Determinants of stillbirth in Tigray, Ethiopia: A facility-based study

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Abstract

Background: Stillbirth is an unexpected fetal catastrophe and a neglected global epidemic. The epidemiological situation of stillbirth in Ethiopia has not been thoroughly studied, nor does the nation have an established systematic prevention and control program. Assessing the determinants of stillbirth is vital to design appropriate measures for its reduction.

Methods: We conducted a facility-based cross sectional study design to assess the determinants of stillbirth in Tigray from May-August 2018. All births during the study period were included as study participants. We used a pretested structured questionnaire to collect data. Data were entered into Epi info 7 and analyzed using SPSS version 20. Binary logistic regression was fitted and odds ratios (OR) with 95% confidence intervals (CI) were calculated to identify factors associated with stillbirth.

Results: Stillbirth was found to be 27 per 1000 live births in Tigray. Mothers who had not attended school experienced stillbirth 42% times more than those who completed secondary school (AOR =1.42 95%CI: 1.02-1.98). The odds of stillbirth among merchant mothers were four times more compared to self-employed (AOR= 4.01, 95%CI: 1.79, 13.85). Stillbirth is more than two times higher among mothers with no antenatal care (ANC) visits (AOR=2.8; 95%CI: 1.95, 3.99). Moreover, mothers referred to the health center had more than 50% higher odds of experiencing stillbirth (AOR=1.56, 95%CI: 1.17, 2.07). Mothers without partograph were 35% more odds of stillbirth (AOR = 1.35, 95%CI: 1.04, 2.07). Stillbirth was almost three times higher among mothers who gave birth by vacuum (AOR= 2.72, 95%CI: 1.27, 5.84) and forceps (AOR=3.56, 95%CI: 2.58, 12.71). The odds of stillbirth was four times higher in low birth weight babies (1500-2499gram) (AOR = 4.2, 95%CI: 3.12, 6.71).

Conclusion: Level of education, occupational status, and history of ANC visit, referral status, partograph use, instrumental delivery and birth weight were the determinants of stillbirth. Hence, integrated, comprehensive health care targeted to maternal and fetal health care service should be implemented to meet the sustainable development goals.

Keywords: Determinants, Stillbirth, Facility-based maternal and fetal health care services, Tigray, Ethiopia

Introduction

The World Health Organization (WHO) defines stillbirth as a baby born with no signs of life at 28 weeks of gestation or more, with a birth weight of $\geq$1000g [1]. Globally, at least 2.6 million (uncertainty range 2·4–3·0 million) stillbirths occur each year. This is more than 7100 deaths a day, of which three quarters are in sub-Saharan Africa and Asian countries. In 2015, the rate of reduction for stillbirths was 2%, much slower than progress made for reducing maternal and child deaths globally. In Ethiopia, the World Health Statistics 2013 report showed a stillbirth rate of 26 per 1000 deliveries making it the third highest estimated number of stillbirths in East Africa next to Djibouti and Somalia [2, 3, 4].

Lack of access and quality of maternal and pregnancy care are a risk for stillbirth. Nearly 60% of stillbirths occur in rural areas, in places that are more socioeconomically disadvantaged; more than half are in conflict and emergency zones affecting families most underserved by healthcare systems. Half of all stillbirths, 1.3 million each year, occur in health facilities and could be prevented with improved quality of care [5-9].

Prior to the launch of the Sustainable Development Goals (SDG), stillbirth was a neglected global epidemic: it remains an unexpected fetal catastrophe often bringing a devastating emotional experience to couples [5, 7]. Stillbirth is a tragedy and hidden from society, and has wide-reaching consequences for parents, care providers, communities, and society that are frequently overlooked and under-appreciated. An estimated 4.2 million women who have experienced a stillbirth are more likely to experience it again in subsequent pregnancies; as are women living with depression [10-16].

Pregnancy-related problems preeclampsia, gestational diabetes, placental abruption and premature rupture of membrane (PROM), prolonged and obstructed labor, and maternal infections like malaria, syphilis and HIV, and maternal disorders including hypertension, diabetes, obesity, fetal growth restriction and congenital anomalies appeared to account for the majority of stillbirths [11-12, 16-20].

Eight percent of all stillbirths are attributable to malaria, increasing to 20.0% in sub-Saharan Africa, and 7.7% of all stillbirths are associated with syphilis, increasing to 11.2% in sub-Saharan Africa. Nearly, 10% of all stillbirths are linked to obesity and non-communicable diseases, and women in the most disadvantaged communities face at least double the risk of stillbirth [2,5]. Advanced

maternal age, poverty and lack of education, multiparty, lack of antenatal care, low birth weight, history of stillbirth and abortion were also factors that increased the occurrences of stillbirths [2, 3, 5, 6, 8, 21].

Evidence based measurement of level and causes of stillbirth from reliable and timely data source is crucial for planning and effective interventions. This has great role to achieve the global agenda planned in the form of the health-related SDGs to have a better data towards the target of $\leq$12stillbirths/1000births by 2030 [3]. Due to the lack of national death registration and surveillance system and limited knowledge, Ethiopia has not yet thoroughly studied the burden and its associated problems or implemented a perinatal death audit to evaluate interventions to reduce stillbirth. Therefore, this study aimed to assess the burden and factors associated with stillbirth among deliveries at Tigray Region, Ethiopia.

Methodology

Study design, period and area

We conducted a facility-based cross-sectional study from May-August 2018. The study was carried out in all public hospitals and selected health centers in Tigray Region, northern Ethiopia. Based on the 2007 Census report, it has a projected population of 5,151,998 of whom 2,612,001are females. Tigray has a total of 16 public general hospitals, two referral hospitals, 202 health centers, and 712 health posts. According to the regional 2015/2016 Health Management Information System (HMIS) report, 2207 stillbirths and 116,600 births were reported.

Sample size determination and sampling procedure

We included all hospitals and 53 health centers (those serving >40 births/month) in the region. All mothers who gave birth in health facilities were the source and study population. All births during the study period were included as study participants. We excluded stillbirth following termination of pregnancy. All births were recorded and interviewed on daily bases from the selected facilities.

Data collection technique and tool

We collected the data using a structured questionnaire that was adopted from the Ethiopian Demographic Health Survey (EDHS) [22]. Three trained supervisors and 68 data collectors participated in data collection. Data were collected under the follow-up of the trained supervisors.

Outcome Measurement

Stillbirth in this study is a baby born with no signs of life at 28 weeks of gestation or more,

with a birth weight of $\geq$1000g [1]. The primary outcomes were rates of stillbirth per 1000 total births (live births and stillbirths) by gestational age and birth weight. Gestational age at delivery was determined based on the date of last menstrual period, earliest ultrasound before 20 weeks' gestation and other documentation in the medical charts**.** The response variable for this study, stillbirth outcomes is **Yes** when stillbirth occurred, and **No** when stillbirth does not occur). We identified causes of stillbirths using the International Classification of Diseases (ICD-10 coding manual) WHO-INDEPTH questionnaire for all deaths Via VA (30). We adapted a structured questionnaire from the EDHS [22] to collect data on socio-demographic and economic characteristics (residence, age, educational level, and age at first birth) and obstetrics related characteristics (number of ANC Visits, and time of first ANC visit). Vital sign data were extracted from each mother's charts using a checklist.

Data collection procedure via Verbal autopsy (VA)

Data on numbers of stillbirth among all births during the study period were obtained from the selected health facilities on daily basis. We assessed data on causes of stillborn using VA. VA data collectors reported stillborn everyday from the study site. VA interviews were

carried out after three days of the date of event using a standardize WHO-INDEPTH questionnaire from all mothers with stillbirth occurring in health facilities [30]. The first respondents were parents or spouses. We trained clinicians on the application of the ICD-10 manual to assess cause of stillbirth [31].Two blinded clinicians separately assessed the completed VA questionnaires to determine the causes of stillbirth using the ICD-10coding manual. Agreement status between the two clinicians was checked and confirmed by a research team member. When disagreements in diagnosis happened, a third clinician assigned to review the case. The team considered case as ''undetermined'' if all the three reviewers assigned a different diagnosis and unspecified causes of death (VA-99)'' for a case when difficulties to classify diseases. The final diagnosis was assigned based on the agreement between the third clinician and any of the two clinicians.

Classification the cause of death

The cause of stillbirth, coded using the International Classification of Diseases 10[th]revision (ICD-10), was based on the hierarchical cause of death information in the death registration [31]. Based on the international disease classification, we categorized causes of system as:

1.**Pregnancy, childbirth and puerperium related deaths (VA-09):** All stillbirth related

to pregnancy and childbirths problems (e.g. associated with abortion, childbirth related hemorrhage etc.).

2. **Diseases (Ds) (VA-01**): All infectious and parasitic diseases (VA-01) including Human immunodeficiency virus (HIV), tuberculosis, malaria, intestinal infection, infectious diseases of unspecified cause, acute lower respiratory infections, meningitis, viral hepatitis, typhoid and paratyphoid), neoplasms (VA-02), mental and nutritional and endocrine disorders (VA-03), Diseases of circulatory system (VA-04, respiratory disorders (VA-05)gastrointestinal disorders (VA-06), renal disorders (VA-07)and nervous system disorders (VA-08).

3. **External causes of death (ECs) (VA-11):** Accidental falls, accidental drowning and submersion, intentional self-harm, assault and others which are not related to the above categories.

Data quality control

The questionnaire was initially prepared in English and was translated into local language Tigrigna. Three days training was given to data collectors and supervisors. The data collection tool was pretested in Kasech health center in Mekelle city and changes were made accordingly.

Data analysis

An experienced data clerk entered the data into Epi-Info version 3.5.3and analyzed using SPSS version 20. Bivariate and multivariable logistic regression analysis was conducted to assess factors associated with stillbirth at a P-value<0.05.

Ethical considerations

We secured a permission letter from the Tigray Health Bureau. Collected data were de-identified, delinked and stored in a secure location. Informed verbal consent was obtained from each subject and information was kept confidential. Informed verbal consent procedure was specifically approved for this study and ethical clearance was obtained from the Institutional Review Board of Mekelle University and WHO-IRB (Reference Letter-ERC0007/2016).

Results

Socio-demographic characteristics of the study

A total of 11,114 mothers consisting of 303 (27/1000) stillborn and 10,811 live-born mothers were interviewed, making a response rate of 100%. The mean age of the respondents was 27 (SD±6.4) years ranging from 17–45 and the majority 3,223(29%) were found between 21-25 years of age. More than 45% of the respondents had no formal education and 6,864(63.5%) were housewives. More than 90% of the respondents 10,252(94.8%) were Ethiopian Orthodox followers, and married 10,391(96.1%) (Table 1).

Obstetric characteristics of mothers who gave birth in the health facilities

Nearly half 5,275(47.5%) of the mothers were primipara and 1,613(14.5%) had abortion history. More than 40% of the respondents, 4,615(41.5%) attended the fourth ANC visit. Nearly 50% of respondents gave birth in a hospital. More than three-fourths, 8,731(78.6%) labor used partograph and 10,299(92.7%) gave birth through Spontaneous-Vaginal-Delivery (**Table 2**).

Causes of stillbirth among deliveries in the health-facilities

Fetal causes of stillbirth were congenital anomalies (12%), asphyxia (6%), and cord accident (5%). Maternal infection (41%), malaria (5%), premature ruptures of the membrane (6%), hypertensive disorder of pregnancy (3%), abdominal trauma(4%) and multiple pregnancies (3%) were reported as the maternal causes of stillbirth (Fig.1).

The contributing factors for stillbirth were reported as failure of recognition of the problem 152(21%). Delayed referral from home 142(20%), lack of decision to go health facility 127(18%), harmful tradition practice 110(15%), family poverty 110(15%) and lack of transportation 81(11%) (**Fig.2**).
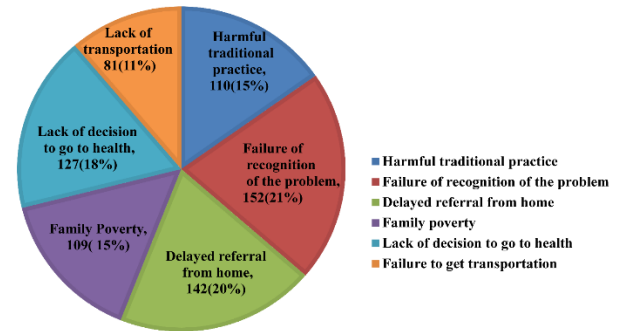

Fig.1: Probable causes of stillbirth among mothers who gave birth in health facilities in Tigray Region, Northern Ethiopia, 2018.

Factors associated with stillbirth among mothers who gave birth in a health facility

Eleven variables were entered into a multivariable logistic regression model. Eight of them were identified as predictors of stillbirth. Mothers who had not attended school experienced stillbirth 40% times more than those who completed secondary school (AOR =1.42, 95%CI:1.02-1.98). The odds of stillbirth among merchants were four times more compared to self-employed (AOR = 4.01, 95%CI:1.79,13.85). Stillbirth among primipara was nearly 50% higher than para II-IV (AOR=1.54; 95%CI: 1.13, 2.09). Stillbirth was two times higher among mothers with no ANC visits (AOR=2.8; 95%CI: 1.95, 3.99) and third ANC visits (AOR=1.59;95%CI:1.12,2.26) compared to mothers with fourth ANC visit. Mothers referred from health center had 50% higher odds of experiencing stillbirth compared with not referred (AOR=1.56, 95%CI: 1.17, 2.07).

A mother whose labor was not followed by partograph has 35% higher odds of experiencing stillbirth than those whose labor was followed by partograph(AOR = 1.35, 95%CI: 1.04, 2.07). Stillbirth was three times higher among mothers who gave birth by vacuum (AOR= 2.72, 95%CI: 1.27, 5.84) and forceps (AOR=3.56, 95%CI: 2.58, 12.71) compared to mothers who gave birth through spontaneous vaginal delivery. The odds of stillbirth was four times higher among low birth weight babies (1500-2499 gram) compared to birth weight of ≥2500gm (AOR = 4.2, 95%CI:3.12, 6.71) (Table3).
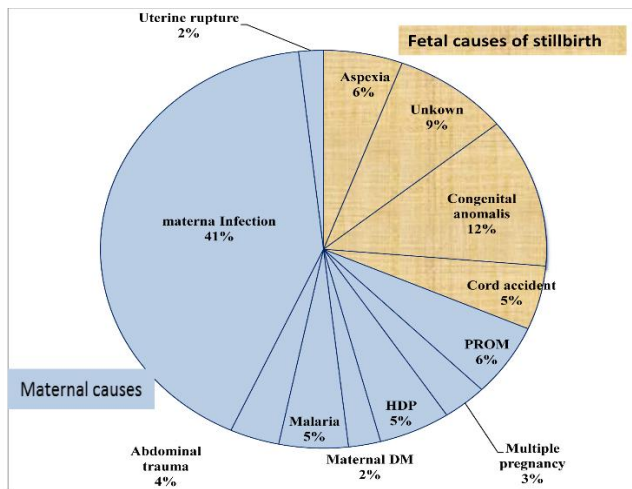

Fig.2: Possible contributing factors of stillbirth among mothers who gave birth in health facilities in Tigray Region, Northern Ethiopia,2018

Discussion

The overall prevalence of stillbirth was 27 per 1000 total births. Level of education, occupation, parity, history of ANC visits, referral history, partograph usage, mode of delivery and birth-weight were factors associated with stillbirth.

The prevalence of stillbirth was 27/1000 total birth (95% CI: 24-30/1000). This is higher as compared with the recent national figure [22]. Despite the goal established for 2020 for countries with a stillbirth rate of more than five per 1000 births to reduce their stillbirth rates by at least 50% from the 2008 rates[23], the rate of experiencing stillbirth among women of childbearing age is still increasing in low income countries like Ethiopia. For countries with a current stillbirth rate of <5/1000 births, the goal by 2020 is to eliminate all preventable stillbirths and close equity gaps [24]. This variation may be due to the absence of advanced antenatal care service, access and quality of clinical care, in particular midwives and physicians, who are not always available for essential care during childbirth and for obstetric emergencies. Deliveries in low-income countries may occur at a health facility without access to emergency obstetric care. It is thought that many of these deaths could be prevented with adequate obstetric care.

Table1: Birth-outcome distribution among mothers in health-facilities in Tigray, 2018 Live birth (n=10,811)

Background characteristics		Live birth (n=10811)	Stillbirth (n=303)	Total (n=11114)
		N(%)	N (%)	N (%)
Maternal Age	17-20	2323(21.5)	54(17.8)	2377(21.4)
	21-25	3150(29.1)	73(2)	3223(29)
	26-30	3034(28.1)	87(28.7)	3121(28.1)
	31-35	1320(12.2)	56(18.5)	1376(12.4)
	36-40	878(8)	28(9.2)	906(8.2)
	41-45	106(1.0)	5(1.7)	111(1.0)
Educational status of the mother	No education	4963(45.9)	170(56.1)	5133(46.2)
	Complete primary	2972(27.5)	61(20)	3033(27.3)
	Complete secondary	2876(26.6)	72(23.8)	2948(26.5)
Religion of the mother	Orthodox	10252(94.8)	296(97.7)	10548(94.9)
	Muslim	526(4.9)	7(2.3)	533(4.8)
	Protestant	18(0.2)	0(0)	18(0.2)
	Others	15(0.1)	0(0)	15(0.1)
Occupation of the mother	Housewife	6864(63.5)	203(67)	7067(63.6)
	Farmer	2675(24.7)	69(22.8)	2744(24.7)
	Merchant	323(3)	18(5.9)	341(3.1)
	Gov't employee	415(3.8)	10(3.3)	425(3.8)
	Self-employed	84(0.8)	0(0)	84(0.8)
	other	450(4.2)	3(1)	453(4.1)
Marital status	Married	10391(96.1)	285(94)	10676(96.1)
	Not married	420(3.9)	18(5.9)	438(3.9)

Table2: Obstetric characteristics of mothers in Tigray region, 2018

Obstetric Characteristics		Live birth (N=10811)		Stillbirth (N=303)		Total (N=11114)	
		N	%	N	%	N	%
Parity	0-1	5115	47	160	52.8	5275	47.5
	2-4	4219	39	93	30.7	4312	38.8
	5 and above	1477	14	50	16.5	1527	13.7
Abortion history	Yes	1591	15	22	7.3	1613	14.5
	No	9220	85	281	92.7	9501	85.5
ANC	No ANC	1025	9	84	27.7	1109	10.0
	First visit	748	7	13	4.3	761	6.8
	Second visit	2168	20	57	18.8	2225	20.0
	Third visit	2333	22	71	23.4	2404	21.6
	Four visit	4537	42	78	25.7	4615	41.5
TT2	Yes	8274	77	183	60.8	8457	76.1
	No	2537	23	118	39.2	2655	23.9
Duration of labour	Normal	10764	100	298	98.3	11062	99.5
	Prolonged	47	0	5	1.7	52	.5
Place of delivery	Home	1068	10	119	39.3	1187	10.7
	Health post	360	3	82	27.1	442	4.0
	Health center	4202	39	31	10.2	4233	38.1
	Hospital	5181	48	71	23.4	5252	47.3
Use of partograph	Yes	8568	79	163	53.8	8731	78.6
	No	1988	18	125	41.3	2113	19.0
	Unknown	255	2	15	5.0	270	2.4
Mode of delivery	SDV	10029	93	270	89.1	10299	92.7
	Vacuum	240	2	10	3.3	250	2.2
	Forceps	21	0	4	1.3	25	.2
	CS	521	5	19	6.3	540	4.9
Weight of the baby	1500-2499	1608	15	274	90.4	1882	16.9
	>=2500 gm	9203	85	29	9.6	9232	83.1
Sex of the new born	Male	5835	54	183	60.4	6018	54.1
	Female	4976	46	120	39.6	5096	45.9

TT2-Tetanus Toxoid2, ANC-antenatal care, SDV-spontaneous vaginal delivery

This study showed that the proportion of stillbirth was more likely higher among mothers with no education compared with mothers who had completed secondary education. This is similar to other studies in China, Iraq, Ethiopia and the WHO report [13, 18, 27, 28, 9]. This may be because educated women are able to make wise decisions about their own and family health and seek proper modern health care than their counterparts. Moreover, educated women are more likely to be aware of the effect of delay to reach the facility and educated mother assumes greater responsibility in planning her family and makes use of maternal services appropriately.

Table3: Factors associated with stillbirth among mothers in health-facilities in Tigray, 2018

Variables		Live-birth	Stillbirth	COR	AOR (95% C.I.)
Education	**No education**	**4933**	**170**	**1.37**	**1.42(1.02,1.98)**
	Complete primary	2957	61	0.82	0.84(0.57, 1.23)
	complete secondary	2860	72	1	1
Age	15-20	2323	54	1	1.18(0.83, 1.68)
	21-25	3150	73	1	1
	26-30	3034	87	1.24	1.49(0.97, 2.29)
	31-35	1320	56	1.83	0.96(0.56, 1.63)
	36-40	878	28	1.38	1.48(0.49, 4.47)
	41-45	106	5	2.04	0.73(0.49, 1.08)
Occupation	House wife	6864	203	4.44	3.03(0.93, 9.90)
	Farmer	2675	69	3.87	2.57(0.77, 8.60)
	Merchant	323	18	8.36	**4 (1.79, 13.85)**
	Government employee	415	10	3.61	3.29(0.85, 12.8)
	Self-employee	84	0	0.00	0.00
	other	450	3	1	1.00
Marital status	Married	10391	285	0.64	1
	Not Married	420	18	1	0.94(0.54, 1.65)
Parity	**0-1**	**5115**	**160**	**1.42**	**1.54(1.13, 2.09)**
	2-4	4219	93	1	1.00
	5 and above	1477	50	1.54	1.23(0.81, 1.89)
ANC	**No ANC**	**1025**	**84**	**4.77**	**2.79(1.95, 3.99)**
	First visit	748	13	1.01	1.03(0.55, 1.93)
	Second visit	2168	57	1.53	1.45(1.00, 2.11
	Third visit	**2333**	**71**	**1.77**	**1.59(1.12, 2.26)**
	Four visit	4537	78	1	1.00
Referral status	Not referred	8156	176	**1**	1
	Health Post	268	4	**0.69**	0.58(0.20, 1.66)
	Health center	**1814**	**98**	**2.50**	**1.56(1.17, 2.07)**
	Hospital	437	24	**2.55**	0.98(0.60, 1.59)
	Others	136	1	**0.34**	0.22(0.03, 1.67)
Partograph use	Yes	8568	163	1	1
	No	**2243**	**140**	**3.28**	**1.35(1.04, 1.75)**
Labor duration	Normal	10764	298	1	1
	Prolonged	47	5	3.84	2.31(0.78, 6.86)
Mode of delivery	SVD	10029	270	1	1.00
	Vacuum	**240**	**10**	**0.74**	**2.72(1.27, 5.84)**
	Forceps	**21**	**4**	**1.14**	**3.6(2.58, 12.04)**
	CS	521	19	5.22	0.90(0.53, 1.53)
Birth Weight	>=2500 gram	9203	29	1	1
	1500-2499 gram	**1608**	**274**	**54.07**	**4.2(3.12, 6.71)**

CS- Cesarean section, SVD-Spontaneous Vaginal Delivery

The odds of experiencing stillbirth among mothers who had no ANC and third ANC visit was higher compared with those who had a fourth ANC visit. This finding is consistent with studies in Niger, Nigeria and Ethiopia [25-28]. This could be because focused ANC can help to maintain a healthy pregnancy and identify risks of pregnancy early and take appropriate action. This study might also indicate that the uptake of quality of ANC determines the birth outcome and to generate impact using evidence-based interventions at

the community level, which in turn is essential to reduce the proportion of the silent killer stillbirth.

This study revealed that small birth weight to be a factor to stillbirth experience similar to studies done in Gondor and Zambia [28, 16]. This may be due to poor health care seeking behavior and absence of skilled birth attendants (midwives and physicians) for essential care during childbirth. Most stillbirths could have been prevented through focused antenatal interventions and skilled birth attendance.

The proportion of stillbirth was higher in labor that was not attended by partograph. This is consistent with studies in Hawassa and Gondar (Ethiopia), Zambia and Iraq [27, 28, 16, 18]. This may be due to the fact that partograph is essential to detect intrapartum fetal problems early and thereby prevent stillbirth. Assisted delivery (forceps and vacuum) was also associated with the higher experience of stillbirth.

Conclusion

Competing interest

The authors report no conflicts of interest in this work.

Acknowledgments

The proportion of stillbirth was 27/1000 live births. Level of education, occupational status, referral status, history of ANC visit, partograph utilization, instrumental delivery, and birth weight were the determinants factors of stillbirth. Hence, reducing stillbirth requires wide action, along with the development of a national vital registration system, health system policies, and behavior-change communication interventions through all media. Stillbirth remains a neglected issue and is missing from the MDGs; subsequently it is missed in policies and programmes. We suggest that reviews of the National Strategy for Newborn and Child Survival in Ethiopia, 2015/16 –2029/20 [29] should include targets to reduce stillbirth alongside those aiming to reduce newborn and under-five mortality rates [1,5].Integrated comprehensive health care targeted maternal and newborn health should be implemented to meet all the SDGs.

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