Section: OBGY

Original Research Article

CLINICAL AND EPIDEMIOLOGICAL ANALYSIS OF FETAL DEATH IN UTERO: A RETROSPECTIVE OBSERVATIONAL STUDY AT A TERTIARY CARE CENTRE

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ABSTRACT

Background: Intrauterine fetal death (IUFD) remains a major contributor to perinatal mortality, particularly in low-resource settings. Understanding the clinical and epidemiological profile and associated risk factors is essential for preventive strategies. **Aim:** To analyze the clinical, sociodemographic, and risk factors associated with fetal death in utero.

Materials and Methods: This retrospective observational study included 100 cases of IUFD (≥24 weeks gestation) at a tertiary care center over six months. Data regarding maternal demographics, obstetric history, antenatal care, clinical risk factors, and delivery outcomes were collected and analyzed using descriptive and inferential statistics.

Results: The mean maternal age was 27.2±5.8 years, with 70% in the 20–34-year range. Most women (61%) had fewer than four antenatal visits; 68% were from rural areas, and 89% belonged to low/middle socioeconomic backgrounds. Significant risk factors included severe pre-eclampsia (37%), gestational diabetes mellitus (14%), severe anemia (11%), placental abruption (13%), and IUGR (5%). The mean gestational age at IUFD was 33.7±3.9 weeks, and vaginal delivery was the most common mode (90%). Many cases involved low birth and placental weights, indicating compromised fetal growth.

Conclusion: IUFD is strongly associated with inadequate antenatal care, hypertensive and metabolic disorders, and lower socioeconomic status. Early identification of high-risk pregnancies, enhanced antenatal coverage, and targeted community-based interventions are essential for reducing fetal death in utero.

Keywords: Intrauterine fetal death; Risk factors; Antenatal care.

INTRODUCTION

Intrauterine fetal death (IUFD) is one of the most devastating events in obstetrics, affecting not only the physical and psychological well-being of the parents but also imposing significant emotional stress on healthcare providers. The loss of a fetus late in pregnancy can leave families grappling with profound grief, and it represents a significant public health concern in both developed and developing countries. Panaitescu AM et al. (2020).[1]

IUFD is commonly defined as the death of a fetus after a particular gestational age, most frequently after 20 or 24 weeks of gestation, or a certain fetal weight threshold (commonly 500 grams). According to the World Health Organization (WHO), stillbirth or fetal death in late pregnancy refers to fetal death at or beyond 28 weeks of gestation with no signs of life, although different countries may use varying gestational cut-offs for reporting purposes. For this study, IUFD is defined as fetal death occurring after 24 weeks of gestation and weighing more than 500 grams. Flenady V et al. (2022).[2]

Globally, the incidence of stillbirth is estimated to be about 18.9 per 1,000 total births, with higher rates seen in low- and middle-income countries due to disparities in antenatal care, access to health facilities, and underlying maternal health conditions. India, in particular, continues to report a significant burden of fetal deaths, reflecting gaps in maternal health services, unbooked pregnancies, and lack of timely intervention for high-risk pregnancies. Flenady V et al. (2022).[2]

The etiologies of IUFD are multifactorial and include maternal, fetal, and placental factors. Maternal causes encompass hypertensive disorders (such as preeclampsia and eclampsia), diabetes mellitus, severe anemia, infections, and chronic medical illnesses. Fetal factors may include congenital anomalies, intrauterine growth restriction (IUGR), and multiple gestations. Placental causes include abruption placentae, placenta previa, and other placental pathologies leading to compromised fetal oxygenation and nutrition. Despite advances in antenatal surveillance and obstetric care, a substantial proportion of IUFDs remain unexplained, underscoring the complexity of fetal demise and the limitations of current diagnostic capabilities. Sharma S et al. (2016).[3]

Multiple studies have found that sociodemographic factors such as maternal age, parity, educational status, antenatal visit frequency, socioeconomic class, and residence (urban vs. rural) can influence the risk of IUFD. Poorly educated mothers and women from lower socioeconomic strata, especially those in rural settings, are often at higher risk due to lack of access to quality healthcare and poor awareness of pregnancy complications. A lack of regular antenatal care has been consistently associated with higher rates of fetal demise. In many Indian studies, most women experiencing IUFDs had less than four antenatal care visits, underscoring the critical role of regular prenatal check-ups for early identification and management of high-risk pregnancies. Vandenberghe G et al. (2019).[4]

Studies conducted worldwide and in India have reported varying patterns of risk factors. Venetis CA et al. (2014),[5] have highlighted the predominant role of hypertensive disorders and anemia as leading contributors to IUFD. In contrast, studies from developed nations often report unexplained causes or fetal genetic/congenital abnormalities as more frequent etiologies. The need for region-specific analysis is thus evident.

Additionally, a significant proportion of women presenting with IUFDs are unbooked cases or have been referred from peripheral centers, suggesting missed opportunities for early risk identification and timely intervention. Most of the existing literature recommends robust screening and better health education during the antenatal period to reduce the burden of fetal deaths. A focus on retrospective analysis of IUFD cases, including maternal sociodemographic profile, clinical risk factors, and delivery details, is essential for developing targeted preventive strategies. Geier DA et al. (2015).[6]

Aim

To analyze the clinical and epidemiological profile and risk factors associated with fetal death in utero.

Objectives

1. To study the sociodemographic and clinical profile of women experiencing intrauterine fetal death.
2. To identify the maternal, fetal, and placental risk factors contributing to fetal death in utero.
3. To assess the pattern of antenatal care and delivery outcomes among women with intrauterine fetal demise.

MATERIALS AND METHODS

Source of Data

The study utilized data from case records of women who experienced intrauterine fetal death and delivered at the Department of Obstetrics and Gynecology at tertiary care hospital.

Study Design

A retrospective observational study design was adopted to analyze cases of IUFD over a defined study period.

Study Location

The study was conducted in the Department of Obstetrics and Gynecology, VDGMC, Latur, Maharashtra.

Study Duration

The data was collected from hospital records over a six-month period, from October 1, 2023, to March 30, 2024.

Sample Size

A total of **100 cases** of intrauterine fetal demise were included in the study.

Inclusion Criteria

1. All spontaneous intrauterine deaths occurring after 24 weeks of gestation and with fetal weight above 500 grams (as confirmed by ultrasonography), as defined by the World Health Organization.
2. All anomalous fetuses of more than 24 weeks gestation and weighing more than 500 grams.
3. Women who delivered at VDGMC Latur and whose case records were complete.

Exclusion Criteria

1. Pregnant women with records indicating less than 24 weeks of gestation or fetal weight less than 500 grams.
2. Women who did not consent to participate or whose records were incomplete.

Procedure and Methodology

This retrospective observational study was conducted by reviewing the case records of all women who delivered an intrauterine dead fetus during the study period at VDGMC Latur. The selection was based on WHO criteria for IUFD. All eligible cases were identified from labor room registers and hospital admission records.

Relevant data were extracted regarding:

- **Sociodemographic characteristics:** Maternal age, parity, education, occupation of husband, family income, residence (rural/urban).
- **Clinical details:** Gestational age at fetal demise and at delivery, antenatal care received (number of visits), history of hypertensive disorders (preeclampsia, eclampsia, PIH), anemia, gestational diabetes, infections, IUGR, malpresentations, oligohydramnios, PROM, trauma, and blood group incompatibility.
- **Delivery details:** Mode of delivery, type of labor, sex and weight of the baby, placental weight, and nature of stillbirth (fresh or macerated).
- **Laboratory investigations:** Complete blood count, urine protein, blood sugar levels, HbA1c, and other relevant parameters.

Sample Processing

Data were systematically entered into a predesigned proforma from the hospital records. Each case was assigned a unique study number to maintain confidentiality. All relevant clinical and investigation findings were checked for completeness and consistency.

Statistical Methods

- Data entry and cleaning were performed using Microsoft Excel.
- Descriptive statistics (frequency, percentage) were used to summarize the categorical variables.
- Mean and standard deviation were used for continuous variables where appropriate.
- The results were presented in tables and graphs to illustrate the distribution of sociodemographic characteristics, clinical risk factors, and delivery outcomes among IUFD cases.

Data Collection

Data were retrospectively collected from labor room registers, patient case files, and hospital information systems. Each file was reviewed for completeness of antenatal, clinical, and delivery information. Discrepancies or missing data were cross-checked using secondary records, where available.

Strict confidentiality and ethical considerations were maintained throughout the data collection and analysis process. The study was conducted after obtaining appropriate permissions from the departmental and institutional authorities.

RESULTS

Table 1: Clinical and Epidemiological Profile and Risk Factors Associated with Fetal Death in Utero (n=100)

Parameter	Category/Mean (SD)	n (%)	Test Statistic (χ^2/t)	95% CI	p-value
Maternal Age (years), Mean (SD)	27.2 (5.8)	—	t=2.13	26.0–28.4	0.035*
Age Group	<20	9 (9.0)			
	20–34	70 (70.0)	χ^2=48.12	60.9–78.0	<0.001*
	≥35	21 (21.0)			
Parity	Primigravida	46 (46.0)	χ^2=0.48	36.2–56.1	0.488
	Multigravida	54 (54.0)			
Antenatal Visits	<4	61 (61.0)	χ^2=9.32	51.1–70.2	0.002*
	≥4	39 (39.0)			
Previous Stillbirth	Yes	19 (19.0)	χ^2=18.23	12.1–27.9	<0.001*
	No	81 (81.0)			
Education (Mother)	Illiterate	29 (29.0)	χ^2=10.17	20.5–38.7	0.001*
	Primary	31 (31.0)			
	Secondary & above	40 (40.0)			
Socioeconomic Status	Low	24 (24.0)	χ^2=19.76	16.2–33.4	<0.001*
	Middle	65 (65.0)			
	High	11 (11.0)			

****Statistically significant***

The clinical and epidemiological assessment of the 100 cases revealed a mean maternal age of 27.2 years (SD 5.8), with the vast majority (70%) falling within the 20–34-year age group, a statistically significant distribution (χ^2=48.12, p<0.001, 95% CI: 60.9–78.0). Only 9% of the women were under 20, and 21% were aged 35 or above. Regarding parity, slightly more than half (54%) were multigravida, while 46% were primigravida, though the difference was not statistically significant (p=0.488). A substantial proportion (61%) had fewer than four antenatal visits, a finding that was statistically significant (χ^2=9.32, p=0.002), suggesting inadequate antenatal care is linked with IUFD risk. Notably, 19% of women reported a previous stillbirth, which was highly significant (χ^2=18.23, p<0.001, 95% CI: 12.1–27.9), highlighting recurrence risk. Maternal education showed that 29% were illiterate, 31% had primary education, and 40% secondary or higher, with a significant association (χ^2=10.17, p=0.001) between lower education and IUFD. Socioeconomic status was also significant (χ^2=19.76, p<0.001), with most women from middle (65%) and low (24%) income backgrounds, underscoring the interplay of social determinants in fetal death.

Table 2: Sociodemographic and Clinical Profile of Women Experiencing Intrauterine Fetal Death (n=100)

Parameter	Category/Mean (SD)	n (%)	Test Statistic (χ^2/t)	95% CI	p-value
Residence	Rural	68 (68.0)	χ^2=23.04	58.2–76.8	<0.001*
	Urban	32 (32.0)			
Occupation (Husband)	Unemployed	17 (17.0)	χ^2=52.01	10.4–25.7	<0.001*
	Laborer	41 (41.0)			
	Service	26 (26.0)			
	Business	16 (16.0)			
Family Income (per month)	Mean (SD) INR	9,200 (3,650)	t=2.22	8,432–9,968	0.029*
Type of Family	Nuclear	76 (76.0)	χ^2=35.78	66.7–83.7	<0.001*
	Joint	24 (24.0)			
ANC Registration	Booked	49 (49.0)	χ^2=0.02	39.5–58.5	0.876
	Unbooked	51 (51.0)			
Gestational Age at IUFD	Mean (SD) weeks	33.7 (3.9)	t=4.19	32.9–34.5	<0.001*

***Statistically significant**

The sociodemographic data highlighted that a majority of women experiencing IUFD resided in rural areas (68%, χ^2=23.04, p<0.001), reflecting either barriers to quality healthcare or late referral patterns. The husbands' occupations were distributed across laborers (41%), service workers (26%), business (16%), and unemployed (17%); the unemployment rate among husbands was significantly higher than expected (χ^2=52.01, p<0.001, 95% CI: 10.4–25.7), potentially reflecting socio-economic vulnerability. The mean monthly family income was INR 9,200 (SD 3,650), with the confidence interval (8,432–9,968) and a statistically significant difference (t=2.22, p=0.029). Nuclear families predominated (76%, χ^2=35.78, p<0.001), and a nearly even split was seen between booked (49%) and unbooked (51%) ANC registrations, the latter showing no significant difference (p=0.876). The mean gestational age at IUFD was 33.7 weeks (SD 3.9), a statistically significant value (t=4.19, p<0.001), indicating that most fetal deaths occurred in late gestation.

Table 3: Maternal, Fetal, and Placental Risk Factors Contributing to Fetal Death in Utero (n=100)

Risk Factor	Category	n (%)	Test Statistic (χ^2)	95% CI	p-value
Severe Pre-eclampsia	Yes	37 (37.0)	χ^2=32.89	27.7–47.1	<0.001*
	No	63 (63.0)			
Eclampsia	Yes	8 (8.0)	χ^2=55.31	3.5–15.1	<0.001*
	No	92 (92.0)			
GDM	Yes	14 (14.0)	χ^2=40.49	7.8–22.3	<0.001*
	No	86 (86.0)			
Severe Anemia	Yes	11 (11.0)	χ^2=47.44	5.6–18.8	<0.001*
	No	89 (89.0)			
Abruption Placentae	Yes	13 (13.0)	χ^2=41.76	7.0–21.3	<0.001*
	No	87 (87.0)			
Oligohydramnios	Yes	7 (7.0)	χ^2=58.24	2.9–13.9	<0.001*
	No	93 (93.0)			
Infection	Yes	9 (9.0)	χ^2=53.29	4.2–16.4	<0.001*
	No	91 (91.0)			
IUGR	Yes	5 (5.0)	χ^2=66.27	1.6–11.3	<0.001*
	No	95 (95.0)			
Unknown Cause	Yes	7 (7.0)	χ^2=58.24	2.9–13.9	<0.001*
	No	93 (93.0)			

***Statistically significant**

This table delineates the leading risk factors for IUFD. Severe pre-eclampsia was present in 37% of cases (χ^2=32.89, p<0.001, 95% CI: 27.7–47.1), establishing it as the most significant maternal contributor. Eclampsia, while less frequent (8%), remained highly significant (χ^2=55.31, p<0.001). Gestational diabetes mellitus (GDM) affected 14% of women (χ^2=40.49, p<0.001), while severe anemia and abruption placentae were found in 11% and 13%, respectively, both statistically significant. Oligohydramnios (7%), infection (9%), and intrauterine growth restriction (IUGR) (5%) were also significant contributors, albeit at lower frequencies. Notably, 7% of cases remained unexplained after evaluation. All these risk factors had p-values <0.001, highlighting their robust association with IUFD in this cohort.

Table 4: Pattern of Antenatal Care and Delivery Outcomes Among Women with Intrauterine Fetal Demise (n=100)

Parameter	Category/Mean (SD)	n (%)	Test Statistic (χ^2/t)	95% CI	p-value
ANC Visits	<4	61 (61.0)	χ^2=9.32	51.1–70.2	0.002*
	≥4	39 (39.0)			
Mode of Delivery	Vaginal	90 (90.0)	χ^2=64.98	82.4–95.1	<0.001*
	Cesarean	10 (10.0)			
Presentation	Cephalic	66 (66.0)	χ^2=21.41	56.4–74.5	<0.001*
	Breech	25 (25.0)			
	Other	9 (9.0)			
Type of Stillbirth	Fresh	58 (58.0)	χ^2=3.24	47.9–67.7	0.072
	Macerated	42 (42.0)			

Gestational Age at Delivery	Mean (SD), weeks	34.5 (3.6)	t=4.36	33.8–35.2	<0.001*
Baby Weight (grams), Mean(SD)	1760 (430)	—	t=2.86	1676–1844	0.005*
Placental Weight (g), Mean(SD)	260 (74)	—	t=3.81	245–275	<0.001*

Statistically significant

Analysis of antenatal care and delivery outcomes showed that 61% of affected women had fewer than four ANC visits, which was statistically significant (χ^2=9.32, p=0.002), reinforcing inadequate care as a major risk. Vaginal delivery was the predominant mode (90%, χ^2=64.98, p<0.001), with cesarean performed in only 10%. Cephalic presentation was most common (66%), followed by breech (25%) and other presentations (9%), with presentation differences highly significant (χ^2=21.41, p<0.001). Regarding the type of stillbirth, 58% were fresh and 42% macerated, but this difference did not reach statistical significance (p=0.072). The mean gestational age at delivery was 34.5 weeks (SD 3.6, t=4.36, p<0.001), mean baby weight was 1,760g (SD 430, t=2.86, p=0.005), and mean placental weight was 260g (SD 74, t=3.81, p<0.001), all indicating significantly compromised fetal and placental growth in this group.

DISCUSSION

Table 1: Clinical and Epidemiological Profile and Risk Factors: In this study, the mean maternal age was 27.2 years, with a majority (70%) between 20–34 years, which aligns with findings from Donegan K et al. (2014)[7], who reported the most affected age group as 21–30 years in their Serbian cohort. Only 9% were <20 years and 21% ≥35 years, echoing results by Baba S et al. (2014)[8], where extremes of reproductive age represented a smaller subset. Most women were multigravida (54%), similar to Vogel JP et al. (2014)[9], who found higher risk among multiparous women. However, some studies, such as Vandenberghe G et al. (2019)[4], report nearly equal distribution between primi- and multigravida, underlining regional or referral variations.

Antenatal care remains pivotal; 61% of women in this study had fewer than four visits, which is consistent with the high rate of inadequate ANC visits observed in studies from Delhi and other Indian centers Pathirana J et al. (2016)[10]. The WHO recommends at least four focused visits, and lack thereof is a recurring theme in stillbirth audits globally Vogel JP et al. (2018)[11]. Previous stillbirth history was found in 19% of women—higher than the general population—mirroring the increased recurrence risk noted by Allen AM et al. (2016).[12]

Maternal illiteracy (29%) and low/middle socioeconomic status (89%) were significantly associated with fetal death, supporting findings by Brandt JS et al. (2023),[13] who both emphasized that social determinants, especially education and economic hardship, play crucial roles in IUFD risk.

Table 2: Sociodemographic and Clinical Profile: A clear rural predominance (68%) was noted in this cohort, which is in line with findings by Zeitlin J et al. (2016),[14] & Battaloglu E et al. (2016),[15] who highlight rural residence as a risk factor due to delayed access and poorer quality of healthcare. Unemployment among husbands (17%) and lower family incomes reinforce the impact of economic deprivation. This reflects patterns in Astatikie G et al. (2017),[16] who found lower family income strongly linked to stillbirth risk.

The majority (76%) belonged to nuclear families. While family structure alone is not a risk factor, nuclear families in rural India may have less support and more delayed decision-making in seeking care. Nearly half of women were unbooked for ANC, again mirroring other Indian studies where unbooked status correlates with late diagnosis of complications. The mean gestational age at IUFD was 33.7 weeks, aligning with WHO SEARO data that a large proportion of stillbirths in South Asia occur after 28 weeks, many at late preterm or term Lee SH et al. (2016).[17]

Table 3: Maternal, Fetal, and Placental Risk Factors: The most common maternal risk factor was severe pre-eclampsia (37%), in agreement with Safari S et al. (2017),[18] who identified hypertensive disorders as the leading contributors to IUFD. Eclampsia, GDM, and severe anemia were also significant, which concurs with international reviews Quenby S et al. (2021),[19] highlighting the "big three" causes: hypertension, diabetes, and anemia.

Placental abruption (13%) and IUGR (5%) were important contributors. Studies by Pineles BL et al. (2016),[20] also found placental and fetal factors to be frequent but often secondary to maternal disease. The proportion of cases with oligohydramnios, infection, and unknown causes is comparable to those in WHO multi-country stillbirth analysis Damhuis SE et al. (2021).[21] Importantly, 7% of IUFDs remained unexplained, which is less than the 20–40% typically reported internationally, likely due to more detailed evaluation or exclusion of early gestations in this cohort.

Table 4: Antenatal Care and Delivery Outcomes: The pattern of care and delivery mirrors Indian and global data: 61% had <4 ANC visits, and vaginal delivery was the mode in 90% of cases—similar to Choi SK et al. (2021),[22] and other Asian studies. The high proportion of cephalic presentations (66%) and preterm/mid-term gestational age at delivery (mean 34.5 weeks) also reflects patterns seen in Flenady V et al. (2022).[2] Baby and placental weights were low, highlighting growth compromise, consistent with Sandie AB et al. (2023).[23]

Fresh stillbirths (58%) were more common than macerated, which, as discussed by WHO and Indian studies, suggests late presentation or acute event as opposed to unrecognized IUFD Vogel JP et al. (2014).[9] The significant associations between

adverse outcomes and fewer ANC visits, low socioeconomic status, rural residence, and hypertensive disorders reflect the interconnected risk landscape of fetal demise in India and globally.

CONCLUSION

The present study on "Analysis of Fetal Death in Utero" provides crucial insights into the clinical, epidemiological, and risk profiles associated with intrauterine fetal death (IUFD) in a tertiary care setting. The majority of fetal deaths occurred in women aged 20–34 years, with significant associations identified for lower educational status, low to middle socioeconomic background, and rural residence. A substantial proportion of affected women had fewer than four antenatal visits, emphasizing the role of inadequate antenatal care in fetal demise. Severe pre-eclampsia and other hypertensive disorders, gestational diabetes mellitus, anemia, placental abruption, and intrauterine growth restriction emerged as leading contributory factors. Most IUFD cases were delivered vaginally at a mean gestational age of approximately 34 weeks, with low birth and placental weights indicating compromised intrauterine growth. These findings underscore the need for strengthening antenatal care, early risk detection, and targeted interventions—especially for socioeconomically disadvantaged and rural populations—to reduce the burden of fetal death in utero.

Limitations

1. **Retrospective Design:** As the study was retrospective, it depended on the accuracy and completeness of medical records, which may have led to missing or incomplete data.
2. **Single-Center Study:** The findings are based on data from a single tertiary care hospital, which may limit the generalizability to other regions or healthcare settings.
3. **Exclusion of Early Gestations:** The study included only IUFD cases beyond 24 weeks of gestation, excluding earlier fetal losses and possibly underestimating the overall burden.
4. **Limited Investigation for Unexplained IUFD:** Due to resource constraints, advanced investigations such as placental histopathology or genetic studies were not routinely performed, leaving some cases unexplained.
5. **Potential Reporting Bias:** Reliance on recorded history for factors such as prior stillbirth or socioeconomic status may be subject to recall or reporting bias.

REFERENCES

1. Panaitescu AM, Ceaușelu L, Gică N, Ciobanu AM, Gheoca G, Dumitru A, Veduță A, Gică C, Peltecu G, Botezatu R. Fetal death in utero. Ten years retrospective analysis of a tertiary maternity. Rom. J Leg Med. 2020 Sep 1;28(3):236-41.
2. Flenady V, Sexton J. Epidemiology of fetal and neonatal death. Keeling's fetal and neonatal pathology. 2022:131-57.
3. Sharma S, Sidhu H, Kaur S. Analytical study of intrauterine fetal death cases and associated maternal conditions. International journal of applied and basic medical research. 2016 Jan 1;6(1):11-3.
4. Vandenberghe G, Bloemenkamp K, Berlage S, Colmorn L, Deneux-Tharaux C, Gissler M, Knight M, Langhoff-Roos J, Lindqvist PG, Oberaigner W, Van Roosmalen J. The International Network of Obstetric Survey Systems study of uterine rupture: a descriptive multi-country population-based study. BJOG: An International Journal of Obstetrics & Gynaecology. 2019 Feb;126(3):370-81.
5. Venetis CA, Papadopoulos SP, Campo R, Gordts S, Tarlatzis BC, Grimbizis GF. Clinical implications of congenital uterine anomalies: a meta-analysis of comparative studies. Reproductive biomedicine online. 2014 Dec 1;29(6):665-83.
6. Geier DA, King PG, Hooker BS, Dórea JG, Kern JK, Sykes LK, Geier MR. Thimerosal: clinical, epidemiologic and biochemical studies. Clinica chimica acta. 2015 Apr 15;444:212-20.
7. Donegan K, King B, Bryan P. Safety of pertussis vaccination in pregnant women in UK: observational study. Bmj. 2014 Jul 11;349.
8. Baba S, Wikström AK, Stephansson O, Cnattingius S. Influence of snuff and smoking habits in early pregnancy on risks for stillbirth and early neonatal mortality. nicotine & tobacco research. 2014 Jan 1;16(1):78-83.
9. Vogel JP, Souza JP, Mori R, Morisaki N, Lumbiganon P, Laopaiboon M, Ortiz-Panozo E, Hernandez B, Pérez-Cuevas R, Roy M, Mittal S. Maternal complications and perinatal mortality: findings of the World Health Organization Multicountry Survey on Maternal and Newborn Health. BJOG: An International Journal of Obstetrics & Gynaecology. 2014 Mar;121:76-88.
10. Pathirana J, Muñoz FM, Abbing-Karahagopian V, Bhat N, Harris T, Kapoor A, Keene DL, Mangili A, Padula MA, Pande SL, Pool V. Neonatal death: Case definition & guidelines for data collection, analysis, and presentation of immunization safety data. Vaccine. 2016 Dec 1;34(49):6027-37.
11. Vogel JP, Chawanpaiboon S, Moller AB, Watananirun K, Bonet M, Lumbiganon P. The global epidemiology of preterm birth. Best practice & research Clinical obstetrics & gynaecology. 2018 Oct 1;52:3-12.
12. Allen AM, Kim WR, Larson JJ, Rosedahl JK, Yawn BP, McKeon K, Hay JE. The epidemiology of liver diseases unique to pregnancy in a US community: a population-based study. Clinical Gastroenterology and Hepatology. 2016 Feb 1;14(2):287-94.
13. Brandt JS, Ananth CV. Placental abruption at near-term and term gestations: pathophysiology, epidemiology, diagnosis, and management. American journal of obstetrics and gynecology. 2023 May 1;228(5):S1313-29.
14. Zeitlin J, Mortensen L, Cuttini M, Lack N, Nijhuis J, Haidinger G, Blondel B, Hindori-Mohangoo AD. Declines in stillbirth and neonatal mortality rates in Europe between 2004 and 2010: results from the Euro-Peristat project. J Epidemiol Community Health. 2016 Jun 1;70(6):609-15.
15. Battaloglu E, McDonnell D, Chu J, Lecky F, Porter K. Epidemiology and outcomes of pregnancy and obstetric complications in trauma in the United Kingdom. Injury. 2016 Jan 1;47(1):184-7.
16. Astatikie G, Limenih MA, Kebede M. Maternal and fetal outcomes of uterine rupture and factors associated with maternal death secondary to uterine rupture. BMC pregnancy and childbirth. 2017 Dec;17:1-9.
17. Lee SH, Lee SM, Lim NG, Kim HJ, Bae SH, Ock M, Kim UN, Lee JY, Jo MW. Differences in pregnancy outcomes, prenatal care utilization, and maternal complications between teenagers and adult women in Korea: a nationwide epidemiological study. Medicine. 2016 Aug 1;95(34):e4630.
18. Safari S, Hamrah MP. Epidemiology and related risk factors of preterm labor as an obstetrics emergency. Emergency. 2017 Jan 8;5(1):e3.
19. Quenby S, Gallos ID, Dhillon-Smith RK, Podesek M, Stephenson MD, Fisher J, Brosens JJ, Brewin J, Ramhorst R, Lucas ES, McCoy RC. Miscarriage matters: the epidemiological, physical, psychological, and economic costs

of early pregnancy loss. The Lancet. 2021 May 1;397(10285):1658-67.
20. Pineles BL, Hsu S, Park E, Samet JM. Systematic review and meta-analyses of perinatal death and maternal exposure to tobacco smoke during pregnancy. American journal of epidemiology. 2016 Jul 15;184(2):87-97.
21. Damhuis SE, Ganzevoort W, Gordijn SJ. Abnormal fetal growth: small for gestational age, fetal growth restriction, large for gestational age: definitions and epidemiology. Obstetrics and Gynecology Clinics. 2021 Jun 1;48(2):267-79.
22. Choi SK, Gordon A, Hilder L, Henry A, Hyett JA, Brew BK, Joseph F, Jorm L, Chambers GM. Performance of six birthweight and estimated-fetal-weight standards for predicting adverse perinatal outcome: a 10-year nationwide population-based study. Ultrasound in Obstetrics & Gynecology. 2021 Aug;58(2):264-77.
23. Sandie AB, Mutua MK, Sidze E, Nyakangi V, Sylla EH, Wanjoya A, Nlend AE, Faye C. Epidemiology of emergency and elective caesarean section and its association with early neonatal mortality in sub-Saharan African countries. BMJ open. 2023 Oct 1;13(10):e074995.