ORIGINAL ARTICLE | CHILD HEALTH

Predictors of Intrapartum Stillbirths among Women Delivering at Mulago Hospital, Kampala, Uganda

Paul Kiondo, MBChB, MMed, PhD;[1][✉] **Annettee Nakimuli,** MBChB, MMed, PhD;[1] **Samuel Ononge,** MBChB, M.Med, PhD;[1] **Julius N. Wandabwa** MBChB, MMed, PhD;[2] **Milton W. Musaba,** MBChB, M.Med[2.]

[1]Department of Obstetrics and Gynecology, School of Medicine, College of Health Sciences, Makerere University, Kampala, UGANDA; [2]Department of Obstetrics and Gynecology, Faculty of Health Sciences, Busitema University, Mbale, UGANDA

[✉]Corresponding author email: kiondop@yahoo.com

ABSTRACT

Background: Over the last decade, Uganda has registered a significant improvement in the utilization of maternity care services. Unfortunately, this has not resulted in a significant and commensurate improvement in the maternal and child health (MCH) indicators. More than half of all the stillbirths (54 per 1,000 deliveries) occur in the peripartum period. Understanding the predictors of preventable stillbirths (SB) will inform the formulation of strategies to reduce this preventable loss of newborns in the intrapartum period. The objective of this study was to determine the predictors of intrapartum stillbirth among women delivering at Mulago National Referral and Teaching Hospital in Central Uganda.

Methods: This was an unmatched case-control study conducted at Mulago Hospital from October 29, 2018 to October 30, 2019. A total of 474 women were included in the analysis: 158 as cases with an intrapartum stillbirth and 316 as controls without an intrapartum stillbirth. Bivariable and multivariable logistic regression was done to determine the predictors of intrapartum stillbirth.

Results: The predictors of intrapartum stillbirth were history of being referred from lower health units to Mulago hospital (aOR 2.5, 95% CI:1.5-4.5); maternal age 35 years or more (aOR 2.9, 95% CI:1.01-8.4); antepartum hemorrhage (aOR 8.5, 95% CI:2.4-30.7); malpresentation (aOR 6.29; 95% CI:2.39-16.1); prolonged/obstructed labor (aOR 6.2; 95% CI:2.39-16.1); and cesarean delivery (aOR 7.6; 95% CI:3.2-13.7).

Conclusion and Global Health Implications: Referral to hospital, maternal age 35 years and above, obstetric complication during labor, and cesarean delivery were predictors of intrapartum stillbirth in women delivering at Mulago hospital. Timely referral and improving access to quality intrapartum obstetric care have the potential to reduce the incidence of intrapartum SB in our community.

Key words: • Stillbirths • Intrapartum • Predictors • Maternal Health • Child Health • Child Death • MCH • Case-Control • Uganda • Africa

1. Introduction

Death of a child at whatever age is a disaster to many families and has an enormous lifelong psychological and economic burden. Unfortunately, stillbirths are not accounted for in many societies and are not routinely registered in the National Demographic Health Surveys and therefore remain invisible and unaccounted for.[1,2] Consequently, stillbirth reduction does not attract funding from the National budgets as well as from the development partners. Yet globally, an estimated 2.6 million stillbirths (delivered at ≥ 28 weeks gestation or ≥ 1000g) occur annually and almost exclusively in low- and middle-income countries. [3,4] About half of these deaths occur in the intrapartum period, where the risk is highest because of obstetric complications such as prolonged/obstructed labor, fetal malpresentation, and abruption placenta if not appropriately managed.[4,5]

The rates of intrapartum SB vary across the world because of disparities in access to quality intrapartum care services, being lowest or non-existent in high-income countries and highest in low-income countries. For instance, in sub-Saharan Africa, 47% of the SB are intrapartum compared to 57% in South East Asia and 13.1% in Europe.[4] Delay in receiving quality obstetric care is one of the leading causes of SB.[6] This may be due to delay at home or delay in transport to reach a health facility and delay within health facilities.[7,8] The risks are higher with births outside the facility by non-skilled attendants.[7] Suboptimal care has been identified as a cause in some cases of intrapartum stillbirth. Women's conditions may not be correctly identified and managed or the required intervention may not be given in time.[9,10] In some settings, cesarean section coverage is low[6] due to a shortage of trained healthcare personnel and shortage of theatre equipment and supplies. Sometimes women are required to pay for medications and supplies, which may delay timely interventions.[9,10]

Many intrapartum stillbirths could be averted with appropriate maternal and fetal monitoring.[11] For example, using a partogram to monitor labor progress would lead to early identification of complications and offer timely interventions. Many of the conditions associated with SB can be managed without significant increases in the healthcare budgets and therefore can be managed in low resource settings.[3] Appropriate interventions at the facility level with improvement in obstetric care can prevent a number of these stillbirths.[11,12]

It is important to identify predictors of stillbirths in Uganda as the current rate of stillbirths is 45 per 1000 deliveries.[13] This represents a slight decline from 54 death per 1,000 deliveries in 2011.[14] Over the same period, there has been a significant increase from 39% to 73% in the number of health facility deliveries. Relatedly, 60% of pregnant women attend antenatal care (ANC) visits at least four times during the entire pregnancy, an increase from 48% in 2011.[14] This represents a mismatch between the utilization of maternity care services and maternal and child health (MCH) indicators. The study set out to examine the risk factors for intrapartum stillbirth in Uganda, so as to develop ways of reducing preventable stillbirths. Especially now that the improved utilization of maternity services has not been commensurate with the reduction in maternal and perinatal morbidity and mortality. Therefore, the major aim of this study was to identify risk factors for intrapartum stillbirth in women delivering at Mulago hospital, Uganda.

2. Methods

2.1. Study Variables

This study's independent variables were socio-demographic characteristics, medical, obstetric, and family history that were compared among cases and controls. The main exposure variable was the proportion of participants with birth asphyxia among the cases and controls.

2.2. Study Design and Setting

This was an unmatched case-control study conducted from October 29, 2018 to October 30, 2019. Cases were women who had given birth to fresh stillbirths, while controls were women who had given birth to live babies. This study was conducted at Mulago hospital. Mulago Hospital is a National Referral hospital for Uganda and a teaching hospital for Makerere University College of Health

Sciences. It is located in the central region within Kampala, which is both a commercial and capital city. Kampala has a total population of five million by day and about one and half million at night.[15] Mulago hospital conducts about 32,000 deliveries per year. Most (60 %) patients are admitted as referrals from the surrounding health facilities (Kiswa HCIII, Naguru Hospital, Kisenyi HCIV and Kawala HCIII, Komamboga HC III and Kisugu HC III). On average, 50 intrapartum stillbirths occur per month to approximately 600 stillbirths per year, according to the 2016 departmental records.

2.3. Data Collection Technique and Tools

Data collection was conducted by four midwives. They were trained by the Principal Investigator about the purpose of the study and how to conduct the interviews using the data collection tool before the data collection process began. We used interviewer-administered questionnaires to collect the data. They had both open- and closed-ended questions. The questionnaires were in English and Luganda (which is a local language spoken by the women in the area of study). The women who understood English were given questionnaires written in English and the women who understand the local language were given questionnaires written in the local language. Women who did not understand any of these languages were excluded from the study.

The information collected included the socio-demographic characteristics, medical and family history, present and past obstetric performances. Socio-demographic characteristics included information on age, marital status, educational level, and distance from the hospital. Medical history included the history of medical diseases (e.g. hypertension, diabetes mellitus, renal diseases, malaria in the current pregnancy, anemia, urinary tract infection, and HIV serostatus) and obstetric history (e.g. parity, antenatal clinic attendance, obstetric complications, partogram use, fetal heart monitoring, mode of delivery, babies' weight and sex.

The research assistants measured the blood pressure of women and collected information on their HIV status. Routine counseling and testing for HIV are done for all women who deliver at Mulago hospital. HIV status of all the women was extracted from the clinical notes. Participants were identified by study identification numbers on the case report forms. All the case report forms were kept in individual files in a secure filing cabinet in the study office. Additional records were kept in the clinical and laboratory record books at the study office in the labor ward.

2.4. Eligibility Criteria

The study included women aged 15-49. Cases were women who had delivered a stillborn baby at the gestational age of 28 weeks or more or weighed 1000g or more. Women were excluded as cases if they delivered a stillbirth in which fetal death occurred before the onset of labor, or if they delivered before arrival to the hospital, or if they delivered a baby with congenital abnormalities. Controls were women who delivered live babies after 28 weeks of pregnancy or more. Women were excluded if they delivered before arrival to the hospital or delivered a baby with congenital abnormalities.

2.5. Sample Size Estimation and Sampling Technique

The sample size was calculated using a formula for comparing two proportions.[16] Using a proportion of asphyxia of 14.8% among the controls and 26% among the cases[17] as was found in a study in Western Uganda, a sample size of 474 women (158 cases and 316 controls, in the ratio of 2 controls per case) was sufficient with 95% confidence level, power of 80% and odds ratio of worth detecting at least 2.

Research Assistants from the labor ward identified women with intrapartum stillbirth delivery. The Principal Investigator confirmed the diagnosis of intrapartum stillbirth. The women who had stillbirths were managed using the standard hospital protocol of managing stillbirth which involved determining the cause of death and helping women cope with bereavement, counseling, and support. The women were given information about the study and they were requested to participate. Consent

was administered to the women who accepted to join the study. Recruitment of these participants was done consecutively until the sample size was achieved. For each identified case, two women with live birth were immediately identified by systematic sampling from the register of all the live births in the last 24 hours. The Principal Investigator checked the women for eligibility. They were given information about the study by the Research Assistants. If they accepted to join, then informed consent was obtained.

2.6. Data Management and Statistical Methods

The data collected was cleaned, coded, and double entered using EpiData version 3.1.[18] We exported the data to Stata software version 14.0 (Stata Corp: College Station, TX, USA) for cleaning and analysis.[19]

Continuous variables were compared between groups using the independent sample t-test. Categorical variables between groups were compared using the Chi-squared test. Continuous variables were categorized and compared between groups as above.

Bivariable analysis was done to establish the strength of association between the maternal socio-demographic characteristics, medical and obstetric history, and the risk of stillbirth delivery.

Factors with a p-value of 0.2 or less at bivariate analysis and factors known *a priori* to be associated with stillbirth were entered into a multivariable logistic regression model and adjusted. The backward elimination method was used until a stable model was obtained. Results are reported as adjusted odds ratios with the corresponding 95% confidence intervals.

2.7. Ethical Approval

The study was approved by the Makerere University School of Medicine Research and Ethics Committee, the Mulago Hospital Research and Ethics Committee, and the National Council for Science and Technology in Uganda. The participants gave written informed consent. Only the participants' identification numbers were used and no names were entered in the database.

3. Results

3.1. Socio-demographic and Medical Characteristics of the Cases and Controls

A total of 474 women were included in the analysis, 158 as cases with an intrapartum stillbirth and 316 as controls without an intrapartum stillbirth. The cases were more likely to stay more than five kilometers from the hospital (61% Vs. 43%), P-value <0.001; to be referred (70% Vs. 41%), P-value <0.001 and have suffered trauma during pregnancy (2.5% Vs. 0.3%), P-value 0.020 than the controls. Other study characteristics are presented in table 1.

3.2. Factors Associated with Intrapartum Stillbirths at Bivariate Analysis

The factors associated with intrapartum stillbirth delivery were the distance from Mulago hospital, being referred by a health worker from a lower health facility to Mulago hospital, antepartum hemorrhage, malpresentation, prolonged labor, mode of delivery, and trauma during pregnancy (Table 2).

3.3. Predictors of Intrapartum Stillbirths

After controlling for other factors, referral to a hospital was associated with 2.4 times the risk of delivering stillbirth compared with women who were not referred. Women who developed antepartum hemorrhage were 6.2 times more likely to deliver stillbirth compared to women who did not have an antepartum hemorrhage. Women with malpresentation were associated with 5.5 risks of delivering stillbirth compared to women who did not have malpresentation. Women who had prolonged labor were 5.1 times at increased risk of delivering stillbirth compared to women who did not have prolonged labor. Women delivered by cesarean section were 7.7 times more likely to deliver a stillbirth than women who delivered vaginally. Finally, women who had trauma during pregnancy were 26 times more likely to deliver stillbirth than women who did not experience trauma in pregnancy (Table 3).

4. Discussion

This study was conducted to identify predictors of intrapartum stillbirth in women delivering at Mulago

Table 1: Demographic and medical factors of women with intrapartum stillbirths and women with live births at Mulago hospital, Kampala

Variable	Cases n=158 (%)	Controls n=316 (%)	P-values
Distance from Mulago			
5km or less	61 (38.6)	181 (57.3)	<0.001
More than 5km	97 (61.4)	135 (42.7)	
Referral to hospital in active labor			
Yes	110 (69.6)	128 (40.8)	<0.001
Age of mothers(years)			
14-19	21 (13.3)	60 (19.0)	0.05
20-35	122 (77.2)	241 (76.3)	
>35	15 (9.5)	15 (4.7)	
Marital status			
Married	126 (79.8)	266 (84.2)	0.23
Single	32 (20.2)	50 (15.8)	
Educational level			
Primary or less	49 (31)	89 (28.1)	0.52
Secondary or higher	109 (69)	227 (71.8)	
Parity			
1	70 (44.3)	126 (38.9)	0.61
2 - 4	69 (43.7)	150 (47.5)	
5+	19 (12.0)	40 (12.6)	
Antenatal attendance			
Less than 4 visits	109 (68.9)	190 (60.9)	0.06
4 or more visits	49 (31.1)	126 (39.1)	
Antepartum hemorrhage			
Yes	16 (10.1)	08 (1.6)	0.001
Multiple pregnancies			
Yes	01 (0.6)	08 (2.5)	0.15
Malpresentation			
Yes	22 (13.9)	10 (3.2)	<0.001
Prolonged labor			
Yes	38 (24.1)	25 (7.9)	<0.001
Preeclampsia/Eclampsia			
Yes	09 (5.9)	09 (2.8)	0.126
History of PROM			
Yes	21 (13.3)	30 (9.5)	0.208)
Fetal heart rate monitoring			
Yes	12 (7.6)	24 (7.6)	0.99
Partogram use			
Yes	12 (7.6)	33 (10.4)	0.32
Partogram used correctly			
Yes	6 (3.8)	24 (7.6)	0.11

(Contd...)

Table 1: (Continued)

Variable	Cases n=158 (%)	Controls n=316 (%)	P-values
Mode of delivery			
Vaginal delivery	83 (52.5)	279 (88.3)	<0.001
Assisted vaginal delivery	7 (4.4)	7 (2.2)	
Cesarean section	68 (43.1)	30 (7.5)	
Sex of baby			
Male	88 (55.7)	170 (53.8)	0.70
Female	70 (44.3)	146 (46.2)	
Birth Weight			
<2500g	17 (10.8)	252 (79.7)	0.64
2500-3500g	111 (70.2)	225 (71.2)	
>3500g	30 (18.0)	65 (20.6)	
Diabetes history			
Yes	01 (0.63)	05 (1.6)	0.80
Hypertension history			
Yes	09 (5.7)	10 (3.2)	0.19
Renal disease			
Yes	01 (0.6)	02 (0.6)	1.00
Malaria history			
Yes	37 (23.4)	70 (22.2)	0.75
Anaemia			
Yes	11 (7.0)	23 (7.3)	0.90
Urinary tract infection (UTI)			
Yes	58 (36.7)	91 (30.1)	0.14
Trauma history in pregnancy			
Yes	04 (2.5)	01 (0.3)	0.02
HIV status			
Positive	23 (14.6)	29 (9.2)	0.07
Negative	135 (85.4)	287 (85.4)	

PROM: premature rupture of membranes; UTI: urinary tract infection;

Hospital in Kampala, Uganda. The modifiable risk factors were delivery by cesarean section, antepartum hemorrhage, malpresentation, and prolonged labor. Another risk factor was maternal age of more than 35 years and was referred to Mulago hospital.

Table 2: Demographic and medical factors of women associated with intrapartum stillbirths in women who delivered at Mulago hospital, Kampala

Variable	Cases n=158 (%)	Controls n= 316 (%)	Crude OR (95% CI)	P-values
Distance from Mulago				
5km or less	61 (38.6)	181 (57.3)	Ref	<0.001
More than 5km	97 (61.4)	135 (42.7)	1.70 (1.16 - 2.51)	
Referral to hospital				
Yes	110 (69.6)	128 (40.8)	2.83 (1.60 - 5.15)	<0.001
No	48 (30.4)	186 (59.2)	Ref	
Age of mothers(years)				
14-19	21 (13.3)	60 (19.0)	0.7 (0.4-1.2)	0.05
20-35	122 (77.2)	241 (76.3)	Ref	
>35	15 (9.5)	15 (4.7)	1.9 (0.9 - 4.1)	
Marital status				
Married	126 (79.8)	266 (84.2)	Ref	0.23
Single	32 (20.2)	50 (15.8)	1.53 (0.86 - 2.36)	
Educational level				
Primary or less	49 (31)	89 (28.1)	Ref	0.52
Secondary or higher	109 (69)	227 (71.8)	0.88 (0.58 - 1.34)	
Parity				
1	70 (44.3)	126 (38.9)	1.2 (0.8 -1.8)	0.61
2 - 4	69 (43.7)	150 (47.5)	Ref	
5+	19 (12.0)	40 (12.6)	1.03 (0.6 - 1.91)	
Antenatal attendance				
Less than 4 visits	109 (68.9)	190 (60.9)	Ref	<0.06
Four or more visits	49 (31.1)	126 (39.1)	0.68 (0.45 - 1.01)	
Antepartum hemorrhage				
Yes	16 (10.1)	8 (1.6)	7.0 (2.5 - 19.5)	0.001
No	142 (89.9)	311 (98.4)	Ref	
Multiple pregnancies				
Yes	01 (0.6)	8 (2.5)	4.0 (0.5 - 32.8)	0.15
No	157 (99.4)	307 (97.5)	Ref	

(Contd...)

Table 2: (Continued)

Variable	Cases n=158 (%)	Controls n= 316 (%)	Crude OR (95% CI)	P-values
Malpresentation				
Yes	22 (13.9)	10 (3.2)	4.9 (2.28 - 10.7)	<0.001
No	136 (86.1)	306 (96.8)	Ref	
Prolonged labor				
Yes	38 (24.1)	25 (7.9)	3.6 (2.1 - 6.4)	<0.001
No	120 (75.9)	291 (92.1)	Ref	
Preeclampsia/Eclampsia				
Yes	9 (5.9)	9 (2.8)	2.8 (0.8 - 5.2)	0.13
No	149 (94.1)	307 (97.2)	Ref	
PROM				
Yes	21 (13.3)	30 (9.5)	1.5 (0.8 - 2.6)	0.21
No	137 (86.7)	286 (90.5)	Ref	
Fetal heart rate monitoring				
Yes	12 (7.6)	24 (7.6)	1.00 (0.48 - 2.00)	0.99
No	146 (92.4)	292 (92.4)	Ref	
Partogram use				
Yes	12 (7.6)	33 (10.4)	1.00 (0.48 - 2.1)	0.32
No	146 (92.4)	283 (89.6)	Ref	
Partogram used correctly				
Yes	6 (3.8)	24 (7.6)	0.4 (0.19 - 1.2)	0.11
No	152 (96.2)	292 (92.4)	Ref	
Mode of delivery				
Vaginal delivery	83 (52.5)	279 (88.3)	Ref	<0.001
Assisted vaginal delivery	7 (4.4)	7 (2.2)	3.36 (1.14 - 9.85)	
cesarean section	68 (43.1)	30 (7.5)	7.61 (4.64 - 12.5)	
Sex				
Male	88 (55.7)	17 0(53.8)	Ref	0.70
Female	70 (44.3)	146 (46.2)	0.92 (0.63 - 1.35)	
Birth Weight				
<2500g	17 (10.8)	252 (79.7)	1.32 (0.70 - 2.5)	0.64

(Contd...)

Table 2: (*Continued*)

Variable	Cases	Controls	Crude OR	P-values
	n=158 (%)	n= 316 (%)	(95% CI)	
2500-3500g	111 (70.2)	225 (71.2)	Ref	
>3500g	30 (18.0)	65 (20.6)	0.90 (0.60 - 1.50)	
Diabetes history				
Yes	01 (0.63)	05 (1.6)	2.50 (0.29 - 21.7)	0.80
No	157 (99.37)	311 (98.4)	Ref	
Hypertension history				
Yes	09 (5.7)	10 (3.2)	1.80 (0.73 - 4.60)	0.19
No	149 (94.3)	306 (96.8)	Ref	
Renal disease				
Yes	01 (0.6)	02 (0.6)	1.20 (0.90 - 11.10)	1.00
No	157 (99.4)	314 (99.4)	Ref	
Malaria history				
Yes	37 (23.4)	70 (22.2)	1.10 (0.70 - 1.69)	0.75
No	121 (76.6)	246 (77.8)	Ref	
Anaemia				
Yes	11 (7.0)	23 (7.3))	0.90 (0.50 - 2.00)	0.90
No	147 (93.0)	293 (92.7)	Ref	
Urinary tract infection (UTI)				
Yes	58 (36.7)	91 (30.1)	1.3 (0.9 - 2.0)	0.14
No	100 (63.3)	221 (69.9)	Ref	
Trauma history				
Yes	04 (2.5)	01 (0.3)	8.10 (0.9-73.8)	0.02
No	154 (97.5)	315 (99.6)	Ref	
HIV status				
Positive	23 (14.6)	29 (9.2)	1.68 (0.94 - 3.00)	0.07
Negative	135 (85.4)	287 (85.4)	Ref	

PROM: premature rupture of membranes; UTI: OR: odds ratio; CI: confidence interval.

In this study, women who were referred from a lower health unit (Kisenyi HC IV, Naguru Hospital, Kawala HC III, Kitebi HC III, Komamboga HC III, Kiswa HC III, and Kisugu HC III) to Mulago hospital were two times at risk of an intrapartum stillbirth

Table 3: Predictors of intrapartum stillbirths in women delivering at Mulago hospital

Variable	Crude OR	Adjusted OR
	(95% CI)	(95% CI)
Referral to hospital		
Yes	2.8 (1.6 - 5.2)	2.4 (1.4 - 4.1)
No	Ref	Ref
Age of mothers(years)		
14-19	0.7 (0.4 -1.2)	0.5 (0.2 -1.2)
20-35	Ref	Ref
>35	1.9 (0.90 - 4.10)	2.9 (1.01- 8.4)
Antepartum hemorrhage		
Yes	7.0 (2.5-19.5)	6.2 (1.8 - 20.7)
No	Ref	Ref
Malpresentation		
Yes	4.9 (2.3 - 10.7)	5.5 (2.1 - 14.3)
No	Ref	Ref
Prolonged labor		
Yes	4.9 (2.3 - 10.7)	5.1 (2.4 - 10.8)
No	Ref	Ref
Mode of delivery		
Vaginal delivery	Ref	Ref
Assisted vaginal delivery	3.4 (1.1 - 9.9)	2.3 (0.9 - 11.1)
Caesarean section	7.6 (4.6 -12.5)	7.7 (4.3 - 13.8)
Trauma history		
Yes	8.1 (0.9 -73.8)	26 (1.2 - 574)
No	Ref	Ref
HIV status		
Positive	1.7 (0.9 - 3.0)	2.0 (0.9 - 4.4)
Negative	Ref	Ref

OR: odds ratio; CI: confidence interval.

compared to mothers who were not referred. This is similar to what was found in other studies.[9,20-22] This causes a delay for women to reach Mulago hospital which increases the risk of stillbirth. In addition, women who develop complications during labor are more likely to be referred and have an increased risk of delivering stillbirths.[8,23]

In our study, women who developed complications like prolonged labor, malpresentation, and antepartum hemorrhage were at an increased risk of delivering an intrapartum stillbirth. This is in agreement with what has been found in other studies where obstetric complications were

associated with an increased risk of stillbirth delivery.[21,24] Adequate maternal and fetal heart rate monitoring prevents the development of these intrapartum complications and hence reduces the risk of intrapartum stillbirth. Therefore, the correct use of a partogram and timely interventions can reduce the risk of these complications.[21,24,25] Although the effect of routine use of partograms on maternal and perinatal morbidity and mortality remains controversial.[26]

In this study, we found that women who delivered by cesarean section were eight times more likely to have a stillbirth delivery when compared to women who delivered vaginally. This could be due to the long-time interval between the decisions to conduct a cesarean section to the time it was performed. [27,28] In a busy labor ward like the one in Mulago hospital, there are shortages of doctors and anesthetists to perform the cesarean section. Sometimes the theatre space is inadequate when mothers who need to use the facility are too many. On some occasions, the theatre utilities are used up, and mothers are expected to buy them. These factors cause a delay for mothers to get cesarean sections and increase the risk of intrapartum stillbirth delivery.

In this study, women who were 35 years and above were three times more likely to deliver a stillborn baby when compared to mothers aged 20-35 years. This is similar to what has been found in a study by Waldenstrom et al. and Khalil et al.[29,30] Increased maternal age is associated with placental insufficiency and aging. One of the factors is sclerotic lesions in the myometrial arteries which increase as maternal age increases. This cause placental under perfusion and reduced supply of nutrients to the fetus[31]

In our study, we found that women with a trauma history were twelve times more likely to have a stillbirth when compared to women without a history of trauma. This is similar to what has been found in a study in Malawi.[32] Abdominal trauma can lead to fetal death if the women experience abruption placenta or uterine rupture as a result.[33]

Other factors reported in the literature such as distance from the hospital, education level, antenatal attendance, multiple pregnancies, partogram use, and birth weight were not associated with stillbirth delivery in this study.[9,10,17,22,24]

4.1 Limitations

This was a facility-based study that may not reflect the actual picture in the community. However, it has illustrated how the first, second, and third delays contribute to stillbirth delivery.

5. Conclusion and Global Health Implications

The predictors of intrapartum stillbirth in women delivering at Mulago hospital were: maternal age 35 years and above, a referral from a lower health unit, obstetric complications during labor, and delivery by cesarean section. Improvements in the referral systems from lower health units to hospitals, monitoring of labor using partogram and fetal heart rate, and shortening the time interval between decision and performing the cesarean section delivery may reduce intrapartum stillbirth in our community.

Key Messages

► Mothers who take longer to reach a hospital when referred from a lower health unit are at increased risk of stillbirth delivery.
► Mothers who develop a complication during labor that needs immediate treatment have an increased risk of stillbirth delivery.
► Timely referral and offering quality obstetric services will reduce intrapartum stillbirth in our community.

References

1. Moxon SG, Ruysen H, Kerber KJ, et al. Count every newborn; a measurement improvement roadmap for coverage data. *BMC Pregnancy Childbirth.* 2015;15 Suppl 2:S8. doi: 10.1186/1471-2393-15-S2-S8

2. Kiguli J, Namusoko S, Kerber K, Peterson S, Waiswa P. Weeping in silence: community experiences of stillbirths in rural eastern Uganda. *Glob Health Action.* 2015;8:24011. doi: 10.3402/gha.v8.24011

3. Lawn JE, Blencowe H, Oza S, et al. Every newborn: progress, priorities, and potential beyond survival. *Lancet.* 2014;384(9938):189-205. doi: 10.1016/S0140-6736(14)60496-7

4. Lawn JE, Blencowe H, Pattinson R, et al. Stillbirths: Where? When? Why? How to make the data count? *Lancet.* 2011;377(9775):1448-1463. doi: 10.1016/S0140-6736(10)62187-3

5. Liu L, Johnson HL, Cousens S, et al. Global, regional, and national causes of child mortality: an updated systematic analysis for 2010 with time trends since 2000. *Lancet.* 2012;379(9832):2151-2161. doi: 10.1016/S0140-6736(12)60560-1

6. Wall SN, Lee AC, Carlo W, et al. Reducing intrapartum-related neonatal deaths in low- and middle-income countries-what works? *Semin Perinatol.* 2010;34(6):395-407. doi: 10.1053/j.semperi.2010.09.009

7. Lawn JE, Blencowe H, Darmstadt GL, Bhutta ZA. Beyond newborn survival: the world you are born into determines your risk of disability-free survival. *Pediatr Res.* 2013;74 Suppl 1:1-3. doi: 10.1038/pr.2013.202

8. Pilkington H, Blondel B, Drewniak N, Zeitlin J. Where does distance matter? Distance to the closest maternity unit and risk of foetal and neonatal mortality in France. *Eur J Public Health.* 2014;24(6):905-910. doi: 10.1093/eurpub/ckt207

9. Mongbo V, Ouendo EM, Agueh V, et al. Factors associated with post-cesarean stillbirth in 12 hospitals in Benin: a cross-sectional. *Pan Afr Med J.* 2016;25:117. doi: 10.11604/pamj.2016.25.117.9827

10. Worede DT, Dagnew GW. Determinants of stillbirth in Felege-Hiwot comprehensive specialized referral hospital, North-west, Ethiopia, 2019. *BMC Res Notes.* 2019;12(1):579. doi: 10.1186/s13104-019-4621-5

11. Nahar S, Rahman A, Nasreen HE. Factors influencing stillbirth in bangladesh: a case-control study. *Paediatr Perinat Epidemiol.* 2013;27(2):158-164. doi: 10.1111/ppe.12026

12. Jammeh A, Vangen S, Sundby J. Stillbirths in rural hospitals in the gambia: a cross-sectional retrospective study. *Obstet Gynecol Int.* 2010;2010:186867. doi: 10.1155/2010/186867

13. Kiondo P, Wamuyu-Maina G, Wandabwa J, Bimenya GS, Tumwesigye NM, Okong P. The effects of vitamin C supplementation on pre-eclampsia in Mulago Hospital, Kampala, Uganda: a randomized placebo controlled clinical trial. *BMC Pregnancy Childbirth.* 2014;14:283. doi: 10.1186/1471-2393-14-283

14. Uganda Bureau of Statistcs and ICF. *Uganda Demographic and Health Survey 2016: Key Indicators Report.* Kampala, Uganda: UBOS, and Rockville, Maryland, USA: UBOS and ICF; 2017.

15. Uganda Bureau of Statistics. *Statistical Abstract for Kampala City.* Report prepared with support from Uganda Bureau of Statistics; 2019.

16. Schlesselman JJ. Sample size requirements in cohort and case-control studies of disease. *Am J Epidemiol.* 1974;99(6):381-384. doi: 10.1093/oxfordjournals.aje.a121625

17. Moyer CA, Kolars CK, Oppong SA, Bakari A, Bell A, Busingye P. Predictors of stillbirths and neonatal deaths in rural western Uganda. *Int J Gynaecol Obstet.* 2016;134(2):190-193. doi: 10.1016/j.ijgo.2016.01.009

18. Lauritsen JM, Bruus M. EpiData Command Processor tool. *The EpiData Association, Odense Denmark.* 2010, version 31; 2010.

19. StataCorp. Stata Statistical Software: Release 14. *College Station, TX: StataCorp LP;* 2015.

20. Nakimuli A, Mbalinda SN, Nabirye RC, et al. Still births, neonatal deaths and neonatal near miss cases attributable to severe obstetric complications: a prospective cohort study in two referral hospitals in Uganda. *BMC Pediatr.* 2015;15:44. doi: 10.1186/s12887-015-0362-3

21. Mmbaga BT, Lie RT, Olomi R, Mahande MJ, Olola O, Daltveit AK. Causes of perinatal death at a tertiary care hospital in Northern Tanzania 2000-2010: a registry based study. *BMC Pregnancy Childbirth.* 2012;12:139. doi: 10.1186/1471-2393-12-139

22. Millogo T, Ouedraogo GH, Baguiya A, Meda IB, Kouanda S, Sondo B. Factors associated with fresh stillbirths: A hospital-based, matched, case-control study in Burkina Faso. *Int J Gynaecol Obstet.* 2016;135 Suppl 1:S98-S102. doi: 10.1016/j.ijgo.2016.08.012

23. Gabrysch S, Campbell OM. Still too far to walk: literature review of the determinants of delivery service use. *BMC Pregnancy Childbirth.* 2009;9:34. doi: 10.1186/1471-2393-9-34

24. Kc A, Wrammert J, Ewald U, et al. Incidence of intrapartum stillbirth and associated risk factors in tertiary care setting of Nepal: a case-control study. *Reprod Health.* 2016;13(1):103. doi: 10.1186/s12978-016-0226-9

25. Mathai M. The partograph for the prevention of obstructed labor. *Clin Obstet Gynecol.* 2009;52(2):256-269. doi: 10.1097/GRF.0b013e3181a4f163

26. Lavender T, Hart A, Smyth RM. Effect of partogram use on outcomes for women in spontaneous labour at term. *Cochrane Database Sys Rev.* 2012; 8(8):CD005461. doi: 10.1002/14651858.CD005461.pub3

27. Hughes NJ, Namagembe I, Nakimuli A, et al. Decision-to-delivery interval of emergency cesarean section in Uganda: a retrospective cohort study. *BMC Pregnancy Childbirth.* 2020;20(1):324. doi: 10.1186/s12884-020-03010-x

28. Weiner E, Bar J, Fainstein N, et al. The effect of a program to shorten the decision-to-delivery interval for emergent cesarean section on maternal and neonatal outcome. *Am J Obstet Gynecol.* 2014;210(3):224. e1-6. doi: 10.1016/j.ajog.2014.01.007

29. Khalil A, Syngelaki A, Maiz N, Zinevich Y, Nicolaides KH. Maternal age and adverse pregnancy outcome: a cohort study. *Ultrasound Obstet Gynecol.* 2013;42(6):634-643. doi: 10.1002/uog.12494

30. Waldenstrom U, Cnattingius S, Norman M, Schytt E. Advanced maternal age and stillbirth risk in nulliparous and parous women. *Obstet Gynecol.* 2015;126(2):355-362. doi: 10.1097/AOG.0000000000000947

31. Flenady V, Wojcieszek AM, Middleton P, et al. Stillbirths: recall to action in high-income countries. *Lancet.* 2016;387(10019):691-702. doi: 10.1016/S0140-6736(15)01020-X

32. Rao N, Turner AN, Harrington B, Nampandeni P, Banda V, Norris A. Correlations between intimate partner violence and spontaneous abortion, stillbirth, and neonatal death in rural Malawi. *Int J Gynaecol Obstet.* 2017;138(1):74-78. doi: 10.1002/ijgo.12173

33. Tarvonen M, Ulander VM, Suvari L, Teramo K. [Minor trauma during pregnancy can cause severe fetomaternal hemorrhage]. *Duodecim.* 2011;127(16):1727-1731.