No. 11 January 2011

MANOSHI
working paper

Stillbirth in the Urban Slums of *MANOSHI*

Atiya Rahman
Shamsun Nahar
Hashima-E-Nasreen

brac

icddr,b
KNOWLEDGE FOR
GLOBAL LIFESAVING SOLUTIONS

Stillbirth in the urban slums of *MANOSHI*

Atiya Rahman
Shamsun Nahar
Hashima-E-Nasreen

January 2011

MANOSHI **Working Paper Series**
No. 11

Published by

ICDDR,B

68 Shaheed Tajuddin Ahmed Sharani
Mohakhali, Dhaka 212, Bangladesh
Tel: +(880-2) 8860523-32, Fax: +(880-2) 8823116
Email: info@icddrb.org, Website: www.icddrb.org

BRAC

BRAC Centre, 75 Mohakhali
Dhaka 1212, Bangladesh
Tel: +(880-2) 9881256, Fax: +(880-2) 8823542
Email: brac@brac.net, Website: www.brac.net

Cover design by
Md. Abdur Razzaque
BRAC

ACKNOWLEDGEMENT

This research activity was funded by the Bill & Melinda Gates Foundation, USA and BRAC, Bangladesh. ICDDR,B acknowledges with gratitude the commitment of the Bill & Melinda Gates Foundation and BRAC to its research efforts.

The *MANOSHI* project is developed by BRAC to establish a community-based health programme targeted at reducing maternal, neonatal, and child deaths and diseases in urban slums of Bangladesh. It is supported by the Bill and Melinda Gates Foundation's Community Health Solutions (CHS) initiative that aims at strengthening and leveraging community organizations and individuals to be proactive in community based interventions. This five-year project is led and implemented by BRAC. ICDDR,B, in collaboration with the Research and Evaluation Division (RED) of BRAC provide technical assistance to the project through monitoring, evaluation and research support. This project is guided by a Technical Advisory Committee and a Technical Management Committee.

BRAC and ICDDR,B would like to acknowledge the Bill and Melinda Gates Foundation for their continued support. We are grateful to all the researchers and members of programme team for their unabated diligence and efforts. We want to extend our appreciation to all the respondents from the various communities for their wilful contributions and sincere commitment towards fulfilling this research endeavour. We also acknowledge the contributions of ACPR (Associates for Community and Population Research) for field data collection.

We would like to acknowledge the contributions of Samira Choudhury and Zeeshan Rahman for helping to finalize the working papers.

The authors especially would like to thank Dr. Kaosar Afsana, Associate Director, BRAC Health Program for initiating the study and the participants for giving their time and cooperation in this study. We are pleased to acknowledge the contributions of the SS, SK, UBA and PO of BRAC *MANOSHI* program for making the records easily accessible. The authors also would like to acknowledge the support of Dr. Zia Uddin Hyder, Director, Research and Evaluation Division BRAC; the contributions of the reviewer Dr. AKM Fazlur Rahman, Director, Centre for Injury Prevention and Research, Bangladesh for constructive opinion that stimulated the preparation of this paper and Mr. Shamsul Islam Khan, Head of Publications, ICDDR,B for editing the Manuscript.

Technical Advisory Committee

Dr. Abhay Bang
Director
SEARCH
India

Dr. Lynn Freedman
Director
Averting Maternal Death and Disability (AVDD)
Columbia University, USA

Dr. Jon Rohde
Chair,
International Advisory Board
James P. Grant School of Public Health
BRAC, Bangladesh

Ms. Julienne Hayes Smith
Advisor/Trainer
Safe Motherhood Project
CARITAS CH-NFP, Bangladesh

Dr. Abbas Bhuiya
Deputy Executive Director
Executive Director's Division
ICDDR,B, Bangladesh

Prof. Sameena Chowdhury
Professor and Head of Department
Obstetrics and Gynaecology Institute of Child and Mother Health, Bangladesh

Prof. Mohammod Shahidullah
Pro-Vice Chancellor (Admin.) and Chairman Dept. of Neonatology
BSMMU, Bangladesh

Dr. Zafrullah Chowdhury
Trustee Member
Gono Shasthaya Kendra
Bangladesh

Dr. Kaosar Afsana
Associate Director
Health Programme
BRAC, Bangladesh

Technical Management Committee

Dr. Abbas Bhuiya
Deputy Executive Director
Executive Director's Division
ICDDR,B, Bangladesh

Dr. Peter Kim Streatfield
Head
Health & Demographic Surveillance Unit
ICDDR,B, Bangladesh

Dr. Shams El Arifeen
Senior Scientist
Child Health Unit
ICDDR,B, Bangladesh

Mr. Faruque Ahmed
Director
Health Programme
BRAC, Bangladesh

Dr. Kaosar Afsana
Associate Director
Health Programme
BRAC, Bangladesh

Dr. Syed Masud Ahmed
Research Co-ordinator
Research and Evaluation Division
BRAC, Bangladesh

Dr. Hashima-e-Nasreen
Senior Research Fellow
Research and Evaluation Division
BRAC, Bangladesh

Dr. Jahangir Khan
Health Economist
Health Economics Unit
ICDDR,B, Bangladesh

Dr. Laura Reichenbach
Social Scientist and Head
Reproductive Health Unit
ICDDR,B, Bangladesh

Dr. Alayne Adams
Senior Social Scientist
Executive Director's Division
ICDDR,B, Bangladesh

TABLE OF CONTENTS

EXECUTIVE SUMMARY

There are more than 3.2 million stillbirths occurring in the world every year -and although neonatal deaths have received global attention increasingly in recent years, stillbirths have remained practically invisible among global policy makers. Stillbirth data are not tracked in the MDG indicators. Bangladesh is no exception to this situation. Stillbirths go uncounted in most national statistics and even in the research in Bangladesh. Stillbirths deserve the same attention with systematic evaluation as neonatal deaths. To reduce neonatal and maternal deaths, the *MANOSHI* program of BRAC has initiated a community based maternal, neonatal and child health service for the urban slum dwellers of Dhaka City Corporation. The aim of this study was to quantify the relationship between known or suspected risk factors for stillbirths, and to assess the effect of the services of the *MANOSHI* program on reduction of stillbirths.

Materials and Methodology

This unmatched case-control study was conducted among mothers who gave birth in the slums of Dhaka City Corporation areas where BRAC has implemented a maternal, neonatal and child health program named *MANOSHI*. The cases were mothers who had stillborns while the controls were those mothers who had live births. The case to control ratio was 1:2. A total of 231 cases and 464 controls were identified by listing of all deliveries that occurred from November 2008 through April 2009. This data was obtained from the records of delivery registers of the *MANOSHI* program using a data driven form. Twenty-five well-trained data collectors, five field monitors and a field research assistant were involved in data collection and the mothers were interviewed face to face using structured questionnaires. Written consents were taken from the mothers before initiating the interviews. To ensure the quality of data, a three layered monitoring and supervision system was developed with the five team leaders along with the Principal Investigator (PI).

Data were analyzed by SPSS version 16.0. Comparison of continuous variables between cases and controls was done with the Student's t-test for normally-distributed data or with the Mann-Whitney test for skewed distribution data. Categorical variables were analyzed with the chi-square test. Fisher's exact test was used where the expected count was less than five. Odds ratio (OR) for stillbirths was calculated with 95% confidence interval (CI) for relevant

variables. Finally, the independent variables found to be associated with the dependent variable in Binary logistic regression, were fitted into the unconditional logistic regression model after checking for multi-colinearity to find the adjusted OR for the variables of interest.

Findings

During the six month long study period from November 2008 to April 2009, 22,476 births were recorded from the 247 delivery centres register book where there were 21,686 live births, 574 stillbirths, 51 twin births. This analysis is restricted to singleton births. Thus multiple births (N=51) and births with missing information (N=165) on outcome of deliveries were excluded. The overall stillbirth rate of *MANOSHI* was 26 per 1000 births. Among the cases, 61.9% was fresh and 38.1% was macerate stillbirth. Regarding the causes of stillbirth, the foetal causes account for 23.7% of the total causes while maternal causes were 37.7% and unexplained causes 38.6%.

Risk factors of stillbirths

The dependent variable was the stillbirth and the independent variables were concerned with the socioeconomic, biological and environmental factors. The socioeconomic variables included woman's and husband's education, occupation etc. The biological factors considered were mother's age; gravidity, parity; gestational weeks at delivery, and various complications during pregnancy, namely anaemia, fever, jaundice, excessive bleeding, prolonged or obstructed labour and abnormal presentation of the foetus. Environmental factors included antenatal care (ANC), patterns of delivery care; place of delivery; attendants during delivery and malpractice during delivery etc.

Analysis of crude odds ratio showed that many factors were associated with an increased risk of stillbirths. Since most of the factors were interrelated, a multivariate analysis was used to identify risk factors under consideration that best predicted stillbirth risk. Odds ratio and 95% CI was generated of individual predictors controlling for all other variables in the model. Among the socio-demographic factors only 'no maternal education' exerts as a significant predictor of stillbirth. Biological factors like 'advanced maternal age' 'preterm delivery (before 37 weeks)', foetal and maternal complications such as 'foetal mal-presentation', 'less foetal movement', 'foetal distress' and 'prolonged

labour' and 'non progressing labour' appeared as highly significant predictors of stillbirths.

Impact of Delivery centre services on stillbirth

To assess the changing outcome of the *MANOSHI* program, comparison was made between mothers who have received delivery services and those who have not received any such service from the delivery centres (DC) of *MANOSHI*. The result showed that higher percentage of stillbirths was experienced by mothers who had not received delivery services from *MANOSHI* (33.5%) than by the mothers who had received services from delivery centres (20.8%). The mothers who did not receive services from BRAC delivery centres were at a significantly higher risk of delivering stillborns than those who received (OR 1.7; 95%CI 1.27 - 2.47). Mothers who delivered at home were two times more at risk of giving stillbirth (OR 2.41; 95% CI 1.50 - 3.85) compared to the mothers who delivered at DC. Use of unskilled community birth attendants were found to be 2.2 times more likely to be associated with stillbirths (95% CI 1.42 - 3.70) than the deliveries attended by the BRAC birth attendants. Significant difference regarding harmful practices (i.e. repeated vaginal examination, introduce harmful substances in the vagina, pressure on the abdomen etc) during labour was observed in home delivery cases than the delivery cases at DC (OR 4.88; 95% CI 1.66 -14.38).

Conclusion and recommendations

Many factors were associated with an increased risk of stillbirths and most of the factors were interrelated. Most of these risk factors are amenable to intervention. Considering the lack of education of the mothers as a proxy of poor socioeconomic status, the finding emphasizes that the poorest of the poor mothers in the slum population are the most vulnerable to deliver stillborns, hence they need more attention during antenatal and delivery period. Since socioeconomic factors probably act via these intermediate variables, it may be possible to improve foetal survival, despite persistent poor socioeconomic conditions. The findings of the study indicate that the *MANOSHI* program has an impact on changing the grave outcome. However, there is substantial scope for reducing stillbirth through the *MANOSHI* program and further study is needed to establish the impact of *MANOSHI* on the reduction of stillbirths.

INTRODUCTION

Every year, around 6.3 million perinatal deaths occur in the world. Amongst them almost 98% occur in developing countries and 27% in the least developed countries. Stillbirth is the largest contributor to perinatal mortality, accounting for more than half of perinatal deaths in developing countries (WHO, 2006). Stillbirth is one of the most common adverse pregnancy outcomes, with an estimated rate of 5.3 per 1000 deliveries in developed countries, and 25.5 per 1000 deliveries in developing countries (McClure *et al*., 2007; Smith *et al*., 2007; Stanton *et al*., 2006). Of the 4 million neonatal deaths that occur every year, 98% are in the poorest countries of the world and for every neonatal death there is one stillbirth (Ngoc *et al.*, 2006). Recent estimates suggest that the stillbirth rate is common amongst the least developed countries, especially in sub-Saharan Africa and Southeast Asia (McClure *et al*., 2007; Smith *et al.,* 2007). An estimated 1.29 million stillbirths occurred in South Asia, which is the highest in the world. In Bangladesh, the stillbirth rate was 24/1000 whereas prenatal mortality rate and early neonatal mortality rate was 50 and 27 respectively (WHO, 2006).

The preponderance of foetal deaths and differences in reporting criteria throughout the world show that comparing stillbirth rates and identifying areas of concern can be complicated and imprecise though these rates are strong indicators of maternal and neonatal care. The level and causes of stillbirths with prospective monitoring of pregnant women reveal that poor quality care for a complication is strongly associated with the issues of interest that did not meet the required threshold such as maternal age at marriage, maternal tobacco smoke exposure, having more than one delivery complication also increase the risk for stillbirths (Jehan *et al.,* 2007; Mcclure *et al*., 2007; Dodds *et al*., 2006; Fretts, 2005; Stepansson *et al*., 2001; Maleckiene *et al*., 2001; Jansone *et al*., 2001) Relying on proxy measures of quality of care, the recurrence of certain adverse pregnancy outcomes is well recognized. Studies that have attempted to delineate possible risk factors of antepartum and intrapartum stillbirth show that most of the risk factors of stillbirth. In general prenatal smoking, maternal age > 35years, small-for-gestational-age, lower socioeconomic status, fewer antenatal visits, primiparity, grand multiparity, pre-pregnancy hypertension appear to be associated with antepartum stillbirth (Wood *et al*., 2008; Saishali *et al*., 2008). On the other hand, intrapartum stillbirth has been linked mostly with inadequate care during pregnancy, inappropriate management of complications during

pregnancy and delivery (Dodds *et al*., 2006; Surkan *et al*., 2004; Sheiner *et al.,* 2000; Aquino *et al*., 1998; Little & Weinberg, 1993)

Stillbirth rate is an important indicator of access to and quality of antenatal and delivery care. The stillbirth rate is also considered as a development indicator as it has been seen that the stillbirth rate is higher in lower socioeconomic groups in both developed and developing countries. Separate measure of stillbirths, therefore, is becoming increasingly important (Feresu et *al.,* 2004; Kramer et *al.,* 2*002* and Stephansson et *al.,* 2001).

Stillbirths constitute of a large and invisible loss of life and are becoming a significant public health issue in Bangladesh. Stillbirths go uncounted in most national statistics and even in the published studies due to lack of data. Considering the situation, in 2006, BRAC implemented a community based maternal neonatal health program, focusing on all pregnancies and their outcomes which are recorded in different registers for monitoring the program. This study aims to find the estimate of stillbirth rate per 1000 births per year and the risk factors associated with it. An understanding about the risk factors will be helpful to find out effective components from the development programme to adopt intervention for reducing stillbirth.

OBJECTIVES

Research Questions

1. What is the rate of stillbirth in the slums of Dhaka metropolitan area?

2. What are the risk factors associated with stillbirths amongst women in urban slums under the *MANOSHI* program?

3. Is there any difference of rate, and risk factors of stillbirth among the mothers who received or did not receive services from *MANOSHI* delivery centre?

Hypothesis

There is no difference in risk factors associated with stillbirth occurring in the BRAC delivery centres and homes in urban slums.

Specific Objectives

- To find out the rate of still birth in urban slums under *MANOSHI*.
- To determine the risk factors associated with stillbirths.
- To find out the obstetric causes of stillbirth.
- To compare the proportion of stillbirths among mothers who have received and have not received services of *MANOSHI* delivery centre.
- To compare birth practice associated with stillbirths in BRAC delivery centre & those occurring at home.
- To identify any independent factor related to stillbirth.

METHODOLGY

Study Design

This unmatched based case-control study, conducted among mothers who had child birth in the slums of Dhaka City Corporation areas where BRAC has implemented a maternal, neonatal and child health program named *MANOSHI* since 2007. The cases were mothers who had experienced stillbirth while the controls were those mothers who had live births. The study subjects were identified from the registers of deliveries occurred from November 2008 through April 2009. Two controls were taken against one case.

Study Setting

The study was carried out in purposively-selected old and new urban slum areas under the *MANOSHI* Program. These program providers (SS and SK) offer basic maternal child health services through home visits by cadres of the Community Health Workers. The approach of the project is in accord with the commitment of BRAC and Government of Bangladesh to achieve the MDGs 4 and 5.

For clean and safe deliveries, delivery centres are established in slum areas. One delivery centre covers 2000 households with a population of 10000 (BHP, 2007). A total of 247 delivery centres were established till April 2009. Two trained Urban Birth Attendants (UBAs) are assigned for assisting safe deliveries with the support of SS. SS's are responsible for accompanying birthing women from their catchments area starting from antenatal period till the birthing events. Another cadre, the Community Midwife (CMW) is also responsible for supervising activities of the UBAs and SSs. The responsibilities of SKs are to detect all danger signs for neonates, monitor the growth of under-five children and to campaign for breastfeeding and complementary feeding. They also empower community by providing knowledge regarding maternal and child health. UBA, SS and SK are also responsible for detecting problems during pregnancy, arranging transport and referring maternal complications both from the delivery centre and directly from home. The program also established referral linkage with EmOC facilities in timely and appropriate treatment of obstetric complications in the EmOC facilities. All pregnancy related events are recorded in three different registers, included delivery centre registers, home delivery registers and SK registers.

Sample Size

The study hypothesised one of the risk factors, pregnancy induced hypertension or eclampsia, as an important predictor of stillbirth. As there was no such figure available for Bangladesh, a published report from India suggested that (Vaishali and Pradeep, 2008) around 26.8% of the stillbirths are contributed by the pregnancy induced hypertension and eclampsia; hence the factor was considered as a reference for sample size calculation.

Evidence suggests (Datta, 1992) the prevalence of PIH of all pregnancy be 10% (P1) and to detect an odds ratio of 2. P2 should be 0.182, considering difficulty in recruitment of stillbirth cases. A case (n2) to control (n1) ratio of 0.5 has been decided. The sample size is calculated using 'sampsi' command in STATA (3) at a precision of 80%. The study required 232 cases and 464 controls. (3 StataCorp. Stata Statistical Software, version 8.2 [computer software]. College Station, TX: Stata Corporation 2004).

Development of Research Tools

A data driven form was developed for listing of all births in the study area. The form contained name and age of the mother, actual date of delivery, place of delivery, outcome of the delivery, referral place, reason for referral and name of SS who was responsible for that mother. For interviewing the mothers, a well-designed questionnaire containing pre-coded and open ended questions were developed for data collection. The pre-testing of the questionnaire was done in one of the slums of *MANOSHI* (in Korail slums under Gulshan area) and the necessary modifications of the questionnaire were made based on the pre-testing. Three major types of variables, viz., socioeconomic, biological and environmental factors were considered in the questionnaire.

Study Variables

The dependent variable was the stillbirth and the independent variables were concerned with the socio-demographic factors, obstetric history, and use of antenatal care and details of delivery during the current pregnancy.

Among the socio-demographic variables maternal age was defined as completed years at time of delivery. It was stratified into three groups < 20 years, 20-34 years and 35 or more years. Maternal and paternal education was defined as illiteracy (those who cannot read and write), primary (completed 5 years of schooling) and post primary (completed more than 5 years schooling). Religion of the respondents was grouped as Muslims and others (Hindu, Christian, Buddhist and other religious groups). Marital status was dichotomized between single marriage and multiple marriages. Maternal occupation was grouped as housewife, service (public, private), garments worker (various level of manufacturing) and labourer (daily wager for any type of physical activity).

Gravida was defined as the number of conception including index conception. Interpregnancy interval or birth interval was defined as the time elapsed between the mother's and index pregnancy and last before delivery. Intervals were computed in months then converted to years. Birth intervals were categorized in years as follows: less than 2 years, 2 years and above 2.

Among the obstetric indicators, maternal height was measured during data collection in centimetres and was divided into two categories (<145 cm and ≥ 145 cm). Place of delivery was grouped as delivery centre, home and hospital.

Mode of delivery was grouped as normal (vaginal), c/section and instrumental (using forceps).

The medical risk factor included diseases and obstetric complications during pregnancy and complications during delivery. All these factors were dichotomized between those who had and those who did not have. Among the obstetric complications were the following: APH, eclampsia, oedema, high blood pressure, less foetal movement, white discharge and anaemia and among the delivery complications, foetal mal-presentation, prolonged and obstructed labour, eclampsia, severe bleeding etc. All were dichotomized into two groups as those who had and those who did not have.

Service related factors include service received, delivery place whether in delivery centre or not, place from referral, attendance of delivery, harmful-practices (massages of the abdomen, vaginal examination using hand, pressing something in the vagina, vomiting method using hair and mal treatment use of oxytocin, injection and saline during delivery).

Training of the Interviewers

Twenty-five data collectors, five field monitors and a field research assistant were provided with five days of training on different aspects of data collection. They were oriented on the objectives of the study, full explanation of different terms used in the questionnaire; techniques for gathering information; and communication skills for rapport building; training on sample recruitment and maintenance of confidentiality and privacy in research.

Selection of Cases and Controls

The samples were recruited from all deliveries that occurred between November 2008 to April 2009. For the selection of cases and controls, the study enumerators listed all deliveries from the registers of the 247 delivery centres using the data driven form. A total of 22,476 deliveries were recorded; 574 of the total were identified as stillbirths. Multiple births (N=51) and births with missing information (N=165) on outcome of deliveries were excluded. Then 22260 deliveries were eligible for the study. Stillbirths are defined in this study as "foetal death at gestation of 28 or more weeks and do not show any sign of life after delivery" (Datta, 1992).

From the list, every alternate stillbirth selected as cases and controls were the mothers who have had live births. They were selected randomly from the same neighbourhood. Common practice of the slum population is to relocate in other areas. This was reflected in some cases of the study and as a result, they were excluded. A total of 232 cases and 464 controls at a ratio of 1:2 were selected from the list.

Data Collection

Data collection was done in two phases starting from May to June 2009. Selection of cases and controls was completed in the 1st phase. In the 2nd phase, the enumerators tracked down the mothers who had stillborns. They visited the mothers with the help of SSs, SKs as well as the people of the community.

Four screening questions were asked to every mother who had experienced stillbirths in order to confirm the diagnosis of stillbirths and to cross-check the records in the registers of *MANOSHI*. The screening questions included whether the newborn showed any sign of life or not. For each mother of the stillbirth cases, two mothers of live births from the same neighbourhood were interviewed. The mothers were interviewed face to face using structured questionnaires. In some cases it was found that the mother was unable to answer most of the questions, as she was severely ill during her delivery. Thus, in those cases the person who was accompanying her during the time of delivery was interviewed.

Data Quality Assurance

To ensure the quality of data, a three layered monitoring and supervision system was developed. In the first layer, five team leaders worked as monitoring officers. They monitored the activities of the twenty-five enumerators. Since the *MANOSHI* programme worked in five regions, each team leader and his/her respective team(s) was responsible for one regional area. The monitoring officer checked the data on field in order to verify its completion. The field activities were controlled and supervised by a field research assistant. The research assistant frequently visited the field and solved any problems that arose. Lastly, the principal investigator at the head office supervised the entire process of data collection and verified the data for its internal consistency.

Data Analysis

After initial exploratory analyses and assumption checking, individual risk factors were identified employing uni-variate analysis through cross tabulation. Odds ratios and confidence intervals were generated to quantify relationships between each predictor and outcome. Comparisons of mean age and income between cases and controls were done through independent t-test for normally-distributed data or with the Mann-Whitney test for skewed data. For the purposes of identification of the risk factors of stillbirth, adjusting for all possible confounders, binary logistic regression was employed.

For pooling the variables for logistic regression, the independent variables found to be associated with the outcome (stillbirth) in uni-variate analysis were considered on the first hand. Automated model selection techniques (forward selection, backward elimination and stepwise regression, a combination of both these techniques) were also employed for generating logistic regression models.

Along with the predictors identified by univariate analysis, automated model selection techniques and variables that were excluded but considered as potential predictors of stillbirth based on the theoretical plausibility were pooled and fitted into the logistic regression model in the forced entry method (all the variables were entered simultaneously). This was done after checking for multi-colinearity to find the adjusted OR for the risk factors of stillbirth. Statistical analyses were performed using the computer package SPSS 16.0 for Windows.

Consent

Verbal and written consent was taken from the mothers before initiating the interviews.

Limitations of the Study

The results of the present study could be limited with some aspects. This study relied on self-reported data regarding complications. Thus the stated complications of the mother were not validated with those recorded scientifically, as by medical personnel. Another limitation was lack of information out of recall bias that could not be avoided. Nullification of such intrinsic errors and in-built limitations can be imprecise and amenable to prospective statistical monitoring.

RESULTS

A total of 696 mothers were recruited for the study from a total of 22,476 deliveries. From the sample, 232 were cases (stillbirth) and rest was taken as controls (live birth). One out of 232 stillbirth cases was excluded from the studies as the newborn showed some signs of life. Hence, analysis was done on 231 cases and 464 live births.

Findings are arranged by major types of variables, socioeconomic, biological and environmental factors. The socioeconomic variables included mother's and father's education, occupation etc. The biological factors considered were mother's age; gravidity, parity; gestational weeks at delivery, and various complications during pregnancy, namely anaemia, fever, jaundice, excessive bleeding, prolonged or obstructed labour and abnormal presentation of the foetus. Environmental factors included antenatal care (ANC), patterns of delivery care, place of delivery, presence of attendants during delivery, malpractice during delivery, etc.

Stillbirth rate and Study population

The rate of stillbirth in the slum was 26/1000 births. Among the cases, 61.9% was fresh stillbirth and 38.1% was macerate stillbirth. Table 3.1.1 illustrates area-wise distribution of total live births, stillbirths and total delivery of the study area.

Table 3.1.1: Area wise distribution of delivery in the study area from November 2008 to April 2009

MANOSHI region	*Area*	*Delivery centre*	*Live birth*	*Stillbirth*	*Twin birth*	*Result not recorded*	*Total delivery*
Gulshan	8	54	4711	114	10	9	4844
Uttara	6	45	3560	91	7	30	3688
Jatrabari	8	54	4859	127	6	31	5023
Dhanmondi	7	40	4677	137	11	55	4880
Mirpur	5	54	3879	105	17	40	4041
Total	34	247	21686	574	51	165	22476

Characteristics of study population

Table 3.1.2 describes the background characteristics of the study population. Maternal age ranged from 15 to 48 years with a mean age of 24.1 ± 5.3. Among the respondents, 13.1% were in their teens and around 7% were ≥35 years. Respondents were predominantly Muslim. Most (94%) of them were married for the first time and very few of them were married more than once. A little more than 29% mothers were illiterate while only 17.6% of the husbands were illiterate. The majority of mothers (87%) were housewives and only 13% mothers were engaged in income generating activities. On the contrary, all of the husbands were involved in income generating activities. The median monthly income of the family is BDT 6000 (US $ 85.7, conversion rate BDT 70). Considering the reproductive profile, 33.7% of the women were nullipara (pregnant for the first time) whereas 24.3% were grand multipara (≥4 pregnancies). Of the mothers, about 8% had history of previous stillbirths. Nearly 99% of the mothers had received at least one ANC. Surprisingly 28% of the mothers did not receive any TT vaccination in the index pregnancy. Around 20% of the deliveries took place at home and 42.3% of the *MANOSHI* delivery centre. A little more than 15% of the mothers had caesarean section. Around 19% of the mothers suffered from different medical ailments including tuberculosis, diabetic mellitus, jaundice, diarrhoea, dysentery, heart disease etc. Almost 9% of the mothers were abused physically and mentally during their index pregnancy. Among the mothers, 35% developed complications during labour and nearly 50% of the others had some types of complication during their antenatal period.

Table: 3.1.2: Socioeconomic and obstetric profile of the respondents

Variables	*Categories*	*Case (%) N=231*	*Control (%) N=464*	*Total*
Socioeconomic indicators				
Woman's age	<20 years	7.3	16.0	13.1
	20-34 years	80.9	79.7	80.1
	≥35 years	11.7	4.3	6.8
Mean age ± sd				24.1 ± 5.3
Religion	Muslim	97.8	97.2	97.4
	Other	2.2	2.8	2.6
Marital status	Currently married	91.8	95.7	94.4
	Married (more than once & others	8.2	4.3	5.6

Woman's education	Post primary	27.7	33.2	31.4
	Primary	36.4	40.9	39.4
	Illiterate	35.9	25.9	29.2
Husband's education	Post primary	35.5	39.4	38.1
	Primary	42.0	45.5	44.3
	Illiterate	22.5	15.1	17.6
Woman's occupation	Housewife	76.7	91.8	86.8
	Service	3.0	2.2	2.4
	Garments worker	8.2	3.2	4.9
	Labourer	12.1	2.8	5.9
Husband's occupation	Service	32.5	38.4	36.4
	Labourer	59.3	49.4	52.7
	Garments worker	8.2	12.3	10.9
Monthly house hold income	<5000 TK	26.4	21.8	23.3
	5000-10,000	64.5	63.8	64.0
	>10000 TK	9.1	14.4	12.7
Median income	6000 TK			
Obstetric indicators				
Gravida	1st gravida	29.4	35.8	33.7
	2-3rd gravida	40.3	42.9	42.0
	≥4th gravida	30.3	21.3	24.3
Previous h/o stillbirth	No	87.0	94.8	92.2
	Yes	13.0	5.2	7.8
Use of Antenatal care	No	3.5	.6	1.6
	Yes	96.5	99.4	98.4
Use of TT	No	37.2	23.5	28.1
	Yes	62.8	76.5	71.9
Place of delivery	Delivery centre	21.6	52.6	42.3
	Home	19.5	19.6	19.6
	Hospital	58.9	27.8	38.1
Mode of delivery	Normal vaginal	84.4	84.1	84.2
	Caesarean	13.4	15.3	14.7
	Instrumental	2.2	.6	1.2
Disease	No	18.6	19.2	19.0
	Yes	81.4	80.8	81.0

Abuse	No	90.0	92.2	91.5
	Yes	10.0	7.8	8.5
Antenatal complications	No	42.9	54.1	50.4
	Yes	57.1	45.9	49.6
Delivery complications	No	38.5	78.2	56.0
	Yes	61.5	21.8	35.0

Obstetric causes of stillbirth

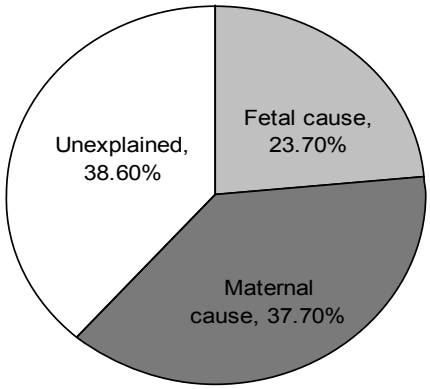

Fig: 1 Perceived obstetric causes of stillbirth

Fig: 1 shows the proportion of obstetric causes of stillbirth. The foetal causes accounted for 23.7% of the total causes while maternal causes were 37.7% and unexplained causes were 38.6%. Of the foetal causes, the most frequent is mal-presentation (10.8%), followed by less foetal movement (9.5%), foetal distress (1.7%) and IUD (1.7%). Of the maternal causes, most frequently observed cases was prolonged labour (16.5%), followed by severe bleeding (9.5%), no progress of labour (5.6%), obstructed labour (3%), eclampsia (1.7%) and high fever(1.4%) (Table: 3.1.3).

Table 3.1.3: Distribution of obstetric causes of stillbirth

Variables	*Case (%) N=231*
Foetal cause	**23.7**
Mal presentation	10.8
Less foetal movement	9.5
Foetal distress	1.7
IUD	1.7
Maternal cause	**37.7**
Prolonged labour	16.5
Severe bleeding	9.5
No progress of labour	5.6
Obstructed labour	3.0
Toxaemia	1.7
High fever	1.3
Unexplained	**38.6**

Risk factors of stillbirth

This section illustrates the uni-variate analysis of risk factors of stillbirth. Crude odds ratio with 95% CI were generated of individual alleged factors through binary logistic regression. A *p* value 0.05 was considered as significant.

Socio-demographic characteristics

Majority of the women in both the groups were aged between 20 – 34 years. Considering the age group as reference, older mothers (≥ 35 yrs) were found to be 2.7 times more at risk of delivering stillbirth.

Similarly illiterate mothers and fathers were slightly (OR 1.66; 95%CI 1.11-2.49; OR 1.65; 95%CI 1.06-2.58 respectively) more likely to have stillbirths in comparison to mothers and fathers with primary education or more. In comparison to housewives, working mothers such as garment workers (OR 3.04; 95%CI 1.51-6.13) and labourers (OR 5.18; 95%CI 2.62 – 10.24) were found to be more at a risk of delivering stillbirths. Fathers who were working as labourers also appeared to be at a higher risk for stillbirth (OR 1.42; 95%CI 1.01-2.00). Low family income and multiple marriages or separated women were found to be associated with greater risk of stillbirth.

Table 3.2.1: Crude odds ratios and 95% confidence intervals for socio-economic factors among cases and controls

Variables	*Categories*	*Case (%) N=231*	*Control (%) N=464*	*OR*	*95%CI*	*p*
Women's age	20-34 years	81.0	79.7	1.0		
	< 20 years	7.4	15.9	.455	.261-.792	*.005*
	≥35 years	11.7	4.3	2.671	1.46-4.88	*.001*
Women's education	Post primary	27.7	33.2	1.0		
	Primary	36.4	40.9	1.06	.721-1.59	*.755*
	Illiterate	35.9	25.9	1.66	1.11-2.49	*.013*
Husbands education	Post primary	35.5	39.4	1.0		
	Primary	42.0	45.5	1.02	.720-1.46	*.887*
	Illiterate	22.5	15.1	1.65	1.06-2.58	*.025*
Women's occupation	Housewife	76.6	91.8	1.0		
	Service	3.0	2.2	1.68	.631-4.49	*.298*
	Garments	8.2	3.2	3.04	1.51-6.13	*.002*
	worker	12.1	2.8	5.18	2.62-	*.000*
	Labourer				10.24	
Husbands occupation	Service	32.5	38.4	1.0		
	Labourer	59.3	49.4	1.42	1.01-2.00	*.045*
	Garments worker	8.2	12.3	.791	.441-1.42	*.433*
Marital status	Currently	91.8	95.7	1.0		
	married	8.2	4.3	1.99	1.04-3.80	*.038*
	Multiple marriage					
Monthly household income	<10,000 TK	9.1	14.4	1.0		
	5000-10,000	64.5	63.8	1.60	.947-2.72	*.079*
	>5000 TK	26.4	21.8	1.92	1.07-3.45	*.028*

Past reproductive history and maternal physical stature

Table 3.2.2 demonstrates the state of stillbirth by reproductive profile and physical stature of the respondents. The gravidae (total number of pregnancy) status was ranging from 1 to 10 more. The grand multigravida (≥4 pregnancy) was found to be at a significant higher risk of delivering stillbirth (OR 1.72; 95%CI, 1.13-2.61) in comparison to primigravida. However birth interval with the index pregnancy did not appear to be a significant predictor.

The proportion of previous history of stillbirths was significantly varied in cases and controls (13.0% Vs 5.2%) and this factor was strongly associated with increased risk of stillbirth. The mothers with previous stillbirths (1 or more) were more than two times likely to have stillbirth in their next pregnancy (OR 2.73; 95%CI 1.56-4.80). However, past history of abortion or miscarriages did not increase the likelihood.

Preterm delivery (<37 weeks of pregnancy) was more among cases (30.3%) than in controls (7.3%). Women with premature delivery showed around five and half folds risk of stillbirth compared to women who delivered at term. (OR 5.49; 95%CI 3.51-8.60). Women's height also appeared as a significant predictor of stillbirth. Women with height < 146 cm were around 54% more at risk of stillbirth (OR 1.54; 95%CI 1.07-2.22).

Table 3.2.2: Crude odds ratios and 95% confidence intervals for reproductive profile & physical stature among cases and controls

Variables	*Categories*	*Case (%) N=231*	*Control (%) N=464*	*OR*	*95%CI*	*p*
Gravida	1st gravidae	29.4	35.8	1.0		
	2-3rd gravida	40.3	42.9	1.14	.784-1.65	*.490*
	≥4th gravida	30.3	21.3	1.72	1.13-2.61	*.010*
Previous h/o stillbirth	No	87.0	94.8	1.0		
	Yes	13.0	5.2	2.73	1.56-4.80	*.000*
Previous abortion/miscarriage	No	84.4	81.7	1.0		
	Yes	15.6	18.3	.823	.537-1.26	*.371*
Gestational week at delivery	≥37 weeks	69.7	92.7	1.0		
	<37 weeks	30.3	7.3	5.49	3.51-8.60	*.000*
Birth to conception interval	≥2 years	58.9	64.1	1.0		
	<2 years	41.1	35.9	1.24	.842-1.84	*.271*
Height	≥146 cm	71.9	79.7	1.0		
	<146 cm	28.1	20.3	1.54	1.07-2.22	*.020*

Antenatal and delivery care

In general, ANC attendance was adequate in both groups. Mothers who did not receive ANC were found to be at a greater risk of stillbirth. Mothers with less than 4 ANC visits were found to be more at a risk (OR1.62, 95%CI1.17 - 2.23). Last ante-natal check-up at 3rd trimester emerged as a significant predictor, and odds among mothers who did not receive last ante-natal check-up at 3rd trimester were 3.7 times more than those who did not (OR, 3.7; 95%CI, 1.43-9.53).

Use of TT, place of delivery, duration of labour, mode of delivery, presence of birth attendant appeared to be significantly related to the stillbirth. Women who did not receive TT were found to be at around 2 fold more risk. Women with duration of labour for more than 12 hours exerted 52% more risk of having stillbirths. Mothers having delivery conducted at home showed greater odds (OR, 2.41; 95%CI, 1.50-3.85) of stillbirths. Surprisingly, hospital deliveries were found to be associated with an even greater risk (OR, 5.14, 95%CI, 3.49-7.58). Although modes of delivery did not show any significantly increased risk, delivery conduction by skilled birth attendant showed significant protection against stillbirths (OR, .456; 95%CI, 3.78- .551). None of the modes of delivery, rest during pregnancy and occurrence of mal-handling during delivery appeared as significant predictors (Table: 3.2.3).

Table 3.2.3: Crude odds ratios and 95% confidence intervals of antenatal and delivery care practice among cases and controls

Variables	*Categories*	*Case (%) N=231*	*Control (%) N=464*	*OR*	*95%CI*	*p*
Use of Antenatal care	Yes	96.5	99.4	1.0		
	No	03.5	00.6	5.51	1.44-20.9	.012
Number of ANC	≥ 4 visits	50.2	62.0	1.0		
	< 4 visits	49.8	38.0	1.62	1.17-2.23	.003
Last check-up of ANC at 3rd trimester	Yes	94.5	98.5	1.0		
	No	05.5	01.5	3.70	1.43-9.53	.007
Use of TT	Yes	62.8	76.5	1.0		
	No	37.2	23.5	1.93	1.37-2.72	.000
Rest during pregnancy	≥2 hours	59.1	59.8	1.0		
	< 2 hours	40.9	40.2	1.027	.729-1.44	.880
Place of delivery	Delivery centre	21.6	52.6	1.0		
	Home	19.5	19.6	2.41	1.50-3.85	.000
	Hospital	58.9	27.8	5.14	3.49-7.58	.000
Duration of Labour	< 12 hours	68.4	76.7	1.0		
	≥ 12 hours	31.6	23.3	1.52	1.07-2.16	.018
Mode of Delivery	Normal vaginal	84.4	84.1	1.0		
	C/Section	13.4	15.3	.873	.554-1.37	.560
	Instrumental	2.2	0.6	3.33	.788-14.09	.102
Mal handling during delivery	No	67.5	68.5	1.0		
	Yes	32.9	31.5	1.06	.762-1.496	.702

Table 3.2.4 illustrates the association of different complications during pregnancy and stillbirth. Uni-variate analysis and risk estimation were done following cross tabulation of individual complication with stillbirth. Unadjusted odds ratios were generated for all possible complications individually. A total of ten antenatal morbidities considered in the study showed significant association with risk of stillbirth. As a whole, occurrence of antenatal complications (OR, 1.57; 95% CI, 1.14-2.16) and delivery complications (OR, 5.73; 95%CI, 4.06-8.09) were found to exert significant excess risk of stillbirth. Among the antenatal complications, particularly APH (OR, 8.28; 95%CI, 1.74-39.3) and less foetal movement (OR, 3.25; 95%CI, 1.69–6.24) were found to be significantly associated with increased risk of stillbirth. Among the delivery related complications, foetal mal-presentation (OR, 3.63; 95%CI, 1.87-7.03), prolonged labour (OR, 1.93; 95%CI, 1.21-3.08) and severe bleeding (OR, 16.1; 95%CI, 4.78-54.6) were significantly associated with increased risk of stillbirth. However, medical illness did not show any statistically significant association.

Table 3.2.4: Crude odds ratios and 95% confidence intervals of complications during pregnancy and delivery among cases and controls

Risk factors	*Value Labels*	*Case (%) N=231*	*Control (%) N=464*	*OR*	*95% CI*	*p*
Antenatal complication	No	42.9	54.1	1.0		
	Yes	57.1	45.9	1.57	1.14-2.16	.005
APH	No	96.5	99.6	1.0		
	Yes	03.5	00.4	8.28	1.74-39.3	.003
Less foetal movement	No	89.6	96.6	1.0		
	Yes	10.4	3.4	3.25	1.69-6.24	.000
Delivery complications	No	38.5	78.2	1.0		
	Yes	61.5	21.8	5.73	4.06-8.09	.000
Foetal Mal-presentation	No	89.2	96.8	1.0		
	Yes	10.8	03.2	3.63	1.87-7.03	.000
Prolonged labour	No	83.5	90.7	1.0		
	Yes	16.5	9.3	1.93	1.21-3.08	.006
Severe bleeding	No	90.5	99.4	1.0		
	Yes	09.5	00.6	16.1	4.78-54.6	.000
Medical illness	No	81.4	80.8	1.0		
	Yes	18.6	19.2	0.96	.643-1.44	.858

Table 3.2.5 illustrates the results of adjusted multivariate logistic model. Among the socio-demographic factors 'no maternal education' (P=.024) and 'maternal age' (P=.002) showed significant association with stillbirth. Odds of having stillbirths were more than 1.5 times higher among illiterate mothers than mothers with education and were around 3 times higher among older mothers (≥35 years) than younger ones. 'Delivery before 37 weeks' (P=.000), 'foetal mal-presentation' (P=.000) and 'prolonged labour' (P=.000) appeared as highly significant predictors of stillbirth. Mothers who 'delivered before 37 weeks' were 5.2 times more likely, with 'foetal mal-presentation' were 4.16 times more likely (P=.000) and who had 'prolonged labour' were around 3 times more likely to have stillbirths. 'Less foetal movement' (P=.000), 'foetal distress' (P=.026) and 'non progressing labour' (P=.03) were also found to be significantly associated with stillbirth.

Table 3.2.5: Adjusted odds ratios of stillbirth for all factors in final model

Predictors	*Value levels*	*Case (%)*	*Control (%)*	*OR*	*95%CI*	*P*
Women's education	Literate	63.2	73.5	1.0		
	Illiterate	36.8	26.5	1.57	1.06-2.27	.024
Women's age	<35 years	88.3	95.7	1.0		
	≥35 years	11.7	04.3	2.87	1.5-5.5	.002
Gestational period	≥ 37 weeks	69.7	92.7	1.0		
	<37 weeks	30.3	7.3	5.25	3.2-8.5	.000
Less foetal movement	No	90.5	99.6	1.0		
	Yes	9.5	0.4	25.5	5.7-113.2	.000
Mal-presentation	No	89.2	96.8	1.0		
	Yes	10.8	3.2	4.14	2.02-.8.47	.000
Foetal distress	No	98.3	99.6	1.0		
	Yes	01.7	00.4	7.33	1.3-42.4	.026
Prolonged labour	No	83.5	90.7	1.0		
	Yes	16.5	09.3	2.81	1.6-4.65	.000
No progress of labour	No	94.4	96.8	1.0		
	Yes	05.6	03.2	2.44	1.08-5.50	.03

Impact of services of *MANOSHI* delivery centre on pregnancy outcome

To assess the changing outcome of the *MANOSHI* program, data were divided into two groups, mothers who have received delivery services (group1) and those who have not received any such service (group2) from the delivery centres (DC) of *MANOSHI*. Group1 included mothers who delivered at and referred from home to the EmOC facilities. Comparison of the two groups showed that higher percentage of stillbirths was experienced by women who did not receive delivery services from *MANOSHI* (33.5%) as compared to women who did receive services from delivery centres (20.8%). Among women who delivered at home, almost double proportion of them experienced stillbirths than those who delivered at DC (33% vs. 17%). The higher percentage of stillbirth was also notable with the women who were referred from home (34.1). These findings clearly indicate that the *MANOSHI* program has had an impact on changing the grave outcome (stillbirths) (Table: 3.3.1).

Table 3.3.1: Comparison of stillbirths among women who received obstetric care of the *MANOSHI* project with those who had not received

Variables	*Stillbirth*	*Live birth*	*Total*	*% Stillbirth*
Women received delivery services (Delivered at & referred from DC)	139	338	477	20.8
Not receive delivery services (Delivered at & referred from home)	92	126	218	33.5
Place of delivery				
Delivered at DC	50	244	294	17.0
Delivered at home	45	91	136	33.0
Place from where the women were referred				
Referred from Dc	89	94	183	26.8
Referred from home	47	35	82	34.1

Table 3.3.2 shows group 1 mothers who did not receive any service from BRAC delivery centres were at significantly higher risk of stillbirths rather than group 2 i.e. who received (OR, 1.7; 95%CI, 1.27 - 2.47). Mothers delivering at home had more than two fold increased risk of stillbirth (OR, 2.41; 95%CI, 1.50 -3.85) compared to the women who delivered at DC. The result showed that the skilled

attendances at birth lowered the risk of stillbirths. Community unskilled birth attendances were found to be 2.29 times more likely to be associated with stillbirths (OR, 2.29; 95%CI, 1.42 - 3.70) than the deliveries attended by the BRAC birth attendants. Significant difference regarding harmful practices (i.e. repeated vaginal examination, introduce harmful substances in the vagina, pressure on the abdomen etc) during labour was observed in home delivery cases than the delivery cases at DC (OR, 4.88; 95% CI, 1.66- 14.38). Place from where the women were referred and maltreatment (i.e. use of oxytocin, saline, drip etc) did not show any such significant increase in case of the risks of stillbirths.

Table 3.3.2: Birth practice among slum mothers and its association with stillbirth

Variables	*Categories*	*Case (%)*	*Control (%)*	*OR*	*95%CI*	*p*
N		231	464			
Services received	From DC	29.1	70.9	1.0		
	Not received from DC	42.2	57.8	1.77	1.27-2.47	*.001*
N		95	335			
Place of delivery	DC	17.0	83.0	1.0		
	Home	33.1	66.9	2.41	1.50-3.85	*.000*
N		95	335			
Attendance of delivery	BRAC provider	17.7	82.3	1.0		
	Non skilled	33.1	66.9	2.29	1.42-3.70	*.001*
N		136	129			
Place from referral	DC	48.6	51.4	1.0		
	Home	57.3	42.7	1.41	.839-2.39	*1.92*
N		95	335			
Mal treatment	DC	27.8	72.2	1.0		
	Home	47.8	52.6	2.34	.696-7.86	*.169*
N		95	335			
Harmful practice	DC	10.0	90.0	1.0		
	Home	35.2	64.8	4.88	1.66-14.3	*.004*

DISCUSSION

This community based case-control study was conducted among mothers who had child birth in the slums of Dhaka City Corporation areas where BRAC has implemented a maternal, neonatal and child health program named *MANOSHI*. The study aimed to quantify relationship between known or suspected risk factors for stillbirth. The study has also assessed the effect of the *MANOSHI* program on this grave outcome.

Stillbirth rate and causes of stillbirth

The rate of stillbirth was found to be 25.78/1000 birth in the urban slums of Dhaka which is slightly higher than the urban stillbirth (25/1000birth) rate of slum area (NIPORT, ORC Macro, John Hopkins University, ICDDR,B 2003). Among the cases, 61.9% of the cases were fresh stillbirth and 38.1% of the cases were macerated stillbirth which is in keeping with another study (Gazi *et al.,* 1999). Higher rate of fresh stillbirth suggests that foetuses probably died due to complications arising during labour and delivery. It points out that late detection of complications, late referrals and inadequate intrapartum management of complications might be the causes contributing to the high rate of fresh stillbirth. The findings are supported by a number of studies and stillbirth rate still continues to be high in the world (Smith and Fretts, 2007).

A study in Pakistan (Jehan *et al.,* 2007) found stillbirth rate of 33.6/1000 births which in comparison with the present study was higher. The higher rate of stillbirths in Pakistan may be due to the difference in study setting and design. The present study is retrospective community based whereas the study conducted in Pakistan was a hospital based prospective study; therefore minimal chances of under reporting.

Regarding perceived causes of stillbirths, the most frequent is mal-presentation which is in accordance with a study in rural Bangladesh (Gazi *et al.,* 1999) where they identified foetal mal-presentation is an important cause of stillbirth. Amongst the maternal causes, the most frequent cause was prolonged labour. Similar findings were found from other studies (Owolabi *et a*l., 2008; Vaishali and Pradeep, 2008; Smeeton *et al.,* 2004; Aquino *et al.,* 1998; Fretts and Usher, 1997 and Mavalankar *et al*., 1991).

The unexplained causes of stillbirth in our study were found to be higher compared with the study done at the Royal Victoria Hospital in Montreal (Huang *et al.,* 2000). The higher percentage of unexplained stillbirth in our study can be explained by the fact that the present study was a community based one and majority of the mothers lacked adequate information regarding causes associated with stillbirth. It is important to note that, the women who had experienced an unexplained stillbirth did not have any complications during pregnancy and labour, which is in accordance with another study (Huang DY *et al*. 2000).

Risk factors of stillbirths

In the present study, young age of the mothers (<20 years) exhibited significant protection against stillbirth unexpectedly, that is not in accordance with other studies (Gazi *et al*., 1999). This could be due to the fact that the younger group of mothers in this study was pregnant for the first time and family members were being more careful for the first pregnancy. This area needs further exploration. Advanced maternal age ≥35 years were associated with increased odds of stillbirth, which is consistent with other studies. (Huang *et al*., 2008; Dodds *et al.,* 2006; Wiredu and Tetty, 2004; Smeeton *et al*., 2004; Jansone *et al*., 2001; Anderson *et al*., 2000; Huang *et al.,* 2000; Conde-Agustin *et al.,* 2000; Amoa *et al.,* 1998 Aquino *et al.,* 1998; Fretts and Ushar, 1997; Fretts *et al.,* 1995;). Studies in Denmark (Andersen *et al.,* 2004), Canada (Fretts and Usher, 1997) and USA (Naeye, 1977) reported relationship of higher stillbirth rate among women 35 years and older and were more likely due to increase in lethal congenital anomalies. The present study failed to identify the cause because of paucity of data on the issue.

There are several socioeconomic factors such as maternal and paternal illiteracy, physical labour-related occupation of mothers, history of multiple marriages and low family income identified in the literature as being associated with increased risk of stillbirth (Dodds *et al.,* 2006; Wiredu *et al*., 2004; Stephanson *et al*., 2001; Maleckiene *et al*., 2001; Gazi *et al.,* 1999) that have been confirmed in this study. An association between low socio-economic status (SES) and increased risk of stillbirth has been observed consistently over several decades. This could be due to the fact that the lower level of education may relate to low family income which acts as a hindering factor for early decision to seek care and thereby delay to receive care.

The reproductive profiles of the respondents in the present study revealed that grand multigravida (≥4 pregnancy), premature delivery and previous stillbirth were important risk factors of stillbirth. Our results support the association of these factors previously identified in the literature with stillbirth risk (Vaishali and Pradeep, 2008; Pasha et al., 2008; Sharma et al., 2007; Feresu et al., 2005; Wiredu and Tetty, 2004; Smeeton et al., 2004; Maleckiene et al., 2001; Amoa et al., 1998).

The present study revealed that infrequent or no ANC visits during pregnancy were associated with substantially increased risk of foetal death. These results are in agreement with studies in Northern Iran (Pasha *et al.,* 2008), Zimbabwe (Feresu *et al.,* 2005), Ghana (Wiredu and Tetty, 2004); Latvia (Jansone *et al*., 2001); Latin America (Conde-Agustin *et al.,* 2000); Bangladesh (Gazi *et al.,* 1999), and Ahmedabad, India (Mavalankar *et al*.,1991).

A prospective community-based study in rural Tanzania (Walraven *et al.,* 1995) strongly suggests that there are high risks of stillbirth in home deliveries supervised by attendants without formal training. Likewise, the result of the present study showed that deliveries conducted by untrained attendants at home were found to be at greater risks of stillbirth than those who delivered at the *MANOSHI* delivery centres. Surprisingly, in the present study, hospital deliveries were associated with greater risk which is consistent with other studies (Walvaren *et al.,* 1995; Mavalankar *et al*., 1991). The high rate of stillbirth in hospitals may be explained by late referral or admission of the high risk birthing mothers from the community to the hospital. This indicates lack of awareness regarding risk factors of stillbirth and their grave outcome among the birth attendants and the community. However, it was not possible to differentiate between avoidable deaths at home due to unqualified obstetric care or late arrival at hospital because of poor transportation facilities from home to the EmOC facilities due to paucity of data on those factors.

Since most of the factors were interrelated, a multivariate analysis was used to identify risk factors that best predicted stillbirth, controlling for all other variables in the regression model. All the socioeconomic variables became insignificant after being adjusted for other variables except maternal education. The effects of socioeconomic status were perhaps partly diminished because cases and controls were chosen from the same poor slum population. Considering

the illiteracy of the mother as a proxy of poor socioeconomic status, the finding emphasizes that the poorest of the poor mothers in the slum population were more vulnerable to deliver a stillbirth. It has been stated elsewhere that advanced maternal age is a strong independent risk factor of stillbirth; multivariate analysis also confirmed our finding. Other risk factors such as preterm delivery, foetal and maternal complications emerged as major independent risk factors for stillbirth, most of which are amenable to intervention (Olusanya *et al*., 2009).

The assessment of changing outcome of MANOSHI

The findings revealed that higher percentages of stillbirths were experienced by women who did not receive obstetric services from the delivery centres than women who did. Among women who delivered at home, almost double proportion of them experienced stillbirths compared to those who delivered at delivery centres. The higher percentage of stillbirth was also notable with the women who were referred from home. This depicts that the attendants carrying out deliveries at home lack the necessary skills needed to identify the complications of labour and also lack adequate intrapartum case management skills. This finding is consistent with other studies (Walraven *et al*., 1995; Shah *et al*., 1984).

In order to assess the impact of *MANOSHI* on reduction of stillbirths methodologically, this study is not sufficient. However, in order to consider the performance appraisal of *MANOSHI*, the *MANOSHI* delivery centres' services would be taken as input, the number of deliveries occurred in delivery centres as output and the proportion of stillbirths as outcome, which would then reflect the achievement of delivery centres in the reduction of stillbirths in comparison to home deliveries. Increasing number of facility-based deliveries (i.e. in delivery centres) and its consequences are outcome-based analysis. Therefore, these changes in the proportion of stillbirths (as beneficial effects on pregnancy outcomes) owing to receiving *MANOSHI* services are a positive impact. Such findings indicate that the *MANOSHI* program has an impact on changing the grave outcome.

CONCLUSIONS & RECOMMENDATIONS

The aim of this study was to identify the risk factors for stillbirth as well as to evaluate the effect of the *MANOSHI* program on reducing the rate of stillbirth. Multivariate analysis identified factors that best predicted the risk of stillbirth and showed that there was no sole factor but rather all were interrelated. Our results support the association of some factors previously identified in the literature with stillbirth risk. Increasing number of facility-based deliveries (i.e. in delivery centres) and the changes in the proportion of stillbirths compared to home delivery and referred from home owing to receiving services from *MANOSHI* program is a positive impact and also a revelation of the project potential.

This study recommends the following strategies to reduce stillbirth rate in the slums through improving *MANOSHI* services:

- Identification of mothers at risk of stillbirth should be given more attention during antenatal period and ensured facility delivery by referring them at the first point of contact.
- List of risk factors of stillbirth should be included in the antenatal card for early detection of mothers at risk.
- Concentration should give on family planning service to mother and their partners especially for multigravida and elderly women (≥ 35 years). Making family planning assistance more available to this population could decrease unwanted pregnancy and stillbirth.
- Training of the providers should not only include danger signs of pregnancy, but it must also include risk factors of stillbirth.
- Avoidance of home delivery is a very difficult task. In order to reduce stillbirth, it is necessary to develop an operationalized network to involve the unskilled community birth attendants in the programme.
- Effective strategies are needed to convince women with high-risk pregnancies to deliver in hospital.
- Mothers and family members should be trained on risk factors of stillbirth for early detection as a prevention strategy.

To advance our knowledge on the cause of stillbirths, future studies should attempt to evaluate exposures within months or trimester of pregnancy and analyze risk factors of stillbirths based on cause of death for appropriate intervention.

REFERENCES

Amoa AB, Klufio CA, Moro M, Kariwiga G, Mila G (1998). A case-control study of stillbirths at the Port Moresby General Hospital. *PN G Med J* 41(3-4):126-36

Anderson AMN, Wohlfahrt J, Christens P, Olsen J, Melbye M (2000). Maternal age and foetal loss: population based register linkage study. *BMJ* 320:1708-12

Aquino MMA, Cecatti JG, Mariani Neto C (1998). Risk factors associated to foetal death. *Rev Paul Med* 116 (6):1852-7

Conde-Agudelo A, Belizan JM, Diaz-Rosello JL (2000). Epidemiology of foetal death in Latin America. *Acta Obstet Gynecol Acand*; 79 (5):371-8

Dodds L, King WD, Fell DB, Armson BA, Allen, Nimrod C (2006). Stillbirth risk factors according to timing of exposure. *Annals of Epidemiology*. 16(8):607-13

EM McClure, LL Wright, RL Goldenberg (2007).The global network: a prospective study of stillbirths in developing countries',*Am J Obstet Gynecol.*197:247.e1-247.e5.

Feresu SA, Harlow SD, Welch K, Gillespie BW (2005). Incidence of stillbirth and perinatal mortality and their associated factors among women delivering at Harare Maternity Hospital, Zimbabwe: a cross-sectional retrospective analysis. *BMC Pregnancy and Childbirth* 5:9

Feresu SA, Harlow SD, Welch K, Gillespie BW (2004). Incidence of and socio-demographic risk factors for stillbirth, preterm birth and low birth weight among Zimbabwean women. *Paediatr Perinat Epidemiol* 18**:**154-63.

Fretts RC (2005). Etiology and prevention of stillbirth. *Am J Obstet Gynecol* 193:1923-35.

Fretts RC, Schmittdiel J, McLean Fh, Usher Rh, Goldman MB (1995). Increased maternal age and the risk of foetal death. *N Engl J Med* 333(15):953-57.

Fretts RC, Usher RH (1997). Causes of foetal death in women of advanced maternal age. *Obstet Gynecol* 89(1):40-45.

Gazi R, Goodburn L, Chowdhury AMR (1999). Risk factors for perinatal deaths in rural Bangladesh. *Journal of Health and Population in Developing Countries* 2 (1): 70-77.

Goy J, Dodds L, Rosenberg MW, King WD (2008). Health-risk behaviours: Examining social disparities in the occurrence of stillbirth. *Paediatric and Perinatal Epidemiology* 22(4): 314–320.

Huang DY, Usher RH, Kramer MS, Yang H, Morin L, Fretts RC (2000). Determinants of unexplained antepartum foetal deaths. *Obstet Gynecol* 95:215-221.

Huang L, Sauve R, Birkett N, Fergusson D, Walraven CV (2008). Maternal age and risk of stillbirth: a systematic review. *C MAJ*. 178(2):165-72

Jansone M, Lindmark G, Langhoff-Ross J (2001). Perinatal deaths and insufficient antenatal care in Latvia. *Acta Obstet Gynecol Scand*; 80: 1091-5

Jehan I, McClure EM, Salat S, Rizvi S, Pasha O, Harris H, Moss N, Goldenberg RL (2007). Stillbirths in urban community in Pakistan. *Am J Obstet Gynecol* 197:257.e1-257.e8.

Kalter HD, Khazen Rahil R, Barghouthi M, Odeh M (2008). Prospective community-based cluster census and case-control study of stillbirths and neonatal deaths in the West Bank and Gaza Strip. *Paediatr Perinat Epidemiol* 22: 321–333.

Kramer MS, Liu S, Luo Z, Yuan H, Platt RW, Joseph KS (2002). Analysis of perinatal mortality and its components: time for a change?. *Am J Epidemiol* 156**:**493-7

Lale Say, Allan Donner, A Metin Gülmezoglu, Monica Taljaard and Gilda Piaggio (2006). Reproductive Health Research: The prevalence of stillbirths: a systematic review. *BMC Reproductive Health* 3:1 doi:10.1186/1742-4755-3-1

Lawn JE, Yakoob MY, Haws RA, Soomro T, Dramstadt GL, Bhutta ZA (2009). 3.2 million stillbirths: epidemiology and overview of the evidence review *BMC Pregnancy and Childbirth* 9 (Suppl 1):S2

Little RE, Weinberg CR (1993) 'Risk factors for antepartum and intrapartum stillbirth', *Am J Epidemio* 137:1177–1189.

MANOSHI Annual Report. (2007). Dhaka. BRAC

MANOSHI Research Brief (2009).Issue-1. BRAC & ICDDR,B

Maleckiene L, Nadisauskiene R; Bergström S (2001). Socio-economic. Demographic and obstetric risk factors for late foetal death of unknown etiology in Lithuania. *Acta Obstet Gynecol Scand*; 80(4): 321-25

Mavalankar DV, Trivedi CR, Gray RH (1991). Levels and risk factors for perinatal mortality in Ahmedabad, India', *Bull WHO* 69(4): 435-42

Mcclure EM, Wright LL, Goldenberg RL, Goudar SS, Parida SN, Jehan I, Tshefu A, Chomba E, Alhabe F, Garces A, Harris H, Darman RJ, Panigrahi P, Engmann C, Buekens P, Hambidge M, Carlo . (2007).*AM J Obstet Gynecol*. 197(3): e1-247.e5.

Millennium development Goals. Bangladesh Progress Report: February 2005. The Government of Bangladesh and The United Nations Country team in Bangladesh

National Institute of Population research and Training (NIPORT). Mitra and Associates and Macro International (2009). Bangladesh demographic and health survey 2007. Dhaka and Calverton: NIPORT, Mitra and Associates and Macro International.

National Institute of Population Research and Training (NIPORT), ORC Macro, Johns Hopkins University and ICDDR,B (2003). Bangladesh Maternal Health Services and Maleckiene L, Ladisauskiene R, Bergstrom S (2001). Socio-economic, demographic and obstetric risk factors for late foetal death of unknown etiology in Lithuania: a case-referent study. *Acta Obstet Gynecol Scand*; 80:321-5

Maternal Mortality Survey 2001. Dhaka and Maryland: NIPORT, ORC Macro, Johns Hopkins University, and ICDDR,B.

Ngoc NTN, Marialdi M, Aleem HA, Carroli G, Purwar M, Zavaleta N, Campodonico L, Ali MM, Hofmeyr GJ, Mathai M, Lincetto O, Villar J (2006). Causes of stillbirths and early neonatal deaths: Data from 7993 pregnancies in six developing countries. *Bull WHO* 84(9) 699-705

Olusanya BO, Solanke OA (2009). Predictors of term stillbirths in an inner-city maternity hospital in Lagos, Nigeria. Acta Obstetricia et Gynecologica Scandinavica, 88 (11): 1243-51

Pasha H, Faramarzi M, Bakhtiari A, Hajian K (2008). Stillbirth and the risk factors in Babol, Northern Iran. *Iranian Red Crescent Medical Journal* 10(3):244-45

Reddy UM, Ko CW, Willinger M (2006). Maternal age and the risk of stillbirth throughout pregnancy in the United States. *Am J Obstet Gynecol.*195 764-70

Serenius F, Winbo I, Dahlquist G, Kallen B (2001). Cause-specific stillbirth ad neonatal death in Sweden: a catchment area-based analysis. *Acta Paediatr* 90: 1054-61

Shah U, Pratinidhi AK and Bhatlawande PV (1984). Perinatal mortality in rural India: a strategy for reduction through primary care. I Stillbirths. *J Epidemiol Commuity Health*. 38 134-37

Sharma PP, Salihu HM and Kirby RS (2007). Stillbirth recurrence in a population of relatively low-risk mothers. *Paediatr Perinat Epidemiol* 21(Suppl. 1): 24–30

Sheiner E, Hallak M, Shoham-Vardi I, Goldstein D, Mazor M, Katz M (2000). Determining risk factors for intrapartum foetal death. *J Reprod Med* 45(5):419–424.

Sinha.S (2006). Outcome of antenatal care in an urban slum of Delhi. *Ind Jr of Comm Med* 31(3):189-91

Smeeton NC, Rona R J, Dobson P, Cochrane R, Wolfe C (2004). Assessing the determinants of stillbirths and early neonatal deaths using routinely collected data in an inner city area. *BMC Medicine* 2:27

Smith G CS, Fretts RC (2007). Stillbirth. *Lancet* 370(17):1715-25.

Stanton C, Lawn JE, Rahman H, Wilczynska-Ketende K, Hill K (2006). Stillbirth Rates: Delivering Estimates in 190 Countries. *Lancet* 367(9521)1487-94.

Stephansson O, Dickman PW, Johansson AL, Cnattingius S (2001). Influence of socioeconomic status on stillbirth risk in Sweden. *Int J Epidemil* 30(6):1296-301.

Surkan PJ, Stephansson O, Dickman PW, Cnattingius S (2004) 'Previous preterm and small-for-gestational-age births and the subsequent risk of stillbirth' *NEJ M* 350(8):777–785.

Vaishali N KN, Pradeep RG (2008). Causes of stillbirth. *J Obstet Gynecol India* 58(4):314-18

Walraven GEL, Mkanje RJB, Roosmalen J, van Dongen PWJ, Dolmans WMV (1995). Perinatal mortality in home births in rural Tanzania. *European Journal of Obstetrics and Gynecology and Reproductive Biology* 58: 131-134

Wiredu EK, Tettey Y (2004). Still births at Korle Bu teaching hospital: characteristics of parent's pregnancy and labour *Ghana Med J* 38(1):15-19

Wood SL, Chen S, Ross S, Sauve R. (2008). The risk of unexplained antepartum stillbirth in second pregnancies following caesarean section in the first pregnancy. *BJOG*; 115: 726-31

World Health Organization (2006).Neonatal and Perinatal Mortality. Country, regional and global estimates.