Maternal, Fetal and Service-Related Risk Factors for Stillbirths During Conflict Situation, Yemen, 2015-2016

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ABSTRACT

Background: Stillbirth is a silent traumatic canker, which is a major concern to individuals, health institutions countries worldwide and continues to be a major global problem responsible for nearly three million deaths each year. To estimate the stillbirth rate (SBR) and to identify the potential risk factors for stillbirth.

Subjects and Method: A community-based prospective cohort study was undertaken between August 2015 and December 2016 in which 980 pregnant women in Sana'a city of Yemen were identified. A multi-stage cluster sampling was used to select participants from community households. The independent variables were socio-demographic, prenatal and past obstetric, special habit, birth and fetal. The dependent variable was stillbirth. The data collection of this study used a questionnaire. Binomial regression together with generalized linear models, were employed in this study.

Results: The results identified that the stillbirth rate (SBR) was presently between 46.2 per 1000 and 45.2 per 1000 cases. The multivariable analysis identified teenage mothers aged < 20 years, with their first childbirth, had a (aOR= 3.70; 95% CI= 1.76 to 7.76; p<0.001) women with anemia (aOR = 2.23; 95% CI= 1.67 to 2.98; p<0.001), smoking snuff (aOR = 4.27; 95% CI= 1.17 to 15.55; p= 0.028), prolonged labor (> 24 hours) (aOR= 2.02; 95% CI= 1.38 to 2.96; p< 0.001), prolonged rupture of membranes (≥ 24 hours) (aOR= 2.22; 95% CI= 1.66 to 2.98; p<0.001), fetal mal-position (aOR= 4.60; 95% CI= 2.97 to 7.12; p<0.001), low birth weight (aOR= 14.90; 95% CI= 4.30 to 51.75; p<0.001) and fetal gestational age (in weeks) (aOR = 5.60; 95% CI= 2.52 to 12.41; p<0.001). These factors were associated with an increased risk of stillbirths.

Conclusion: This study is encouraging pregnant women to deliver at health facilities, providing better management of obstetrical complications, proper antenatal care, and prompt referral services are essential for the reduction of stillbirths in Yemen.

Keywords: stillbirth, risk factors, community-based study, cohort study, Sana'a city, Yemen

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BACKGROUND

Stillbirths represent a devastating outcome from pregnancy, placing a high burden on women, families, communities, and the health system. The global estimated average stillbirth (SB) rate in 2015 was 18.4 per 1000 births, with an estimated 2.6 million babies stillborn at 28 weeks or more (Flenady et al., 2011). Each day more than 7,300 babies are stillborn, which makes it the fifth cause of death on a global scale (Blencowe et al., 2016). About 98% of stillbirths that have been reported occur in low to middle-income countries (LMIC), where the registration of births is low. (Flenady et al., 2011). The SB rate in LMICs (which includes Yemen) was around 32:1000 births compared to < 5:1000 births in high-income countries (HIC) (Yakoob et al,. 2010).

The stillbirth rate is a sensitive marker of quality of care in pregnancy and childbirth, and the strength of the health system. There is a paucity of quality information on causes of stillbirth globally (Reinebrant et al., 2018)

A previous study reported an increase of 17% in SBs during the previous four years in Yemen (Banajeh, Al-Rabee et al. 2005) whereas a more recent report by the United Nations Population Fund (NFPA) revealed that about 14.8 million people have limited access to basic health care services (UNFPA January 2017). This conflict continues by exposing an estimated two million pregnant and lactating women at risk of death due to famine strikes.

Sadly, Yemen's health indicators are among the lowest in the region, and the reproductive health situation is one of the least favorable in the Arab world. Approximately 148 women per 100,000 live births die as a result of complications due to pregnancy and childbirth, making maternal death the leading cause of mortalities among women of the reproductive age in Yemen (YMoPHP and CSO, 2013). The lifetime risk of death of 1 in 60 compared with a ratio of 12 and the lifetime risk of 1 in 4900 in developed countries (WHO, 2015), and the under-five aged mortality rate was 42 mortalities per 1000 live births compared with a rate of 6 in developed countries (UNICEF 2015).

Accordingly, Yemen ranks 158 out of 193 countries and is one of the first Arabic countries having the highest stillbirth rate (SBR) of 23:1000 live births (WHO 2010). Further, only 45% of all deliveries are attended by skilled personnel, (YMoPHP & CSO. 2013) and only 30% of births occur in a health facility. In order to plan effective interventions, it is crucial to estimate the stillbirth rate (SBR) and determine the relative risk (OR) factors linked with stillbirth through undertaking a community-based study. The previous estimation of the SBR in Yemen was performed either from retrospective hospital-based studies by non-governmental organizations (NGO) or via household (domestic) surveys. However, many of these studies were limited with the selection of the sample or via recall bias. In addition, risk factors for stillbirths in Yemen were poorly recorded and not well understood. Therefore, this follow-up community-based study aims to estimate the SBR in Yemen and identify the potential risk of stillbirth in communities.

SUBJECTS AND METHOD

1. Study Design

As a prospective community-based cohort study, the study was conducted in Sana'a city, which is the capital of Yemen between 1st August 2015 and 31st December 2016.

2. Population and Sample

The study was conducted among pregnant women aged between 15 and 49 years, residing in the five districts of Sana'a city governorate, Yemen (Central Statistical Organization 2004). All pregnant women were followed up seven days post-delivery or seven days post termination of their pregnancies (spontaneous or induced abortion).

The sample used was 980 pregnant women in Sana'a city of Yemen were identified who filled out a questionnaire by fulfilling the inclusion criteria, which were all pregnant women (at any stage of pregnancy) reside in the study area between August 2015 to December 2016 in Sana'a city were included in this study. Women with severe illness, learning difficulties or psychiatric disorder were exclude in this study

3. Study Variables

The dependent variable was stillbirth in Sana'a City. The independent variables were socio-demographic, prenatal and past obstetric, special habit, birth, and fetal.

4. Operational Definition of Variables

Stillbirth: Stillbirth refers to fetal mortality or death. According to WHO, stillbirth is the birth of a baby with a birth weight of 500 g or more, 22 or more completed weeks of gestation, or a body length of 25 cm or more, who died before or during labor and birth.

5. Data Analysis

Data analysis was done through bivariate analysis by using binary logistic regression and multivariate using multiple logistic regression test with the help of SPSS software version 23.0 and Stata 12 (Stata-Corp, Texas 77845, USA) to estimate the adjusted OR and 95% confidence intervals (CIs) of the independent variables on stillbirth to determine the relationship between independent variables and dependent variables. A two-sided test with the level significance at alpha = 0.05 was used.

6. Research Ethics

This research has been complemented by consent, anonymity, and was confidential. Ethical approval was obtained from the Ministry of Public Health and Population of Yemen Ethical Review Board (G 7 /77). A consent form was presented and signed by each participant before conducting the interviews.

1. Characteristics of the mothers

More than three quarters (85.3%) of childbirths in the sample were attributed to women aged between 18 and 34 years. The mean age of the women at the initial age of recruitment was 26.0 years (SD 5.7). Stillbirths were more likely to be born to mothers aged less than 18 years and 35 years and older.

Only 3.3% of births were attributed to women aged less than 18 years. Among the births whose mothers received ANC, nearly half (48.2%) had attended the initial visit during the first trimester of pregnancy, whereas 31.6% waited until the third trimester of pregnancy to seek care. Additionally, 1.7% of women were orange snuff (smokeless tobacco) Smoker. Around half of the women (50.0%) were also Khat chewers, and 3% had a history of female genital mutilation. Other characteristics are shown in Table 1.

2. Bivariate analysis

There was a significant association between stillbirth and the mothers' age at birth. With regards to the age at birth, teenage mothers (aged < 18) and older women (aged 35 and above) were observed as having higher stillbirths (OR= 4.03; 95% CI= 1.15 to 10.81; p=0.006) and (OR= 4.01; 95% CI= 2.16 to 7.44; p<0.001), respectively (Table 2).

Women with a low Hb (< 12.3 g/dl) had a significantly increased risk of stillbirth (OR= 1.80; 95% CI= 1.01 to 3.21; p=0.046) in the univariate analysis compared to women with normal hemoglobin. Female genital

mutilation (OR= 2.82; 95% CI= 0.94 to 8.47, p= 0.065) did not appear to be a significant factor for stillbirths (Table 2).

The unadjusted analysis showed that mothers who used orange snuff (smokeless tobacco) had significantly increased the risk

of stillbirth (OR= 4.28; 95% CI= 1.48 to 12.39; p=0.007), whereas Khat chewers OR= 1.32; 95% CI= 0.73 to 2.36, p= 0.356) did not appear to be a significant factor for stillbirths (Table 2).

Table 1. Distribution of factors analyzed, of women experiencing stillbirth among 952 pregnant women in Sana'a City, Yemen (Aug 2015–Dec 2016)

Variables	Total births (n = 952)		Stillbirths (n = 44)	
	n	%	n	%
Maternal age at birth (years)	26.0± 5.70		28.0 ± 8.14	
< 18	31/952	3.3	4/31	12.9
18 – 34	812/952	85.3	26/812	3.2
35 or more	109/952	11.4	14/109	12.8
Time of 1st ANC visit [1] (n = 917)				
First trimester	442/917	48.2	16/422	3.6
Second trimester	185/917	20.2	10/185	5.4
Third trimester	290/917	31.6	18/290	6.2
Female genital mutilation				
Yes	24 (2.5)		3/24	12.5
No	928 (97.5)		41/928	4.4
Maternal anemia (g/dl) [2] (n=951)				
< 12.3 g/dl	282/951	29.7	19/282	6.7
≥ 12.3 g/dl	669/951	70.0	25/669	3.7
Orange snuff (smokeless tobacco) Smoker				
Yes	16/952	1.7	3/16	18.8
No	936/952	98.3	41/936	4.4
Khat chewer during this pregnancy				
Yes	476/952	50.0	25/476	5.3
No	476/952	50.0	19/476	4.0
Prolonged labor [3] (n = 906)				
Yes	327/906	36.1	22/327	6.7
No	579/906	63.9	16/579	2.8
Prolonged rupture of membranes (≥ 2 hours) (n = 754)				
Yes	13/106	12.3	13/106	12.3
No	18/648	2.8	18/648	2.8
Baby's position [4](n = 789)				
Normal position	760/789	96.3	26/760	3.4
Mal-position	29/789	3.7	7/29	24.1
Birth weight (g)[5](n = 947)				
Low birth weight (< 2500 g)	169/947	17.8	31/169	18.3
Normal birth weight (≥ 2500 g)	778/947	82.2	8/778	1.0
Gestation age (weeks)				
Preterm (< 37 weeks)	101/952	10.6	20/101	19.8
Term (≥ 37 weeks)	851/952	89.4	24/851	2.8

[1]There were 32 cases not on antenatal care visits, [2]One mother was not Hb tested, [3]In 46 cases it was unknown whether there was prolonged labour, [4]160 births not counted (caesarean section) and 3 cases were unknown [5] For 5 cases birth weight was not recorded.

The result for the birth factors indicated that the risks associated with prolonged labour (> 24 hours) (OR= 2.43;

95% CI= 1.30 to 4.57; p=0.006), births to women experiencing a longer duration of water breaks (≥ 24 hours) before births (OR=

4.41, 95% CI-=2.23 to 8.74; p<0.001) and the baby's abnormal presentation (OR= 8.18, 95% CI= 4.35 to 15.40; p<0.001) (Table 2).

The risk of stillbirth was 17.84 (OR= 17.84; 95% CI= 8.35 to 38.11; p<0.001) times greater among 'low birth weight' births

compared to normal birth weight babies. In addition, babies with a gestational age < 37 weeks at the time of birth experienced significantly higher stillbirths (OR= 6.31; 95% CI= 3.61 to 11.05; p<0.001) as compared to term births (Table 2).

Table 2. Risk factors for stillbirths (SB) in bivariate analysis in a cohort of 952 births, Sana'a City, Yemen, (Aug 2015 to Dec 2016)

Variable	[a]SB/ total (%)	Stillbirth rate per 1000	Unadjusted OR[b]	(95% CI)[c]	p
Maternal age at birth (Years) (n = 952)					
< 18	4/31 (12.9)	129.0	4.03	1.51-10.84	0.006
18 - 34	26/812 (3.2)	32.0	1.00		
≥ 35	14/109 (12.8)	128.4	4.01	2.16-7.44	<0.001
Maternal anemia (n = 951) [1]					
Hb < 12.3 g/dl	19/282 (6.7)	67.4	1.80	1.01-3.21	0.046
Hb ≥ 12.3 g/dl	25/669 (3.7)	37.4	1.00		
Female genital mutilation (n = 952)					
Yes	3/24 (12.5)	125	2.82	0.94-8.47	0.065
No	41/928 (4.4)	44.2	1.00		
Orange snuff (smokeless tobacco) smoker (n = 952)					
Yes	3/16 (18.8)	187.5	4.28	1.48-12.39	0.007
No	41/936 (4.4)	43.8	1.00		
Khat chewer (n = 952)					
Yes	25/476 (5.3)	52.5	1.32	0.73-2.36	0.356
No	476 (4.0)	39.9	1.00		
Prolonged labor (n = 906)[2]					
Yes	22/327 (6.7)	67.3	2.43	1.30-4.57	0.006
No	16/579 (2.8)	27.6	1.00		
Prolonged rupture of membranes (≥ 2 hours) (n = 754)[3]					
Yes	13/106 (12.3)	122.6	4.41	2.23-8.74	< 0.001
No	18/648 (2.8)	27.8	1.00		
Baby's position (n = 789)[4]					
Normal presentation	26/760 (3.4)	34.2		1.00	
Abnormal presentation	9/29 (31.0)	310.0	8.18	4.35-15.40	< 0.001
Birth weight (g) (n = 947)[5]					
Low birth weight (< 2500 g)	31/169 (18.3)	183.4	17.84	8.35-38.11	< 0.001
Normal birth weight (≥ 2500 g)	8/778 (1.0)	10.3		1.00	
Fetal gestational age (weeks) (n = 952)					
Preterm (< 37 weeks)	20/100 (18.0)	180.2	6.31	3.61-11.05	< 0.001
Term (≥ 37 weeks)	24/847 (2.9)	28.5		1.00	

[a]SB-Stillbirth, [b]OR- Relative risk, [c]CI- Confidence interval, [1]One mother was not Hb tested, [2] For 46 of mothers the prolonged labour was unknown, ,[3] There were 198 cases of unknown prolonged rupture of membranes, [4] Excluding 160 cases with caesarean and 3 cases with an unknown baby presentation., [5] Excludes 5 cases was not obtained birth weight.

3. Multivariable analysis: predictors of stillbirths

In the multivariate analysis, the risk associated with stillbirth was adjusted for socio-

demographic factors, prenatal and past obstetric factors, special habit factors, birth factors and fetal factors. Backward elimination of the variables, one by one, was carried out to obtain the final model. In this model, the variables observed to influence stillbirths of significance were the mother's age at birth, maternal anemia, prolonged labor, baby's position, newborn birth weight and fetal gestational age (Table 3).

Table 3. Risk factors for stillbirth in multivariable analysis in a cohort of 952 births, Sana'a City, Yemen (Aug 2015 to Dec 2016)

Variable	Unadjusted OR[b]	Adjusted OR[b]	Adjusted (95% CI[c])	p
Mother's age at birth (years)				
< 20 vs 20-34	3.88	3.70	1.76-7.76	<0.001
Maternal anemia (Hb g/dl)				
< 12.3 g/dl vs ≥ 12.3 g/dl	1.80	2.23	1.67-2.98	< 0.001
Orange snuff (smokeless tobacco)				
Yes vs No	4.28	4.27	1.17-15.55	0.028
Prolonged labor (> 24 hours)				
Yes vs No	2.43	2.02	1.38-2.96	<0.001
Prolonged rupture of membranes (≥ 24 hours)				
≥ 24 hours vs < 24 hours	4.42	2.22	1.66-2.98	<0.001
Baby's position				
Mal-position vs Normal position	9.07	4.60	2.97-7.12	<0.001
Newborn birth weight (g)				
*LBW vs Normal birth weight	17.84	14.90	4.30-51.75	<0.001
Fetal gestational age (weeks)				
Preterm vs. Term	7.02	5.60	2.52-12.41	<0.001

OR[b] - Relative Risk, 95% CI[c] – Confidence interval, *LBW-low birth weight
Deviance = 0.1393951, Pearson = 1.789529, BIC = -4107.343

DISCUSSION

The stillbirth rate (SBR) of 46.2 per 100 births (95% CI: 32.7-59.3) resulting in this study was higher compared to the data reported in a hospital-based study in 2005, (Banajeh, Al-Rabee et al. 2005) in which the data were collected from a sub-national household survey undertaken in six rural districts of four Yemeni provinces between 2008 and 2009 (Alosaimi et al., 2016). The result is also highser than the SBR in other Eastern Mediterranean Region (EMR) countries, such as Kuwait, (Al-Seaidan et al., 2016) Palestine (Assaf et al., 2009) and Pakistan (Ghazi et al., 2009).

The present study was a community-based study within households in Yemen, in which the burden of stillbirths was anticipated to be significantly higher at home than in the hospital setting. In Yemen, the majority of deliveries (70%) occur domestically at home. However, the majority of stillbirths in the present study highlighted that they tend to occur in health facilities compared to home birth (5.5% vs 3.3%). The hypothetical explanation for this suggests that coupled with the unavailability of specialized perinatal care units in many hospitals in Yemen, by the time these women arrived at the hospital, significant harm could have already occurred and rarely would the child be safe from a stillbirth.

This may also explain why the level of stillbirths in this study is different between home and hospital deliveries. Furthermore, essential public services, including healthcare, which is crucial in supporting mothers and childbirth, are on the verge of

total collapse in Yemen. Only 51 per cent of all health facilities are fully functional due to the ongoing conflict (war), and consequently face severe shortages in the supply of medicines, equipment, staff and other resources. This is further exacerbated by the high population growth rate of 4.4%, and very low health awareness at the community level, especially with respect to maternal and infant health care (YMoPHP & CSO. 2013). These structural challenges, in addition to the ongoing conflict in the country, also raises security problems leading to food shortages. This also impacts on the effectiveness and deliverability of antenatal and childbirth services in Sana'a city, and hence, play a significant role in the high rate of stillbirths. In the multivariable analysis of this study, the OR factors for stillbirths were attributed to young maternal age, anemia, smoking orange snuff, prolonged labor, prolonged rupture of membranes, mal-position of the baby at delivery, newborn birth weight and fetal gestational age. In the present study, babies born to women younger than 20 years of age had a significantly increased risk of stillbirth (aOR 3.70, 95% CI= 1.76 to 7.76; p<0.001) compared to those aged between 20 and 34 years. Similar findings have been reported in a study from Nigeria that examined this pattern which correlates stillbirths in a hospital setting where the young maternal age (<20 years) was discovered to increase the risk of stillbirth (OR 2.50; 95% CI: 1.22 to 5.14). in the multivariable analysis women with a low hemoglobin Hb level (< 12.3 g/dl) had an increased risk of stillbirth (aOR= 2.23; 95% CI: 1.67-2.98; <0.001) compared to the women with normal hemoglobin.

The proportion of anemia may be explained as follows; teenage pregnant women rarely receive an education, so there is a high possibility that they originate from a poor, underprivileged family. Accordingly, it is unlikely they will realise just how crucial it is to have regular ANC and blood tests for anemia. In addition, taking iron and folic acid supplements during pregnancy could help to prevent and treat anemia.

In Yemen, the most commonly used smokeless tobacco is orange snuff (or Shamma) made of powdered tobacco, lime, ash, black pepper, oils, and flavorings. In this study, the SBR was found to be significantly higher among smokeless tobacco (orange snuff) mothers compared to mothers who were non-users (188/1000 vs 44/1000) with the OR identified in the multivariable analysis of 4.27 (95% CI= 1.17 to 15.55; p=0.028). This finding is consistent with other studies finding that snuff has been linked to immune dysfunction, reproductive impacts such as stillbirth, preterm birth, and cardiovascular implications, among other adverse health outcomes (Willis, Popovech et al. 2012).

This study also found that women who had experienced prolonged labour (≥ 24 hours) and mal-position appeared to increase the risk of stillbirths (aOR= 2.02; 95% CI= 1.38 to 2.96; p<0.001) and (aOR= 4.60; 95% CI= 2.97 to 7.12; p <0.001), respectively. Several other studies showed similar findings (Jammeh et al., 2010, Yakoob et al., 2010, Laughon, Berghella et al. 2014).

The latency time between rupture of the membrane and birth was found to be a significant risk factor for stillbirth in this study (aOR= 2.22; 95% CI= 1.66 to 2.98; p<0.001). It is also likely that the reduction in amniotic fluid infections due to prolonged rupture of membranes causes a substantial impact on stillbirth rates. Perinatal outcomes due to preterm premature rupture of membranes (PPROM) include prematurity, neonatal sepsis, respiratory

distress syndrome (RDS), intraventricular hemorrhage (IVH), inducing the possible risk of foetal and neonatal death (Weissmann-Brenner et al., 2009).

In the current study, the multivariable analysis results indicated that low birth weight was the leading risk factor for stillbirth in which low birth weight babies were 15 times more likely to die in the perinatal period compared to babies weighing 2500 g or more (aOR=14.90; 95%CI= 4.30 to 51.75; p<0.001). Similarly, other studies have identified that low birth weight exposes the risk of stillbirth (Bhattacharya et al., 2010, Jammeh et al., 2010).

Another important variable influencing stillbirth was fetal gestational age, with the SBR reaching almost 180.2 per 1000 births among preterm babies. Premature birth at the gestation age, fewer than 37 weeks, was six times more likely to be associated with stillbirth compared to those who delivered at 37 weeks of gestation or more (aOR= 5.60; 95% CI: 2.52 to 12.41; p<0.001). These findings have also been reported in other studies (McClure et al., 2009). Concerning public health, stillbirth remains a significant problem in Yemen and in other LMIC. In this study, stillbirths were linked to teenage mothers (aged <20), women with a hemoglobin (Hb) level below 12.3 g/dl, smoking snuff, prolonged labor (> 24 hours), prolonged rupture of membranes (≥ 24 hours), baby's malposition, low birth weight (< 2500 g) and preterm gestational age (< 37 weeks).

Accordingly, the findings of this study lend further weight to the argument surrounding the need to establish a minimum age for moorage to be set at 18 years for women in accordance with the definition of a child in the convention on the Rights of the Child. Additionally, improving the maternal nutrition and provision of universal care during pregnancy and birth by trained personnel are crucial areas where priority should be directed towards, in addition to those who are most vulnerable, such as the underprivileged, dwelling in slum areas and those who are marginalized.

Furthermore, urgent action is necessary by the local authority and NGOs to control or regulate the smoking of snuff and cultivation of khat by creating awareness programs to improve the knowledge and understanding on the harmful effects among women and the younger generation. Also, urgent attention needs to be directed towards developing sustainable interventions to improve maternal and newborn health in Yemen. As such, the calling is for all parties, including the international community to direct resources in supporting the poor, marginalized and internally displaced communities, and to improve the primary health care system in the country, with particular focus on maternal and newborn health.

ACKNOWLEDGMENT

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