DETERMINANTS OF STILLBIRTHS IN NAIROBI, KENYA.

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ABSTRACT

Introduction: The World Health Organization (WHO) estimates that 75% of the 2.6 million stillbirths occur annually in Africa. This study aimed to evaluate stillbirth etiology and determine the association between antenatal care quality and utilization, and intrapartum care quality with stillbirths in Nairobi, Kenya.

Methodology: This was a case-control study conducted in four Kenyan tertiary hospitals between August 2018 and April 2019. Two hundred and fourteen (214) cases and 428 controls were enrolled and evaluated at more than 28 weeks of gestation. Data were collected via interviews and data abstraction from medical records. The outcome variable was the birth outcome (stillbirth vs. livebirth); the exposure variables were socio-demographic characteristics, medical & obstetric risk factors, antenatal care utilization and quality, and intrapartum care quality. The exposure variables were compared using the two-sample t-test for continuous variables, whereas the Chi-square or Fisher's exact tests were used for categorical variables.

Results: Mothers who did not receive antenatal care, made 1 or 2 ANC visits, received low quality antenatal & intrapartum care, and were referred, were likely to have a stillbirth. The prevalence of hypertensive disorders (P=<0.001), antepartum haemorrhage (P=<0.001), preterm delivery (P=<0.001), previous preterm birth (P=0.01), and diabetes mellitus (P=<0.001) was higher among those with stillbirth. There was no statistically significant difference between the prevalence of intrauterine growth restriction (IUGR), multiple gestation, congenital anomalies, previous stillbirth, previous abortion, HIV, anaemia amongst cases versus controls.

Conclusion: Our findings reiterate the significance of medical and obstetric complications, antenatal care quality and utilization, referral status, and intrapartum care associated with stillbirth in a Kenyan urban setting. Proper antepartum and intrapartum care, surveillance to identify and manage medical or obstetric conditions, and improved referral systems are recommended.

Keywords: stillbirth, obstetric complications, stillbirth etiology, antenatal care, intrapartum care

INTRODUCTION

The burden of stillbirth in Africa is high. This is in spite of the concerted efforts to improve pregnant women's antenatal and intrapartum care (1,2). A recent study in 4 African countries, for example, puts the stillbirth rate at 20-118/1000 live births with Kenya having a stillbirth rate of 38/1000 (3). Unlike HIV/AIDs, malaria, tuberculosis, and neonatal and infant mortality, stillbirths have largely not been considered a priority and were not included in the millennium and the sustainable development goals (4).

Stillbirth is of multifactorial determinants and has been associated with several risk factors, including obstetric complications, pre-existing medical conditions, sexually transmitted infections, foetal factors, and contextual socioeconomic factors that impede access to or delay care (5–12). For a medical

condition to be linked to stillbirth, it must be present before the stillbirth or be diagnosed while evaluating the stillbirth with evidence in the literature linking it as a possible cause (13).

Several interventions have been put place to prevent stillbirths and other adverse pregnancy outcomes. They include focused antenatal care, screening for and treating various obstetric and medical conditions, folic acid supplementation, and foetal heart rate monitoring during labour (6). For policymakers in low and middle-income countries (LMIC) and specifically Kenya to know which of these interventions will work and achieve the global stillbirth target of fewer than 12/1000 births (4), there is a need to understand the patient characteristics and etiological and risk factors within the local context. This work provides information to guide policy decisions and interventions aimed at women at risk of stillbirth.

METHODOLOGY

Study design and setting

This was an unpaired prospective case-control study where 214 stillbirth cases and 428 women with normal live births between 28- and 42-weeks' gestation were recruited. The study was conducted in 4 tertiary public hospitals in Nairobi County, Kenya. The sites' choice was based on their large delivery volumes, geographical location, and stillbirth burden.

Kenyatta National Hospital is the largest referral, teaching, and research hospital in Kenya, with an 1800 bed capacity, and handles about 12000-18000 deliveries annually. Pumwani Maternity Hospital is the largest maternity hospital in East and Central Africa and is the third busiest maternity hospital in Africa. It handles approximately 1300-15000 deliveries per year. Mama Lucy Kibaki Hospital, located in Eastlands, Nairobi, handles between 9000-12000 deliveries annually. Lastly, Mbagathi District Hospital is located on the edge of Kibera, Africa's largest slum, and handles between 6000-8000 deliveries per year.

Study participants

Mothers above the age of 14 years, able to give written consent and of any parity with a stillbirth or live birth, and met the inclusion criteria were included as cases and controls, respectively. Women whose pregnancy was terminated electively and those who delivered before arrival in the hospital were excluded. Gestational age was determined using the Last normal menstrual period (LNMP), fundal height measurement, and ultrasound scan. Where there was a discrepancy between these parameters, an early pregnancy scan was used.

Sample size calculation

The sample size was calculated as a function of the probability of exposure to various exposure variables, assuming a power of 80% to detect differences between cases and controls and a two-sided $\alpha=0.05$, using the PS Power and sample size calculator application*

Exposure variable	The hypothetical proportion of controls with exposure	The hypothetical proportion of cases with exposure	Minimum odds ratio to be detected.	Sample size cases	Sample size controls	Total sample size
ANC utilization(14)	58	40	0.5	108	216	324
Obstetric complications(15)	10	18	2	205	410	615
Partogram use(16,17)	37	22.7	0.5	132	264	396
foetal heart rate monitoring(16,17)	37	22.7	0.5	132	264	396

*PS Power and Sample Size Calculations, Version 3.0, January 2009. Copyright © 1997-2009 by William D. Dupont and Walton D. Plummer

Data collection

Enrollment of cases was done as soon as a diagnosis of stillbirth was made. The research assistants explained the purpose, nature, and the benefits and risks of the study to the mothers, and written consent was obtained from those who met the inclusion criteria. After obtaining consent, the clients' medical records were tagged then reviewed to abstract data on antenatal care (ANC) attendance and care, antepartum and intrapartum obstetric/medical conditions and their management, use of partograph, and foetal outcomes. Since this was a distressing time for the mothers, they were tracked from delivery to discharge and were interviewed at their convenience to obtain information on the social, demographic, economic, and past and current obstetric history.

The information obtained was entered into a structured questionnaire. Patients in the control group were recruited using systematic sampling from mothers who delivered a live birth on the same day a stillbirth occurred. The maternity delivery register was used as the sampling frame. Any woman with a stillbirth recruited into the study acted as the random starting point; after this, every third woman with a livebirth that met the inclusion criteria was recruited until the desired sample size was attained.

Study Variables

The outcome variable of interest was the birth outcome: stillbirth or live birth. The primary exposure variables of interest were socio-demographic factors, concomitant medical conditions, obstetric conditions, antenatal care (ANC) utilization, quality, intrapartum care, referral status, and intrapartum complications, and mode of delivery. Quality of ANC was assessed using individual surrogate indicators (antenatal profile tests, weight/blood pressure/urinalysis in each antenatal visit, utilization of early obstetric ultrasound completeness of antenatal records) and a codified indicator made up of 7 parameters (attending ANC; booking first ANC in the first trimester; making ≥4 antenatal visits; having all antenatal profile tests; having a complete antenatal record; having blood pressure and weight measured in all visits).

Quality control and statistical analysis

The study questionnaire was pretested and validated. Two research assistants with biomedical research experience were recruited and trained on confidentiality, interviewing, information retrieval, and filling the questionnaire. The principal researcher regularly monitored the collected data, which included checking of each filled questionnaire for completeness. Ten per cent of the completed questionnaires were manually checked against the primary data source to ensure data accuracy. Data analysis was done using STATA 13.1 (StataCorp. 2013. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP).

Sociodemographic, obstetric risk factors, medical characteristics, antenatal care, and intrapartum characteristics of cases and controls were compared using the two-sample t-test or Wilcoxon-Mann-Whitney test for continuous variables or the Pearson's Chi-square test for categorical variables, along with Fischer's exact test as appropriate. The association between the medical, obstetric risk factors, antenatal care, and intrapartum characteristics with stillbirth was assessed using univariate and multivariate analysis using logistic regression. Statistical significance was defined as a two-tailed p-value or less or equal to 0.05.

Ethics

Ethical approval was sought and obtained from the Kenyatta National Hospital/University of Nairobi (KNH/UON) Ethics and Research Committee (ERC) on 04th June 2018 (ERC reference number P40/01/2017). Administrative approval to conduct the study and access data was obtained from the study sites. Participation in the study was voluntary and written consent was obtained from all the study participants. For minors under 18 years of age, consent was obtained from the parents or guardians. The collected information was coded, kept confidential, and only be used to address the study objectives. The study participants were given bereavement counselling as per the hospital protocols.

RESULTS

During the study period, a total of 20,301 deliveries occurred in the 4 study sites. Out of these, 19,581 were live births, and 720 were stillbirths (231 fresh stillbirths, 489 macerated stillbirths), which translates to a stillbirth rate (SBR) 35/1000 total births. Out of the 720 stillbirths, 450 were screened, and 214 met the inclusion criteria and were included

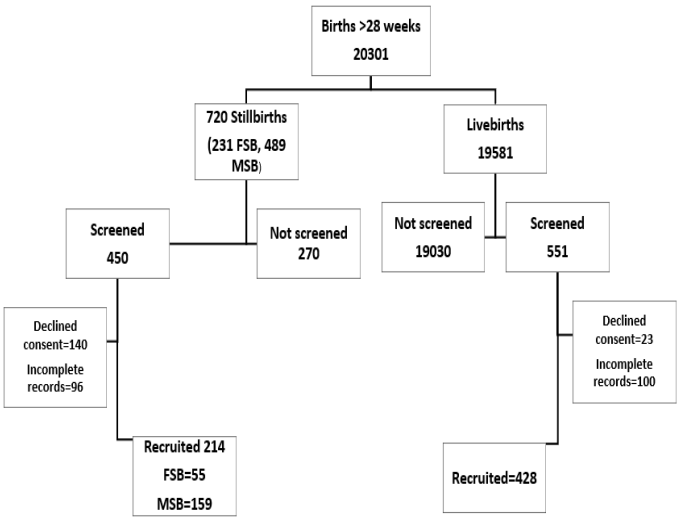

Figure 1: Study flow chart

in the analysis. Out of the 19581 live births, 551 were screened through systematic sampling, and 428 were included as controls in the final analysis (figure 1).

Baseline socio-demographic characteristics

The cases compared to controls were likely to be older (mean age 28 vs. 26 years, P=<0.001), unlikely to have had a university education (5.6 % vs. 13.1%, P=0.002), and their spouses were unlikely to have had a university education (6.8% vs. 13.6%, P=0.002). The two groups were similar concerning the women and spouses' employment status, marital status, alcohol intake, and cigarette smoking (Table 1).

Baseline obstetric and medical characteristics

Compared to controls, cases were likely to have a parity ≥4 (19.6% vs 12.6%, P=0.03); previous preterm birth (3.3% vs 0.7%, P=0.01); an obstetric complication (36% vs 8.6%, P=0.001); a medical disorder (21% VS 11.7%, P=0.001); an intrapartum complication (12. 2% vs 6.5%, P= 0.02); be referred from another facility (44.8% vs 28.2%, P=<0.001); have an early preterm delivery between 28-34 weeks (36.8% vs 6.8%, P=<0.001); have a late preterm birth between 34-37 weeks (20.2% vs 17.5%, P=0.003); have a breech delivery(4.5% vs 0.6%%, P=<0.001) and have a birth weight less than 2.5kg or more than

Table 1: Baseline sociodemographic characteristics of cases versus controls in 4 tertiary hospitals in Nairobi (n=642)

Variable	Cases (n=214)	Controls (n=428)	p-value
Maternal mean age	28(±6)	26(±5.6)	<0.001
Maternal age categories			
<20years	21 (9.8)	54 (12.6)	0.3
21-34years	160 (74.8)	321 (75.0)	
≥ 35 years	33 (15.4)	53 (12.4)	
Education			
None	23 (10.7)	47(11.4)	
Primary level	74 (34.6)	99 (23.1)	0.002
Secondary	105 (49.1)	226 (52.8)	
College/ university	12 (5.6)	56 (13.1)	
Employment status			
Salaried	33 (15.4)	62 (14.5)	
Self- employed	114 (53.3)	245 (57.2)	0.626
Unemployed	67 (31.3)	121 (28.3)	
Marital status			
Married	172 (80.4)	355 (82.9)	
Single	32 (15.0)	65 (15.2)	0.229
Divorced/ separated	8 (3.7)	7 (1.6)	
Widowed	2 (0.9)	1 (0.2)	
Spouse education			
None	26 (14.8)	71 (20.1)	
Primary	37 (21.0)	36 (10.2)	0.002
Secondary	101 (57.4)	199 (56.2)	
College/ university	12 (6.8)	48 (13.6)	
Spouse's Employment status			
Salaried	62 (35.4)	135 (39.8)	
Unemployed	20 (11.4)	22 (6.5)	0.13
Self-Employed	93 (53.1)	182 (53.7)	
Drinking Alcohol (%)	7 (3.3)	7 (1.6)	0.181
Cigarettes smoking (%)	-	3 (0.7)	0.220

Table 2: A comparison of the baseline obstetric and medical characteristics among cases versus controls in 4 tertiary hospitals in Nairobi (n=642)

Variable	Cases (n=214)	Controls (n=428)	P-value
Parity (Mean)	1.9(±0.7)	1.7(±0.07)	<0.001
Parity			
Primipara	55 (25.7)	164 (38.3)	0.02
2-3	117 (54.7)	208 (48.6)	0.26
>4	42 (19.6)	56(13.1)	0.03
Previous abortion	27(12.6)	52(12.1)	0.86
Previous preterm birth	7(3.3)	3(0.7)	0.01
Previous stillbirth	11(5.1)	11(2.6)	0.09
Obstetric complication in the current pregnancy	78 (36.4)	37 (8.6)	<0.001
A medical complication in the current pregnancy	45(21)	49 (11.7)	<0.001
Refferal	88(44.8)	100(28.2)	<0.001
Use of partogram (Yes)	116(54)	318(74.3)	<0.001
foetal heart rate monitoring (Yes)	20(9.3)	131(30.6)	<0.001
Intrapartum complication (yes)	26(12.2)	28(6.5)	0.02
Gestational age at delivery			
28-34weeks	71 (36.8)	25 (6.8)	<0.001
34-37 weeks	39 (20.2)	64 (17.5)	0.003
38-42 weeks	82 (42.4)	275 (75.4)	<0.001
>42 weeks	1 (0.5)	2 (0.3)	
Mode of delivery			
Svd	135(68.2)	244(68.7)	0.97
Cesarean section	50(22.3)	101(28.5)	0.62
Breech	9(4.5)	2(0.6)	0.001
Vacuum	4(2.0)	7(2)	0.96
Birth weight			
<2500g	100(48.1)	31(8.1)	0.001
2501-3999g	98(47.1)	336(87.3)	0.001
>4000g	10(8.8)	18(4.68)	0.04

4kg (P=<0.001 and 0.05 respectively). Controls were likely to be monitored with a partogram (74% vs 54%) and their fetuses foetal heart rate monitored as per schedule (30.6% vs 9.3%, P=<0.001). The two groups were similar with regard to previous abortion, previous stillbirth (Table 2).

Detailed comparison of the baseline obstetric and medical risk factors

Controls were likely to have obstetric and medical complications, and a probable cause was found in 76.6% of all stillbirths. In almost a quarter of the cases (23.4%) of the stillbirths, a cause could not be found, and these were classified as unexplained stillbirths. Among the obstetric complications, cases were likely to have antepartum haemorrhage (13.6 vs 1.9%, P=<0.001); hypertensive disorders (18.7 vs 2.3%, P=<0.001); PROM/PPROM (6 vs 1.2%, P=0.01); diabetes mellitus (5.6 vs 0.5%, P=0.001); spontaneous preterm labour (4.2 vs 0.7, P=0.002); and multiple gestation (3.3% vs 0.7%, P=0.01). The prevalence of HIV, anaemia, IUGR, congenital anomalies, and physical trauma was higher in cases; however, the differences were not statistically significant (Table 3).

Comparison of antenatal care utilization and quality of antenatal care

Cases were less likely to attend ANC (6.1% VS 2.1%, P=0.01), likely to make only 1 or 2 ANC visits (P=0.003 and 0.001 respectively). Also, they were more likely to have low quality antenatal care as measured by individual surrogate indicators (defined as not having the individual antenatal profile tests done): haemoglobin level test (37% vs. 26.2%, P=0.003); blood group testing (15 % vs. 6.1%, P=0.001); HIV testing (18 vs. 6.3%, P=0.001); VDRL (18 vs. 6.1%, P=0.001); and weight not measured during each antenatal visit (40.7% vs. 32.7%, P=0.047). There was no difference between the two groups about gestation age at ANC booking, blood pressure monitoring in each visit, urinalysis testing in each visit, early pregnancy obstetric scanning, and having complete antenatal records. As per the composite "quality antenatal care" indicator, only 5.6% of cases vs. 8.7% (P=0.17) had quality antenatal care (table 4).

Table 3: Descriptive analysis of the obstetric and medical complications among cases versus controls in 4 tertiary hospitals in Nairobi (n=642)

Variable	Cases N=214(%)	Controls N=428(%)	P-value
Obstetric complications			
Antepartum haemorrhage	29(13.6)	8(1.9)	
Placenta praevia	16(7.5)	4(0.9)	<0.001
Abruptio placenta	13(6.1)	4(0.9)	
Hypertensive disorders	40(18.7)	10(2.3)	
Pre-eclampsia without severe features	13(6.1)	3(0.7)	
Pre-eclampsia with severe features	14(6.5)	4(0.9)	<0.001
Eclampsia	13(6.1)	3(0.7)	1
Amniotic fluid disorders (PROM/PPROM)	13(6)	5(1.2)	0.01
Congenital anomalies	3(1.4)	3(0.7)	0.4
IUGR	4(1.9)	1(0.25)	0.06
Postdates	11(5.2)	46(10.7)	0.02
Spontaneous Preterm labour	9(4.2)	3(0.7	0.002
Multiple gestation	7(3.3)	3(0.7)	0.01
Rhesus isoimmunization	-	-	
Ruptured uterus	1	-	
NRFS	9(4.2)	15(3.6)	
Obstructed labour	2(1.)	5(1.2)	0.2
Cord prolapse	1(0.5)	-	0.8
Medical Complications			
HIV	7(3.3)	11(2.6)	0.45
Anaemia	25(11.7)	38(8.9)	0.27
Chronic hypertension	1(0.5	-	
GDM/DM	11(5.6)	2(0.5)	0.001
Sickle Cell Disease	-	-	
Trauma	6(2.8)	7(1.6)	0.3
Unexplained (No medical/obstetric complication)	50(23.4%)	274(64%)	
Total	214(100)	428(100)	

Table 4: A comparison of the baseline antenatal care characteristics of the cases versus controls in 4 tertiary hospitals in Nairobi county (n=642)

Variable	Cases (214)	Controls (428)	P-value
No ANC attendance	13 (6.1)	9(2.1)	0.01
ANC visits			
1 visit	19 (9.4)	18 (4.3)	0.003
2 visits	46 (22.9)	44 (10.5)	0.001
3 visits	50 (24.9)	112 (26.6)	0.29
4 visits	46 (22.9)	129 (30.6)	0.3
>4 visits	40 (19.9)	117 (27.8)	0.8
Gestational age at ANC booking			
<12 weeks	23 (12.1)	39 (9.5)	0.3
13-20 weeks	40 (21.1)	93 (22.6)	0.37
20-28weeks	116 (61.1)	247 (60.1)	0.46
>29 weeks	11 (5.8)	32 (7.8)	0.21
No antenatal profile testing	85 (39.7)	158(36.9)	0.50
Haemoglobin	80(37.4)	112(26.2)	0.003
Blood group	32(15)	26(6.1)	<0.001
VDRL for syphilis	38(18)	26(6.1)	<0.001
HIV testing	39(18.2)	27(6.3)	<0.001
Urinalysis at each visit (Yes)	36(16.8)	84(19.63)	0.39
No Blood pressure measurement at each visit	154 (28)	306 (28.5)	0.901
No Weight measurement at each visit	87 (40.7)	140(32.7)	0.047
Early Obstetric ultrasound	10(8.7)	21(13.5)	0.2
Complete ANC card/record	115 (53.7)	201 (47.0)	0.11
Quality antenatal care	12(5.6)	37(8.7)	0.17

DISCUSSION

In the present study, slightly older women without a college/university education and those with more than four pregnancies were more likely to have a stillbirth, similar to studies by Waldenstrom et al., 2015 (18) and Auger et al., 2012 (19). Advanced age causes general sclerotic changes in the body, including placental insufficiency that may result in placental underperfusion and impaired nutritional transfer to the fetus, leading to intrauterine foetal demise. Education is an essential social determinant of health as it influences the health-seeking behaviour of an individual. Multiparity is associated with the 'maternal depletion syndrome' with a high likelihood of an adverse pregnancy outcome, including stillbirth (20).

Patients with hypertensive disorders, antepartum haemorrhage, diabetes mellitus, multiple gestation, preterm labour, and premature rupture of membranes were likely to have a stillbirth; this is similar to other studies (15,21) that found hypertensive disorders as one of the leading causes of stillbirth. Furthermore, studies done in West Africa and Pakistan strongly associated late 3rd trimester per vaginal bleeding and intrapartum bleeding with stillbirths (22). Previa and abruptio may cause stillbirth due to impaired uteroplacental vascular flow by causing maternal vascular malperfusion and retroplacental haemorrhage, resulting in an inadequate supply of nutrients and oxygen to support the developing foetus' life and growth.

Term and preterm premature rupture of membranes, especially when prolonged, is likely to lead to chorioamnionitis, one of the leading infectious causes of stillbirth. Multiple pregnancies were also associated with stillbirth, also demonstrated in other studies (23,24). Multiple gestation is associated with increased risk of other pregnancy complications, foetal abnormalities, twin to twin transfusion, and intrauterine growth restriction resulting in stillbirth. Cases had a higher prevalence of HIV and anaemia compared to those who delivered a live birth. These findings are similar to the findings that HIV and anaemia significantly associate with stillbirth (25,26).

Antenatal care is one of the interventions that can be employed to screen women for risk factors and reduce preventable stillbirths (20, 27). In this study, 6.1% of cases compared to 2.1% of controls did not have antenatal care, while 59.8% vs. 42.6% did not attend four or more antenatal visits. These findings are similar to recent studies done in Gambia, Namibia, and Malaysia that revealed a strong association between lack of antenatal care with stillbirths (15, 16, 25). Gestational age at ANC booking did not show any association with stillbirth, probably because pregnant women in both groups started their ANC late.

Our study found a significant association between individual surrogate quality of ANC indicators and stillbirth. High-risk pregnancies are likely to be picked and managed in time to avert an adverse perinatal outcome with quality care. Early obstetric ultrasound scanning uptake was low, with 8.7% of those with stillbirth vs. 13.5% of those with a livebirth having the scan. Early obstetric scanning is necessary for accurate dating of pregnancy, diagnosis of foetal anomalies, and may also be used to predict those pregnancies that are likely to develop complications, e.g., pre-eclampsia (27,28), all of which are direct causes of stillbirth.

Foetuses are at the most significant risk of dying during labour and delivery, and 30-70% of all stillbirths occur intrapartum (29–31). In this study, 54% of mothers with a stillbirth vs. 74% of those with a live birth had their labour monitored using a partogram. In comparison, only 9.3% vs. 30.6% had foetal heart rate monitoring (FHRM) as per schedule, similar to a study done in 2016 by Ashish et al. in Nepal that found that only 50% of pregnancies were monitored using a partogram while only 25% had FHRM (11). The referred women who were more likely to get a stillbirth, similar to a study done in the Gambia that found referred patients had high odds of having a stillbirth (32). Addressing the quality of intrapartum care and the gaps in the referral system can significantly reduce intrapartum stillbirths.

Study strengths and Limitations

To the best of our knowledge, this is the first multisite study on stillbirths in Kenya that has interrogated the association between ANC utilization, quality

of antenatal care, quality of intrapartum care, and stillbirth. However, the study was not without limitations. Detailed placental studies and autopsies on the stillbirths were not done. Data from about 30-40% of deliveries at home was not captured, since it was a hospital-based study. Quality of care is multifactorial, and while surrogate indicators of quality of care were used, it is possible that the study did not capture the whole picture of the quality of care.

CONCLUSION

This study's findings reiterate the strong association between medical and obstetric complications, poor intrapartum care, and gaps in the referral system with stillbirth in a Kenyan urban setting. Others included lack of antenatal care, making less than four antenatal visits, and poor-quality antenatal care. Focus on these challenges can help reduce the risk of stillbirth.

RECOMMENDATIONS

Proper antepartum care and surveillance to identify and manage medical and obstetric conditions with the potential of causing stillbirth are recommended. Improving the utilization of 4 or more antenatal visits and antenatal care quality may reduce stillbirth risk. Improving the referral system and improvement of intrapartum care can reduce the risk of fresh stillbirth.

Abbreviations: KNH: Kenyatta national hospital; UON: University of Nairobi; ERC: Ethical and review committee; PHERT: Partnerships for Health Research and Training; PPROM: preterm premature rupture of membranes; PROM: term prelabour rupture of membranes; GDM: gestational diabetes mellitus; IUGR: Intrauterine growth restriction; HIV: Human immunodeficiency Virus; LnMP: Last normal menstrual period; ANC: antenatal care.

Competing interests: The authors have no conflict of interest to declare.

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