THINGS TO CONSIDER

Exposures to substances and potential toxins
Exposure to infection
Physical Stress
Psychosocial stress
OB specific outcomes: preeclampsia, preterm labor, preterm delivery, LBW, SGA
Non work related exposures
Healthcare worker specifics
DEMOGRAPHICS

47% of the American work force are women

Working mothers are the sole or primary breadwinners in 40% of American families

37% of those are married and make more than their spouses

63% are single mothers

66% of first time pregnant women work

Was 44% 1961-1965

82% of those that work do so up until one month or less before delivery


WHAT TO ASK HER

What do you do for a living?
How many hours do you work?
What is your workplace like?
How is your stress level at work?
Are there any chemicals or other substances used there?
Do you have to wear protective gear of any kind?
What have other pregnant women at your job done?
How long are you planning on working?
Is your job changeable if need be?
  • The answer is no for a lot of people
Could you stop working early if need be?
  • The answer is “heck no” for a lot of people
EMPLOYMENT ITSELF IS NOT THE PROBLEM

Multiple studies have shown that unemployment is associated with adverse obstetrical outcomes

Partly from “healthy worker effect”

Partly from social and economical benefits that employed people have like insurance, financial stability and social interaction

Work categorized as non-stressful is not associated with pregnancy risks

Sources:

EXPOSURES TO CHEMICALS ET AL

Occupational exposure limit: level at which an exposure is thought to be safe

- Different in different countries
- TLV: threshold limit value in the U.S.
  - Airborne concentrations of substances under which workers can be exposed day after day without adverse health effects
- MAK: Maximum concentration in the workplace in Germany
  - Concentration of a substance in the air which does not impair the health of the employee or cause undue annoyance
- About 100,000 different compounds are used in various workplaces
  - About 500 of these have been studied

CONFOUNDERS TO ASSESSING WORKPLACE EFFECTS ON FERTILITY

Men:
- Drugs, ETOH, smoking
- Anatomical variants of genitals
- Cryptorchidism
- Mumps
- DM
- Hormonal dysfunction
- Testicular trauma

Women:
- Drugs, alcohol, smoking
- Ovulatory dysfunction
- Hyperandrogenism
- Hormonal disorders
- Endometriosis
- Genital infections
- Uterine factors
- Cervical factors
- Causes originating from the fetus

CHEMICAL EXPOSURES

Only a few substances are proven to influence fertility

- **Lead**
  - Increasing serum concentrations associated with decreased sperm quality and concentration
  - Increased serum values associated with longer time to conception
  - Increased maternal exposure associated with increased risk of spontaneous abortion
    - No effect with low to moderate range

- **Organic mercury compounds**

- **Manganese**

- **Carbon disulfide**

- **2-bromopropane**

- **Dibromochloropropane (DBCP)**
  - Alters testicular tissue
  - Banned in 1977, but stockpiles in 3rd world countries caused mass male sterilization in Honduras

CHEMICAL EXPOSURES

Also of concern:

- Glycol ethers with a methyl or ethyl group in the primary position
  - Used in water-soluble varnishes
  - Embryotoxic and teratogenic in animal studies
  - Toxic to human reproduction even at very low levels
  - Classified by the EU as toxic to human reproduction

- Inorganic mercury
  - Reduced concentration of testosterone in serum

- Styrene
  - In the plastics industry
  - Reduced sperm count among exposed workers

PHYSICAL NOXA EXPOSURES

Those with proven effects on fertility

- Welding
  - Proportion of normally shaped sperm declined after 6 weeks of exposure to heat and increased after a break from exposure
- Professional driving
- Working with heat
- Magnetic fields
  - Increased rate of miscarriage as well
- Vibration
- Radiation exposure
  - 100 prisoners who volunteered for testicular radiation
    - Dose of 0.11 Gy could cause substantial suppression of sperm counts and a dose of 3-5 G could lead to permanent sterility

**PHYSICALLY DEMANDING WORK**

Meta-analysis of 29 studies, physically demanding work = manual labor with exertion or repetitive lifting

- Increased risk of preterm birth: RR = 1.22 (1.16-1.29)
- Association with SGA: RR = 1.37 (1.3-1.44)
- Association with hypertensive disorders: RR = 1.6 (1.3-1.96)
- Prolonged periods of standing (>3 hours/day) increased risk of preterm birth compared to sedentary jobs: RR = 1.26 (1.13-1.4)
  - RR = 1.28 in another meta-analysis
- Shift work/night work associated with preterm birth: RR = 1.24 (1.06-1.46)
  - Risk of miscarriage may be higher: RR = 1.6 (1.3-1.9) in Nurses’ Health Study
- Working increased hours not found to be associated with preterm birth
  - But when 6 high quality studies were analyzed separately, was an association RR = 1.24 (1.04-1.48)
  - Another meta-analysis found an association between >40 hours/week and preterm birth: RR = 1.2 (1.01-1.42)

PHYSICALLY DEMANDING WORK

Study of 4680 working pregnant women in the Netherlands found no consistent associations between physically demanding work, long working hours and adverse birth outcomes.

After adjustment for potential confounders, no association between physically demanding work in the second trimester and fetal growth.

After adjustment for potential confounders, long periods of standing in the third trimester associated with lower fetal head circumference:
- 3% lower than average.

Working > 25 hours/week reduced fetal growth rates, especially head circumference.

None of these findings were reflected in adverse birth outcomes.

Authors conclude that they were unable to find a clear negative effect of working until 34-36 weeks of pregnancy.

OCCUPATIONAL FATIGUE

A scored criterion of:

- prolonged standing
- working with industrial machines
- carrying significant loads
- repetitive physical tasks
- working with increased noise, vibration, or cold
- working with chemicals

Increased risk of preterm birth: RR= 1.63 (1.33-1.98) in a meta-analysis
Case-control study of 6000 Canadian women associated with SGA and preterm delivery
risk of SGA increased as occupational fatigue increased

High psychological work stress has been associated with increased risk of miscarriage, lower birth weight and preterm delivery.

PSYCHOLOGICAL WORK STRESS

Assessed using the Job Demand and Control model

- 3 dimensions: job demands (psychological), job control (decision latitude), job social support

High strain = combo of high job demands with low control over work
Relaxed = low demands and high control
Passive = low demands and control
Active = high demands and control

Social support important

- Low support exacerbates effects of job strain
- High support attenuates effects of job strain

PSYCHOLOGICAL WORK STRESS

High strain jobs with low or moderate social support at the beginning of pregnancy significantly associated with preterm delivery; OR = 1.4 (1.1-1.8)

High strain jobs associated with a modest non significant increase in preterm delivery OR = 1.3 (0.9-1.8)
  - Women who worked > 30 weeks in high strain jobs had higher risk; OR = 1.4 (1.0-2.2)

Risk of preterm delivery increased in both passive and high strain jobs, both of which have low level of control

Social support moderated the association between work stress and preterm delivery

Low control associated with low birth weight; OR = 2.6 (1.1-6.8)

Low birth weight modestly associated with high strain and passive jobs

African American women experienced a greater relation of job strain to low birth weight
  - 273 gm versus 88 grams for Caucasian women under the same strain

Low social support associated with spontaneous abortion only in women who work > 40 hours/week

Fixed night work increased risk of spontaneous abortion; OR = 9.58 (1.41-65-35)

Self reported stress positively but not significantly associated with spontaneous abortion; OR = 1.4 (0.8-2.3)

Hours worked per week strongly related to stress at work
- Women working >45 hours week more likely to report high stress during pregnancy

Duration of employment and irregular working hours influence the strength of the relationship between job strain and pregnancy outcomes
- In the presence of job stress, working >30 hours/week associated with premature delivery, but <30 was not
- Working a fixed night schedule associated with spontaneous abortion in women who have job strain
  - OR = 9.58 (1.41-65-35)

All in all, work stress is modestly associated with adverse outcomes in most studies of a 13 study meta-analysis.

All of this analysis could be affected by “healthy worker effect”

- You’re more likely to work if you’re healthy
- You’re more likely to self-select out of a high strain job, leaving behind the ones who can handle it
  - So there might be a lot of effects of high strain jobs that aren’t measured because the affected ones are gone
STUDIES ABOUT PREECLAMPSIA

Generation R study from the Netherlands 4465 pregnant women in a population-based prospective cohort study from early pregnancy onward.

- Patients were asked about manually handling loads of 25 kg or more, long periods of standing or walking, night shifts, and working hours.
- Occupational exposure to chemicals, job titles and task descriptions were linked to a job-exposure-matrix (JEM), an expert judgment on exposure to chemicals at the workplace.
- Hypertensive disorders during pregnancy was obtained from medical records.
- Results: no consistent associations between any of the work related risk factors, such as long periods of standing or walking, heavy lifting, night shifts, and working hours, nor exposure to chemicals with hypertensive disorders during pregnancy.

STUDIES ABOUT PREECLAMPSIA

Population based case-control study from Quebec of >4000 women phone interviewed a month after delivery

All information obtained retrospectively from patient

- standing daily at least 1 hour consecutively without walking
  - higher risk of preeclampsia [aOR 2.5, 95% confidence interval (95% CI) 1.4–4.6]
- climbing stairs frequently (aOR 2.3, 95% CI 1.2–4.1)
- working more than 5 consecutive days without a day-off (aOR 3.0, 95% CI 1.0–9.5)
- Squatting or kneeling, pushing or pulling objects, whole-body vibration, forced pace, job strain, and no control on breaks were positively, but nonsignificantly, associated with preeclampsia.

INFECTIONS IN PREGNANCY FROM WORKING

Common cold most common
  - But that’s a bunch of different viruses and the implications of infection are not clear

Women can be occupationally exposed to CMV, rubella, parvo B19, herpes and toxoplasmosis

(and zika and, and, and...)
STUDY ABOUT INFECTIONS IN PREGNANCY BASED ON OCCUPATION

Study from Denmark; 83,448 pregnant women, 65,377 employed

Occupations categorized at first interview (16 weeks gestation)
- Contact with patients: 8,699
- Contact with children: 9,151
- Contact with food products: 932
- Contact with animals: 287
- “unexposed workers”: 46,308

Source: Morales-Suárez-Varela et al. Risk of infection and adverse outcomes among pregnant working women in selected occupational groups: A study in the Danish National Birth Cohort. Environmental Health 2010, 9:70
Second interview at 30 weeks by telephone asked:
- Absent from work due to illness >3 days
- If she had taken any medicine for infections
- If she had had a fever
- If she had had diarrhea
- If she had a cold sore or herpes
- If she had cystitis
- If she had a skin infection

Pregnancy outcomes identified from a national discharge and national birth register

Outcomes studied: miscarriages, sex ratio, preterm birth, SGA, Apgar scores, congenital anomalies

Work with patients: higher miscarriage and incidence of sick > 3 days, medically treated infections, oral herpes and cystitis

Work with children: increased risk of sick leave for more than 3 days, fever and skin infections

Work with food: increased risk of sick > 3 days

Prevalence of congenital anomalies for work with patients; OR= 1.09 (1.00-1.18) reported as higher

Prevalence of SGA higher for women who worked with food products; OR= 1.33 (1.07-1.59)
- But there were more smokers in this group and they tended to be younger and have decreased socioeconomic status

Other reproductive failures not increased in any of the groups
GIANT CONFOUNDER: SMOKING

First and second hand smoke implicated in LBW

Retrospective population based study with interview at delivery of 6866 Czech women

- Patients grouped as non-smoking, moderate or heavy smoker
- 25, 67, 85% respectively reported being exposed to environmental smoke
- Daily number of cigarettes smoked by others in her presence: 11, 14, 23 respectively
- Impact of active smoking on birth weight significant and dose-related
- Impact on birthweight worse in later pregnancy versus early pregnancy
- Environmentally exposed non-smoking mothers had lower birth weight babies than non-exposed
- Highest impact: the actively smoking mother who was also around others who smoke
- Environmental smoking exposure associated with IUGR in smokers but not non-smokers

Conclusion: Don’t smoke, for Pete’s sake!!!!!!!!!!! And don’t be around people who smoke either

EXPOSURES IN THE NON-WORKING WORLD

Paint
Air pollution
SHOULD SHE PAINT THE HOUSE OR MAKE SOMEONE ELSE DO IT?

She can probably paint the house, particularly if she’s Dutch

Paint is a concern because it contains organic solvents
  ▪ Volatile liquids at room temp; exposure is by inhalation or through skin
  ▪ Epidemiological studies suggest that occupational exposure could increase risk of SAB, preterm delivery
    ▪ Most likely to be exposed: dry-cleaners, house painters, graphic arts industry workers, hairdressers, lab techs

No association between exposure to paint fumes while at home and low birth weight, SGA and preterm birth
  ▪ Phone interview study of 19,000 women
  ▪ 45% were exposed to paint fumes during pregnancy when the above occupations were excluded
  ▪ Thought to be due to moving or nesting behavior

Maybe associated with congenital abnormalities when exposed in the first trimester?

Authors conclude: “An association between exposure to paint fumes in the first trimester of pregnancy and risk of congenital anomalies in the nervous system, the ear, face neck and renal system.”

But…

<table>
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<th>Non-cases</th>
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<td>1399</td>
<td><strong>2.13</strong></td>
<td><strong>2.15</strong></td>
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</tbody>
</table>
SO WHAT DOES THAT MEAN?

If the overall OR is less than 1, and 3 categories have an OR more than 1, then…

There’s others with OR’s less than 1

TRUE! OR for genital malformations, heart defects, digestive defects and limb anomalies is less than one

SO what do you tell her?

You could say:
- Don’t paint the nursery until you’re 14 weeks to avoid certain birth defects
- Paint the nursery before you’re 13 weeks to avoid certain birth defects

AIR POLLUTION DEFINITIONS

Particulate matter (particle pollution or PM), is a complex mixture of extremely small particles and liquid droplets

- made up of a number of components, including acids (such as nitrates and sulfates), organic chemicals, metals, and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems.

Particles that are 10 micrometers in diameter or smaller thought to be the most dangerous

- generally pass through the throat and nose and enter the lungs
- once inhaled, these particles can affect the heart and lungs and cause serious health effects

Two kinds of PM according to the EPA

- "Inhalable coarse particles," such as those found near roadways and dusty industries, are larger than 2.5 micrometers and smaller than 10 micrometers in diameter.
- "Fine particles," such as those found in smoke and haze, are 2.5 micrometers in diameter and smaller.
  - directly emitted from sources such as forest fires, or can form when gases emitted from power plants, industries and automobiles react in the air.

AIR POLLUTION AND PREGNANCY

Systematic review and meta-analysis of 62 studies, mostly based on data from the 1990’s and early 2000’s from 39 locations, most from North America

For relative concentrations of CO, NO2, PM10, PM 2.5
  - Decrease in birth weight of approximately 10-30g
  - OR of 1.05-1.10 for low birth weight
  - OR of 1.04-1.06 for preterm birth

Less consistent results for ozone and SO2.

Systematic review of 41 studies
  - Exposure to SO2 associated with preterm birth
  - Exposure to PM25 associated with low birth weight, preterm birth, SGA
  - Exposure to PM 10 associated with SGA

Both reviews state that there are different outcomes for different pollutants across different studies

AIR POLLUTION AND PREGNANCY

Bottom line for practice: it’s probably a reasonable idea to avoid polluted areas if possible as a pregnant person

But it’s pretty tough to tell

Reasonable to advise her to follow the recommendations for the general population based on air quality

LAW ABOUT PREGNANCY AND WORKING

http://www.eeoc.gov/laws/types/pregnancy.cfm

Pregnancy discrimination act (PDA) is an amendment to Title VII of the Civil Rights Act of 1964

Workers are permitted to work as long as they are able to perform the essential function of their job

Pregnant workers cannot be tested with special procedures to determine their functional ability

Essentially up to the worker to determine her ability

If you feel your patient is being discriminated against based on pregnancy, encourage her to contact the EEOC

Source: Hood J. The Pregnant Health Care Worker—An Evidence-Based Approach to Job Assignment and Reassignment. AAOHN Journal, August 2008, vol. 56, no. 8
SPECIFIC RISK WITH CERTAIN JOBS

• Risk of preterm delivery similar among working and non working women regardless of the timing in pregnancy or the number of hours worked
• Increased risk of preterm delivery in electrical equipment operators, janitors, textile workers and food workers
  • Consistent with a study showing the same for janitors and food service workers in Montreal, textile workers in Scotland, and food service in U.S.
• Decreased risk of preterm delivery, SGA and very low birth weight for teachers and librarians
• Very LBW showed little association with work at any time during pregnancy
  • Decreased risk in work < 25 hours/week
• SGA births were more rare in employed versus unemployed women
  • Increased in electrical equipment operators, textile and food service workers
• Reduced risk of stillbirth among employed women
• Reduced risk of infant death among employed women

HEALTH CARE WORKERS AND PREGNANCY RISKS

Survey of 1197 physicians found slightly higher rates of pregnancy induced HTN
Cohort study of 67 physicians found RR of any pregnancy complication= 1.86 (1.0-3.46)
   RR= 4.0 for preterm labor (1.58-10.51)
   RR= 2.23 for preterm delivery (0.93-5.8)

Study of OB gyn residents from 1987 noted significantly increased birth weight of babies born after residency than during
Increased risk of preterm labor, preeclampsia, and low birth weight among 424 pregnancies in women who worked >80h/wk.

HEALTHCARE WORKERS AND PREGNANCY RISKS

Survey study of 1284 resident pregnancies compared to spouses of residents
similar rates of spontaneous abortion
rate of PIH 8.8% versus 3.5%
preterm labor rate 11% in residents versus 6% in controls
**25% of pregnant residents needed to take off work or be hospitalized**
but, preterm delivery rates similar

HEALTH CARE WORKERS AND PREGNANCY RISKS

Oncology drugs

Nurses, pharmacists and pharm techs required to wear PPE when preparing cytotoxic drugs and spills are handled in a specific manner

Modern handling techniques were introduced in 1985

Studies of effects before that not as relevant

Systematic review of 14 studies with 11 focused on reproductive outcomes

Spontaneous abortion OR = 1.49 (1.25-1.73) among women exposed to cytotoxic drugs

Congenital malformation

6 studies: one before 1985 reported twice the expected rates of defects
One in 2000 found OR for cleft lip with or without cleft palate = 3.34 (0.34-3.21)
Pooled data for the rest OR = 1.64 (0.91-2.94)

Stillbirth: no association with exposure to cytotoxic drugs

Ectopic: no association with exposure to cytotoxic drugs

HEALTH CARE WORKERS AND PREGNANCY RISKS

Helpful websites to help you figure out what to do with pregnant nurses and other health care workers:

National Institute for Occupational Safety and Health (NIOSH)  www.cdc.gov/niosh
“Preventing Occupational Exposures to Antineoplastic and Other Hazardous Drugs in Health Care Settings”
www.cdc.gov/niosh/docs/2004165/#sum
“Safe Patient Handling and Movement” www.cdc.gov/niosh/review/public/safepatient/ patienthandling2.html
“The Effects of Workplace Hazards on Female Reproductive Health” www.cdc.gov/niosh/docs/99104

Occupational Safety and Health Administration (OSHA)  www.osha.gov/index.html

Association of periOperative Registered Nurses (AORN)  www.aorn.org
“AORN Workplace Safety” www.aorn.org/PracticeResources/SafetyResources/ WorkplaceSafety

March of Dimes Foundation  www.marchofdimes.com
“Cytomegalovirus” www.marchofdimes.com/professionals/14332_1195.asp

Source: Alex MR. Occupational Hazards for Pregnancy Nurse. AJN ▼ January 2011 ▼ Vol. 111, No. 1
IN THE END

Definitely worth it to take an occupational history of all pregnant patients

Work itself is not a problem for pregnancy, but high stress (physical and psychological) might be

Have to individualize the advice based on what she does, what she’s exposed to, and what is actually changeable given the rest of her life

This is where I go when I need to look up an occupational-pregnancy question:
http://www.mothertobabyca.org/
QUESTIONS?

What makes these pregnancies unusual?