postpartum sepsis, obstructed labor and ante partum and postpartum hemorrhage<sup>[13,14,21,22]</sup>. It was observed that prior to death, 42 percent of the pregnancies were attended by traditional practitioners and 33 percent were not attended *et. al.*<sup>[16,23]</sup>. In another study, Koblinisky *et. al.*, reported that the number of acute morbidities related to childbirth could be as many as 67 episodes for every maternal death in a country such as Bangladesh<sup>[24]</sup>.

As morbidities vary in pregnancy, delivery and postpartum period, to understand its levels and determinants prospective studies can provide important insight. However, due to cost and time, very few prospective studies were conducted. Bangladesh Rural Advancement Committee (BRAC), in collaboration with London School of Hygiene and Tropical Medicine, undertook a prospective study on postpartum morbidity and its relation to delivery practices<sup>[25]</sup>. In another study, Chowdhury *et al.*, reported that complications of delivery and postpartum period are more frequent in the rural areas of Bangladesh<sup>[26]</sup>. They identified that postpartum morbidities were very common in the community. Akanda and Khanam reported that the risk of suffering from complications was higher if the pregnancy was unwanted. There was a negative association between level of respondent's education and prevalence of complications. It was demonstrated in the model that the risk was significantly higher among the respondents who reported their higher socio-economic status. That analysis also has shown the maternal health problems increases with the increase of the number of pregnancy in the rural areas of Bangladesh<sup>[27]</sup>. Bangladesh Institute of Research for Promotion of Essential and Reproductive Health and Technologies (BIRPERHT) conducted in 1993 a prospective study on maternal morbidity in Bangladesh, which was funded by Ford Foundation.

Data on maternal morbidity make it possible to assess how women are likely to need essential obstetric care, and helps the government's short-term and long-

term planning and policy making process<sup>[11]</sup>. The present report is based on data from a prospective study on maternal morbidity in rural Bangladesh. Here an attempt is made to identify the risk factors that affect the normal delivery with respect to selected delivery characteristics and find out the complication's association at the time of delivery and postpartum period in rural Bangladesh.

## MATERIALS AND METHODS

We used the data from the prospective survey on Maternal Morbidity in rural Bangladesh, conducted by the Bangladesh Institute of Research for Promotion of Essential and Reproductive Health and Technologies (BIRPERHT). The data collection period spanned from November 1992 to December 1993.

A multistage random sampling was employed to collect data on maternal morbidity. One district from each of four divisions was selected in the first stage. In the second stage, one thana (a thana is comprised of several unions, giving a population size of 0.2-0.25 million) from each selected district was selected randomly. In the third stage, two unions (unions are comprised of several wards, which are small geographical areas comprised of villages in rural areas) from each selected thana were considered as study area. Finally, for the prospective study, 1020 pregnant women (pregnancy less than 6 months) were interviewed. Prospective subjects were followed-up at intervals of on an average of one month, through full-term pregnancy, delivery and till 90 days postpartum period or 90 days after any other pregnancy outcome. The information on socio-economic background, pregnancy-related care and practice, extent of morbidity during the index pregnancy, delivery and postpartum period or abortion were collected.

For this analysis we selected 993 pregnant women out of 1020 who had at least one antenatal follow-up and 1005 had information on the termination of pregnancy. To avoid complications arising from the association among repeated observations on the same individual, we considered only first occurrence of specific disease conditions in any follow-up. Among the selected pregnant women, progressively large proportions were lost to follow-up at each subsequent interview. Table 1 shows the exact number of respondents interviewed during each follow-up. Finally, 1007 had at least one delivery and postpartum follow-up.

**Delivery Complications:** This study makes an attempt to address several important issues concerning complications at the time of delivery: (1) delivery assistance from trained or untrained personnel, (2)

**Table 1:** The number of respondents interviewed during each follow-up period (n=993)

Follow-up	Frequency	Percentage
1	992	97.3
2	917	89.9
3	771	75.6
4	594	58.2
5	369	36.2
6	145	14.2
7	34	3.3
8	1	0.1

place of delivery (own home, mother's home, hospital/clinic), (3) complications at the time of delivery (no complication, excessive hemorrhage before or after delivery, obstructed labor, prolonged labor, retained placenta/others), (4) duration of delivery pain (less than 1 hour, 1 hour or more), (5) education level of the respondents (no formal education, formal education), (6) age at marriage (less than or equal to 15 years, more than 15 years), and (8) economic status (poor, middle, upper). These are the independent variables of interest in the present study.

The respondents were asked about the nature of delivery. The reported categories of nature of delivery were (i) normal delivery (coded as 0), (ii) trial labor, (iii) breech, (iv) forceps assisted delivery, (v) c-section, and (vi) destructive procedure. Due to small number of cases in our analysis, we regrouped (ii)-(vi) as complicated delivery (coded as 1). In other words, trial labor, breech and assisted deliveries are considered as delivery complications treated as dependent variables. The following postpartum complications were considered: hemorrhage, any other discharge, pelvic pain, cough or fever for more than three days, headache, giddiness, palpitation, weakness, weight loss, anxiety, convulsion, fits, burning sensation during micturition, and others. All these complications were coded, as binary variables (yes, no).

Respondents were asked about complications at different delivery and postpartum visits. To avoid complications arising from any association between repeated observations on the same individual, we considered only the first occurrence of a specific complication in any delivery and postpartum follow-up. The problems that demand a relatively sophisticated diagnosis may be under-reported, or misreported as something else, or lumped into an extensive symptomatic part that does not allow a particular diagnosis.

## RESULTS AND DISCUSSIONS

The present study makes an attempt to focus on some important concerns associated with delivery and their associations with the delivery and postpartum complications among the rural women. In the rural

areas of Bangladesh, it is likely to arrange for trained delivery among the vast majority of the poor women without or very low level of schooling. However, it is observed that only the most vulnerable cases are referred to the trained birth attendants as appear from the results.

In the rural areas of Bangladesh, it is unlikely to arrange for trained delivery among the vast majority of the poor women without or very low level of schooling. However, it is observed that only the most vulnerable cases are referred to the trained birth attendants as appear from the results. Postnatal complications like hemorrhage, pelvic pain, cough or fever more than three days, headache and weight loss were significantly associated with the delivery attendance. Pelvic pain, cough or fever more than three days, headache, and weight loss were less frequent among the women whose deliveries were attended by trained personnel. The women whose deliveries were attended by trained personnel had experienced a lower rate of suffering from complications during postnatal period except for hemorrhage. The incidence of hemorrhage during postpartum appeared to be higher among those reported to have been attended by trained personnel at the time of delivery. This might be attributed to the fact that trained personnel attended most of the pregnancies with complications at the time of delivery.

The nature of delivery addresses normal or assisted deliveries. The association between nature of delivery and selected postnatal complications are examined. About 39 percent of the assisted delivery cases experienced hemorrhage as compared to that of about 38 percent among normal deliveries. This difference is not statistically significant. However, the percentage of hemorrhage cases among both the groups appears to be very high. On the other hand, any other discharge is prevalent among 50 % of the assisted deliveries and about 48 % of the normal deliveries. However, the incidence of pelvic pain is much higher among the respondents having had assisted delivery (52.5% among abnormal delivery cases compared to 38.8% among normal delivery cases). Among other selected postnatal complications, nature of delivery is found to have significant association with cough or fever more than three days, headache, giddiness, palpitation, loss of weight, anxiety, and burning sensation during the postpartum period. The percentage of all these significant postpartum complications was higher for assisted deliveries compared to the normal ones.

Complications at the time of delivery were significantly associated with headache, giddiness, weight loss, anxiety, and other complications during postpartum period. The reported incidence of headache during postpartum period was highest for those who

**Table 2:** Distribution of Respondents by Postnatal Complications and Delivery Complications

Delivery Complications	Percentage of Postnatal Complications											
	Hemorrhage	Any other Discharge	Pelvic Pain	Cough or Fever 3+ days	Headache	Giddiness	Palpitation	Weakness	Weight loss	Anxiety	Convulsion	Fits
Delivery Attendant	**		*	**	*				*			
Untrained TBA	35.6	48.0	41.0	19.6	35.6	39.4	54.8	93.8	68.8	33.0	0.5	1.4
Trained	51.2	46.4	32.8	10.4	27.2	44.0	52.0	95.2	59.2	36.8	1.6	1.6
Nature of delivery			**	*	**	**	**		**	**		
Normal	37.5	47.6	38.8	17.7	33.3	37.9	52.4	93.7	66.0	31.2	0.7	1.5
Abnormal	38.8	50.0	52.5	26.3	47.5	63.8	77.5	97.5	85.0	51.8	-	1.3
Complications at the time of delivery					*	**			**	**		
Excessive hemorrhage before or after delivery	41.9	51.6	48.4	21.0	45.2	54.8	64.5	93.5	87.1	56.5	3.2	3.2
Obstructed Labor	32.3	41.9	48.4	24.2	40.3	58.1	58.1	91.9	72.6	51.6	-	1.6
Prolonged Labor	34.3	50.4	37.2	12.4	36.5	47.4	55.5	93.4	67.9	34.3	-	1.5
Placenta /others	25.0	62.5	50.0	25.0	62.5	56.3	68.8	93.8	87.5	68.8	-	-
No problems	38.7	47.2	38.7	18.7	32.0	35.2	52.7	94.3	64.8	28.8	0.6	1.3
Duration of labor	**		**	*				0		**		
<1 hour	37.5	46.9	31.9	13.1	33.8	41.3	50.0	90.6	64.4	43.8	-	-
1+ hour	37.7	48.0	41.5	19.5	34.7	39.8	55.4	94.6	58.2	31.4	0.7	1.7
Place of delivery	**	**	**	**			**	**		**		
Own House	32.5	67.5	60.0	17.5	52.5	50.0	65.0	95.0	77.5	52.5	-	-
Hospital/clinic	19.5	54.4	26.5	4.9	33.6	41.6	45.1	89.4	61.5	41.2	-	-
Mothers house	33.3	52.4	57.1	4.8	23.8	47.6	76.2	90.5	66.7	71.4	4.8	-
Outside (house/ others)	44.1	44.3	42.7	23.4	34.1	38.7	56.3	95.6	69.0	28.6	0.7	2.1

\*\* Significant at 1 % level; \* significant at 5 % level

**Table 3:** Estimates Obtained by Logistic Regression Model for Assisted Delivery with Associated Wald Test and Odds Ratio

Variable	Estimate	Standard Error	Wald Statistic	P-value	Odds ratio
Constant	-1.275	0.728	1.751	0.080	0.280
Education level of the respondents	-0.513	0.258	1.989*	0.047	0.666
Age at marriage	-0.035	0.256	0.134	0.892	0.966
Economic status	0.205	0.299	0.684	0.494	1.227
Delivery attendant	-0.727	0.332	2.189*	0.029	0.483
Place of delivery	-1.894	0.551	3.436**	0.001	0.150
Duration of labor	1.437	0.528	2.723**	0.006	4.209
No. of new born	0.750	0.870	0.863	0.389	2.117
Likelihood ratio	514.452				

\*\* Significant at 1 % level; \* significant at 5 % level

had retained placenta/other problems at the time of delivery and lowest when there was no delivery complication. Giddiness during the postpartum period was reported to be highest for those who had obstructed labor at the time of delivery. It was followed by retained placenta/other problems, excessive hemorrhage before or after delivery, prolonged labor, and no problem at delivery. The incidence of weight loss and anxiety during postpartum period was found

to be the highest among respondents who had retained placenta/other problems. These features were also found, in decreasing order, in subjects who had excessive hemorrhage before or after delivery, obstructed labor, prolonged labor, and no problems.

Duration of labor was significantly associated with pelvic pain, cough or fever for more than three days, weakness, anxiety, and burning sensation. All these postpartum complications were more frequent for

longer duration of labor (one hour or more) except for anxiety. However, anxiety was more frequent among those who had experienced labor for less than one-hour.

The place of delivery showed a significant association with hemorrhage, any other discharge, pelvic pain, cough or fever for more than three days, palpitation, weakness, and anxiety during postpartum period. Hemorrhage, pelvic pain, cough or fever for more than three days, palpitation, weakness, and anxiety were less frequent among the deliveries performed at hospital or clinics as compared to those performed at the own house of the respondents.

In the following part, we represent the resulting estimates of the coefficient of the covariates obtained by logistic regression model. The tables 3 provide the estimates of the parameters of the link function along with their estimated standard error, associated wald test, p-value and odds ratio.

The risk of assisted delivery increased significantly during the delivery period for those who had no formal education as compared to those who had formal education. According to our result, assisted delivery decreased 33% in case of the women who received formal education as compared to those who had no formal education, after controlling for all other factors.

From the analysis, we found that the risk of assisted delivery increases significantly during the delivery period for those who were attended by trained personnel at the time of delivery as compared to those by untrained personnel. In terms of odds ratio, assisted delivery decreased 52% by untrained personnel as compared to those by trained personnel, after controlling for all other factors. This may be due to the fact that in rural areas where most of the deliveries are performed at one's own home or mother's home, only the complicated cases are taken to the local clinics or hospitals for delivery. It is difficult to bring trained personnel home for delivery. Hence, subjects with severe problems or indications of possible complications are likely to be attended by trained personnel.

The place of delivery emerged as a strong determinant of nature of delivery in our study. The deliveries that took place at hospital/clinics have higher risk compared to those at mothers' home. There exists negative association between the response variable and the place of delivery. In terms of odds ratio, after controlling for all other factors, normal delivery increased 85% at own house and mother's house compared to those hospitals/clinics. In the socio-economic setting of Bangladesh, only small proportions of deliveries are performed in hospitals/clinics. In most of the cases, particularly in rural areas, only the complicated cases of pregnancies are referred to the

hospitals/clinics. The deliveries performed in hospitals/clinics have increased risk of having assisted delivery compared to those at own house and mother's house.

Longer duration of labor (more than one hour) showed a significantly higher risk of assisted delivery during delivery period. However, women doing more than one hour this time increased the odds by 4.209 times likely as those who labor less than or equal to one hour, after controlling for all other factors. The other variables showed insignificant. That is, there was no statistically significant variation in the nature of delivery.

In this paper we discussed the complications of delivery and postpartum period in the rural areas of Bangladesh. The government of Bangladesh is trying to improve the maternal health of women through different programs. We hope that the findings from this study will assist in the planning of resource allocation, service modification, expansion and enhancement of the policy development regarding maternal health services in Bangladesh.

**Policy Implications:** From the findings of this paper, we observed that a number of policy implications emerge. The potential policy implications are listed below:

**Strengthening of Services During Antenatal Period:**

The antenatal services can be strengthened to take account of the following important strategies to reduce maternal morbidity: (a) to provide maternal education regarding safe motherhood, (b) to measure the necessary indicators (blood pressure, pregnancy history, height, weight, blood glucose level, etc.) in order to provide specific suggestions, (c) to identify status regarding malnutrition, (d) to identify by the category of high risk or low risk by age, parity, anemia, and other factors, etc. In other words, if there is enough information about the pregnant women during the pregnancy, if adequate suggestions are provided during early stage and if the high risk pregnancies are identified at the early stage then the number and severity of complications will be reduced to a large extent.

**Adequate Facilities During Delivery:** In Bangladesh, only a very negligible proportion of deliveries take place in hospitals/ clinics. Moreover, there is acute shortage of trained personnel in assisting deliveries or there is communication gap between the availability of services and their proper utilization. This has been a longstanding problem in the context of safe motherhood issues in Bangladesh. This concern needs immediate attention.

**Follow-up of Postnatal Complications:** There is no appropriate mechanism to follow-up the pregnancies from antenatal to delivery and then from delivery to postnatal period. Due to lack of such care in the network of health system, most of the pregnancies suffer as a result of unnecessary time lags attributable to absence of the mechanism to identify the problems and to suggest remedial measures before being too late. These lapses result in an increase in the more severe complications in the long run. Hence, immediate policy measures are necessary to revise the health policy such that there should be a system to follow-up each pregnancy at antenatal, delivery and postnatal stages, so that the problems can be identified at an early stage and proper measures can be suggested before it is too late.

**Conclusions:** There is limited but growing evidence suggesting that complications of delivery and postpartum period are more frequent in the rural areas of Bangladesh. Results from this study may provide information to the policy makers and health planners to target, plan, develop and deliver of maternal health services to those in greatest need.

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#### REFERENCES

1. Weil, O. and H. Fernandez, 1999. Safe motherhood: is the initiative an orphan? *J. Gynecol Obstet Biol Reprod (Paris)*, 28: 205-210.
2. Shah, D., S. Shroff and S. Sheth, 1999. Reproductive and sexual health and safe motherhood in the developing world. *Eur J. Contracept Reprod Health Care*, 4: 217-228.
3. Jowett, M., 2000. Safe Motherhood interventions in low-income countries: an economic justification and evidence of cost effectiveness. *Health Policy*, 53: 201-228.
4. Royston, E., and S. Armstrong, 1989. Preventing maternal deaths. Geneva: WHO.
5. Maine, D., and A. Rosenfield, 1999. The Safe Motherhood Initiative: why has it stalled? *Am. J. Public Health*, 89:480-482.
6. De Silva, W.I., 1998. Puerperal morbidity: a neglected area of the maternal health in Sri Lanka. *Social Biology*, 45: 223-45.
7. Danel, I., L. Grummer-Strawn, M. Caceres, and P. Stupp, 1997. Maternal mortality and morbidity in El Salvador. De los Mayas a la planificacion familiar: demografia del istmo, [edited by] Luis Rosero Bixby, Anne Pebley, Alicia Bermudez Mendez. San Jose, Costa Rica, Editorial de la Universidad de Costa Rica. Programa Centroamericana de Poblacion, 383-95.
8. Smith, J.B., B. Lakhey, S. Thapa, S. Rajbhandari, and S. Neupane, 1996. Maternal morbidity among women admitted for delivery at a public hospital in Kathmandu. *JNMA*. 34: 132-140.
9. Bhatia, J.C., 1995. Levels and determinants of maternal morbidity: results from a community based study in India. *Int. J. Gynaecol Obstet.*, 50: S153-S163.
10. Bhatia, J.C., and J. Cleland, 1995. Self-reported symptoms of gynecological morbidity and their treatment in South India. *Study in Family Plan.*, 26: 203-216.
11. Prual. A., M.H. Bouvier-Colle, L. De Bernis and G. Breart, 2000. Severe maternal morbidity from direct obstetric causes in West Africa: incidence and case fatality rates. *Bulletin of the World Health Organization.*, 78: 593-602.
12. Chen, L.C., M.C. Gesche, S. Ahmed, A.I. Chowdhury and W.H. Mosley, 1974. Maternal mortality in rural Bangladesh. *Study Family Plan*. 5: 334-341.
13. Rochat, R.W., S. Jabeen, M.J. Rosenberg, A.R. Measham, A.R. Khan, M. Obaidullah and P. Gould, 1981. Maternal and abortion related deaths in Bangladesh. *Int. J. Gynaecol Obstet.*, 19: 155-164.
14. Khan, A.R., F.A. Jahan and S.F. Begum, 1986. Maternal mortality in rural Bangladesh: The Jamalpur districts. *Study in Family Plan.*, 17: 13-21.
15. Obaidullah, M., A.R. Khan, A.R. Measham, M.J. Rosenberg, S. Jabeen, R.W. Rochat and A.I. Chowdhury, 1981. Induced abortion in rural Bangladesh (mortality levels and physicians' attitude). *Rural Demography*, 8: 89-120.
16. Fauveau, V., B. Wojtynaik, M.A. Koenig, J. Chakraborty and A.I. Chowdhury, 1989. Epidemiology and cause of deaths among women in rural Bangladesh. *Int. J. Epidemiology*, 18: 139-45.
17. Akhter, H.H., M.E.E.K. Chowdhury and A. Sen, 1986. A cross-sectional study on maternal morbidity in Bangladesh. BIRPERHT, Dhaka, Bangladesh.
18. Liskin, L.S., 1992. Maternal morbidity in developing countries: a review and comments. *Int. J. Gynaecol Obstet*, 37: 77-87.

19. Fortney, J.A. and J.B. Smith, 1999. Measuring maternal morbidity. In safe motherhood initiatives: critical issues., pp: 43-50. Oxford, England: Blackwell Science.
20. Fortney, J.A. and J.B. Smith, 1996. The base of the iceberg: prevalence and perceptions of maternal morbidity in four developing countries. The Maternal Morbidity Network Research Triangle Park, North Carolina, Family Health International [FHI], Maternal and Neonatal Health Center, Dec. vii, pp: 104.
21. Koenig, M.A., V. Fauveau, A.I. Chowdhury, J. Chakraborty and M.A. Khan, 1998. Maternal mortality in Matlab, Bangladesh: 1976-85. Study in Family Plan., 19: 69-80.
22. Bhuiyan, A.B. and F. Hussain, 1995. Maternal mortality: national versus hospital situation. Int. J. Gynaecol Obstet., 50: S165-S168.
23. Goodburn, E.A., R. Gazi and M. Chowdhury, 1995. Beliefs and practices regarding delivery and postpartum maternal morbidity in rural Bangladesh. Study in Family Plan., 26: 22-32.
24. Koblinsky, Campbell O.M., Harlow S.D. Mother and more: 1993. a broader perspective on women's health, pp: 33-62. In the health of women: a global perspective. Westview Press.
25. BRAC, 1994. Maternal morbidity in Bangladesh. BRAC, Dhaka, Bangladesh.
26. Chowdhury, R.I, M.A. Islam, H.H. Akhter and N. Chakraborty, 2004. Analysis of postpartum complications in relation to selected delivery characteristics in rural Bangladesh. J. Health & population in developing countries, 1-11.
27. Akanda, Md. Abdus Salam and Maksuda Khanam, 2007. Analysis of Maternal Health Complications in Rural Bangladesh by Using GEE. Dhaka Univ. J. Sci., 55(1): 91-95.