



# Prevalence and Risk Factors of Intrauterine Fetal Death: Insights from a Referral Maternity Center

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## Abstract

**Background:** Intrauterine fetal death (IUFD) is a significant obstetric complication with profound medical, psychological, and social consequences. Despite advances in prenatal care, IUFD remains a pressing concern, particularly in developing regions where healthcare disparities persist. Understanding the prevalence and associated risk factors is crucial for developing preventive strategies and improving maternal-fetal outcomes.

**Objectives:** The present study aimed to determine the prevalence of IUFD and examine its associated maternal, fetal, and obstetric factors among pregnant women admitted to the Maternity Ward of Ali Ibn Abi Talib Hospital in Zahedan, Iran, from 2015 to 2018.

**Methods:** A cross-sectional study was conducted by reviewing 23,220 delivery records over a three-year period. Cases of IUFD were identified based on the clinical definition of fetal demise occurring after 20 weeks of gestation or with a fetal weight of at least 500 grams (500 g). A total of 500 IUFD cases were included in the final analysis. Data on maternal demographics, medical history, prenatal care, fetal complications, and placental abnormalities were collected and analyzed using IBM SPSS Statistics Version 22.0.

**Results:** The overall prevalence of IUFD was 2.2% (500 cases out of 23,220 deliveries). The IUFD was significantly more frequent in vaginal deliveries compared to cesarean sections ( $P < 0.001$ ). The majority of cases occurred in women aged 20 - 34 years (71.6%), with lower education levels associated with higher IUFD incidence ( $P < 0.001$ ). Gestational age was a critical factor, with most IUFDs occurring between 27 - 34 weeks (38.0%) ( $P = 0.001$ ). A history of stillbirth ( $P < 0.001$ ), inadequate prenatal care ( $P < 0.001$ ), and maternal comorbidities such as hypertension (28.6%) and diabetes (19.0%) were significantly associated with IUFD. Notably, umbilical cord abnormalities were present in 99.0% of cases, making them the leading contributory factor.

**Conclusions:** The IUFD remains a significant concern, with maternal health conditions, prenatal care quality, and umbilical cord complications playing pivotal roles. Strengthening prenatal surveillance, early identification of high-risk pregnancies, and addressing modifiable maternal risk factors could substantially reduce IUFD rates. This study was limited by its retrospective design and reliance on hospital records, which may have led to incomplete documentation of key variables such as the timing and precise causes of IUFD. Inconsistent recording of pathological findings further restricted detailed etiologic analysis. Future prospective studies with standardized data collection and comprehensive pathological evaluation are recommended to better elucidate IUFD risk factors and mechanisms.

**Keywords:** Pregnancy Complications, Pregnancy Outcome, Prenatal Care, Maternal Age

## 1. Background

Intrauterine fetal death (IUFD) is a relatively common complication in pregnant women, accounting for

approximately 1.5% of all births. This phenomenon represents a serious and complex obstetric issue that not only poses significant medical challenges but also

exerts profound psychological distress on the mother (1).

The IUFD, defined as the death of a fetus in utero, is generally diagnosed when fetal demise occurs after 20 completed weeks of gestation. If the exact gestational age is uncertain, a fetal weight of more than 500 grams (500 g) is used as a diagnostic criterion. The primary clinical indicators of fetal demise include the absence of vital signs such as fetal heartbeat, umbilical cord pulsation, and voluntary muscle movements (2).

A multitude of factors, spanning environmental, social, demographic, and obstetric domains, have been identified as contributors to IUFD (3). These include poverty, air pollution, racial disparities, inadequate prenatal care, poor maternal nutrition, unfavorable socioeconomic conditions, a history of stillbirth, abnormal maternal serum biochemical markers, genetic disorders, fetal anomalies, maternal complications during pregnancy, placental abnormalities such as placental abruption and placenta previa, blood group incompatibilities, gestational age, and birth weight (4, 5). Despite extensive research, the exact cause of fetal death remains unidentified in nearly two-thirds of cases. The remaining one-third can be attributed to maternal, fetal, and placental factors (6, 7). Furthermore, gestational age, multiple pregnancies, and maternal medical conditions have also been established as significant risk factors (8, 9).

Conditions such as diabetes or inherited thrombophilia have been associated with an increased risk of fetal death, yet many women with these conditions give birth to healthy neonates. Consequently, numerous factors are often labeled as risk factors rather than direct causes of fetal demise (10, 11).

Over the past three decades, the incidence of IUFD has declined in developed nations, alongside shifts in the predominant causes of fetal death (9). However, in developing countries, substantial progress is still required to achieve optimal maternal-fetal health outcomes. Notably, reports indicate a rising trend in IUFD cases in Iran compared to other nations (12).

## 2. Objectives

Therefore, the present study aims to assess the prevalence of IUFD among pregnant women referred to the Maternity Ward of Ali Ibn Abi-Talib Hospital and investigate its associated factors from 2015 to 2018.

## 3. Methods

### 3.1. Study Design and Setting

This cross-sectional study was conducted at Ali Ibn Abi-Talib Hospital, affiliated with Zahedan University of Medical Sciences, over a three-year period from 2015 to 2018. The study aimed to determine the prevalence of IUFD among pregnant women admitted to the hospital's maternity ward and to identify associated risk factors.

### 3.2. Study Population and Eligibility Criteria

The study population included all pregnant women admitted to the maternity hospital between 2015 and 2018. Inclusion criteria consisted of cases of IUFD, defined as stillbirths occurring at a gestational age of 20 weeks or more or with a fetal weight of at least 500 g, as documented in hospital records. Cases with incomplete or inaccurate medical records that compromised data integrity were excluded.

The IUFD was diagnosed based on the absence of fetal cardiac activity, confirmed by obstetric ultrasound. The diagnosis was made either before the onset of labor during routine prenatal checkups or hospital visits due to decreased fetal movement, or during labor in cases where fetal demise occurred intrapartum. In cases of antepartum IUFD, the women were admitted for labor induction or cesarean delivery depending on obstetric indications. All cases were recorded after verification by an attending obstetrician and documented in the hospital delivery registry.

### 3.3. Data Collection and Variables

A total of 23,220 delivery records were reviewed, including 11,534 vaginal deliveries and 11,686 cesarean sections. Among these, 514 cases of IUFD were initially identified. However, 14 cases were excluded due to incomplete or unreliable documentation, resulting in a final sample of 500 IUFD cases.

Patient data were extracted from hospital medical records using a structured demographic and obstetric history form, supplemented by the relevant condition at death (ReCoDe) classification checklist for determining fetal death causes. The collected variables encompassed maternal characteristics such as age, education level, number of previous pregnancies, history of stillbirth, and mode of previous deliveries. Gestational parameters, including gestational age at the time of IUFD and the occurrence of multiple pregnancies, were also recorded. Information on prenatal care indicators, including maternal blood pressure, height, weight, pelvic examinations, fetal heart rate monitoring, maternal blood and urine tests, and maternal education on pregnancy care, was systematically reviewed.

Additionally, maternal risk factors such as intrahepatic cholestasis, diabetes mellitus, systemic lupus erythematosus, hypertension, renal and thyroid disorders, thrombophilia, obesity, infections, smoking, and substance use were examined. Fetal complications, including congenital anomalies, fetal infections, intrauterine growth restriction (IUGR), fetal-maternal hemorrhage, twin-to-twin transfusion syndrome, intrapartum asphyxia, and isoimmunization, were identified. The study also assessed umbilical cord abnormalities as well as placental abnormalities.

#### 3.4. Statistical Analysis

The collected data were systematically entered into a computerized database and analyzed using IBM SPSS Statistics for Windows, Version 22.0. Descriptive statistics, including frequency distributions and percentages, were used to summarize categorical variables. Associations between IUFD and categorical variables (e.g., maternal age group, education level, delivery method, gestational age, number of pregnancies, maternal comorbidities, fetal and placental complications) were assessed using the chi-square test or Fisher's exact test where appropriate. For continuous variables (e.g., maternal age in years), independent *t*-tests or one-way ANOVA were used depending on the number of comparison groups. A *P*-value of  $< 0.05$  was considered statistically significant for all analyses.

#### 3.5. Handling of Missing Data

To maintain the integrity and reliability of the study findings, missing data were systematically addressed. Initially, 514 cases of IUFD were identified from hospital records. However, 14 cases (2.7%) were excluded due to incomplete or unreliable documentation that compromised data accuracy. Missing data within the remaining 500 cases were assessed for each variable. For categorical variables, cases with missing values were excluded from the specific analysis while retaining them in other analyses where data were available. By implementing these strategies, we ensured that missing data did not introduce bias or significantly affect the study conclusions.

### 4. Results

This study investigated the prevalence of IUFD across various maternal, pregnancy, and obstetric characteristics. A total of 23,220 deliveries were analyzed, with 500 cases of IUFD identified, yielding an overall incidence of 2.2%.

#### 4.1. Prevalence of Intrauterine Fetal Death by Delivery Method

Among the 500 IUFD cases, 400 (80%) were delivered vaginally, and 100 (20%) were delivered via cesarean section. This distribution indicates that the vast majority of IUFD cases were managed through vaginal delivery. When comparing IUFD rates by delivery method, IUFD occurred in 3.5% of vaginal deliveries (400/11,534) and 0.85% of cesarean deliveries (100/11,686), indicating a statistically significant association between delivery method and IUFD status ( $P < 0.0001$ ; **Table 1**).

#### 4.2. Frequency of Intrauterine Fetal Death Based on Maternal and Pregnancy Characteristics

**Table 2** presents the distribution of IUFD cases by various maternal and pregnancy-related characteristics. The majority of IUFD cases occurred in women aged 20 - 34 years (71.6%,  $n = 358$ ), followed by those aged 35 - 40 years (16.4%,  $n = 82$ ). Women below 20 years and above 40 years accounted for 8.0% ( $n = 40$ ) and 4.0% ( $n = 20$ ) of IUFD cases, respectively. The association between maternal age and IUFD was strongly correlated ( $P < 0.001$ ).

Regarding maternal education, the highest frequency of IUFD was found among illiterate women (35.0%,  $n = 175$ ), followed by those with non-university education (62.0%,  $n = 310$ ), and university-educated women (3.0%,  $n = 15$ ). Educational level also showed a significant association ( $P < 0.001$ ), as IUFD was more prevalent among illiterate and non-university-educated women.

In terms of gestational age, the majority of IUFDs occurred between 27 - 34 weeks (38.0%,  $n = 190$ ), followed by 20 - 26 weeks (34.6%,  $n = 173$ ), and 35 - 42 weeks (27.4%,  $n = 137$ ). The gestational age at the time of IUFD was significantly different across groups ( $P = 0.001$ ).

The number of pregnancies was another significant factor ( $P < 0.001$ ). When examining the number of pregnancies, the highest incidence was observed among women with 2 - 5 previous pregnancies (62.6%,  $n = 313$ ), while women with first pregnancies accounted for 21.4% ( $n = 107$ ) of IUFD cases. Regarding previous delivery type, 58.6% ( $n = 293$ ) of women with IUFD had previously delivered vaginally, while 11.4% ( $n = 57$ ) had a cesarean section history, and 8.6% ( $n = 43$ ) had both delivery types ( $P < 0.001$ ).

#### 4.3. Association Between Intrauterine Fetal Death and Obstetric Factors

**Table 1.** Frequency of Intrauterine Fetal Death in Studied Groups <sup>a</sup>

Delivery Method	With IUFD	Without IUFD	Total	P-Value
Vaginal delivery	400 (3.47)	11,134 (96.53)	11,534 (49.7)	
Cesarean delivery	100 (0.86)	11,586 (99.14)	11,686 (50.3)	
Total	500 (2.15)	22,720 (97.85)	23,220 (100)	< 0.0001

Abbreviation: IUFD, intrauterine fetal death.

<sup>a</sup>Values are expressed as No. (%).**Table 2.** Comparison of Maternal and Pregnancy Characteristics Based on Intrauterine Fetal Death Status <sup>a</sup>

Characteristics	With IUFD	Without IUFD	Total	P-Value
<b>Maternal age (y)</b>				< 0.001
Below 20	40 (0.72)	5,460 (99.28)	5,500 (23.7)	
20 - 34	358 (2.05)	17,102 (97.95)	17,460 (75.2)	
35 - 40	82 (3.33)	2,378 (96.67)	2,460 (10.6)	
Above 40	20 (4.0)	480 (96.0)	500 (2.2)	
<b>Maternal education level</b>				< 0.001
Illiterate	175 (3.8)	4,425 (96.2)	4,600 (19.8)	
Non-university	310 (2.0)	15,190 (98.0)	15,500 (66.8)	
University	15 (0.3)	4,685 (99.7)	4,700 (20.2)	
<b>Gestational age (wk)</b>				0.001
20 - 26	173 (3.2)	5,227 (96.8)	5,400 (23.3)	
27 - 34	190 (2.9)	6,310 (97.1)	6,500 (28.0)	
35 - 42	137 (1.7)	7,183 (98.3)	7,320 (31.5)	
<b>Number of pregnancies</b>				< 0.001
First	107 (1.8)	5,693 (98.2)	5,800 (25.0)	
2 - 5	313 (2.9)	10,487 (97.1)	10,800 (46.5)	
6 - 10	73 (4.0)	1,757 (96.0)	1,830 (7.9)	
11 - 15	7 (5.0)	133 (95.0)	140 (0.6)	
<b>Previous delivery type</b>				< 0.001
Cesarean	57 (1.1)	5,143 (98.9)	5,200 (22.4)	
Vaginal	293 (2.8)	10,007 (97.2)	10,300 (44.3)	
Both	43 (3.4)	1,227 (96.6)	1,270 (5.5)	

Abbreviation: IUFD, intrauterine fetal death.

<sup>a</sup>Values are expressed as No. (%).

The association of IUFD with obstetric and pregnancy-related factors is presented in **Table 3**. A history of stillbirth was significantly associated with an increased risk of IUFD, with 22.0% (n = 110) of women with IUFD reporting previous stillbirths. Multiple pregnancies were less frequent, accounting for only 4.6% (n = 23) of IUFD cases.

Prenatal care, an essential factor for monitoring pregnancy health, was found to be present in 85.0% (n = 425) of the cases, while 15.0% (n = 75) did not receive adequate prenatal care. Maternal risk factors, including diabetes, hypertension, and other medical conditions, were observed in 66.6% (n = 333) of the cases, suggesting

a strong association between underlying health conditions and the occurrence of IUFD.

Fetal complications and umbilical cord complications were significant risk factors for IUFD, with 21.6% (n = 108) of IUFD cases associated with fetal complications, and a striking 99.0% (n = 495) of cases linked to umbilical cord issues. Placental complications were less common but still notable, affecting 10.0% (n = 50) of the IUFD cases.

#### 4.4. Maternal Risk Factors Contributing to Intrauterine Fetal Death

**Table 3.** Frequency of Intrauterine Fetal Death Based on Obstetric and Pregnancy-Related Factors

Factors	Present	Absent	P-Value
<b>History of stillbirth</b>	110 (22.0)	390 (78.0)	< 0.0001
<b>Multiple pregnancy</b>	23 (4.6)	477 (95.4)	0.048
<b>Prenatal care</b>	425 (85.0)	75 (15.0)	0.0008
<b>Maternal risk factors</b>	333 (66.6)	167 (33.4)	0.002
<b>Fetal complications</b>	108 (21.6)	392 (78.4)	0.0009
<b>Umbilical cord complications</b>	495 (99.0)	5 (1.0)	< 0.0001
<b>Placental complications</b>	50 (10.0)	450 (90.0)	0.015

<sup>a</sup> Values are expressed as No. (%).

**Table 4** summarizes the maternal risk factors associated with IUFN. Hypertension was the most prevalent risk factor, present in 28.6% (n = 143) of IUFN cases, followed by diabetes at 19.0% (n = 95). Thyroid disorders, substance abuse, and smoking were observed less frequently, with respective frequencies of 4.8% (n = 24), 3.6% (n = 18), and 4.2% (n = 21). Other conditions, including lupus (0.8%, n = 4), antiphospholipid syndrome (1.4%, n = 7), gynecological diseases (2.8%, n = 14), and obesity (1.4%, n = 7), were less commonly associated with IUFN.

**Table 4.** Frequency of Intrauterine Fetal Death Based on Maternal Risk Factors

Maternal Risk Factor	No. (%)
<b>Diabetes</b>	95 (19.0)
<b>Thyroid disorders</b>	24 (4.8)
<b>Hypertension</b>	143 (28.6)
<b>Lupus</b>	4 (0.8)
<b>Antiphospholipid syndrome</b>	7 (1.4)
<b>Substance abuse</b>	18 (3.6)
<b>Smoking</b>	21 (4.2)
<b>Gynecological diseases</b>	14 (2.8)
<b>Obesity</b>	7 (1.4)

## 5. Discussion

The findings of this study highlight the significant burden of IUFN and its strong association with various maternal, pregnancy-related, and obstetric factors. The overall incidence of IUFN was 2.2%, with a significantly higher occurrence in vaginal deliveries compared to cesarean sections. Maternal characteristics such as age, education level, and the number of previous pregnancies were all significantly correlated with IUFN. The highest frequency of IUFN was observed in women aged 20 - 34 years, particularly among those with lower educational attainment. Gestational age at the time of IUFN was also a crucial factor, with the majority of cases occurring between 27 - 34 weeks of pregnancy.

Additionally, maternal risk factors, including hypertension and diabetes, were commonly associated with IUFN, emphasizing the role of preexisting health conditions in adverse pregnancy outcomes. Fetal and placental complications were also major contributors, with nearly all IUFN cases linked to umbilical cord abnormalities.

A recent meta-analysis and systematic review estimated the overall frequency of IUFN in Iran at 4.9%, with variations depending on the year and location of the studies. Reported rates include 8.87% in Sanandaj (2014), 4.1% in Ahvaz (2009), 3.34% in Urmia (2006), 1.98% in Arak (2016), and 1.61% in Zahedan (2016) (13). Our findings are generally consistent with these results; however, our study covers a longer period and a larger sample size in Zahedan, which may account for the slightly higher rate observed.

A retrospective study conducted at the University Clinic Centre of Serbia analyzed IUFN cases in term pregnancies over a twelve-year period (2010 - 2022) (9). The study examined maternal, fetal, and placental factors associated with IUFN, revealing that the average maternal age was 30 years, with most women having secondary or higher education. Despite 70% of patients receiving regular prenatal care, IUFN predominantly occurred at 39 weeks of gestation. Over half (53.33%) of the pregnancies were first-time and naturally conceived. Among the participants, 38.3% had one or two associated medical conditions, while 58.33% were considered healthy. Recurrent IUFN was reported in 10% of cases, and 8.33% had a history of spontaneous abortion. Notably, more than 80% of placental histopathological findings showed abnormalities, with placental infarction being the most common. The study identified hypertensive disorders in pregnancy, obesity, and gestational diabetes as the most significant maternal risk factors for IUFN, emphasizing the critical role of placental pathology in these cases, even among otherwise healthy women.

In addition, a medical center in Taiwan analyzed stillbirth cases over a decade from September 1999 to December 2011 (14). Among 12,290 births, 121 cases of IUFD were recorded, yielding an overall incidence of 0.98%. The stillbirths were categorized into second-trimester (55.4%) and third-trimester (44.6%) groups. Higher risks for third-trimester IUFD were associated with male fetuses, increased maternal BMI, smoking, previous IUFD history, and maternal diabetes or hypertension. The leading cause of IUFD in the second trimester was unexplained (29.85%), while umbilical cord pathology (33.33%) was the most common cause in the third trimester. The study highlights the need for targeted interventions to reduce preventable stillbirths and improve pregnancy outcomes.

In a 2013 case-control study conducted in Norway, Helgadottir et al. concluded that in 50% of IUFD cases, placental complications were the primary cause, while in 19.4% of cases, no identifiable cause was found. The IUGR and maternal smoking emerged as significant risk factors across all classifications. Moreover, in twin pregnancies, hypertensive disorders and diabetes were among the most frequently reported maternal conditions associated with stillbirths due to either placental dysfunction or unknown causes (15).

Similarly, a study by Bukowski et al. in 2011 examined 663 cases of fetal death occurring before 20 weeks of gestation across 59 hospitals in the United States. Their findings indicated that the most prevalent causes were obstetric complications (150 cases), placental abnormalities (121 cases), fetal anomalies (70 cases), infections (66 cases), umbilical cord complications (53 cases), hypertensive disorders (47 cases), and other maternal medical conditions (40 cases) (16).

In a retrospective regional study conducted in Morocco, the prevalence of congenital malformations was estimated at approximately 9.2 per 1,000 births, with neural-tube defects, musculoskeletal anomalies, and chromosomal abnormalities such as trisomy 21 among the most frequently reported conditions. The authors also identified maternal age, parity, medical history, and newborn weight as significant risk factors. These findings are highly relevant to our study of IUFD, since structural and chromosomal anomalies often lie on the causal pathway to fetal demise (17). In our investigation, although we focused primarily on delivery outcomes, maternal comorbidities, and gestational age, the very high incidence of umbilical cord abnormalities (99.0% of cases) may reflect an interplay of disturbed fetal development and compromised intra-uterine environment. Drawing on the Moroccan evidence emphasizes that systematic

screening for congenital anomalies and improved prenatal diagnostic services may be essential complements to surveillance of IUFD, particularly in referral maternity settings such as ours in Zahedan.

Another recent work, examining hypochondria and pandemic-related anxiety among pregnant women during COVID-19 in Iran, found that older maternal age, advanced gestational age, and a history of abortion or stillbirth were associated with higher rates of health anxiety. Although this study did not directly assess fetal death, it underscores the role of maternal psychological stress and the potential impact on prenatal care engagement and fetal monitoring. In our setting, where 15.0% of IUFD cases lacked adequate prenatal care, it is plausible that psychological barriers – such as fear, reduced health service access, or delayed healthcare seeking during crises – may contribute indirectly to fetal demise. Recognizing the psychological dimension alongside clinical and obstetric risk factors strengthens a more holistic understanding of IUFD and suggests that future interventions should integrate mental health support and improved maternal-fetal surveillance, especially in high-risk populations (18).

The results of this study align with previous research and reveal the importance of maternal health, pregnancy monitoring, and early intervention strategies in reducing IUFD risk. The high prevalence of umbilical cord complications in our study further emphasizes the need for improved fetal surveillance methods, especially in high-risk pregnancies. Given that IUFD remains a significant global concern, implementing effective prenatal screening programs, optimizing maternal healthcare, and addressing modifiable risk factors such as hypertension, diabetes, and smoking could contribute to better pregnancy outcomes.

This study has several limitations that should be considered when interpreting the findings. First, as a retrospective analysis based on hospital medical records, the availability and completeness of data were dependent on the quality of documentation in patient files. In many cases, the exact timing of fetal death (antenpartum vs. intrapartum) was not recorded, which limited our ability to perform subgroup analyses based on the onset of IUFD. Second, although we applied the ReCoDe classification to identify relevant conditions at death, the precise causes (e.g., chromosomal abnormalities, structural cardiac defects, prolonged labor, uterine rupture) were not consistently documented. Similarly, while some cases were referred for placental and fetal pathological examination, the results were not systematically recorded across all files,

preventing comprehensive pathological analysis. These limitations highlight the need for prospective studies with standardized data collection, including detailed obstetric timelines, confirmed etiologies, and complete pathological evaluations, to improve understanding of IUFD risk factors and causes.

### 5.1. Conclusions

The findings of this study highlight several well-established causes of IUFD. To mitigate this adverse outcome, it is imperative to adopt preventive measures for high-risk pregnancies and implement stricter monitoring protocols. Specifically, advanced maternal age and maternal anomalies should be closely evaluated around the 20th week of gestation to assess fetal health and detect potential abnormalities. The absence of adequate prenatal care has been linked to unfavorable pregnancy outcomes; therefore, healthcare authorities must take decisive and proactive measures to address this issue and enhance maternal and fetal health. Future research should focus on identifying additional predictors of IUFD and developing targeted prevention strategies tailored to high-risk populations.

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### Footnotes

**Authors' Contribution:** M. Z. collected and analyzed the data. A. A. and F. R. M. performed data and wrote the manuscript. M. R. designed the project and reviewed the manuscript. All authors read and approved the final draft of the paper.

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### References

- Gravensteen IK, Helgadottir LB, Jacobsen EM, Sandset PM, Ekeberg O. Long-term impact of intrauterine fetal death on quality of life and depression: a case-control study. *BMC Pregnancy Childbirth*. 2012;12:43. [PubMed ID: 22676992]. [PubMed Central ID: PMC3405471]. <https://doi.org/10.1186/1471-2393-12-43>.
- Gibbs RS, Danforth DN. *Danforth's Obstetrics and Gynecology*. Philadelphia, USA: Lippincott Williams & Wilkins; 2008.
- Wainstock T, Yoles I, Sergienko R, Kloog I, Sheiner E. Prenatal particulate matter exposure and Intrauterine Fetal Death. *Int J Hyg Environ Health*. 2021;234:113720. [PubMed ID: 33639584]. <https://doi.org/10.1016/j.ijheh.2021.113720>.
- Dzekem BS, Aschbrook-Kilfoy B, Olopade CO. Air Pollution and Racial Disparities in Pregnancy Outcomes in the United States: A Systematic Review. *J Racial Ethn Health Disparities*. 2024;11(1):53-44. [PubMed ID: 36897527]. [PubMed Central ID: PMC10781802]. <https://doi.org/10.1007/s40615-023-01539-z>.
- Mathieu M, Lambert V, Carles G, Picone O, Carod JF, Pomar L, et al. Incidence, causes, and risk factors of stillbirth in an Amazonian context: Saint Laurent du Maroni maternity ward 2016-2021. *Eur J Obstet Gynecol Reprod Biol X*. 2023;18:100190. [PubMed ID: 37095766]. [PubMed Central ID: PMC10121620]. <https://doi.org/10.1016/j.eurox.2023.100190>.
- McClure EM, Goldenberg RL. Infection and stillbirth. *Semin Fetal Neonatal Med*. 2009;14(4):182-9. [PubMed ID: 19285457]. [PubMed Central ID: PMC3962114]. <https://doi.org/10.1016/j.siny.2009.02.003>.
- McClure EM, Silver RM, Kim J, Ahmed I, Kallapur M, Ghanchi N, et al. Maternal infection and stillbirth: a review. *J Matern Fetal Neonatal Med*. 2022;35(23):4442-50. [PubMed ID: 33233978]. <https://doi.org/10.1080/14767058.2020.1852206>.
- Flenady V, Middleton P, Smith GC, Duke W, Erwich JJ, Khong TY, et al. Stillbirths: the way forward in high-income countries. *Lancet*. 2011;377(9778):1703-17. [PubMed ID: 21496907]. [https://doi.org/10.1016/S0140-6736\(11\)60064-0](https://doi.org/10.1016/S0140-6736(11)60064-0).
- Jovanovic I, Ivanovic K, Kostic S, Tadic J, Dugalic S, Petronijevic M, et al. Intrauterine Fetal Death in Term Pregnancy-A Single Tertiary Clinic Study. *Life (Basel)*. 2023;13(12). [PubMed ID: 38137921]. [PubMed Central ID: PMC10745047]. <https://doi.org/10.3390/life13122320>.
- Lemieux P, Benham JL, Donovan LE, Moledina N, Pylypiuk C, Yamamoto JM. The association between gestational diabetes and stillbirth: a systematic review and meta-analysis. *Diabetologia*. 2022;65(1):37-54. [PubMed ID: 34676425]. <https://doi.org/10.1007/s00125-021-05579-0>.
- Delis M, Emmanouilidou-Fotoulaki E, Chatzakis C, Theodoridis T, Sotiriadis A. Inherited thrombophilias and stillbirth: a systematic review and meta-analysis. *Arch Gynecol Obstet*. 2025;312(1):37-50. [PubMed ID: 40087172]. [PubMed Central ID: PMC12177024]. <https://doi.org/10.1007/s00404-025-07989-6>.
- Jahanfar S, Ghiyasi P, Haghani H. Risk factors related to intra uterine fetal death in Iran, A case-control study. *Shiraz E Med J*. 2005;6(3 and 4):32897.
- Keikhaie KR, Kazemi Z, Moshfeghi M, Moghaddam MN. Prevalence of Intrauterine Fetal Death in Iran: A Meta-Analysis and Systematic Review. *Ann Med Health Sci Res*. 2018;8(5):275-8.
- Liu LC, Huang HB, Yu MH, Su HY. Analysis of intrauterine fetal demise—a hospital-based study in Taiwan over a decade. *Taiwan J Obstet Gynecol*. 2013;52(4):546-50. [PubMed ID: 24411041]. <https://doi.org/10.1016/j.tjog.2013.10.016>.
- Helgadottir LB, Turowski G, Skjeldestad FE, Jacobsen AF, Sandset PM, Roald B, et al. Classification of stillbirths and risk factors by cause of death—a case-control study. *Acta Obstet Gynecol Scand*. 2013;92(3):325-33. [PubMed ID: 23157574]. <https://doi.org/10.1111/aogs.12044>.

16. Bukowski R, Carpenter M, Conway D, Coustan D, Dudley DJ, Goldenberg RL, et al. Causes of Death Among Stillbirths. *Obstet Gynecol Surv.* 2012;67(4):223-5. <https://doi.org/10.1097/OGX.0b013e3182502211>.
17. Adri I, Touloun O, Boussaa S. Prevalence and Risk Factors for Congenital Malformations in Morocco. *Middle East J Rehabil Health Stud.* 2024;11(3). <https://doi.org/10.5812/mejrh-141684>.
18. Sarlak Z, Dadkhahtehrani T, Heidari Z. Factors Related to Hypochondria Disorders During the COVID-19 Pandemic in Pregnant Women. *J Nurs Midwifery Sci.* 2025;12(2). <https://doi.org/10.5812/jnms-160104>.