Table 1. Alterations in Pulmonary Physiology During Pregnancy		
Measured Parameter	**Physiological Change**	**Clinical Application / Pearl**
Anatomical Changes		
Diaphragm AP Diameter Subcostal Angle Diaphragmatic excursion	Displaced cephalad 4cm Increases Increases from 68° to 103° Increases by 2cm	Chest wall compliance is reduced in pregnancy but lung compliance is unchanged.
Hormonal Changes		
Mucous Membranes	Hyperplasia and hyperemia	May result in friable mucosa, nose bleeds, congestion
Ventilatory Changes		
Minute Ventilation	40-50% increase	
Tidal Volume	40-50% increase	
Respiratory Rate	Unchanged	Tachypnea is a reliable sign of potential pathologic disease states in pregnancy
Functional Residual Capacity	10-20% decrease by term	Results in decreased maternal tolerance to respiratory compromise
Expiratory Reserve Volume	10% decrease	Results in decreased tolerance of hypoxia
Residual Volume	20% decrease	
Forced Expiratory Volume in 1 second (FEV1)	Unchanged	Useful for diagnosis of asthma
Peak Expiratory Flow Rate (PEFR)	Unchanged	Useful for monitoring asthma control
Changes in Arterial Blood Gas Values		
Arterial CO Pressure	Decreased to 28-32mmHg	Pregnancy is a state of compensated respiratory alkalosis. pH values near the lower limit of normal (7.35-7.40) for non-pregnant women may reflect decompensation and early acidosis in pregnant women.
Bicarbonate levels	Decreased to 18-21 mmol/L	
Arterial pH	Slightly increased 7.40-7.47	

Table 2. Classification of Asthma Severity and Management in Pregnancy

Asthma Severity	Mild Intermittent	Mild Persistent	Moderate Persistent	Severe
Overall Control	Well Controlled	Not Well Controlled	Not Well Controlled	Very Poorly Controlled
Symptoms	≤ 2x's/week	≥2x/week but not daily	Daily	Continuous
Night Awakenings	≤2x's/month	≥2x's/mo	≥1 per week	Frequent
FEV1 or PEF (% predicted)	≥ 80 %	≥ 80 %	>60% to <50%	< 60%
PEF Variability	≤20%	20-30%	>30%	>30%
Preferred Management	Albuterol as needed	Low-dose Inhaled Corticosteroid*	Low-dose ICS **AND** LABA (Salmeterol) *OR* **Medium-dose ICS and Salmeterol if needed****	High-dose Inhaled Corticosteroid and LABA (Salmeterol) AND oral corticosteroid if needed
Alternative Management		Cromolyn or Leukotriene Receptor Antagonist or Theophylline	Low-dose or (if needed) medium-dose inhaled corticosteroid and EITHER leukotriene receptor antagonist OR Theophylline	High-dose ICS and Theophylline AND oral corticosteroid if needed
Provider Management	General Ob-Gyn	General Ob-Gyn	Maternal-Fetal-Medicine Specialist or Pulmonologist	Maternal-Fetal-Medicine Specialist or Pulmonologist

- Adapted from National Heart, Lung, and Blood Institute, National Asthma Education and Prevention Program. Expert panel report: guidelines for the diagnosis and management of asthma. NIH Publication No. 05–5236. Bethesda (MD): NHLBI. & Schatz M. Dombrowski MP. Clinical Practice. Asthma in Pregnancy. NEJM 2009; 360: 1862-69
- FEV1 denotes forced expiratory volume in 1 second
- ICS = Inhaled Corticosteroid
- LABA = Long Acting Beta-2 Agonist; LABA should never be used as monotherapy
- * Budesonide is preferred in pregnancy since more safety data are available; however, if asthma is well controlled on a different inhaled corticosteroid, it should be continued in pregnancy.
- **In pregnancy, consider use of medium dose ICS first (instead of low-dose ICS + LABA) since there is less data available on Salmeterol
- Patients should be instructed to continue use of ICS even if symptoms improve while taking LABA.
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Table 3. Controller Medications for Asthma Management

Drug	Dosing Regimen	Recommended Use	Breastfeeding
Inhaled Corticosteroids		Preferred Controller Therapy	May breastfeed
Budesonide*		*Preferred in pregnancy	
Low Dose	180-600 ug/day		
Medium Dose	600-1200 ug/day		
High Dose	>1200 ug/day		
Becloamethasone			
Low Dose	80-240 ug/day		
Medium Dose	240-480 ug/day		
High Dose	>480 ug/day		
Fluticasone			
Low Dose	100-300 ug/day		
Medium Dose	300-500 ug/day		
High Dose	>500 ug/day		
LABA		Preferred add-on therapy to medium or high-dose ICS	May breastfeed
Salmeterol	50mcg blister BID		
Formoterol	12mcg capsule BID		
Leukotriene Receptor Antagonist		Alternative for mild asthma or as add-on therapy to ICS, especially in patients with good response before pregnancy	May breastfeed
Montelukast (Singulair)	10mg PO QHS		
Zafirlukast (Accolate)	20mg twice daily		
Cromolyn	2 puffs four times daily	Alternative for mild asthma	May breastfeed
Theophylline	400–600 mg/day (based on level)	Alternative for mild asthma or as add-on therapy to ICS	May breastfeed
Anti-Histamines		Used to treat allergic rhinitis that can trigger asthma exacerbations	May breastfeed
Diphenhydramine (Benadryl)	25-50 mg every 4-6 hours		
Fexofenadine (Allegra)	60 mg twice daily *or* 180 mg once daily		
Loratadine (Claritin)	10mg daily		
Desloratadine (Clarinex)	5mg daily		
Cetirizine (Zyrtec)**	5mg or 10mg daily		

- Adapted from National Heart, Lung, and Blood Institute, National Asthma Education and Prevention Program. Expert panel report: guidelines for the diagnosis and management of asthma. NIH Publication No. 05–5236. Bethesda (MD): NHLBI. & Schatz M. Dombrowski MP. Clinical Practice. Asthma in Pregnancy. *NEJM* 2009; 360: 1862-69.
- ICS = Inhaled Corticosteroids
- LABA = Long Acting Beta Agonists; daily use of Salmeterol should not exceed 100mcg
- *Budesonide is preferred in pregnancy since more safety data are available; however, if asthma is well controlled on a different inhaled corticosteroid, it should be continued in pregnancy.
- **Cetirizine preferred in pregnancy since more safety data are available

Table 4. Antiviral Medication Dosing Recommendations for Treatment or Chemoprophylaxis of Influenza A (Seasonal & H1N1) Infection

Anti-Viral	Treatment Dose	Chemoprophylaxis Dose	Breastfeeding
Oseltamivir (*Tamiflu*)	75mg PO BID x 5days	75mg PO Daily x 10days	Safe
Zanamivir (*Relenza*)	Two 5-mg Inhalations (10mg total) BID x 5days	Two 5-mg Inhalations (10mg total) Daily x 10days	Safe

- All antivirals used for treatment should be administered within 48hrs of onset of symptoms.
- Antivirals are compatible with breast feeding and doses do not need to be adjusted.
- Amantadine and Rimantadine are not recommended for use because of high rates of resistance among circulating influenza A viruses.

Table 5. Use of Nicotine Replacement Products in Pregnancy		
Product	**Typical Dosing Regimen in Pregnancy**	**Use in Pregnancy**
Transdermal Patch**	16mg patch for 16 hours per day x 6 weeks; no taper	Provides nicotine-free interval for fetus at night
	21mg patch per day x 4-5wks 14mg per day x 2 weeks 7mg per day x 2 weeks	Used for moderate to heavy smokers (>10 cigarettes per day)
Nicotine Gum	<25 cigarettes per day: 2mg piece q 1-2 hrs x 6wks then q2-4 hrs x 3wks the q4-8 hrs x 3 wks. >25 cigarettes per day: same regimen as above but use 4mg pieces	Not recommended
Nicotine Lozenge	1st cigarette >30mins after waking: 2mg lozenge q 1-2 hrs x 6wks then q2-4 hrs x 3wks the q4-8 hrs x 3 wks. 1st cigarette <30mins after waking: same regimen as above but use 4mg lozenge.	Not recommended
Nicotine Nasal Spray	0.5mg/spray Use 1-2 sprays each nostril q1hr Max is 80 sprays or 40mg/day Taper dose over 4-6 weeks	Not recommended
Nicotine Inhaler	4mg delivered per cartridge 6-16 cartridges/day inhaled. Use continuous puffing x 20min each cartridge.	Not recommended
Buprioprion (Zyban)	150mg daily x 3 days then 150mg BID Start 2 weeks before the anticipated quit date	Used as an alternative for those who cannot tolerate NRT or those who smoke > half pack per day or who fail NRT.
Varenicline (Chantix)	Not applicable	Contraindicated in pregnancy
****** Preferred NRT method in pregnancy because compared to other NRT methods, patches produce lower, longer-lasting, steadier concentrations of nicotine that are no higher than that observed with smoking more than 10 cigarettes per day.		