

Providing a safe lab environment for pregnant and immunocompromised laboratorians

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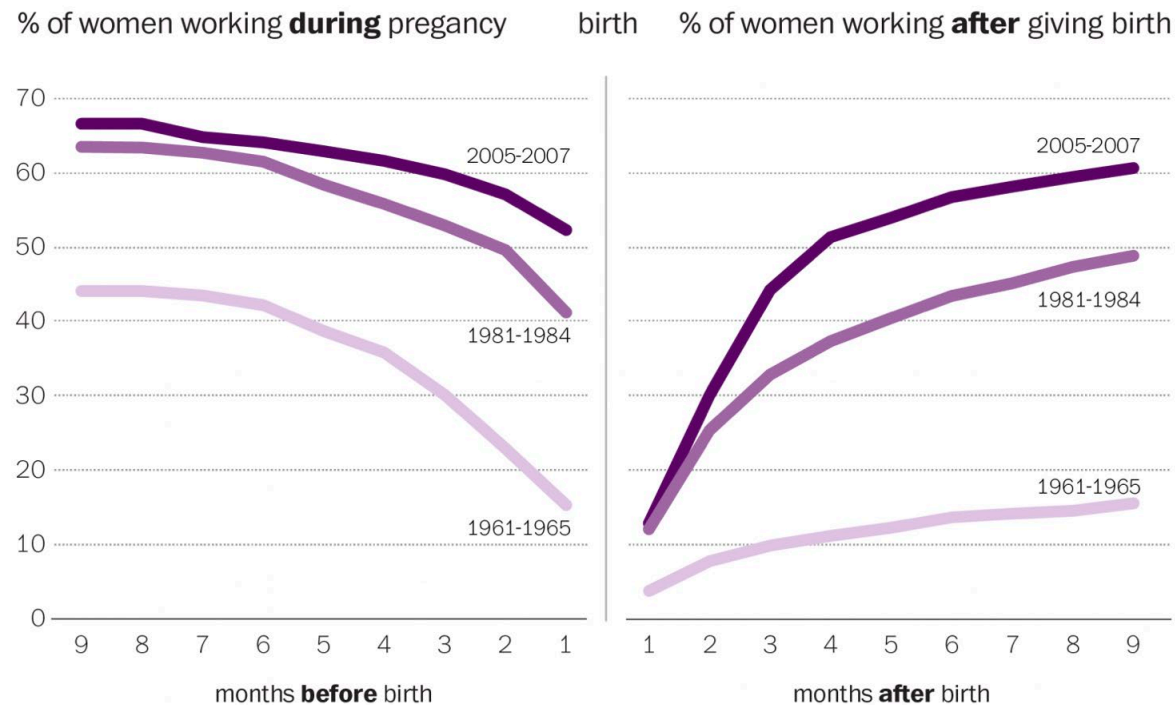
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More women work later into pregnancy and return to work earlier after giving birth

Working while pregnant – and afterwards too

Cumulative percentage of women working during and after pregnancy, by selected years



WASHINGTONPOST.COM/WONKBLOG

Source: U.S. Census Bureau

https://www.washingtonpost.com/news/wonk/wp/2015/04/01/stingy-policies-mean-american-women-are-taking-less-maternity-leave-than-ever/?utm_term=.b319c47b71dc

A Word About Pregnancy Discrimination

- The Pregnancy Discrimination Act was passed in the U.S. in 1978
- Charges of alleged discrimination persist today across all 50 states:
 1. Most common report is being fired for being pregnant (30% of reports)
 2. Report being denied minor modifications to job duties needed to continue working while pregnant
- This presentation is meant to inform the audience of the possible hazards that are specific to pregnant laboratorians and how to best avoid them (when deemed necessary). The intent is to help you keep mother and baby safe while performing their job duties.

National Partnership for women and families. Data Brief (2016):
<http://www.nationalpartnership.org/research-library/workplace-fairness/pregnancy-discrimination/by-the-numbers-women-continue-to-face-pregnancy-discrimination-in-the-workplace.pdf>

Outline

1. Regulations & guidelines
2. Specific Information
 - I. Select agents
 - II. Biologicals
 - Organisms of high risk
 - Organisms of medium-low risk
 - III. Chemicals
 - IV. Others
3. Risk assessments



Doc Momma Designs Lab Coats for pregnant women:
<https://www.prlog.org/12222704-doc-momma-designs-lab-coats-for-pregnant-doctors.html>

1. Regulations and guidelines

- OSHA 29 CFR 1910.1200 “Right to know”
- Biosafety in Microbiological and Biomedical Laboratories (BMBL 2009) 5th Edition (pages 115-116) guidance stating that when an occupational exposure is substantially more hazardous to identifiable sub-populations (such as pregnant women) “workers should be informed about risks”.
- US Pregnancy Discrimination Act of 1978: Self-reporting of pregnant status is entirely at the discretion of the individual and is in no way required. Nor can a change in job duties be imposed upon an individual solely because they are pregnant or planning to become pregnant.

2. Specific Information: I. Select Agents

Organism	Risk	Transmission route from mother to child
Bacillus anthracis (anthrax)	Limited evidence suggests that pregnant women are not at increased risk for anthrax infection compared to the general population, infants not at an increased risk for birth defects	Unknown
Burkholderia mallei (glanders)	No case has been reported in the literature, unknown effects	Unknown
Burkholderia pseudomallei (melioidosis)	Only two cases reported in the literature: <ol style="list-style-type: none"> 1. Pregnant woman presented with cystitis and later had a stillborn 2. Pregnant woman presented with placenta previa and severe vaginal bleeding, had emergency C-section, infant born with sepsis and respiratory distress (survived with treatment) 	Unknown <ol style="list-style-type: none"> 1. Burkholderia pseudomallei cultured from urine 2. Burkholderia pseudomallei identified in blood and tracheal aspirate from infant

2. Specific Information: I. Select Agents

Organism	Risk	Transmission route from mother to child
Clostridium botulinum toxin (botulism)	Little is known about the effects of botulism in pregnant women. Due to potential routes of exposure (ingestion or inhalation) it is not expected that pregnant women would be at increased risk for infection. It is not known if infants are more likely to experience adverse effects.	Unknown
Francisella tularensis (tularemia)	<p>It is not known if pregnant women and fetuses are at increased risk from infection.</p> <p>Eight recorded cases of tularemia during pregnancy (two in the 1930s, and 6 between 2008-2012 in Turkey).</p> <ul style="list-style-type: none">-2 fetal deaths (both untreated)-6 delivered healthy infants (1 untreated and 5 treated successfully) <p>*Due to such a small number of cases, birth defects cannot be excluded.</p>	Unknown

2. Specific Information: I. Select Agents

Organism	Risk	Transmission route from mother to child
Rickettsia prowazekii (typhus)	No case has been reported in the literature, unknown effects	Unknown
Variola virus (smallpox) fetal vaccinia	Mother and fetus: high morbidity and mortality Fetus: death, slight increase in risk for birth defects	Unknown (but likely)
Yersinia pestis (plague)	It is not known if pregnant women and fetuses are at increased risk from infection. One case of intrauterine infection reported Pregnant women diagnosed with plague have experienced spontaneous abortion, fetal tachycardia, and fetal distress.	Unknown (possible intrauterine infection)

2. Specific Information II. Biologicals: Organisms of high risk

Organism	Risk	Transmission route from mother to child
Brucella spp.	Spontaneous abortion, preterm delivery, chorioamnionitis (intra amniotic infection-IAI), and fetal death	Placenta
Chikungunya virus	Miscarriage, fetal death, harmful fever, neurodevelopmental disorders	Not clear
Chlamydia psittaci	Death of unborn child, premature delivery	Placenta
Coccidioides (Valley fever)	Mothers: coccidioimycosis, severe respiratory disease, meningitis Fetus: coccidioimycosis, severe respiratory disease, death	Delivery (aspiration of amniotic fluid or vaginal secretions)
Coxiella burnetii (Q fever)	Miscarriage, preterm delivery, infant small for gestational age, oligohydramnios (deficiency in amniotic fluids), fetal growth restriction, or perinatal death	Placenta
Cytomegalovirus (CMV)	Long term complications include damage to the central nervous system, learning disabilities, deafness	Placenta
Ebola virus	100% fetal death rate, fatal to mother	Placenta

2. Specific Information II. Biologicals: Organisms of high risk

Organism	Risk	Transmission route from mother to child
Listeria monocytogenes	Fetal septicemia or meningitis (death rate 50-100%), miscarriage, premature birth. Long term effects in many organs including the eyes, airways, and central nervous system	Placenta, delivery
Lymphocytic choriomeningitis virus (LCM)	Injury of brain and retina leads to permanent dysfunction (microcephaly, periventricular calcifications, and hydrocephalus)	Not known
Malaria	Miscarriage, premature delivery, low birth weight, congenital infection, perinatal death	Placenta
Measles (unvaccinated)	Miscarriage, stillbirth, premature delivery	Not known
Mycobacterium tuberculosis (TB)	Low birthweight, child born with TB	Not known, but placenta suspected
Parvovirus B19	Fetal death, miscarriage	Placenta

2. Specific Information II. Biologicals: Organisms of high risk

Organism	Risk	Transmission route from mother to child
Rubella virus	Wide range of birth defects including deafness, cataracts, microcephaly, heart defects, and learning disabilities.	Placenta
Toxoplasma gondii	Long term eye damage, hydrocephaly, inflammation of the eyes, various non-specific signs	Placenta
Varicella-zoster (chickenpox)	Skin scarring, brain damage resulting in learning disability, limb abnormalities	Placenta
Zika virus	Miscarriage, microcephaly, deafness, other long term conditions	Placenta

2. Specific Information II. Biologicals: Organisms of medium-low risk

Organism	Risk	Transmission route from mother to child
Borrelia burgdorferi (Lyme disease)	Stillbirth, premature birth, and other complications	Not known
Campylobacter spp.	Neonatal sepsis and death (if infected during 3 rd trimester), severe enteritis, meningitis, fetal wastage, spontaneous abortion, premature labor, stillbirth, neonatal diarrhea, neonatal bacteremia, death of mother	Placenta
Clostridium perfringens	Sepsis and death	Not known
group B Streptococcus (GBS)	Maternal colonization with GBS in the genitourinary or gastrointestinal tracts is the primary risk factor for disease	Not known
Haemophilus influenzae	Miscarriage, chorioamnionitis (intra amniotic infection-IAI)	Placenta

2. Specific Information II. Biologicals: Organisms of medium-low risk

Organism	Risk	Transmission route from mother to child
Hepatitis A (unvaccinated)	Transmission from mother to child	Mother to child transmission
Hepatitis B (unvaccinated)	Severe fulminant hepatitis after birth	Delivery and exposure to mother's blood
Hepatitis C	Gestational cholestasis (jaundice), low birth weight, small for gestational age, more likely to be admitted to NICU and require assisted ventilation, long term effects lead to chronic hepatitis	Placenta, delivery (contact through the birth canal)
Hepatitis E	Mother: fulminant hepatic failure and death, acute hepatitis	Not known
HIV	AIDS and other diseases and infections	Placenta, delivery, breastfeeding
Herpes simplex virus (HSV)	Miscarriages, serious birth defects	Placenta
Influenza virus	Premature labor and delivery, severe birth defects, flu related complications for mother and child	Placenta

2. Specific Information II. Biologicals: Organisms of medium-low risk

Organism	Risk	Transmission route from mother to child
Measles (vaccinated)	Miscarriage, stillbirth, premature delivery	Not known
Salmonella spp. (enteritidis and typhimurium)	Sepsis, miscarriage, chorioamnionitis (intra amniotic infection-IAI)	Placenta
Treponema pallidum (syphilis)	Fetal death, congenital syphilis	Placenta
Pathogenic Escherichia coli (E. coli)	STEC: infection experiments in rats have shown pre-term labor, fetal death, and stillbirth	Placenta (Hypothesized)
Shigella spp.	Chorioamnionitis (intra amniotic infection-IAI) leading to premature rupture of membranes leading to preterm labor and pre-term delivery	Placenta

2. Specific Information II. Biologicals: Organisms of medium-low risk

Organism	Risk	Transmission route from mother to child
Staphylococcus aureus Staph enterotoxin B (SEB) Staph enterotoxin C (SEC) toxic shock syndrome toxin-1 (TSST-1)	Child born colonized (especially MRSA)	Umbilical cord
West Nile virus	Congenital malformations cannot be ruled out (but risk is minor)	Mother to fetus in pregnancy, breastfeeding
Vibrio cholerae Vibrio parahaemolyticus Vibrio vulnificus	Mother can experience extreme diarrhea, vomiting, fever, low blood pressure leading to Intrauterine fetal death, neonatal death	Not known, effects to fetus due to extreme dehydration and low blood pressure
Yersinia enterocolitica	Fetal growth retardation (leading to death), hypoalbuminemia, preeclampsia	Placenta

2. Specific Information: III. Chemicals

Chemical	Risk	Common use
Anesthetic gases	Fetal loss, reduced birth weight, reduced fertility	Operating rooms, animal surgeries
Antineoplastic agents	Menstrual dysfunction, reduced fertility, fetal loss, premature birth, low birth weight, birth defects	Hospitals, pharmaceutical industry
Benzene	Fetal loss, reduced fertility, low birth weight	Organic solvent
Cobalt chloride hexahydrate	Suspected of causing genetic defects, may damage fertility or the unborn child	Oligo labeling kit
Ethylene glycol ether	Fetal loss, reduced fertility, birth defects, menstrual disorders	Organic solvent
Formamide	DNA cross links, mutagenic	Tissue fixation
Mercury	Reduced fertility, fetal loss, premature birth, birth defects	Light bulbs and thermometers in the labs

2. Specific Information: III. Chemicals continued

Chemical	Risk	Common use
Nitrous oxide	Fetal loss, reduced birth weight, reduced fertility	Operating rooms, animal surgeries, dental offices
Pesticides -dibromochloropropane (DBCP) -2,4-dichlorophenoxyacetic acid (2,4-D) -ethylene dibromide -chlordecone -carbonyl -alachlor -atrazine -diazinon	Reduced fertility, fetal loss, birth defects, preterm birth, reduced fetal growth, neurodevelopmental effects, childhood leukemia	Greenhouses
Phenol:chloroform	Causes adverse birth defects and miscarriages	DNA and RNA isolation
Tetrachloroethylene	Reduced fertility, fetal loss	Organic solvent
Toluene	Reduced fertility, fetal loss	Organic solvent

2. Specific Information: III. Chemicals having female and male reproductive toxicity

Female Chemical	Male Chemical
Alkylating/antineoplastic agents	Carbon disulfide
Arsenic	1,2-dibromo-3-chloropropane (DBCP)
Carbon disulfide	Dinitrobenzene
Ethylene oxide	Ethylene glycol monoethyl ether
Ionizing radiation	Ethylene glycol monoethyl ether acetate
Mercury	Ethylene glycol monomethyl ether
	Ethylene glycol monomethyl ether acetate
	Lead

2. Specific Information: IV. Others

	Risk	Common use
Endotoxins/lipopolisaccharides (LPS)	Toxicosis (fever, malaise, changes in white blood cells counts, respiratory distress, shock, and death)-when in μg quantities)	Used as a reagent in various molecular biology assays Can be aerosolized when growing and lysing larger volumes of gram (-) bacteria It is heat stable thus not eliminated by autoclaving
Fungus spores	Asthma, toxicosis, hypersensitivity pneumonitis	Aerosols when working with different fungi
Animal effluents	asthma	Animal research
Amoebae <i>Acanthamoeba</i>	May spread from wounds/bloodstream infections into the brain, especially immunocompromised individuals	Infection when working with the agent
Arthropods	Asthma, hypersensitivity pneumonitis, IgE mediated allergies	Infection when working with the animal or other animals known to carry them (such as birds)

Bioaerosols, H.A. Burge

2. Specific Information: III. Chemicals and physical factors

Note: physical factors can add stress on the body so that the effects of exposure to chemicals and other toxic agents may be altered or worsened

- high atmospheric pressure
- high altitude
- heat
- ultraviolet and ionizing radiation
- extending the workweek by more than 25%

3. Risk Assessment: Zika virus example*

Links to birth defects and Guillain-Barré syndrome²: During recent Zika outbreaks, mostly in Brazil 2014-2016 (ongoing), a higher rate of babies born with microcephaly to mothers infected with Zika during pregnancy has been reported. In some cases, Zika virus has been detected in brain tissue from miscarried fetuses affected with microcephaly and in babies born with microcephaly who died shortly after birth. A higher incidence of Guillain-Barré syndrome has also been reported in countries affected with Zika outbreaks. Although no direct scientific evidence exists to prove that Zika virus infection directly causes microcephaly in babies whose mothers were infected during pregnancy, or that Zika infection triggers Guillain-Barré syndrome, the evidence strongly suggests it. The CDC has issued recommendations for women of childbearing age traveling to countries affected with Zika to avoid pregnancy and that women already pregnant or trying to become pregnant postpone travel plans to affected countries.

*risk assessment performed in 2016, some information may have changed since then

3. Risk Assessment: Zika virus example*

*Lab acquired infections (LAIs)*⁵: *Flaviviridae* family has been a major cause of LAIs (464 documented cases). However, Kyasanur Forrest Disease (KFD), Yellow Fever (YF), louping-ill, Tick Borne Encephalitis (TBE), and West Nile virus are responsible for the majority of the cases. With the exception of hepatitis C virus (HCV) and dengue, flaviviruses in general are able to infect through aerosol transmission. There is only one report of a Zika LAI (no death).

*Treatment*⁵: Currently there is no treatment for Zika virus infection, no vaccine is available, and no postexposure prophylaxis is available.

*Postaccident management*⁵: In the event of a potential lab exposure/accident, the laboratorian should undergo a thorough physical exam, with close clinical follow-up, and a diagnostic assay to establish exposure/infection. Zika can be transmitted from male to female through sexual contact, therefore contact tracing in male laboratorians is required and abstaining from sexual intercourse without the use of a condom is recommended. Women of childbearing age who are pregnant or planning to become pregnant will be followed more closely.

Note:

Because of the evidence suggesting a link between Zika infection and birth defects, we strongly recommend that female laboratorians who are pregnant or planning to become pregnant self-identify to their supervisor so that proper accommodations can be made to avoid exposure to Zika virus^{6,7}.

*Because of the possible link between Zika and Guillain-Barré syndrome, we strongly recommend that any laboratorian who is affected by an autoimmune disorder and/or is immunosuppressed/immunocompromised self-identify to their supervisor so that proper accommodations can be made to avoid exposure to Zika virus*².

*risk assessment performed in 2016, some information may have changed since then

3. Risk Assessment: Ebola virus example*

Links to miscarriages, still births, neonatal death²: During recent Ebola outbreaks, mostly in Africa 2014, the perinatal survival rate was 0 %. There were no reported fetal survivors and all pregnancies ended in spontaneous miscarriages, still births, or neonatal death. The same observations have been made in all other Ebola outbreaks.

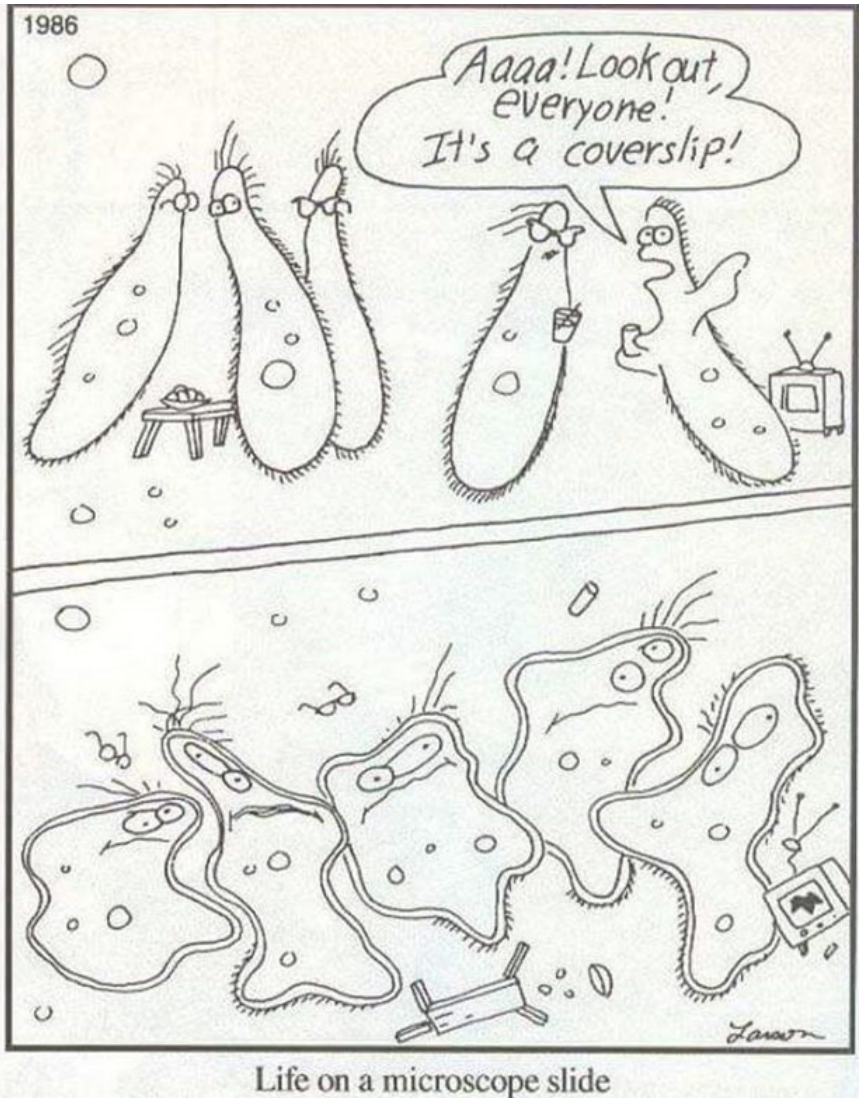
Treatment⁵: Currently there is no treatment for EVD. Although some vaccines and antiviral treatments are in different stages of clinical trials for safety and efficacy, none are yet FDA approved and no postexposure prophylaxis is available. Supportive care and fluid management to sustain blood-pressure are recommended.

Postaccident management⁵: In the event of a potential lab exposure/accident, the laboratorian should undergo a thorough physical exam, with close clinical follow-up, and a diagnostic assay to establish exposure/infection at the recommended time. CDC and the appropriate state authorities should be immediately informed. The laboratorian will be monitored for 3 weeks postexposure for onset of fever and/or flu-like symptoms. Ebola can be transmitted from male to female through sexual contact, therefore contact tracing in male laboratorians is required and abstaining from sexual intercourse without the proper use of a condom is recommended. Women of childbearing age who are pregnant will be followed very closely.

Note:

Because of the overwhelming evidence linking Ebola infection and neonatal death, we strongly recommend that female laboratorians who are pregnant or planning to become pregnant self-identify to their supervisor prior to working with the virus. Pregnant women will be reassigned to other job responsibilities to avoid exposure to Ebola virus^{6,7}.

*risk assessment performed in 2016, some information may have changed since then



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Thank you!

Questions and Resources:

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