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Using routine data to examine factors associated with stillbirth in three tertiary maternity facilities in Kabul, Afghanistan

Zainab Ezadi[1*], Sayed Murtaza Sadat Hofiani[2] and Aliki Christou[3,4]

Abstract

Background Over one-third of the global stillbirth burden occurs in countries affected by conflict or a humanitarian crisis, including Afghanistan. Stillbirth rates in Afghanistan remained high in 2021 at over 26 per 1000 births. Stillbirths have devastating physical, psycho-social and economic impacts on women, families and healthcare providers. Data on the risks and causes of stillbirths are critical to target prevention measures and are currently lacking. This study aimed to use routine health facility data to examine the socio-demographic, maternal, fetal, and obstetric characteristics associated with stillbirth.

Methods This was a hospital-based case-control study of births at the maternity units of the three tertiary care referral hospitals in Kabul, Afghanistan between March-September 2021. Cases were defined as stillbirths that occurred at 22 weeks or later in pregnancy while live births occurring after each case were selected as controls. Multivariable logistic regression was used to explore factors associated with stillbirth after performing multiple imputation to impute missing data for independent variables.

Results A total of 497 cases (stillbirths) and 1069 controls (live births) were included in the analysis. Factors independently associated with stillbirth while adjusting for maternal age and baby's sex were: being referred from another facility which increased the odds of stillbirth by over three times (aOR 3.24; 95% CI 1.17, 8.85) compared to those who were not referred; being born extremely preterm (< 28 weeks) (aOR 13.98; 95% CI 7.44, 26.27), very preterm (28–31 weeks) (aOR 3.91; 95% CI 2.73, 5.62), and moderate to late preterm (32–36 weeks) (aOR 2.32; 95% CI 1.60, 3.37) compared to term babies; and being small-for-gestational age (aOR 1.70; 95% CI 1.10, 2.64) compared to those that were average size for gestational age. Placental abruption also increased the odds of stillbirth by two times (aOR 2.07; 95% CI 1.37–3.11).

Conclusions Improving the detection and management of preterm births, and small-for-gestational age babies through improvements in antenatal care attendance and quality will be important for future stillbirth prevention in Afghanistan. More research is needed to understand referral delays and contributing factors to increased risk among referrals. Strengthening routine data quality for stillbirths is imperative for improved understanding and prevention of stillbirths.

Keywords Stillbirth, Fetal death, Perinatal mortality, Risk factors, Routine data, Afghanistan, Case-control, Conflict, Humanitarian crises

*Correspondence:
Zainab Ezadi
zainabezadi11@gmail.com
Full list of author information is available at the end of the article

Plain English summary

A stillbirth refers to the death of a baby before or during childbirth, at or after 22 weeks of pregnancy. Stillbirth can have devastating mental, social, and economic impacts on women and families yet many of these deaths can be prevented. Understanding stillbirth and its risk factors is important to design public health interventions to prevent these deaths in the future. There is currently very little publicly available information to understand stillbirth risk factors in Afghanistan.

We used routine hospital data to examine factors associated with having a stillbirth among women that gave birth in three health facilities in urban Kabul, Afghanistan between March- September 2021. We compared the characteristics of stillborn babies (497 cases) to live born babies (1069 controls) to identify the factors that increased the odds of having a stillbirth. Our findings showed that being referred from another health facility; being born extremely preterm, very preterm, and moderate to late preterm, being small for gestational age and placental abruption increased the likelihood of stillbirth.

In Afghanistan, more research is needed to understand referral and what is contributing to increased stillbirths among women who are referred. It will also be important to improve the quality of antenatal care to ensure appropriate management of preterm and small babies. Further, strengthening the quality of data recorded at health facilities will be critical for more accurate understanding of why these deaths occur.

Background

The World Health Organization (WHO) defines a stillbirth as a baby born with no signs of life at or after specific threshold. For a late gestation stillbirth, this threshold is defined as 28 completed weeks of gestation or weighing ≥ 1000 g, and for early gestation stillbirth this is between 22 and 27 weeks' gestation or weighing ≥ 500 g [1, 2]. In 2021, there were an estimated 1.9 million babies stillborn at 28 weeks of pregnancy or later [3]. The global burden of stillbirths is actually much higher if early gestation stillbirths that occur between 22- and 27-weeks' of pregnancy were also included in these estimates [4].

Southern Asia and Sub-Saharan Africa account for the largest share of stillbirths worldwide accounting for 32% and 45% of the global stillbirth burden, respectively [5]. The risk of stillbirth in low-income countries is 7.6 times greater than in high-income countries—the average stillbirth rate is 22.7 stillbirths per 1000 total births compared to an average of 3 per 1000 births in high income nations [6]. Due to the lack of available and quality data from many low-income countries, national level stillbirth rates are based on modelling and often not informed by primary local data. Stillbirth data from conflict-affected fragile countries is even more scarce, yet the UN estimates that 38% of the global burden of stillbirths occurs in just 30 countries with a 2022 UN humanitarian response plan, including Afghanistan [3, 7]. In Afghanistan, the estimated stillbirth rate in 2015 was 27 per 1000 births and in 2021 remained at 26 per 1000 births indicating almost no change over a five year period [5, 8].

Stillbirths are preventable and the stillbirth rate (the number of stillbirths per 1000 births) reflects the standard of prenatal and intrapartum care received during pregnancy and childbirth [9]. The riskiest time for both the mother and baby is between the beginning of labor and birth, when 45% of stillbirths take place [10]. Stillbirths can have wide-ranging and devastating mental, social and economic impacts on women, families and healthcare providers and the importance of their prevention is increasingly gaining global recognition [11, 12].

Stillbirth risk is influenced by a wide range of maternal, fetal, social, and circumstantial factors and these can vary across different contexts and countries [8]. Risk factors that have been found to be associated with stillbirth in the literature, include socioeconomic factors such as low level of education and income [13]; maternal factors such as advanced maternal age (35 years or more) [14], behavioral risks such as smoking and drug use; and maternal conditions in pregnancy including obesity, hypertension and infections (HIV, syphilis and streptococcus B) [15, 16]. Women's obstetric history can also affect their risk, for example being primiparous or grand multiparous, having a previous history of stillbirth, as can complications of pregnancy such as preterm birth, placenta dysfunction, preeclampsia, and birth asphyxia [17]. Fetal factors such as being male sex, small-for-gestational age or multiple births have been linked to higher risks of stillbirth [18, 19]. Risk factors need to be understood for every context and country where there are differing socio-cultural norms and variations in the levels of access to and quality of care.

In Afghanistan, there is little data available on stillbirths that can inform their prevention. Only one study exists that examined risk factors for stillbirth in Afghanistan using household survey data from 2010 which identified that women were at increased risk if they resided in the central highlands, did not receive antenatal care, or received low quality antenatal care, and had antenatal complications including bleeding and infection in pregnancy [20]. To date, there are no studies that investigate risk factors for stillbirth in Afghanistan at the health facility level using routine facility data which can also give some information on clinical and obstetric risk factors that are not captured in household surveys. Given that the proportion of women giving birth at health facilities are increasing particularly in large cities, identifying the risk factors for stillbirth in health facility settings and developing strategies to reduce the number of preventable risk factors is critical.

In 2014, Afghanistan committed to the Every Newborn Action Plan (ENAP) goal to reduce stillbirths to 12 or less per 1000 births by 2030 [21]. To achieve this goal, an understanding is needed of the key reasons stillbirth occur to identify priority areas for prevention. Therefore, the purpose of this study was to use routine facility data to investigate socio-demographic, maternal, obstetric, and fetal risk factors associated with stillbirth.

Methods

The aim, design and setting of the study

This study aimed to examine the risk factors for stillbirths in three large referral maternity hospitals in the capital Kabul in Afghanistan. This was a retrospective hospital-based case-control study conducted on births that occurred between March 2021 and September 2021 at the maternity units of the three tertiary care referral hospitals in Kabul, Afghanistan. These tertiary care centers in Kabul are all public health facilities and each have between 8,000 and 25,000 births per year.

Study population and sampling

The study included women who gave birth at the three tertiary care referral hospitals in Kabul between March-September 2021. Cases were stillbirths born at 22 weeks gestation or later to women that gave birth in the study hospitals. The definition of stillbirth applied in this study was a baby born with no sign of life at 22 or more completed weeks of gestation, which is in accordance with ICD-11 (International Classification of Diseases 11th revision) and the WHO definitions including both early and late gestation fetal deaths [1].

All stillbirth cases that occurred in the study period were identified from the hospital maternity registers. For every case, one to three consecutive live births to women in the maternity registers following the case served as unmatched controls. For each case and control selected from the register, we identified and retrieved the woman's medical file from the medical records department to obtain complete information for data extraction. One health facility had a separate record book for high-risk pregnancies and births that was also referenced data source.

The criteria for inclusion we applied were: (i) The pregnant woman had given birth at the one of the three included study facilities; (ii) The gestational age was 22 weeks or more at delivery; and (iii) The outcome of the birth was a stillbirth or a live birth. We excluded any file where we could not clearly determine if the baby was alive or had died ($n=6$).(Supplementary Appendix, Figure A1).

Data collection

A customized data collection form was developed based on the WHO recommended minimum perinatal data set and used to collect data from the selected cases and controls [1]. Files of cases and their corresponding controls that met the inclusion criteria were sorted following consecutive sampling.

Three data collectors with backgrounds in midwifery extracted the data from the medical files into the data extraction form. The midwives were trained and oriented by the first author on the purpose of the study, the criteria for selecting the cases and controls, and completing the data extract form based on the patient's file. The data collection form consisted of three sections; socio-demographic characteristics; woman's reproductive-obstetrical information; and fetal factors. At the end of each day, the first author reviewed and verified the completed data extraction forms and debriefed with the data collectors to resolve and queries.

Study variables

The main outcome variables were stillbirth and live birth. Stillbirths were identified based on the clinical outcome of the baby from the maternity register book which was recorded as either intrauterine fetal death (IUFD), stillbirth, death, absent fetal heart rate, or Apgar score and was confirmed from information in the corresponding medical files of the woman.

Independent variables included those known to have a relationship to the outcome (stillbirth) according to the literature [8] and what was available in the medical files in the study facilities. These included maternal age, referral status, level of education, occupation, place of residence, parity, gestational age, number of antenatal care visits, gestational age at first ANC visit, number of babies, weight of baby, history of stillbirth, and maternal conditions in pregnancy and obstetric complications. These data were all obtained from the women's medical files.

Statistical analysis

The data were analysed using SPSS version 21 for the descriptive statistics while the multiple imputation and the logistic regression modelling were performed in STATA SE version 14 [22, 23].

We recoded continuous variables such as maternal age, gestational age, parity, number of antenatal care visits, gestational age at antenatal care visit, and birth weight into categories. We created a new variable for birthweight which took into account gestational age to provide a measure of appropriateness of weight according to gestational age (see Table A1, Supplementary Appendix for categorisation of variables).

Missing data

Independent variables with a yes/no response options which had missing data for five or fewer observations were recoded to a No response (e.g. employment, admission status, anemia, premature rupture of membranes (PROM), diabetes, malpresentation, placental abruption, placenta previa, eclampsia, and pre-eclampsia). We excluded 12 observations when there were missing data for other independent variables with response options requiring knowledge of information that was not available (e.g. education, residence, pregnancy type and gestational age).

For the independent variables with larger proportions of missing data (maternal age, sex, parity, gestational age at first ANC, number of ANC visits, place of ANC, history of stillbirth, history of abortion, history of infant or child death, birthweight and birth size) we used multiple imputation using chained equations to impute the data (refer to Supplementary Appendix Table A1 for details of handling of missing data). Data imputation was done a total of 10 times.

Descriptive statistics were used to summarize the characteristics of women who had a stillbirth compared to those who had a live birth which we reported as frequencies and percentages. Chi-square tests were used to explore the association between the categorical variables (not reported). Binary logistic regression was performed to examine the association between the outcome variable and each independent variable to calculate unadjusted odds ratios with 95% confidence intervals. Independent variables that were statistically significant at the $p<0.25$ in the bivariate analysis were retained and included in the multivariable logistic regression model. We decided a priori to keep maternal age and sex of the baby in the model to control for this as male sex is a known biological risk factor for stillbirth [18] and either very young [24] or advanced maternal age [25] is also an important risk factor.

A multivariable logistic regression analysis was used to identify socio-demographic, fetal and obstetrical risk factors independently associated with the outcome and to calculate adjusted odds ratios with 95% confidence intervals. We did not include birthweight in the model as this was highly correlated with gestational age; instead, we included birth size and gestational age. All independent variables that were significant at the $p<0.25$ level in the bivariate analyses were entered into the multivariable model using the imputed dataset. Employment could not be included in either the bivariate or multivariable analyses due to zero cells in the sample of stillbirths. We then fit the multivariable model and removed independent variables one at a time starting with the variable that had the highest p-value. The final model included only those independent variables that were not significant at the 5% level and the variables we decided a priori to retain. We also fit the model without sex and maternal age as a comparison to assess if retaining these variables had any effect on the model. We checked variance inflations factors to identify any multi-collinearity between independent variables. The multivariable models were also fit on complete cases only to examine whether there was any difference in the results after imputation.

Ethical considerations

To protect patient confidentiality, all individual patient data was anonymized by removing identifying information during data collection and data analysis. The identity of the health facilities was also protected through the use of health facility numbers.

Results

The final sample included 497 stillbirths and 1069 live births across the three health facilities during the study period (Figure A1, Supplementary Appendix). The majority of stillbirths identified occurred in facility 2 ($n=275$) followed by facility 3 ($n=155$) then facility 1 ($n=67$) (Table 1).

The socio-demographic, maternal and obstetric characteristics of cases and controls are summarized in Table 1. Several independent variables had a high proportion of missing data; 20% of both cases and controls were missing data on obstetric history variables such as parity and history of stillbirth, while around 30% of cases and controls were missing data on antenatal care, and 21% were missing data on sex of the baby and birthweight (Table 1 and Table A1, Supplementary appendix).

Socio-demographic, maternal, fetal and obstetric characteristics

Around 85% ($n=1334/1566$) of the sample were from urban areas in Kabul and most women were illiterate

Table 1 Characteristics of stillbirths and live births in three tertiary health facilities, Kabul Afghanistan 2021 (*n* = 1566)

Variable	**Live birth (*n* = 1069)**		**Stillbirth (*n* = 497)**		**Total births**	
***N* = 1566**	***n***	**%**	***n***	**%**	***N***	**%**
Health facility						
Facility 1	245	22.92	67	13.48	312	19.92
Facility 2	306	28.62	275	55.33	581	37.10
Facility 3	518	48.46	155	31.19	673	42.98
Maternal characteristics						
Residence						
Urban	903	84.47	431	86.72	1334	85.19
Rural	166	15.53	66	13.28	232	14.81
Education						
No education or primary	1026	95.98	492	97.79	1512	96.55
Secondary or higher	43	4.02	11	2.21	54	3.45
Employment						
Employed	5	0.47	0	0	5	0.32
Homemaker	1064	99.53	497	100.00	1561	99.68
Maternal age (years)						
< 20	32	2.99	23	4.63	55	3.51
20–29	489	44.90	201	40.44	681	43.49
30–34	262	24.51	128	25.75	390	24.90
35+	262	24.51	138	27.77	400	26.47
Missing	33	3.09	7	1.41	40	2.55
Obstetric history						
Parity						
0–1	179	16.74	100	20.12	279	17.82
2–4	336	31.43	154	31.19	491	31.35
5+	271	25.35	178	35.81	449	28.67
Missing	283	23.97	58	11.86	303	20.05
History of stillbirth						
Yes (1 or more)	30	2.81	33	6.64	63	4.02
No	787	73.62	406	81.69	1193	76.10
Missing	252	23.57	58	11.67	310	19.80
History of abortion						
Yes (1 or more)	189	17.68	107	21.53	296	18.90
No	639	59.78	328	66.80	971	62.01
Missing	241	22.54	54	11.04	263	17.41
History of infant/child death						
Yes (1 or more)	91	8.51	28	5.63	119	7.60
No	735	68.76	411	82.70	1146	73.18
Missing	243	22.73	58	11.67	301	1922
Pregnancy care and referral						
Number of ANC visits						
0–1	103	9.64	53	10.66	156	9.96

Table 1 (continued)

Variable	Live birth (*n* = 1069)		Stillbirth (*n* = 497)		Total births	
N = 1566	*n*	%	*n*	%	*N*	%
2–3	297	27.78	231	46.48	528	33.72
4+	264	24.70	108	21.73	372	23.75
Missing	405	37.89	105	21.13	510	32.57
Gestational age at first ANC						
< 12 weeks	300	28.06	202	40.64	502	32.06
12 + weeks	306	28.62	161	32.39	467	29.82
Missing	463	43.31	134	26.96	597	38.12
Place of ANC						
Primary	400	37.42	258	51.91	658	42.02
Secondary	204	19.08	106	21.33	106	19.80
Missing	465	41.19	133	26.76	598	38.19
Admission status						
Referred	8	0.75	16	3.22	24	1.53
Not referred	1061	99.25	481	96.78	1542	98.47
Fetal factors						
Sex of baby						
Female	367	34.33	190	38.23	557	35.57
Male	413	38.63	240	48.29	653	41.70
Missing	289	27.03	67	13.48	356	22.73
Pregnancy type						
Singleton	1038	97.10	491	98.79	1529	97.64
Multiple pregnancy	31	2.90	6	1.21	37	2.36
Gestational age (weeks)						
Extremely preterm (< 28 weeks)	19	1.78	105	21.13	124	7.92
Very preterm (28–31 weeks)	117	10.94	135	27.16	252	16.09
Moderate to late preterm (32–36 weeks)	127	11.88	68	13.68	195	12.45
Term (37–40 weeks)	789	73.81	185	37.22	974	62.20
Post-term (41 + weeks	17	1.59	4	0.80	21	1.34
Birthweight (grams)						
< 1500 g	11	1.03	124	24.95	135	8.62
1500–1999 g	14	1.31	48	9.66	62	3.96
2000–2499 g	50	4.68	62	12.47	112	7.15
2500–3999 g	687	64.27	192	38.63	879	56.13
+ 4000 g	37	3.45	9	1.81	46	2.94
Missing	270	25.26	62	12.47	332	21.20
Birth size						
Small for gestational age	27	2.53	147	29.58	174	11.11

Table 1 (continued)

Variable	**Live birth (*n* = 1069)**		**Stillbirth (*n* = 497)**		**Total births**	
***N* = 1566**	***n***	**%**	***n***	**%**	***N***	**%**
Normal for gestational age	703	65.76	246	49.50	949	60.60
Large for gestational age	69	6.45	42	8.45	111	7.09
Missing	270	25.26	62	12.47	332	21.20
Obstetric factors						
Presentation of baby						
Vertex	989	92.62	482	96.98	1471	93.13
Malpresentation (breech, transverse or face)	80	7.14	15	3.02	95	6.07
Maternal or fetal conditions						
Anaemia (in current pregnancy)						
Yes	393	36.76	182	36.62	575	36.72
No	676	63.24	315	63.38	991	63.28
Chronic hypertension						
Yes	282	26.38	69	13.88	351	22.41
No	787	73.62	420	86.12	1215	77.59
Diabetes						
Yes	82	7.67	35	7.04	117	7.47
No	987	92.33	462	92.96	1449	92.53
Pre-eclampsia						
Yes	221	20.67	86	17.30	307	19.60
No	848	79.33	411	82.70	1259	80.40
Eclampsia						
Yes	70	6.55	29	5.84	99	6.32
No	999	93.45	468	94.16	1467	93.68
Placenta previa						
Yes	34	3.18	21	4.23	55	3.51
No	1035	96.82	476	95.77	1511	96.49
Placental abruption						
Yes	60	5.61	71	14.29	131	8.37
No	1009	94.39	426	85.71	1435	91.63
PROM						
Yes	137	12.82	24	4.83	161	10.28
No	932	87.18	473	95.17	1405	89.72
Acute fetal distress						
Yes	63	5.89	13	2.62	76	4.85
No	1006	94.11	484	97.38	1490	95.15
Oligohydramnios						
Yes	96	8.98	35	7.04	131	8.37
No	973	91.02	462	92.96	1435	91.63

ANC, antenatal care; GA, gestational age; PROM, premature rupture of membranes or had only primary education (96.50%; $n=1512/1566$). Almost all women were homemakers and not employed (99.68%; $n=1561/1566$). Over 40% of women were aged between 20 and 29 years (43.49%; $n=681/1566$) while over a quarter were 35 years or older (26.47%; $n=400/1566$) (Table 1).

Almost one third (28.67%; $n=449/1566$) of mothers had five or more pregnancies prior to the index pregnancy, 4% ($n=63/1566$) had a previous stillbirth, almost 8% ($n=119/1566$) experienced a previous infant or child death and one-fifth had a previous abortion (Table 1).

Nearly one-quarter (23.75%; $n=372/1566$) of women had received four or more ANC visits during their index pregnancy while one-third (33.72%; $n=523/1566$) had received between 2 and 3 visits. Only one-third (32.06%; $n=502/1566$) had received ANC in the first trimester of pregnancy. Multiple pregnancies comprised around 2.36% ($n=37$) of the sample (Table 1).

Over one-third (36.46%) of births were either extremely preterm, very preterm or moderate to late preterm with less than two thirds (62.20%) being born at term. Less than two-thirds of the sample (59.07%) had average birthweight or higher with almost one fifth (19.73%) being low birth weight and 11% were small in weight for their gestational age. Breech or transverse lie births comprised around 6% ($n=95/1566$) of births (Table 1).

Over one-third of mothers had anemia during their pregnancy (36.72%; $n=575/1566$), and over one-fifth had chronic hypertension (22.41%; $n=351/1566$). Preeclampsia was observed among almost 20% of women ($n=307/1566$), while placental abruption and PROM occurred in around 8% ($n=131$) and 10% ($n=161$) of women respectively (Table 1).

Bivariate and multivariable logistic regression analysis

In the bivariate analysis admission/referral status, history of stillbirth or previous death of an infant/child, number of antenatal care visits, multiple pregnancy, gestational age, birthweight and birth size, presentation, hypertension, placental abruption, PROM, and acute fetal distress were all significantly associated with stillbirth (Table 2).

In the multivariable model (Table 2), which adjusted for confounders and maternal age and fetal sex, the factors that were independently associated with stillbirth were admission/referral status, gestational age, birth size, presentation, multiple pregnancy, hypertension, preeclampsia, placental abruption, and PROM. Women that were referred had over three times greater odds of having a stillbirth (OR: 3.21, 95% CI: 1.12, 9.19) compared to non-referred women. Extremely preterm babies had over 13 times the odds of being stillborn (OR: 13.98; 95% CI: 7.44, 26.27), followed by very preterm babies with almost four times the odds (OR: 3.91, 95% CI: 2.73,5.62) and moderate to late preterm with just below two times the odds of stillbirth (OR: 1.60, 3.37)) compared to term babies. Babies that were small in weight for their gestational age had almost twice the odds of being stillborn (OR: 1.70, 95% CI: 1.10, 2.64) compared to those that were average size for gestational age. Fetal factors associated with stillbirth included being breech or transverse presentation and multiple pregnancies both of which had almost a third lower odds of stillbirth compared with vertex presentation and singletons.

Women with pre-eclampsia and PROM also had a significantly lower odds of stillbirth compared to those who did not have these conditions. Whereas women with placental abruption had two times greater odds of stillbirth (OR: 2.05; 95% CI: 1.36, 3.10) compared to women without placental abruption. History of stillbirth, gestational age at ANC, number of ANC visits, place of ANC, and acute fetal distress were no longer significantly associated with stillbirth in the multivariable model after controlling for all other factors.

The multivariable model without adjustment for maternal age and sex (Model 2; Table 2) showed no difference in the factors that were independently associated with stillbirth when these variables were excluded.

Complete case analysis

The multivariable model fit on complete cases showed similar results to the model fit on the imputed data set with the exception that number of ANC visits remained significantly associated with the outcome (Table A2, Supplementary Appendix).

Discussion

This study is one of the first to examine stillbirths using routine health facility data to understand and identify key risk factors in three of the largest tertiary care centers in Kabul, Afghanistan to inform future stillbirth prevention strategies. There is substantial gap in evidence on stillbirth from fragile and conflict-affected settings overall, and our study makes an important contribution to this literature and demonstrates the potential to use and analyze routine data to fill this gap. Our analysis identified several factors that were independently associated with increased odds of stillbirth among women giving birth in three health facilities in Kabul including being born preterm and small-for-gestational age, being referred from another facility, and placental abruption. Several factors were significantly associated with a reduced odds of stillbirth including women with a history of hypertension, pre-eclampsia or PROM, and multiple births.

We found a very strong statistically significant association between gestational age and stillbirth particularly among extremely preterm babies, very preterm and

Table 2 Bivariate and multivariable logistic regression of factors associated with stillbirth in three tertiary health facilities in Kabul, Afghanistan, 2021

	Bivariate			**Multivariable model 1 (adjusted for sex and maternal age)**			**Multivariable model 2 (without adjusting for sex and maternal age)**		
Independent variable	**uOR**	**95% CI**	***p*-value**	**aOR**	**95% CI**	***p*-value**	**aOR**	**95% CI**	***p*-value**
***N* = 1566**									
Maternal characteristics									
Residence									
Urban	1		0.240						
Rural	0.83	0.61, 1.13							
Education									
No education or primary	1.85	0.95, 3.62	0.058			NS			NS
Secondary or higher	1								
Maternal age (years)^									
< 20	1.68	0.97, 2.93	0.097	1.60	0.85, 3.02	0.09			
20–29	1			1					
30–34	1.20	0.92, 1.57		1.20	0.88, 1.62				
35+	1.30	0.99, 1.68		1.43	1.06,1.94				
Admission status									
Referred	4.41	1.88, 10.38	0.0004	3.24	1.17, 8.95	0.023	3.27	1.19,9.03	0.022
Not referred	1						1		
Obstetric history									
Parity^									
0–1	1.24	0.91, 1.69	0.073			NS			NS
2–4	1								
5+	1.34	1.04, 1.71							
History of stillbirth^									
Yes (1 or more)	1.89	1.20, 2.99	0.006			NS			NS
No	1								
History of abortion ^									
Yes (1 or more)	1.07	0.82 ,1.39	0.618						
No	1								
History of infant/child death^									
Yes (1 or more)	0.58	0.38, 0.88	0.011			NS			NS
No	1								
Pregnancy care and referral									
Number of ANC visits^									
0–1	1.54	1.04, 2.28	0.006			NS			NS
2–3	1.73	1.32, 2.26							
4+	1								
Gestational age at first ANC^									
< 12 weeks	1.25	0.98, 1.59	0.078			NS			NS
12 + weeks	1								
Place of ANC^									
Primary health facility	0.84	0.62, 1.13	0.233						
Secondary health facility	1								
Admission status									
Referred	4.41	1.88, 10.38	0.0004	3.21	1.12, 9.19	< 0.0001	3.24	1.17, 8.91	0.023
Not referred	1						1		
Fetal factors									

Table 2 (continued)

Independent variable	Bivariate			Multivariable model 1 (adjusted for sex and maternal age)			Multivariable model 2 (without adjusting for sex and maternal age)		
	uOR	95% CI	*p*-value	aOR	95% CI	*p*-value	aOR	95% CI	*p*-value
***N* = 1566**									
Sex of baby^									
Female	1			1					
Male	1.07	0.83, 1.37	0.592	0.90	0.67, 1.20	0.455			
Pregnancy type									
Singleton	1		0.029	1		0.026			NS
Multiple	0.41	0.17, 0.99		0.31	0.11, 0.87				
Gestational age (weeks)									
Extremely preterm (< 28 weeks)	23.57	14.1, 39.4	< 0.0001	13.98	7.44, 26.27	< 0.0001	13.88	7.40, 26.04	< 0.0001
Very preterm (28–31 weeks)	4.92	3.66, 6.61		3.91	2.73, 5.62		3.90	2.72, 5.60	
Moderate to late preterm (32–36 weeks)	2.28	1.63, 3.19		2.32	1.60, 3.37		2.30	1.58, 3.33	
Term (37–40 weeks)	1			1			1		
Post-term (41 + weeks)	1.00	0.33, 3.02		0.98	0.31, 3.03		0.99	0.32, 3.07	
Birthweight (grams)^									
< 1500 g	13.68	8.66, 21.6	< 0.0001						
1500–1999 g	5.58	3.24, 9.62							
2000–2499 g	3.06	2.20, 4.42							
2500–3999 g	1								
+ 4000 g	0.73	0.34, 1.58							
Birth size^									
Small for gestational age	6.84	4.96, 9.45	< 0.0001	1.70	1.10, 2.64	0.027	1.70	1.10, 2.63	0.03
Normal for gestational age	1			1			1		
Large for gestational age	1.39	0.93, 2.08		0.84	0.53, 1.35		0.84	0.52, 1.36	
Obstetric factors									
Presentation of baby									
Vertex	1			1		0.003	1		0.004
Malpresentation (breech, transverse or face)	0.38	0.22, 0.67	0.0003	0.39	0.22, 0.74		0.40	0.21, 0.75	
Maternal or fetal conditions									
Anaemia (in current pregnancy)									
Yes	0.99	0.80, 1.24	0.956						
No	1								
Chronic hypertension									
Yes	0.45	0.34, 0.60	< 0.0001	0.45	0.32 0.62	< 0.0001	0.45	0.32, 0.63	< 0.0001
No	1						1		
Diabetes									
Yes	0.91	0.60, 1.38	0.658						
No	1								
Pre-eclampsia									
Yes	0.80	0.61, 1.06	0.115	0.63	0.46, 0.88	0.006	0.63	0.46, 0.87	0.005
No	1						1		
Eclampsia									
Yes	0.88	0.57, 1.38	0.587						
No	1								
Placenta previa									
Yes	1.34	0.77, 2.34	0.303						
No	1								

Table 2 (continued)

Independent variable	Bivariate			Multivariable model 1 (adjusted for sex and maternal age)			Multivariable model 2 (without adjusting for sex and maternal age)		
	uOR	95% CI	*p*-value	aOR	95% CI	*p*-value	aOR	95% CI	*p*-value
***N* = 1566**									
Placental abruption									
Yes	2.80	1.95, 4.02	< 0.0001	2.05	1.36, 3.10	0.001	2.07	1.37, 3.11	0.001
No	1			1			1		
PROM									
Yes	0.35	0.22, 0.54	< 0.0001	0.39	0.24,0.64	< 0.0001	0.39	0.24, 0.63	< 0.0001
No	1 (ref.)			1			1		
Acute fetal distress									
Yes	0.43	0.23, 0.79							
No	1		0.003			NS			NS
Oligohydramnios									
Yes	0.77	0.51, 1.15				NS			NS
No	1		0.191						

^Missing values imputed using multiple imputation; NS, Not significant at $p = 0.05$; gray shade indicates variables that were not included in the initial multivariable logistic regression as p-value in bivariate model was > 0.250

ANC, antenatal care; GA, gestational age; PROM, premature rupture of membranes

moderate to late preterm babies. This finding is consistent with other studies in similar settings in Asia and Africa [26–28]. A global modelling study by Okwaraji et al. in 2023 also estimated that 74% of stillbirths globally occur among preterm babies under 37 weeks [17]. Children born preterm may not be well adapted to withstand labour and transition to extra-uterine life compared to children born at term [29, 30] which also increases the risk of death in the newborn period.

Our study also found almost twice the odds of stillbirth among small-for-gestational age babies than babies with an average weight for gestational age. This finding supports studies in the literature that show that a babies that are small-for-gestational age or large-for-gestational age have a higher chance of being stillborn [17, 26, 31, 32]. Our sample did not have many babies that were large-for-gestational age which may account for the lack of association which is normally seen for large babies. Detection of inadequate growth in utero is critical to detect and prevent fetal growth restriction and can be identified during antenatal care visits. However in our study, only a quarter of women received at least four or more antenatal visits among both cases and controls. We were unable to assess the content of antenatal care received to know if fetal growth was assessed, but a recent study in Afghanistan examining content of antenatal care in a cross-sectional survey of over 6000 women found that only 31% received between 5 and 8 services during their ANC visit (these included: blood pressure measurement, weight assessment, blood and urine tests, nutritional advice, advice on complications and availability of health services and vaccination with tetanus) [33]. Notably, these services did not include measurement of uterine height or any ultrasound assessment which could detect fetal growth restriction.

Encouragement of early antenatal care and identification of women who might be at risk of preterm birth should be an area of focus in Afghanistan for stillbirth prevention. It will also be important to assess the quality of antenatal care provided to ensure that women who are at risk are identified early and treated. A recent analysis of secondary data from six South Asian countries rated the quality of antenatal care in Afghanistan as 2.3 out of 10 [34] suggesting that antenatal care quality requires substantial attention and strengthening. Notably in our sample, nearly half of those babies that were stillborn were below 2500 g and a quarter were below 1500 g. It is imperative to investigate these small babies and if this is due to fetal growth restriction or other factors for the future prevention of stillbirth and to improve long term newborn outcomes reduce adverse outcomes in subsequent pregnancies [35]. Being preterm and small for gestational can predispose to future longer-term consequences including stunting, disability, and non-communicable diseases. Recent data in Afghanistan suggests that miscarriages and pre-term births have risen sharply since the political transition in 2021 [36].

In our study, women who were referred from another facility had over three times increased odds of stillbirth compared to non-referred women. This is not surprising as we would expect that referral delays and high-risk pregnancies can both increase stillbirth risk. Given that all three health facilities are national referral hospitals, this could also be a key factor. Most of the health facilities in our study have little equipment for intrapartum monitoring and late referral could account for this observation [37, 38]. Similar findings have been reported in studies carried out in Cameroon, India and Nigeria where referred women had a higher risk of stillbirth [26, 28, 39]. It is critical to understand why referred women in Afghanistan are losing their babies and what are the major contributing delays – if it's the family delaying going to the facility or an absence of means of getting to the facility or whether delays are related to being seen once at the referral facility [40]. The health facilities in our study frequently receive women referred from different areas of the capital Kabul and more distant provinces in Afghanistan. Traveling long distances, and delays in reaching the hospital on time contributes to the worsening of the patient's condition and creates serious difficulties for the hospital staff to manage these already high-risk patients. Challenges also exist with staff shortages in these high-volume maternities which may manage over 80 births a day. Increased attention is needed on the health workforce and ensuring the availability of quality emergency obstetric care at lower level facilities to reduce the load from these large tertiary referral hospitals [41, 42]. This is an ongoing challenge for Afghanistan that requires commitment and investment into the health system by both national and international stakeholders.

In Afghanistan, it is customary for women to obtain the permission of their husband or a male relative before seeking professional health-care such as antenatal care , or even to give birth in a hospital or other health facilities and this could be a reason contributing to delays in, or lack of health-care seeking [43]. Despite advances in gender equality over the last decade, according to the 2023 Human Development Report, Afghanistan ranks 182 out of 193 on the Gender Inequality Index (GII) [44], reflecting high levels of inequality in reproductive health, women's empowerment, and economic activity.

Placental abruption increased the odds of stillbirth in our study by almost three times which aligns with findings from studies in Northern Nigeria, Pakistan and Cameroon where women with placental abruption had a significantly higher risk of stillbirth [28, 31, 45]. In our study, women with pre-eclampsia, chronic hypertension and PROM had a significantly lower odds of stillbirth compared to women without these conditions. This was unexpected and contrasts trends in the literature which tend to show a higher risk of stillbirth when women have these conditions or complications [8, 46]. It is unclear if our result is due to inadequate documentation of these conditions for women who have had a stillbirth, or whether this is a real effect – that perhaps these women were identified as high risk at some point in the continuum of care and managed appropriately. It is also possible that women who are attending these referral centres might be have sought antenatal care at other health facilities and the information on preexisting medical conditions may not be recorded in these facilities [47]. Further studies are needed to investigate this in more depth, and we would caution against any interpretation of this.

We also would have expected that women with a history of stillbirth would show a statistically significant association with stillbirth in the current pregnancy. This was significant in the bivariate analysis but once it was adjusted for in the multivariable model, it was no longer significant. It is possible that the other factors identified had a much stronger effect on stillbirth risk or that there may have been inadequate documentation of a previous stillbirth.

Maternal age (either very low below 20 years or high maternal age over 35 years) is strongly associated with stillbirth [14, 25], however, we did not find a significant relationship in our analysis. Higher maternal age is usually strongly associated with stillbirth among nulliparous women [25] but our sample had very few nulliparous women overall. Furthermore, women in Afghanistan often do not know their exact age because of a lack of birth certificates which may have affected our ability to detect an association. Nulliparity and higher parity were also not significantly associated with stillbirth in our study as would be expected, but our sample had a very high proportion of women with at least five previous births and as mentioned above, very few women with no previous birth. We also did not observe a significant association between fetal sex and stillbirth despite the increased risk known for male babies, [48] but accurate documentation of sex may be affected by the consequences and fear from for healthcare providers when a male baby dies under their care [49].

The findings from our study are relevant for other similar contexts of protracted crises and political instability that face similar challenges; however, Afghanistan is unique in many aspects, particularly in the organization of its healthcare infrastructure, and the availability and quality of healthcare services can differ significantly across regions [37]. Furthermore, there are many socio-political and cultural challenges to accessing timely and quality prenatal care, skilled birth attendance, and emergency obstetric services which requires context specific understanding and interventions. Along with cultural and socioeconomic barriers that limit women's access to health services, health care inequalities, conflict and restrictions on women's rights and access to education and employment can also affect their ability to access to health care [50, 51]. The ongoing conflict in Afghanistan over the past two decades has severely disrupted healthcare system, leading to increased maternal and infant mortality rates.

Limitations of the study

A key limitation of our study is related to the quality of data available in the routine medical files. We had no means of assessing or checking data quality due to the retrospective nature of the study which relied on existing completed medical files. The study team verified the data extraction process, but we cannot be certain of the accuracy of information already recorded in the files and it is possible that there may be a risk of bias. There were also a large proportion of missing data for several variables particularly on women's obstetric history and the baby's birthweight. However, we have addressed this using multiple imputation for missing data. Interestingly, we observed a much higher proportions of missing data for live born compared to stillborn babies. We believe that this is related to the need to document more when a woman arrives at the health facility with a problem or when there is a death, as medical files tend to be scrutinized more closely to understand what happened in such circumstances. These findings highlight the need for future efforts to focus on improving routine data collection and data quality for all birth outcomes in Afghanistan.

Our study was limited to predominantly urban areas in the capital city in Afghanistan so we cannot generalize our findings to other parts of the country. The three health facilities were also key referral centers for high-risk cases in the country which can introduce bias. Further, there were several variables that we could not collect or account for in our analysis including mode of birth (vaginal vs. Caesarean), presence of infections, fetal growth restriction, interpregnancy interval and content of antenatal care – all of which are important factors affecting stillbirth risk.

Also important to note is that this study was conducted before the takeover of the government in August 2021. Since this time, there has been serious deterioration in health service accessibility, availability and the rights of women who are severely restricted with little autonomy [52–54]. Anecdotal evidence and studies suggest that mortality is increasing and women's health is worsening [36]. We expect that the risk factors we have identified now are likely to worsen or be exacerbated. Nevertheless, our findings are still relevant to inform stillbirth prevention strategies in Afghanistan, but future research would also be needed to assess the current situation and impact of political transition and restrictions on women's rights on stillbirths and other adverse pregnancy outcomes.

Afghanistan is one of 193 countries that committed to the ENAP in 2014 to reduce stillbirth rate to 12 per 1000 births by 2030 [21]. With the stillbirth rate in Afghanistan stagnating in recent years and currently at almost double the ENAP target, it will be imperative to ensure that women can continue to access care during pregnancy and childbirth and that national and international stakeholders invest in strengthening the healthcare system to prevent stillbirths.

Strengths of the study

A key strength of our study is the large sample of stillbirths from three high volume maternity referral hospitals. We have also demonstrated how routine data could be used to continuously monitor factors contributing to stillbirth particularly if further improvements can be made to the routine data documented for women within health facilities. Our findings broadly align with the literature and contributes important evidence needed to inform stillbirth prevention efforts in Afghanistan.

Conclusion and recommendations

Our study identified several key risk factors associated with stillbirth in three maternity referral hospitals in Afghanistan which included being born preterm or small for gestational age, referral from another health facility, and placental abruption. Improving the management of preterm births, and detection and management of small-for-gestational age babies earlier in pregnancy as well as improving antenatal care attendance and quality will be important for reducing stillbirths in Afghanistan in the future. More research is needed to understand referrals and what is contributing to increased risk among women who are referred including where preventable delays may be occurring. In depth assessment of healthcare providers ability to detect and treat pregnancy complications will also be important. Improvements in stillbirth data quality and strengthening the quality of routine data overall needs to occur together with improvements in the provision of antenatal and intrapartum care services for women to better inform future stillbirth prevention in Afghanistan. High quality routine data in hospitals is essential to better understand the number of stillbirths and their underlying causes in Afghanistan. Without meaningful data, stillbirths will continue to be overlooked and efforts to reduce these hampered.

Supplementary Information

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Supplementary Material 1

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Author contributions
ZE led the study and conducted the data collection, data analysis and wrote the first draft of the manuscript.SMSH contributed to the data analysis and writing of the first draft of the manuscript and overall supervision, AC contributed to the study design, data analysis, review and revision of the manuscript and overall supervision. All authors read and approved the final manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Ethics statement
The study has received ethical approval from Institutional Review Board of the Afghanistan National Public Health Institute, Ministry of Public Health, Afghanistan (Approval number: A.0621.0312) in accordance with the Declaration of Helsinki.

Authors' information
ZE, Master of Science in Midwifery, Reproductive Health, Kabul, Afghanistan.
SMSH, Research Coordinator Organization: Health Net TPO.
AC, Research Fellow, Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium and Sydney School of Public Health, University of Sydney, Sydney, Australia.

Author details
[1]Master of Science in Midwifery, Reproductive Health, Kabul, Afghanistan. [2]HealthNet TPO, Kabul, Afghanistan. [3]Department of Public Health, Institute of Tropical Medicine, Antwerp, Belgium. [4]School of Public Health, University of Sydney, Sydney, Australia.

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References

1. World Health Organization. Making every baby Count: audit and review of Stillbirths and neonatal deaths. Geneva: WHO; 2016. https://www.who.int/publications/i/item/9789241511223.
2. UNIGME, UNICEF, LSHTM. Stillbirth definition and data quality assessment for health management information systems (HMIS). A guideline. New York: UNICEF; 2022.
3. Neglected Tragedy UNICEFA. The global burden of Stillbirths. New York: UNICEF; 2020.
4. Smith LK, Hindori-Mohangoo AD, Delnord M, Durox M, Szamotulska K, Macfarlane A, et al. Quantifying the burden of stillbirths before 28 weeks of completed gestational age in high-income countries: a population-based study of 19 European countries. Lancet (London England). 2018;392(10158):1639–46.
5. UNICEF, UNIGME, WHO, World Bank, United Nations. Never forgotten: the situation of stillbirth around the globe. New York: UNICEF; 2022.
6. Ali MM, Bellizzi S, Boerma T. Measuring stillbirth and perinatal mortality rates through household surveys: an integrated approach to data quality assessment and adjustment with 155 surveys from 53 countries. Lancet Global Health. 2023;11(6):e854-61.
7. Tappis H, Bryce E, Boerma T. Tracking progress in mortality reduction in humanitarian settings. AlignMNH. 2022. https://www.alignmnh.org/2022/03/31/tracking-progress-towards-maternal-and-neonatal-mortality-reduction-targets-in-countries-affected-by-humanitarian-crises/.
8. Lawn JE, Blencowe H, Waiswa P, Amouzou A, Mathers C, Hogan D, et al. Stillbirths: rates, risk factors, and acceleration towards 2030. Lancet (London England). 2016;387(10018):587–603.
9. Goldenberg RL, McClure EM, Bann CM. The relationship of intrapartum and antepartum stillbirth rates to measures of obstetric care in developed and developing countries. Acta Obstet Gynecol Scand. 2007;86(11):1303–9.
10. Lawn JE, Blencowe H, Pattinson R, Cousens S, Kumar R, Ibiebele I, et al. Stillbirths: where? When? Why? How to make the data count? Lancet (London England). 2011;377(9775):1448–63.
11. Heazell AEP, Siassakos D, Blencowe H, Burden C, Bhutta ZA, Cacciatore J, et al. Stillbirths: economic and psychosocial consequences. Lancet (London England). 2016;387(10018):604–16.
12. Blencowe H, Sinha S, Fariha F, Kerac T, Filippi V. Perinatal mental health consequences of stillbirth and potential interventions: summary of evidence from low- and middle-income countries. Washington, DC: USAID MOMENTUM; 2024.
13. Luque-Fernandez MA, Thomas A, Gelaye B, Racape J, Sanchez MJ, Williams MA. Secular trends in stillbirth by maternal socioeconomic status in Spain 2007-15: a population-based study of 4 million births. Eur J Public Health. 2019;29(6):1043–8.
14. Lean SC, Derricott H, Jones RL, Heazell AEP. Advanced maternal age and adverse pregnancy outcomes: a systematic review and meta-analysis. PLoS ONE. 2017;12(10):e0186287.
15. Aminu M, Unkels R, Mdegela M, Utz B, Adaji S, van den Broek N. Causes of and factors associated with stillbirth in low- and middle-income countries: a systematic literature review. BJOG: Int J Obstet Gynecol. 2014;121(Suppl 4):141–53.
16. Seale AC, Blencowe H, Bianchi-Jassir F, Embleton N, Bassat Q, Ordi J, et al. Stillbirth with Group B streptococcus disease worldwide: systematic review and meta-analyses. Clin Infect Dis. 2017;65(suppl2):S125-32.
17. Okwaraji YB, Suarez-Idueta L, Ohuma EO, Bradley E, Yargawa J, Pingray V, et al. Stillbirths: contribution of preterm birth and size-for-gestational age for 125.4 million total births from nationwide records in 13 countries, 2000–2020. BJOG Int J Obstet Gynecol. 2023. https://doi.org/10.1111/1471-0528.17653.
18. Mondal D, Galloway TS, Bailey TC, Mathews F. Elevated risk of stillbirth in males: systematic review and meta-analysis of more than 30 million births. BMC Med. 2014;12(1):220.
19. Lamont K, Scott NW, Jones GT, Bhattacharya S. Risk of recurrent stillbirth: systematic review and meta-analysis. BMJ. 2015;350:h3080.
20. Christou A, Dibley MJ, Rasooly MH, Mubasher A, Hofiani SMS, Rashidi MK, et al. Understanding country-specific determinants of stillbirth using household surveys: the case of Afghanistan. Paediatr Perinat Epidemiol. 2019;33(1):28–44.
21. World Health Organization. Every Newborn: an action plan to end preventable deaths. Geneva: WHO; 2014.
22. IBM Corp. IBM SPSS statistics for Windows. Armonk: IBM Corp; 2012.
23. StataCorp. Stata statistical software: release 14. College Station: StataCorp LLC; 2015.
24. Wilson RE, Alio AP, Kirby RS, Salihu HM. Young maternal age and risk of intrapartum stillbirth. Arch Gynecol Obstet. 2008;278(3):231–6.

25. Waldenstrom U, Cnattingius S, Norman M, Schytt E. Advanced maternal age and stillbirth risk in Nulliparous and Parous women. Obstet Gynecol. 2015;126(2):355–62.
26. Tolefac PN, Tamambang RF, Yeika E, Mbwagbaw LT, Egbe TO. Ten years analysis of stillbirth in a tertiary hospital in Sub-sahara Africa: a case control study. BMC Res Notes. 2017;10(1):447.
27. Zhu J, Liang J, Mu Y, Li X, Guo S, Scherpbier R, et al. Sociodemographic and obstetric characteristics of stillbirths in China: a census of nearly 4 million health facility births between 2012 and 2014. Lancet Global Health. 2016;4(2):e109–18.
28. Egbe TO, Ewane EN, Tendongfor N. Stillbirth rates and associated risk factors at the Buea and Limbe regional hospitals, Cameroon: a case-control study. BMC Pregnancy Childbirth. 2020;20(1):75.
29. Kim SW, Andronis L, Seppanen AV, Aubert AM, Barros H, Draper ES, et al. Health-related quality of life of children born very preterm: a multinational European cohort study. Qual life Res Int J Qual life Aspects Treat care Rehabilitation. 2023;32(1):47–58.
30. Lammertink F, Vinkers CH, Tataranno ML, Benders M. Premature birth and developmental programming: mechanisms of resilience and vulnerability. Front Psychiatry. 2020;11:531571.
31. Suleiman BM, Ibrahim HM, Abdulkarim N. Determinants of stillbirths in Katsina, Nigeria: a hospital-based study. Pediatr Rep. 2015;7(1):5615.
32. Christou A, Mbishi J, Matsui M, Benova L, Kim R, Numazawa A, et al. Stillbirth rates and their determinants in a national maternity hospital in Phnom Penh, Cambodia in 2017–2020: a cross-sectional assessment with a nested case-control study. Reprod Health. 2023;20(1):157.
33. Stanikzai MH, Tawfiq E, Jafari M, Wasiq AW, Seddiq MK, Currie S, et al. Contents of antenatal care services in Afghanistan: findings from the national health survey 2018. BMC Public Health. 2023;23(1):2469.
34. Neupane S, Scott S, Piwoz E, Kim SS, Menon P, Nguyen PH. More is not enough: high quantity and high quality antenatal care are both needed to prevent low birthweight in South Asia. PLOS Global Public Health. 2023;3(6):e0001991.
35. Bane S, Simard JF, Wall-Wieler E, Butwick AJ, Carmichael SL. Subsequent risk of stillbirth, preterm birth, and small for gestational age: a cross-outcome analysis of adverse birth outcomes. Paediatr Perinat Epidemiol. 2022;36(6):815–23.
36. Rehman MU, Salman A, Rija A, Salman M, Salman Y, Malikzai A. A year of de facto government and the sharp rise in preterm births and miscarriages in Afghanistan. Int J Surgery: Global Health. 2023;6(4):e0212.
37. Kim C, Tappis H, McDaniel P, Soroush MS, Fried B, Weinberger M, et al. National and subnational estimates of coverage and travel time to emergency obstetric care in Afghanistan: modeling of spatial accessibility. Health Place. 2020;66:102452.
38. Zainullah P, Ansari N, Yari K, Azimi M, Turkmani S, Azfar P, et al. Establishing midwifery in low-resource settings: guidance from a mixed-methods evaluation of the Afghanistan midwifery education program. Midwifery. 2014;30(10):1056–62.
39. Devi K, Aziz N, Gala A, Surapaneni T, Pant H. Incidence of stillbirths and risk factors at a tertiary perinatal center in Southern India: retrospective observational study. Int J Gynecol Reprod Sci. 2018;1(1):14–22.
40. Okonofua FE, Ntoimo LFC, Ogu R, Galadanci H, Mohammed G, Adetoye D, et al. Prevalence and determinants of stillbirth in Nigerian referral hospitals: a multicentre study. BMC Pregnancy Childbirth. 2019;19(1):533.
41. World Health Organization. Workload indicators of staffing need (WISN) user manual. 2nd ed. Geneva: WHO; 2023.
42. Safi N, Naeem A, Khalil M, Anwari P, Gedik G. Addressing health workforce shortages and maldistribution in Afghanistan. East Mediterr Health J. 2018;24(9):951–8.
43. van Egmond K, Naeem AJ, Verstraelen H, Bosmans M, Claeys P, Temmerman M. Reproductive health in Afghanistan: results of a knowledge, attitudes and practices survey among Afghan women in Kabul. Disasters. 2004;28(3):269–82.
44. UNDP. Human development report 2023/2024: breaking the Gridlock. New York: United Nations Development Programme (UNDP); 2024.
45. Hossain N, Khan N, Khan NH. Obstetric causes of stillbirth at low socioeconomic settings. JPMA J Pakistan Med Association. 2009;59(11):744–7.
46. Vanotoo L, Dwomoh D, Laar A, Kotoh AM, Adanu R. Modeling clinical and non-clinical determinants of intrapartum stillbirths in singletons in six public hospitals in the Greater Accra Region of Ghana: a case-control study. Sci Rep. 2023;13(1):1013.
47. Ansari N, Manalai P, Maruf F, Currie S, Stekelenburg J, van Roosmalen J, et al. Quality of care in early detection and management of pre-eclampsia/eclampsia in health facilities in Afghanistan. BMC Pregnancy Childbirth. 2019;19(1):36.
48. Mahmood NH, Kadir DH, Yahya RO, Birdawod HQ. The significance of delivery methods and fetal gender in reducing stillbirth rate: using the generalized regression model. Clin Epidemiol Global Health. 2024;29:101710.
49. Christou A, Alam A, Hofiani SMS, Rasooly MH, Mubasher A, Rashidi MK, et al. How community and healthcare provider perceptions, practices and experiences influence reporting, disclosure and data collection on stillbirth: findings of a qualitative study in Afghanistan. Soc Sci Med. 2019;236:112413.
50. Ezadi Z, Mohammadi N, Sarwari R, Jafari SM. Afghan women and access to health care in the past 25 years. EClinicalMedicine. 2022;43:101235.
51. Najafizada SAM, Bourgeault IL, Labonte R. Social determinants of maternal health in Afghanistan: a review. Cent Asian J Glob Health. 2017;6(1):240.
52. Safi N, Anwari P, Safi H. Afghanistan's health system under the Taliban: key challenges. Lancet (London England). 2022;400(10359):1179–80.
53. Glass N, Jalalzai R, Spiegel P, Rubenstein L. The crisis of maternal and child health in Afghanistan. Confl Health. 2023;17(1):28.
54. Valente M, Lamberti-Castronuovo A, Bocchini F, Shafiq Y, Trentin M, Paschetto M, et al. Access to care in Afghanistan after August 2021: a cross-sectional study exploring afghans' perspectives in 10 provinces. Confl Health. 2024;18(1):34.

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