Italian Journal of
Gynæcology & Obstetrics
March 2025 - Vol. 37 - N. 1 - Quarterly - ISSN 2385 – 0868

Impact of stressful life events, including the COVID-19 pandemic, on stillbirth rates: a study in Jordan

Oqba **AlKuran** [1], Lama M. **Al-Mehaisen** [2,*], Soha N. **Albeitawi** [3], Sufian **Abdelhafez** [4], Alexander **Rabadi** [5,6], Hamad Abdulrahman **Alshatti** [1], Meshari Hussain **Almutairi** [1], Fatemah Rasheed **Alshaer** [1], Reem Sami Ali **Rajab** [1], Lena **AlKuran** [1], Alla **Matalka** [1]

[1] Department of Obstetrics and Gynecology, Medical School, The University of Jordan, Amman, Jordan.
[2] Department of Obstetrics and Gynecology, Faculty of Medicine, Al-Balqa Applied University, Amman, Jordan.
[3] Department of Obstetrics and Gynecology, Medical School, Yarmouk University, Irbid, Jordan.
[4] Department of Medicine, King Hussein Cancer Center, Amman, Jordan.
[5] Department of Internal Medicine, College of Human Medicine, Michigan State University, Lansing, U.S.A.
[6] Department of Internal Medicine, McLaren Regional, McLaren Flint, Flint, U.S.A.

ARTICLE INFO

History
Received: 05 April 2024
Received in revised form: 23 July 2024
Accepted: 02 September 2024
Available online: 31 March 2025

DOI: 10.36129/jog.2024.180

Key words
Stillbirth; pandemic; stressful life event; COVID-19.

***Corresponding author:** Lama M. **Al-Mehaisen**, Prof., FRCOG. Department of Obstetrics and Gynecology, Faculty of Medicine, Al-Balqa Applied University, Amman, Assalt 19117, Jordan.
Email: lmehaisen@bau.edu.jo.
ORCID: 0000-0001-7649-5220.

ABSTRACT

Objective. Pregnancy is a transformative period marked by various Stressful Life Events (SLEs), ranging from personal to widespread occurrences, potentially impacting maternal well-being. Against the backdrop of increasing global incidents, both natural and man-made, this study examines the influence of SLEs, including pandemics, on the incidence of stillbirth

Materials and Methods. This is a retrospective cross-sectional study analysing data sourced from delivery records at University Hospital. The study focuses specifically on recent SLEs, notably the initial COVID-19 lockdown, in comparison to periods before and after the lockdown, aiming to elucidate the correlation between these events and the incidence of stillbirth.

Results. A total of 6533 deliveries were examined, revealing a substantial increase in stillbirth incidence during the first COVID-19 lockdown compared to pre- and post-lockdown periods. Analysis showed a significant difference in stillbirth rates across the three periods, with the highest incidence during the lockdown without COVID-19 cases (1.8%) which was statistically significant with a P-value < 0.05.

Conclusions. This study sheds light on the nexus between SLEs and stillbirth rates, emphasizing the necessity for heightened awareness and customized healthcare approaches during challenging times. Further exploration and nuanced understanding of the impact of SLEs on maternal and foetal health are imperative for devising effective interventions and support systems for pregnant women amidst crises.

INTRODUCTION

Stressful Life Events (SLEs) refer to major occurrences or experiences in an individual's life that can profoundly impact their psychological, emotional, social, or physical well-being. These events are significant because they can cause stress, change life circumstances, and prompt personal growth or

adaptation. Examples of SLEs can include the birth of a child, the death of a loved one, wars, illnesses, and others.

The global landscape is punctuated by numerous natural and unnatural events that deeply influence various facets of life, particularly health. Pandemics and other SLEs can inflict physical and emotional trauma, often hindering access to vital healthcare and necessities. Amidst such challenges, stillbirth persists as a profound concern, with a notable percentage classified as unexplained.

When individuals, especially expectant mothers and their families, endure these SLEs, they often face heightened anxiety and fear, compounded by limited access to essential resources such as healthcare. These stressors may significantly impact maternal well-being and foetal health, raising questions about their potential contribution to the unexplained stillbirth rates, which range from 25% to 60% [1].

Stillbirth (the loss of a baby before or during delivery, typically after 20 weeks of pregnancy [1]) is a traumatic event that can lead to grief, depression, anxiety, and other emotional challenges for parents and family members. Stillbirth is a profoundly impactful SLE that can have significant emotional and psychological consequences for individuals and families.

The unprecedented events of 2020, notably the COVID-19 pandemic, wrought widespread disruption across the globe, affecting not only direct health outcomes but also access to care, mental well-being, and economic stability [2-5]. While much attention has been devoted to the pandemic's direct health impacts, less scrutiny has been directed towards its effects on the continuity and accessibility of care for non-COVID-19 conditions, including stillbirth [6, 7]. This paper seeks to explore the influence of the COVID-19 pandemic on stillbirth rates, particularly within regions such as Jordan, which face a unique blend of natural and unnatural adversities. During the initial wave of the pandemic, stringent lockdown measures were implemented in Jordan, severely restricting public activities and transportation, and limiting access to non-emergency medical care. No vaccines were available during that period and telemedicine was not yet implemented.

Pregnancy represents a time-sensitive condition where regular and appropriate medical care is paramount for maternal and foetal well-being. Stillbirth, affecting up to 1% of all births [10], underscores the importance of uninterrupted prenatal care. Studies have indicated varying trends in stillbirth rates during the COVID-19 lockdown period, with some reporting significant increases while others finding no notable changes underscores the importance of uninterrupted prenatal care.

In March 2020, Jordan implemented strict lockdown measures, even before significant COVID-19 cases were reported [9]. Our paper aims to investigate any potential shifts in stillbirth rates at Jordan University Hospital (JUH) across three distinct time periods: pre-COVID-19 (January 2019 to March 2020), the initial lockdown without COVID-19 cases (March 2020 to June 2020), and the post-lockdown phase amidst the COVID-19 pandemic (September 2020 to December 2020) [8, 9]. This unique sample period, encompassing lockdown measures without concurrent COVID-19 cases, offers insights into the potential impact of stress and restricted healthcare access on stillbirth rates.

MATERIALS AND METHODS

Setting

Jordan University Hospital (JUH), a tertiary centre with 433 beds, served as the study site. Data collection occurred from September 2023 to December 2023 from the hospital records by a team of 6 researchers

Sampling and recruitment

A retrospective chart review included pregnant females beyond 24 weeks admitted to JUH before (January 2019 to March 2020), during (March 2020 to June 2020), and after (September 2020 to December 2020) the COVID-19 lockdown. A total of 53 stillbirths within this timeframe were analysed. Data were accessed for research purposes in January 2024. We included healthy pregnant patients who delivered after 24 weeks and showed no record of having COVID-19 infection during pregnancy or vaccination. We chose a 24-week cutoff as this is the viability age in Jordan.

Data analysis

Statistical analysis utilized STATA 15, assessing associations between demographic variables and stillbirth incidence. The chi-square test evaluated associations for categorical variables, while the Mann-Whitney U Test assessed continuous variables, with statistically significant results defined as P-value < 0.05.

Ethical consideration

Ethical approval was obtained from the university's scientific research committee. Privacy was maintained by anonymizing the data.

Data access

The authors had access to information that could identify individual participants only during data collection as we looked at stillbirth records, demographic data, and patients' characteristics.

Study design

This is a retrospective analytical study. Patients were not directly involved or interviewed.

RESULTS

Analysis revealed a significant difference in stillbirth rates across the three periods, with the highest incidence during the lockdown without COVID-19 cases (1.8%) which was statistically significant with a P-value < 0.05. However, no statistically significant differences were found in patient characteristics.

Characteristics of the sample

Table 1 illustrates the significant relationship between different periods and stillbirth incidence compared to live births. Despite stillbirth percentages being less than 2% relative to live births, substantial changes between periods were evident from the total of 6533 deliveries collected.

Table 2 displays patient and foetal characteristics alongside stillbirth incidence before, during, and after lockdown. No variables showed significant relationships across different time windows.

Table 1. *Descriptive statistics for the relationship between stillbirths and different periods of time.*

Birth Status	Total (%)	Before Lockdown (%)	During Lockdown (%)	First COVID Wave (%)	P-value
Live	6,480 (99.2%)	4,686 (99.3%)	712 (98.2%)	1,082 (99.2%)	0.006
Stillbirth	53 (0.8%)	31 (0.7%)	13 (1.8%)	9 (0.8%)	

Table 2. *Descriptive statistics of different variables in relation to different time periods.*

Variable	Subgroup	Total (%)	Before Lockdown (%)	During Lockdown (%)	First COVID Wave (%)	P-value
Total		53 (100%)	31 (58.5%)	13 (24.5%)	9 (17.0%)	
Foetus Gender	Male	35 (66.0%)	23 (74.2%)	7 (53.8%)	5 (55.5%)	0.329
	Female	18 (34%)	8 (25.8%)	6 (46.2%)	4 (44.5%)	
Medical History	Free	41 (77.4%)	25 (86.2%)	10 (76.9%)	6 (66.7%)	0.39
	Diabetes	6 (11.3%)	3 (6.9%)	2 (15.4%)	1 (11.1%)	
	Blood Pressure Disorders	5 (9.4%)	3 (6.9%)	0 (0%)	2 (22.2%)	
	Blood disorder	1 (1.9%)	0 (0%)	1 (7.7%)	0 (0%)	
Surgical History	None	23 (43.4%)	12 (38.7%)	6 (46.2%)	5 (55.6%)	0.835
	Gynecological	26 (49.1%)	16 (51.6%)	6 (46.2%)	4 (44.4%)	
	Non-Gynae	4 (7.6%)	3 (9.7%)	1 (7.6%)	0 (0%)	
Parity	Primigravida	10 (18.9%)	6 (19.6%)	2 (15.4%)	2 (22.2%)	0.917
	Multigravida	43 (81.1%)	25 (80.6%)	11 (84.6%)	7 (77.8%)	
Booking Status	Unbooked	21 (39.6%)	9 (29%)	6 (46.2%)	6 (66.7%)	0.139
	Booked-Regular	13 (24.5%)	10 (32.3%)	1 (7.6%)	2 (22.2%)	
	Booked-Irregular	19 (35.9%)	12 (38.7%)	6 (46.2%)	1 (11.1%)	
Maternal Age	< 25	4 (7.6%)	3 (9.7%)	0 (0%)	1 (25.0%)	0.373
	25-29	20 (37.7%)	11 (35.5%)	6 (54.5%)	3 (37.5%)	
	30-34	14 (26.4%)	11 (35.5%)	3 (27.3%)	0 (0%)	
	35-39	10 (18.9%)	4 (12.9%)	3 (27.3%)	3 (37.5%)	
	≥ 40	5 (9.4%)	2 (6.5%)	1 (9.1%)	2 (25%)	
Gestational Age	Mean (Range)	33 (24-41)	34 (28-40)	27 (24-31)	31 (24-41)	0.82

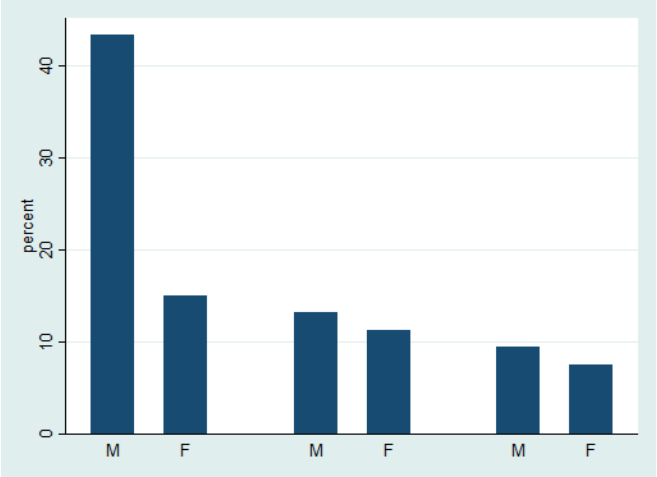

Figure 1. *Gender differences in foetuses with stillbirth.*

This figure illustrates the foetus's gender during the period before lockdown, during lockdown, and first COVID wave, respectively.

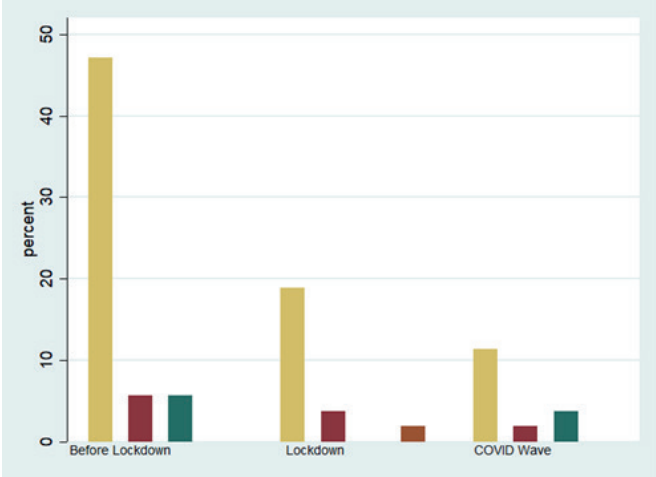

Figure 2. *Past medical history in relation to different periods of time.*

Light brown: free; maroon: diabetes; emerald: BP related; brown: blood disorder.

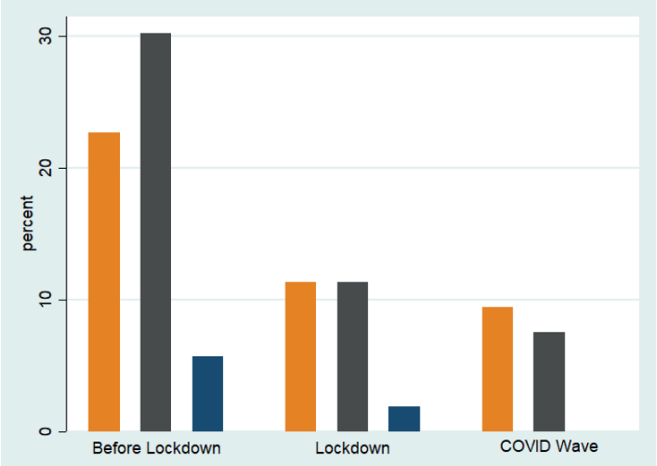

Figure 3. *Past surgical history in relation to different periods of time.*

Orange: none; gray: gynae-related; blue: non-gynae related.

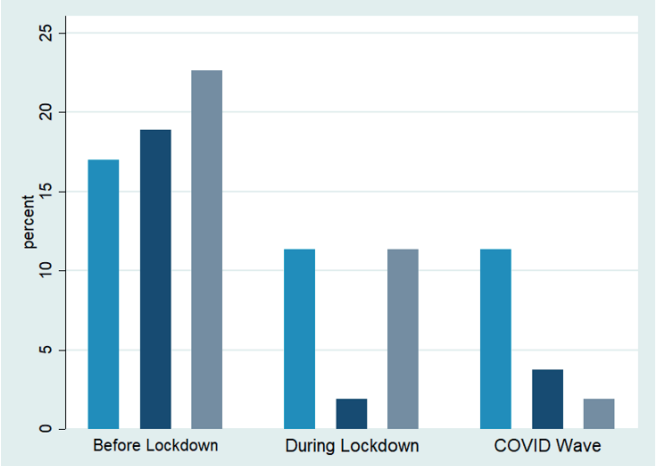

Figure 4. *Booking status in relation to different periods of time.*

Bright blue: unbooked; dark blue: booked-regular; light gray: booked-irregular.

Figure 1 illustrates a minimal higher male gender in fetuses affected by stillbirth during the three periods, while **Figure 2** highlights that most women experiencing stillbirths had no significant obstetric or medical history. Additionally, **Figure 3** depicts the highest prevalence of no previous history during the COVID-19 wave. **Figure 4** indicates that most stillbirths occurred in unbooked or irregularly booked cases, emphasizing irregular antenatal care's potential impact.

DISCUSSION

The World Health Organization (WHO) defines stillbirth as the delivery of a newborn at ≥ 28 weeks of gestation with no signs of life at birth, whereas the United States National Center for Health Statistics defines stillbirth as the death or loss of a foetus at 20 weeks of gestation or later. This discrepancy in stillbirth definition impacts study comparability [11]. This classification further categorizes stillbirth into early (20 to 27 completed weeks), late (28 to 36 completed weeks), and term (≥ 37 completed weeks) [11]. We chose the 24-week cutoff for gestational age based on our neonatal unit's facilities and adjusted gestational age at the university hospital. We made this adjustment considering the age of viability and our institution's neonatal services. Globally, the stillbirth rate has been declining from approximately 21.4 per 1,000 births in 2,000 to approximately 13.9 deaths per 1,000 births in 2019 [12]. This reduction has been attributed to improved access to and utilization of antenatal care,

skilled birth attendants, and increased attention to known maternal risks for stillbirth.

Stillbirth is a complex outcome influenced by multiple maternal, foetal, and placental factors, either individually or in combination, contributing to foetal demise [13].

In our cohort analysis at Jordan University Hospital (JUH), we examined stillbirth trends over three time periods: pre-COVID-19 pandemic, initial lockdown phase without COVID-19 cases, and post-lockdown phase with COVID-19. Few studies have taken a similar approach. For example, Hadley *et al*. studied maternal and foetal parameters in Denmark across different periods and found no significant changes in stillbirths [14]. Similarly, a study in Botswana found no difference in stillbirth rates during lockdown or post-lockdown periods [15]. Other similar studies also reported no significant changes in stillbirths during lockdown. However, Muin *et al*. reported a significant increase in stillbirths during the first lockdown in Austria [16].

Our results (**Table 1**) revealed a statistically significant difference in stillbirth rates among the three time periods, with the highest incidence during the lockdown without COVID-19 cases. This suggests that the strict preventative measures implemented by the government may have affected the continuity of foeto-maternal care, leading to an increase in stillbirths. This underscores the importance of regular and high-quality antenatal care in reducing stillbirth rates.

Although we did not find statistically significant differences in other variables describing the characteristics of patients affected by stillbirth, gender differences in stillbirth-affected foetuses were notable (**Table 2**). This finding is consistent with previous studies showing a higher risk of stillbirth in male foetuses.

In a systematic review and a meta-analysis of 30 million births, the study found that males have 10% higher risk than female foetuses in stillbirths [17]. A study conducted in Jordan covering the years 2011-2012 and another covering the period from Aug 2019 to Jan 2020 found no significant gender differences [18, 19]. Knowing that the male/female ratio in the Jordanian community is 1.05 according to the World Bank statistics [21]. The emotional and psychological impact of the lockdown, including worries about life, the unborn child's future, family, work, income, and prolonged confinement, may have contributed to stress among pregnant women. Stress has been identified as a potential risk factor for stillbirth, emphasizing the need for further exploration of healthcare practices to mitigate its effects.

In a population-based study utilizing data from 13 SLEs sourced from the Stillbirth Collaborative Research Network (SCRN), a linear relationship between the number of SLEs and stillbirth was observed. Notably, individuals reporting ≥ 4 SLEs exhibited a more than two-fold increase in the risk of stillbirth [20]. This discovery necessitates further investigation into healthcare practices, especially considering the absence of similar findings in local studies.

Given the escalating likelihood of natural and/or man-made incidents yielding challenging outcomes periodically, it is imperative to initiate quality improvement endeavours. These initiatives aim to heighten awareness, fortify medical practices, and establish clear emergency protocols and guidelines across all domains, promising significant transformations.

In essence, our study diverges from existing literature by uniquely scrutinizing pre-pandemic, lockdown, and post-lockdown periods and this is in our opinion a strength point added to the paper. The statistically notable surge in stillbirth rates during the lockdown, even amid minimal COVID-19 cases, underscores the potential influence of stress and constrained healthcare accessibility. This observation aligns with literature emphasizing the pivotal role of continuous, high-quality antenatal care in mitigating stillbirth rates.

Furthermore, it is crucial to address gender disparities among stillbirth-affected foetuses and acknowledge the emotional and psychological ramifications of lockdown measures. Stress, identified as a potential risk factor for stillbirth, underscores the urgency for in-depth exploration of healthcare practices.

Our study has a few potential limitations that should be acknowledged. Firstly, we did not include a variable to account for the frequency of clinic visits, which could have provided insights into the continuity of antenatal care received by pregnant women. Additionally, socio-economic parameters, such as income level and transportation access, which may affect the ease of accessibility to Jordan University Hospital (JUH) services, were not included in our analysis. Despite being a major referral hospital in the region, these factors could influence healthcare-seeking behaviour and potentially impact stillbirth rates.

Furthermore, our study focused solely on stillbirth rates and did not explore other adverse pregnancy outcomes or maternal health indicators. Future research could benefit from a comprehensive investigation of potential risk factors and perspectives regarding the observed increase in stillbirth rates during the lockdown period at JUH. Including additional variables related to maternal health, socio-economic status, and healthcare access could provide a more comprehensive understanding of the underlying factors contributing to stillbirth incidence.

CONCLUSIONS

Our study highlights the nuanced interplay of factors influencing stillbirth incidence, particularly during times of crisis such as the COVID-19 pandemic. Quality improvement initiatives aimed at raising awareness, enhancing medical practices, and implementing clear emergency protocols are crucial for mitigating adverse outcomes. Further research into the emotional, psychological, and systemic factors contributing to stillbirth is essential for improving maternal and foetal health outcomes.

COMPLIANCE WITH ETHICAL STANDARDS

Authors' contribution

O.K.: Conceptualization, writing – original draft. L.M.: Writing – original draft, formal analysis. S.B., L.K., A.M.: Writing – review & editing. S.A., A.R., H.S., M.M., F.S, R.R.: Data curation.

Funding

None.

Study registration

N/A.

Disclosure of interests

The authors declare that they have no conflict of interests.

Ethical standards

The researchers were Compliant with Ethical Standards. This research was approved by the Institutional Review Board of Jordan University Hospital, the University of Jordan (IRB-JUH) under protocol number 10/2023/31965. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

This is a retrospective analytical study from hospital records, with the ethical committee of the faculty approval obtained. No patient contact was reported or needed.

Compliance with (strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement) was included during the submission

Data sharing

Data are available under reasonable request to the corresponding author.

REFERENCES

1. Haws RA, Yakoob MY, Soomro T, Menezes EV, Darmstadt GL, Bhutta ZA. Reducing stillbirths: screening and monitoring during pregnancy and labour. BMC Pregnancy Childbirth. 2009;9 Suppl 1(Suppl 1):S5. doi: 10.1186/1471-2393-9-S1-S5.
2. Chen S, Prettner K, Kuhn M, Bloom DE. The economic burden of COVID-19 in the United States: Estimates and projections under an infection-based herd immunity approach. J Econ Ageing. 2021;20:100328. doi: 10.1016/j.jeoa.2021.100328.
3. Gloster AT, Lamnisos D, Lubenko J, Presti G, Squatrito V, Constantinou M, et al. Impact of COVID-19 pandemic on mental health: An international study. PLoS One. 2020 Dec 31;15(12):e0244809. doi: 10.1371/journal.pone.0244809.
4. Ejaz H, Alsrhani A, Zafar A, Javed H, Junaid K, Abdalla AE, et al. COVID-19 and comorbidities: Deleterious impact on infected patients. J Infect Public Health. 2020;13(12):1833-9. doi: 10.1016/j.jiph.2020.07.014.
5. Lytras T, Tsiodras S. Lockdowns and the COVID-19 pandemic: What is the endgame? Scand J Public Health. 2021;49(1):37-40. doi: 10.1177/1403494820961293.
6. De Curtis M, Villani L, Polo A. Increase of stillbirth and decrease of late preterm infants during the COVID-19 pandemic lockdown. Arch

Dis Child Fetal Neonatal Ed. 2021;106(4):456. doi: 10.1136/archdischild-2020-320682.
7. Kniffka MS, Nitsche N, Rau R, Kühn M. Stillbirths in Germany: On the rise, but no additional increases during the first COVID-19 lockdown. Int J Gynaecol Obstet;155(3):483-9. doi: 10.1002/ijgo.13832.
8. COVID-19 Updates in Jordan. Available at: https://corona.moh.gov.jo/en/MediaCenter.
9. Nimer A, Naser S, Sultan N, Alasad RS, Rabadi A, et al. Burnout Syndrome during Residency Training in Jordan: Prevalence, Risk Factors, and Implications. Int J Environ Res Public Health;18(4):1557. doi: 10.3390/ijerph18041557.
10. Silver RM, Varner MW, Reddy U, Goldenberg R, Pinar H, et al. Work-up of stillbirth: a review of the evidence. Am J Obstet Gynecol. 2007;196(5):433-44. doi: 10.1016/j.ajog.
11. Tavares Da Silva F, Gonik B, McMillan M, Keech C, Dellicour S, Bhange S, et al. Brighton Collaboration Stillbirth Working Group. Stillbirth: Case definition and guidelines for data collection, analysis, and presentation of maternal immunization safety data. Vaccine. 2016;34(49):6057-68. doi: 10.1016/j.vaccine.2016.03.044.
12. Hug L, You D, Blencowe H, Mishra A, Wang Z, Fix MJ, et al. Global, regional, and national estimates and trends in stillbirths from 2000 to 2019: a systematic assessment. Lancet. 2021;398(10302):772-85. doi: 10.1016/S0140-6736(21)01112-0.
13. McPherson EW. 3137 fetuses in 33 years: What we have learned from the Wisconsin stillbirth service program. Am J Med Genet A;185(9):2683-9. doi: 10.1002/ajmg.a.62143.
14. Hedley PL, Hedermann G, Hagen CM, Bækvad-Hansen M, Hjalgrim H, et al. Preterm birth, stillbirth and early neonatal mortality during the Danish COVID-19 lockdown. Eur J Pediatr. 2022;181(3):1175-84. doi: 10.1007/s00431-021-04297-4.
15. Caniglia EC, Magosi LE, Zash R, Diseko M, Mayondi G, et al. Modest reduction in adverse birth outcomes following the COVID-19 lockdown. Am J Obstet Gynecol.;224(6):615.e1-615.e12. doi: 10.1016/j.ajog.2020.12.1198.
16. Muin DA, Neururer S, Falcone V, Windsperger K, Helmer H, et al. Antepartum stillbirth rates during the COVID-19 pandemic in Austria: A population-based study. Int J Gynaecol Obstet. 2022;156(3):459-65. doi: 10.1002/ijgo.13989.
17. 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;12:220. doi: 10.1186/s12916-014-0220-4.
18. Khader YS, Batieha A, Khader A, Hamadneh S. Stillbirths in Jordan: rate, causes, and preventability. J Matern Fetal Neonatal Med. 2020;33(8):1307-14. doi: 10.1080/14767058.2018.1517326.
19. Shattnawi KK, Khader YS, Alyahya MS, Al-Sheyab N, Batieha A. Rate, determinants, and causes of stillbirth in Jordan: Findings from the Jordan Stillbirth and Neonatal Deaths Surveillance (JSANDS) system. BMC Pregnancy Childbirth. 2020;20(1):571. doi: 10.1186/s12884-020-03267-2.
20. Hogue CJ, Parker CB, Willinger M, Temple JR, Bann CM, et al. Eunice Kennedy Shriver National Institute of Child Health and Human Development Stillbirth Collaborative Research Network Writing Group. A population-based case-control study of stillbirth: the relationship of Stressful Life Events to the racial disparity for African Americans. Am J Epidemiol. 2013;177(8):755-67. doi: 10.1093/aje/kws381.
21. Guide to the World Bank Group Archives. Available at: https://genderdata.worldbank.org/en/economies/jordan.