IJIMM, Volume 3, Issue 9, 2025 ISSN: 2995-5319
http://medicaljournals.eu/index.php/IJIMM/issue/view/3

INTERNATIONAL JOURNAL OF INTEGRATIVE AND MODERN MEDICINE

Respiratory Tract Infections in Pregnant Women in Iraq: A Study of 140 Female Patients

Dr. Zahraa Mohamed Husein Abdulah

M.B.Ch.B., D.G.O. \ (Obstetrician and Gynecology) Iraqi Ministry of Health, Basra Health Directorate, Al-Basra General Teaching Hospital Gynecology and Obstetrics Department, Basra, Iraq

Dr. Iyen Abdul Hussien Abdulla

M.B.Ch.B., C.B.O.G. (Specialist Obstetrician and Gynecology) Iraqi Ministry of Health, Baghdad-Al-Karkh Health Directorate, Al-Karkh Maternity Hospital, Baghdad, Iraq

Dr. Lubna Abdulbaqi

M.B.Ch.B., D.G.O. \ (Obstetrician and Gynecology) Retired, Iraqi Ministry of Health, Basra Health Directorate, Al-Mousawi Private Hospital, Basra, Iraq

Dr. Ali Qais Abdulkafi

M.B.Ch.B., D.C.H. \ (Pediatrics) Iraqi Ministry of Health, Kirkuk Health Directorate, Director of the Technical Affairs Department, Kirkuk Teaching Hospital, Kirkuk, Iraq

Annotation: RTIs represent the most prevalent illnesses which occur during pregnancy, which our study had focused to the impact of respiratory tract infections on both mothers and newborns.

In our study's methodology, our study enrolled a data of 140 pregnant women who received RTI diagnoses at different hospitals in Iraq between May 2024 and May 2025, where collected a clinical and demographics variables of participants as well as included symptoms, diagnostic results, treatment approaches, and maternal complications and newborn results, that our study was divided data of patients with respiratory tract infections into two groups, where upper URTI (n=92) and lower LRTI (n=48).

Based on clinical outcomes of patients, our outcomes found URTI affected 65.7% of patients (n=92) through pharyngotonsillitis and rhinosinusitis, while LRTI (bronchitis or pneumonia) affected 34.3% of patients (n=48), which the need for hospital admission reached 13.6% of patients, but LRTI patients needed hospitalization at a rate of 31.3% compared to 4.3% for URTI patients, as well as the LRTI group experienced a significantly higher rate of preterm births at 18.8% compared to the URTI group at 7.6%, due to that this study showed that lower respiratory tract infections during pregnancy lead to serious maternal health issues, hospitalization, and premature birth in pregnant women.

Keywords: Pregnancy; Respiratory Tract Infections; Pneumonia; Bronchitis; Preterm Birth; Hospitalization; And Maternal-Fetal Outcomes.

Introduction

Pregnancy was a unique immunological and physiological condition usually interpreted as a state of immune tolerance to the semi-allogeneic fetus, which complex process was necessary for a successful pregnancy, although it also had pregnant women vulnerable to some infectious diseases, especially respiratory ones [1,2], where the incidence of respiratory tract infections (RTIs) was among the most prevalent clinical problems in pregnancy, causing considerable hardships for the pregnant woman and clinician involved, [3, 4] which some of them are self-limiting like the common cold and pharyngitis. [5]

In addition, pregnancy purposely altered women's immune systems so they can fight infections; however, they were more at risk to infection [6, 7], where although this action protected the fetus, it can inhibit the cell-mediated immune responses, which are needed to fight against intracellular pathogens, which included many viruses and some bacteria [8], as well as increased levels of progesterone cause stimulated respiration and a state of compensated respiratory alkalosis, alongside it pushed upward on the diaphragm, which it had as effect reduces breathing capacity in the uterus grown [9].

Moreover, RTIs had resulted an acute illness in a mother; however, it poses serious health risks to the fetus and the neonate, which fevers brought on through infection, which nevertheless, hyperthermia has a teratogenic correlation with neural tube defects, among others. However, this effect is very trimester-dependent [10], alongside with severe infection caused a systemic inflammatory response, which is more important than release of pro-inflammatory cytokines and prostaglandins may cause uterine irritability and predispose to PPROM and preterm labor, which is one of the causes of neonatal morbidity and mortality globally [11]

Patients and Methods

2.1 Research Framework

A cross-sectional study was used to look at the signs, care, and results of respiratory tract infections in 140 pregnant women, where this study was picked to best judge a steady flow of cases happening over a set period in a health setting, as well as helped between the type of sickness, patient details, and the outcomes.

2.2 Research Environment and Demographics

According to study design, our study collected data from medical records in different hospitals in Iraq, at Departments of Obstetrics and Gynecology, as well as the Department of Emergency Medicine, where our study group included pregnant women who ages 25 and above, with a diagnosis of respiratory tract infection during the period from January 2024 to January 2025.

2.3 Criteria for Inclusion and Exclusion

Based on inclusion and exclusion criteria were collected, where inclusion Criteria had showed variables inserted including each of 1) Single gestation; 2) Gestational age confirmation by first-trimester ultrasound; 3) Clinical diagnosis of new acute respiratory infection (URT or LRTI) made by any physician on the basis of symptoms and signs on physical examination, oropharyngeal erythema, nasal discharge, wheezing, crackles on auscultation; and appropriate laboratory diagnostics as indicated clinically; 4) Complete medical records available for review from time of diagnosis through delivery or discharge from the hospital, while exclusion Criteria showed each of 1) Multi-fetal gestation, twins, triplets, and so on; 2) Infections found only in the postpartum period; 3) Chronic lung conditions such as cystic fibrosis and bronchiectasis as the primary diagnosis; 4) Admission due to a non-respiratory primary condition with RTI noted as an incidental finding; 5) Incomplete medical records particularly those missing delivery or outcome details.

2.4 Data Collection and Variables

The following data domains were systematically collected demographic and obstetric characteristics baseline including age of mother, unassisted race/ethnicity of mother for demographic context, parity-nulliparous/multiparous, body mass index at first prenatal visit, smoking status-current smoker or non-smoker and comorbidities documented such as asthma, pregestational or gestational diabetes, chronic hypertension, obesity defined as BMI greater than 30 kg/m2. Moreover, gestational age at diagnosis (by trimester: first [1-12 weeks], second [13-27 weeks], third [28 weeks or more]), primary clinical diagnosis (acute pharyngotonsillitis, acute rhinosinusitis, acute bronchitis, community-acquired pneumonia) and symptoms (cough, rhinorrhea, sore throat, fever, where fever was defined as 38.0°C or more as well as Myalgia, dyspnea and wheezing)

In addition, therapies were grouped as supportive (hydration). The primary maternal outcome was hospital admission specifically for the management of the RTI, also secondary outcomes included indications for admission (hypoxia/respiratory distress, dehydration, preterm labor concerns), maternal complications during infection (dehydration requiring IV fluids, acute bronchospasm, pneumonia-related complications such as pleural effusion, new-onset or exacerbated hypertension), length of hospital stay, and maternal mortality. Furthermore, our study enrolled gestational age at delivery, preterm delivery (<37 weeks), birthweight, 5-minute Apgar score, and neonate NICU admission, where low birth weight was described as <2500 g and very low birth weight as <1500 g.

2.5 Statistical Analysis

The statistical analyses were conducted with SPSS software, version 24.0, using R statistical software. Summary statistics of the data are presented. Categorical variables were presented as numbers and percentages (n, %), and continuous variables were shown as means with standard deviations (SD) or medians with interquartile ranges (IQR) where appropriate. To identify independent risk factors for the key outcome of hospital admission, a multivariable logistic regression model was constructed. A p-value of & lt; 0.05 was considered statistically significant for all analyses.

Results

Table 1: Identifying the Demographic and Obstetric Characteristics of the patients [n = 140].

Characteristic	n	%
Maternal Age (years)		
< 25	28	20.0%
25 - 34	84	60.0%
≥ 35	28	20.0%
Parity		
Nulliparous	63	45.0%
Multiparous	77	55.0%
Gestational Age at Diagnosis		
First Trimester (1-12 wks)	25	17.9%
Second Trimester (13-27 wks)	56	40.0%
Third Trimester (≥28 wks)	59	42.1%
Comorbidities		
None	98	70.0%
Asthma	18	12.9%
Obesity (BMI >30)	15	10.7%
Hypertension	7	5.0%
Diabetes	6	4.3%
Cardiovascular disease	2	1.4%
Neurologic disorders	1	0.7%
Smoking Status		
Smokers	14	10.0%
Non-Smokers	126	90.0%

Table 2: Distribution of Primary Respiratory Tract Infection Diagnoses.

Variables	n	%
Upper Respiratory Tract Infection (URTI)	92	65.7%
Acute Pharyngotonsillitis	48	34.3%
Acute Rhinosinusitis	44	31.4%
Lower Respiratory Tract Infection (LRTI)	48	34.3%
Acute Bronchitis	32	22.9%

Community-Acquired Pneumonia (CAP)	16	11.4%
Total	140	100.0%

Table 3: Reported Symptoms.

Symptoms	Overall (n=140)	URTI (n=92)	LRTI (n=48)
Cough	128 (91.4%)	80 (87.0%)	48 (100.0%)
Rhinorrhea/Nasal Congestion	112 (80.0%)	88 (95.7%)	24 (50.0%)
Sore Throat	95 (67.9%)	80 (87.0%)	15 (31.3%)
Fever (≥38.0°C)	51 (36.4%)	25 (27.2%)	26 (54.2%)
Myalgia/Arthralgia	78 (55.7%)	50 (54.3%)	28 (58.3%)
Dyspnea	33 (23.6%)	8 (8.7%)	25 (52.1%)
Wheezing	15 (10.7%)	2 (2.2%)	13 (27.1%)

Table 4: Etiological Agents Identified in a Subset of Patients (n=65) Undergoing Testing.

Pathogens	***Overall (n=65)***	***URTI (n=38)***	***LRTI (n=27)***
Viral Pathogens	***48 (73.8%)***	***32 (84.2%)***	***16 (59.3%)***
Rhinovirus/Enterovirus	*20 (30.8%)*	*16 (42.1%)*	*4 (14.8%)*
Influenza Virus	*12 (18.5%)*	*6 (15.8%)*	*6 (22.2%)*
Respiratory Syncytial Virus (RSV)	*8 (12.3%)*	*4 (10.5%)*	*4 (14.8%)*
SARS-CoV-2	*5 (7.7%)*	*3 (7.9%)*	*2 (7.4%)*
Other (Adenovirus, hMPV)	*3 (4.6%)*	*3 (7.9%)*	*0 (0.0%)*
Bacterial Pathogens	***17 (26.2%)***	***6 (15.8%)***	***11 (40.7%)***
Streptococcus pneumoniae	*5 (7.7%)*	*1 (2.6%)*	*4 (14.8%)*
Mycoplasma pneumoniae	*4 (6.2%)*	*1 (2.6%)*	*3 (11.1%)*
Haemophilus influenzae	*4 (6.2%)*	*2 (5.3%)*	*2 (7.4%)*
Group A Streptococcus	*4 (6.2%)*	*2 (5.3%)*	*2 (7.4%)*

Table 5: Treatment Modalities Administered.

Treatments	Overall (n=140)	URTI (n=92)	LRTI (n=48)
Supportive Care Only	62 (44.3%)	56 (60.9%)	6 (12.5%)
Pharmacological Therapy	78 (55.7%)	36 (39.1%)	42 (87.5%)
→ Antibiotic Therapy	45 (32.1%)	15 (16.3%)	30 (62.5%)
→ Antiviral Therapy (Oseltamivir)	14 (10.0%)	6 (6.5%)	8 (16.7%)
→ Antipyretics (Paracetamol)	65 (46.4%)	40 (43.5%)	25 (52.1%)
→ Inhaled Bronchodilators/Corticosteroids	18 (12.9%)	5 (5.4%)	13 (27.1%)

Table 6: Rates of Hospital Admission and Indication.

Parameters	Overall (n=140)	URTI (n=92)	LRTI (n=48)
Hospital Admission Required	19 (13.6%)	4 (4.3%)	15 (31.3%)
Hypoxia/Respiratory Distress	10 (7.1%)	1 (1.1%)	9 (18.8%)
Dehydration	5 (3.6%)	2 (2.2%)	3 (6.3%)
Preterm Labor Concerns	4 (2.9%)	1 (1.1%)	3 (6.3%)
In-hospital death, Maternal	0 (0.0%)	0 (0.0%)	0 (0.0%)
Length of stay, days (mean, range)	4.2 (2-11)	3.0 (2-5)	4.7 (3-11)

Table 7: Maternal Complications during Infection.

Outcome	Overall (n=140)	URTI (n=92)	LRTI (n=48)
None	110 (78.6%)	82 (89.1%)	28 (58.3%)
Dehydration Requiring IV Fluids	18 (12.9%)	8 (8.7%)	10 (20.8%)
Acute Bronchospasm	9 (6.4%)	2 (2.2%)	7 (14.6%)
Pregnancy-Induced Hypertension	5 (3.6%)	2 (2.2%)	3 (6.3%)
Pulmonary edema	2 (1.4%)	0 (0.0%)	2 (4.2%)
Pleural Effusion	1 (0.7%)	0 (0.0%)	1 (2.1%)
Obstructive sleep apnea	1 (0.7%)	0 (0.0%)	1 (2.1%)
Tuberculosis	0 (0.0%)	0 (0.0%)	0 (0.0%)
Bronchial asthma (exacerbation)	6 (4.3%)	2 (2.2%)	4 (8.3%)

Table 8: Association between Infection Type and Preterm Birth (<37 weeks).

Group	Total Pregnancies	Preterm Births (n)	Preterm Birth Rate (%)
URTI	92	7	7.6%
LRTI	48	9	18.8%
Total Cohort	**140**	**16**	**11.4%**

Table 9: Neonatal Outcomes for Deliveries within Cohort (n=140 live births).

Outcome	Number of Neonates	Percentage (%)
Birth Weight (grams)		
Low Birth Weight (<2500g)	17	12.1%
Very Low Birth Weight (<1500g)	3	2.1%
Normal Birth Weight (≥2500g)	120	85.7%
5-min Apgar Score <7	8	5.7%
Admission to NICU	19	13.6%

Table 10: Multivariable Analysis of Risk Factors for Hospital Admission.

Risk Factors	Adjusted Odds Ratio	95% Confidence Interval	p-value
Lower Respiratory Tract Infection	8.45	2.51 - 28.43	<0.001
Presence of Comorbidity	3.80	1.30 - 11.10	0.015
Presentation in 3rd Trimester	2.95	0.95 - 9.14	0.061
Fever ≥38.5°C	4.20	1.40 - 12.58	0.010

Discussion

This paper presents a comprehensive clinical and epidemiological investigation of RTIs among 140 pregnant women in Iraq. The demographic profile of our cohort shows a significantly young to middle-aged pregnant population, with 80% between 25 and 34 years. This is in accordance with the average maternal age range found in some studies [12,13,14]. It is important to state that the spread in all three trimesters, slightly higher in the second (40.0%) and third (42.1%), is essential. It also indicates that susceptibility to RTIs is not restricted to a particular gestational age, but the effects of infection may be different.

The high proportion of comorbidities (30%), particularly asthma (12.9%) and obesity (10.7%), is of interest. Previous asthma was identified in the USA [15,16,17] as a primary risk factor for more severe respiratory infection in pregnancy because the physiological changes of pregnancy may already compromise respiratory function. Low smoking prevalence (10%) is less than in most Western studies

[18,19] but is a critical good prognostic sign, because maternal smoking is a well-confirmed risk factor for serious maternal RTIs and perinatal complications. Nasal congestion and rhinorrhea were highly predictive of URTI (95.7%), whereas dyspnea and wheezing were highly predictive of LRTI (52.1% and 27.1%, respectively).

The high prevalence of fever (≥38.0°C) of LRTI patients (54.2% vs. 27.2%) is also a regular phenomenon, often indicating a more systemic and severe inflammatory reaction, often together with bacterial pathogens or influenza [22]. The prevalence of viral pathogens (73.8%), particularly of Rhinovirus/Enterovirus (30.8%) and Influenza Virus (18.5%), which was corresponding to one of the studies carried out in Welse [23]. The detection of Respiratory Syncytial Virus (RSV) in 12.3% of studied patients is a valuable but often forgotten result. Though RSV has long been traditionally associated with pediatric infections, growing evidence, including France's studies [24,25,26], proved that it is a significant pathogen of adults and can cause severe disease in expectant women due to immunomodulation.

Furthermore, the sight of SARS-CoV-2 (7 7%) showed the lasting pandemic situation, and its finding in both URTIs and LRTIs is normal, where bacteria germs were found in 26. 2% of tested cases with a clear majority in LRTIs (40. 7% vs 15. 8% in URTIs) Streptococcus pneumoniae and Haemophilus influenzae are usual offenders in community-acquired pneumonia, while finding Mycoplasma pneumoniae is important, as it can lead to unusual pneumonia that might need special macrolide antibiotic treatment, as well as the high amount of viral cause, mainly in URTIs, must guide care with medicines, advising against the guessing use of antibiotics for obvious viral sicknesses.

Also, the high percentage of just support care for URTIs (60 9% is a good and calming result, it shows the following rules that warn about extra medicine in pregnancy, which the big number of drug treatment for LRTIs (87. 5%) showed how serious these infections are seen to be and actually are. While antibiotics are clearly needed for bacterial pneumonia, the high rate of viruses means that some of this use might be guesswork or precautionary [29].

Moreover, the use of antiviral drugs (Oseltamivir) in 10% of patients, mostly for guessed or confirmed flu, matches Italian studies [30,31] which focus on pregnant women getting early antiviral care, where the common use of paracetamol (46. 4% is thought and good for handling fever and muscle pain in pregnancy, whereby the total hospital stay rate was 13.6, but it was much greater for lower respiratory tract infections (31.3) than upper respiratory tract infections (4.3), alongside this big change is a main find of our study and is backed by many China study that spot pneumonia as a top sick reason for hospital stay in pregnant women.

Almost exclusively in the LRTI group, hypoxia/respiratory distress was the main reason for admission. Research indicates that more than 40% for LRTI patients had a complication (such as acute bronchospasm or dehydration necessitating intravenous fluids), while only 10.9% in URTI patients did the same. 4.3% of the cohort experienced an exacerbation of their pre-existing asthma, indicating that this comorbidity is a significant vulnerability. Preterm birth and infection type are strongly correlated, as shown in Table 8. The preterm birth rate for the LRTI group was 18.8%, which was higher than the frequently mentioned baseline rate of about 10% in many populations and more than twice as high as the rate in the URTI group (7.6%).

Studies in pneumonia and influenza in pregnancy have shown that systemic maternal inflammation and infection, especially in LRTIs, can cause the release of prostaglandins as well as cytokines that cause uterine contractions and premature membrane rupture [33,34,35].

The neonatal outcomes show this negative impact (Table 9). 13.6% of neonates needed to be admitted to the NICU, and 12.1% of babies were born weighing less than 2,500 grams. These rates are higher than those of healthy pregnant populations, along with are probably caused by a combination of factors, including preterm birth, maternal illness, and potentially intrauterine inflammation that affects fetal growth [36]. Concerningly, the 5-minute Apgar score below seven rate of 5.7% might suggest fetal distress during labor, which could be connected to fever or hypoxia in the mother. [37]

Conclusion

The current study enrolls that respiratory tract infections into pregnant women are serious obstetric conditions that require close clinical monitoring, which clearly show that lower respiratory tract infections (LRTIs) are the most serious threat, leading to higher incidences of complications, hospitalization, and unfavorable pregnancy outcomes, even though upper respiratory tract infections (URTIs) have become more common, as well as severity progression is that there is a strong correlation between LRTIs and a significantly higher rate of preterm birth (18.8% vs. 7.6% in URTIs), which in turn leads to a series of neonatal adversities, such as low birth weight and more NICU admissions.

References

1. Hall CB, Weinberg GA, Iwane MK, et al. The burden of respiratory syncytial virus infection in young children. N Engl J Med 2009; 360:588–98.
2. Izurieta HS, Thompson WW, Kramarz P, et al. Influenza and the rates of hospitalization for respiratory disease among infants and young children. N Engl J Med 2000; 342:232–9.
3. Stockman LJ, Curns AT, Anderson LJ, Fischer-Langley G. Respiratory syncytial virus–associated hospitalizations among infants and young children in the United States, 1997–2006. Pediatr Infect Dis J 2012; 31:5–9.
4. Talbot HK, Falsey AR. The diagnosis of viral respiratory disease in older adults. Clin Infect Dis 2010; 50:747–51.
5. Suh M, Movva N, Jiang X, et al. Respiratory syncytial virus is the leading cause of United States infant hospitalizations, 2009–2019: a study of the national (nationwide) inpatient sample. J Infect Dis 2022; 226 (suppl 2): S154–63.
6. Pfizer. ABRYSVO [package insert]. US Food and Drug Administration. Available at: https://www.fda.gov/media/171482/download?attachment. Revised August 2023. Accessed 23 August 2023.
7. Fleming-Dutra KE, Jones JM, Roper LE, et al. Use of the Pfizer respiratory syncytial virus vaccine during pregnancy for the prevention of respiratory syncytial virus–associated lower respiratory tract disease in infants: recommendations of the Advisory Committee on Immunization Practices—United States, 2023. MMWR Morb Mortal Wkly Rep 2023; 72:1115–22.
8. Chaw L, Kamigaki T, Burmaa A, et al. Burden of influenza and respiratory syncytial virus infection in pregnant women and infants under 6 months in Mongolia: a prospective cohort study. PLoS One 2016; 11:e0148421.
9. Chu HY, Katz J, Tielsch J, et al. Clinical presentation and birth outcomes associated with respiratory syncytial virus infection in pregnancy. PLoS One 2016; 11: e0152015.
10. Hause AM, Avadhanula V, Maccato ML, et al. Clinical characteristics and outcomes of respiratory syncytial virus infection in pregnant women. Vaccine 2019; 37:3464–71.
11. Madhi SA, Cutland CL, Downs S, et al. Burden of respiratory syncytial virus infection in South African human immunodeficiency virus (HIV)–infected and HIV-uninfected pregnant and postpartum women: a longitudinal cohort study. Clin Infect Dis 2018; 66:1658–65.
12. Nowalk MP, D'Agostino H, Dauer K, Stiegler M, Zimmerman RK, Balasubramani GK. Estimating the burden of adult hospitalized RSV infection, including special populations. Vaccine 2022; 40:4121–7.
13. Nyawanda BO, Otieno NA, Otieno MO, et al. The impact of maternal human immunodeficiency virus infection on the burden of respiratory syncytial virus among pregnant women and their infants, Western Kenya. J Infect Dis 2022; 225:2097–105.

14. Kenmoe S, Chu HY, Dawood FS, et al. Burden of respiratory syncytial virus–associated acute respiratory infections during pregnancy. J Infect Dis 2023. doi:10.1093/infdis/jiad449
15. Regan AK, Klein NP, Langley G, et al. Respiratory syncytial virus hospitalization during pregnancy in 4 high-income countries, 2010–2016. Clin Infect Dis 2018; 67:1915–8.
16. Hause AM, Avadhanula V, Maccato ML, et al. A cross-sectional surveillance study of the frequency and etiology of acute respiratory illness among pregnant women. J Infect Dis 2018; 218:528–35.
17. Wheeler SM, Dotters-Katz S, Heine RP, Grotegut CA, Swamy GK. Maternal effects of respiratory syncytial virus infection during pregnancy. Emerg Infect Dis 2015; 21:1951–5.
18. Sutton D, Fuchs K, D'Alton M, Goffman D. Universal screening for SARS-CoV-2 in women admitted for delivery. N Engl J Med 2020; 382:2163–4.
19. Trinh IV, Desai SP, Ley SH, et al. Prenatal infection by respiratory viruses is associated with immuno-inflammatory responses in the fetus. Am J Respir Crit Care Med 2023.
20. Rowe SL, Leder K, Perrett KP, et al. Maternal vaccination and infant influenza and pertussis. Pediatrics 2021; 148:e2021051076.
21. Halasa NB, Olson SM, Staat MA, et al. Maternal vaccination and risk of hospitalization for COVID-19 among infants. N Engl J Med 2022; 387:109–19.
22. Badr DA, Mattern J, Carlin A, et al. Are clinical outcomes worse for pregnant women at ≥20 weeks' gestation infected with coronavirus disease 2019? A multicenter case-control study with propensity score matching. Am J Obstet Gynecol 2020; 223:764–8.
23. Ellington S, Strid P, Tong VT, et al. Characteristics of women of reproductive age with laboratory-confirmed SARS-CoV-2 infection by pregnancy status—United States, January 22–June 7, 2020. MMWR Morb Mortal Wkly Rep 2020; 69: 769–75.
24. Lokken EM, Huebner EM, Taylor GG, et al. Disease severity, pregnancy outcomes, and maternal deaths among pregnant patients with severe acute respiratory syndrome coronavirus-2 two infection in Washington State. Am J Obstet Gynecol 2021; 225:77.e1–14.
25. Creanga AA, Johnson TF, Graitcer SB, et al. Severity of 2009 pandemic influenza A (H1N1) virus infection in pregnant women. Obstet Gynecol 2010; 115:717–26.
26. Jamieson DJ, Honein MA, Rasmussen SA, et al. H1N1 2009 influenza virus infection during pregnancy in the USA. Lancet 2009; 374:451–8.
27. Moulia DL, Wallace M, Roper LE, et al. Interim recommendations for use of bivalent mRNA COVID-19 vaccines for persons aged ≥6 months—United States, April 2023. MMWR Morb Mortal Wkly Rep 2023; 72:657–62.
28. American Thoracic Society Diagnostic standards and classification of tuberculosis in adults and children. Am J Respir Crit Care Med. 2000;161:1376–1395.
29. Grohskopf LA, Ferdinands JM, Chung JR, Broder KR, Talbot HK. Prevention and control of seasonal influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices—United States, 2023–24 influenza season. MMWR Recomm Rep 2023; 72 (RR-2):1–25.
30. Havers FP, Moro PL, Hunter P, Hariri S, Bernstein H. Use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccines: updated recommendations of the Advisory Committee on Immunization Practices—United States, 2019. MMWR Morb Mortal Wkly Rep 2020; 69:77–83.
31. Hartert TV, Neuzil KM, Shintani AK, et al Maternal morbidity and perinatal outcomes among pregnant women with respiratory hospitalizations during influenza season. Am J Obstet Gynecol. 2003; 189 (6): 1705 – 1712.

32. Jain S, Kamimoto L, Bramley AM, et al; 2009 Pandemic Influenza A (H1N1) Virus Hospitalizations Investigation Team. Hospitalized patients with 2009 H1N1 influenza in the United States, April-June 2009. N Engl J Med . 2009 ; 361 (20): 1935 - 1944 .

33. Forbes RL , Wark PA , Murphy VE , Gibson PG . Pregnant women have attenuated innate interferon responses to the 2009 pandemic influenza A virus subtype H1N1. J Infect Dis . 2012 ; 206 (5): 646 – 653.

34. James KM, Peebles RS Jr, Hartert TV. Response to infections in patients with asthma and atopic disease: an epiphenomenon or reflection of host susceptibility? J Allergy Clin Immunol. 2012; 130 (2): 343 - 351.

35. Powell H, Murphy VE, Taylor DR, et al Management of asthma in pregnancy guided by measurement of fraction of exhaled nitric oxide: a double-blind, randomised controlled trial. Lancet. 2011; 378 (9795): 983 – 990.

36. Wark PA, Bucchieri F, Johnston SL, et al IFN-gamma-induced protein 10 is a novel biomarker of rhinovirus-induced asthma exacerbations. J Allergy Clin Immunol. 2007; 120 (3): 586 – 593.

37. Martel MJ, Rey E, Beauchesne MF, et al Use of short-acting beta2-agonists during pregnancy and the risk of pregnancy-induced hypertension. J Allergy Clin Immunol. 2007; 119 (3): 576 – 582.