Fostering Reproductive Resilience to Climate and Environmental Change

Marya G. Zlatnik: [Music] I have no financial disclosures. What I'd like to talk about in this brief session this evening is really how climate change and petrochemicals impact reproduction and pregnancy, and so it's really going to be a bit of a whirlwind tour, but I'm going to start with the science, how climate change impacts reproduction, and then a little bit on how climate change and chemicals intersect. Then we'll delve into the concept of endocrine disruption on reproduction because understanding that concept is important. To understand why there are certain chemicals that we worry about exposure to. Then I hopefully will spend a little bit more time going over some practical tips to reduce exposure to toxic chemicals and promoting resilience to climate change.

Starting with the basics. Again, my day job is taking care of high risk pregnancies, and there's an extensive and growing body of literature suggesting that climate change carries particular risks for pregnancy, and I'm not going to have time to go into all of it, but just thinking about the basics, we know that high heat is dangerous for pregnant women. The normal physiology of pregnancy, the woman is breathing a lot more. There's a 20% increase in oxygen consumption. There's a 50% increase in how hard the heart is working in pregnancy. The fetus itself is generating heat. All these things together make the pregnant person more susceptible to high heat. When we look at health outcomes and pregnancy outcomes related to heat waves or extreme temperatures in general, we see shorter pregnancies and more preterm birth.

Preterm birth is it's an important contributor to children's health and certainly a major risk factor for death even in premature infants. This is something that's worth a lot of attention. Research from different parts of the world have shown that higher temperatures increase the risk of preterm birth, and in general, it's thought that absolute higher temperatures may be worse, but that it's also a high temperature relative to what a community is used to because a community that is used to 90 degree weather is going to have air conditioning, hopefully, and is more built around hotter temperatures as opposed to, say, a community like the west side of San Francisco where, you're expecting it to be cooler, and if you have a relatively warm day, it feels like a hot day.

Other issues related to climate change in pregnancy with wildfire smoke, we also see an increased risk of preterm birth. With floods. Again, we see a risk of low birth weight, and then even morbidity and mortality in babies who are born during or after floods. There are lots of ways that we can see climate change directly impacting pregnancy. When we think about how climate change and fossil fuels and petrochemicals and plastics are related, it's bidirectional or multidirectional for all of these things. If we start with petrochemicals, you know, we think of them as being petroleum is being used for fuel and burning that fuel is driving climate change by increasing greenhouse gases in the atmosphere, but those same chemicals can also be turned into plastics and various chemicals that are used for manipulating the physical properties of plastics.

As society makes an effort to stop burning fossil fuels as we go electric, that leaves potentially more fossil fuels to be pushed down into the plastics pathway. Then that makes it into our environment. It makes it into our bodies, water, air, etc. Then we see more health harms from these chemicals. There are really some astounding numbers, and this data is actually a little over 10-years-old, but coming from the EPA, they calculated the amount of chemicals that were either produced or imported into the United States per person per year, and it adds up to 30,000 pounds of chemicals per person per year. Just think about that. Every year, you or other people in your family or people 30,000 pounds of chemicals.

It's a little bit mind boggling, and so no wonder we see our environment getting polluted and no wonder we see our bodies getting polluted. What are some of these chemicals doing? Well, many of the chemicals that I'm going to talk about and that you read about in the newspaper function as

endocrine disrupting chemicals. Rather than the body making a hormone that is intended to work somewhere else in the body for some purpose, this is a chemical that mimics a hormone, and it mimics hormone actions somewhere in the body. When you think about reproduction or pregnancy, those are obviously very hormonally active states. There are lots of very timed specific hormonal steps that need to happen for somebody to get pregnant and to carry a pregnancy.

Anywhere along the line, if there's something that is messing with that hormonal signaling, then reproduction can go awry, and so some of the most famous examples of this is a pharmaceutical chemical called DES or diethylstilbestrol, and then BPA or bisphenol A, which is a chemical used to make to change the properties of plastic. Most famously for a polycarbonate water bottle to make it hard and resilient, and so when you look at the chemical structure, maybe it's not completely obvious on these chemical structure drawings, but these two molecules are able in the body to mimic the function of estrogen. If we think of estrogen as a key acting on the receptor in a cell or an organ, the receptor is like a lock.

Well, if we take BPA, it functions like a pick lock. It's not the chemical that it's supposed to be, but it is able to do some of the same functions, and so we see chemicals that act as endocrine disruptions in the estrogen system. We can see it in the androgen system. We see it in the thyroid system. We see it in some of the the systems around metabolism and obesity. There are a number of hormonal systems that can be interfered with by chemicals that can be found in our environment or our food, and this slide, the figure on the left, it's a little bit tongue in cheek. It's from GQ magazine, but it shows that as global plastic production has grown in the white line over the last 40 years, global sperm counts in the red line have decreased.

I'm not going to talk about male fertility at all, or at least not much, but if you're interested in that topic, there's a new movie out on Netflix, which is interesting following one of the researchers who's done a lot of the important work in this area, and so one of her studies, and they actually I think they show some of this data in the movie that's on Netflix, she looked at pregnant women and collected their urine while they were pregnant. Then after their babies were born, she measured something called the anogenital distance. That's measuring from the bottom of the scrotum to the anus, and that is something that you expect in a boy that distance to be bigger than what you would see if you measured the distance from the vulva to the anus in a girl.

It's something that's known in animals, and rodents and in humans to be sexually dimorphic. In her research, the baby boys that were exposed to more of these thalate plastic chemicals in the womb had shorter antigenital distances. They had sort of an anti testosterone an anti antigen effect while they were in the womb that actually changed their body. We also see these thalates and I've put a rubber ducky here because that's one of the places that they're found. These plastic chemicals have been associated with preterm birth. One recent study estimated that in a year, about two million preterm births globally or almost 10% of preterm births were attributable to one specific type of thalate, and there are hundreds of different varieties of thalates out there.

Another very important way where plastic chemicals are impacting reproduction. I'm not going to go through all these different chemicals, but there's a long laundry list, and the chemical industry is always coming up with new chemicals, and they're not tested before they're put into consumer products. As soon as I learn the alphabet soup for one class of chemicals, there's a new class that springs up and more things for me to learn. What can we do about it? Well, starting on the societal level, we can change the director of climate change, and doing things like moving from coal and oil power to electric power not only impacts greenhouse gases and climate change, but this research study showed that it actually decreases the risk of preterm birth for the people who happen to live very close to those power plants that are spewing out air pollution, those pregnant people had a lower risk of preterm birth.

Another thing that society can do is improve water supplies. This study in Minnesota, they put in a fancy filtration system to get rid of PFAS, which are Teflon type chemicals, and they showed a decrease in low birth weight when using the water filtration. That moves me to the individual level,

and the name of that movie, plastic detox, it's not really detoxing. If we say detoxing means increasing the consumption of healthy nutritious foods, decreasing the intake of toxins, living a healthy, clean life, yes, you can detox. We'll talk a little bit more, but this isn't something where you can do a juice cleanse or take a specific herb or a supplement and remove things from your body. You have to decrease what's coming in and then let your body's metabolism remove what's already there.

Most specifically, we do not recommend something called chelation, which is a medical treatment intended to remove heavy metals in poison levels, and that's something that should only be done under supervision of a medical toxicologist. Black plastic hit the news. This was about a year ago, and there was some back and forth in the media, is it really bad or is it overblown? This is a study where that came from. Basically, these researchers measured some flame returns, which are thyroid endocrine disruptures in a variety of black plastic household products. They were found in black plastic kitchenware. They were found in sushi trays, a number of places where recycled plastic somehow got contaminated with old plastics, probably from old cell phones or whatever that had these flame retardants in them.

There was a miscalculation in this discussion of the paper. They calculated the levels correctly in the work that they did, but they overestimated through a math error, what the EPA safe level would be. There was that one error, which is why there was sort of pushback in the press, but really the conclusion of the paper was that we're finding these toxic chemicals in plastic that we use in our kitchens. This is hot off the presses, some advice from the onion. I haven't really tested any of these out, but I'll share my slides later if anybody's interested. What do I recommend as the top ten things to do to avoid toxins? The first one is simple advice, but not always easy to do in a busy life, but really to eat real food and to avoid ultra processed food.

Ideally to avoid food that has had substantial plastic contact. What I mean is something that's been in plastic or touching plastic for a long time or at high heat or with fatty foods or moist foods, where there's easily a way for the plastic chemicals to leach from the packaging into the food. This doesn't mean if you end up taking your apples home from the store in a plastic bag, I'm not so much worried about that exposure. It's brief, it's dry. It's probably not getting too much plastic into your food. It's not great for the environment, but it's probably not harming you. It's more of the, I'm going to get this lasagna from the premade food thing that comes in a plastic tub. Who knows how long it's been in that thing and heat it in the microwave.

That's where you're going to get the most plastic exposure. Choosing fresh or frozen fruits or vegetables, canned, unfortunately, many cans are lined with plastics. Washing produce, that's obviously a simple inexpensive step most of the time. Then buying organic if you can. Organic produce means that the workers are exposed to less pesticides, but it also means that you're exposed to less pesticides. The environmental working group does share every year the updated lists of which produce have the most or worst amounts of pesticide contamination. That can be one way to decide where you're going to put your dollars. Cooking in glass, storing food in glass or stainless steel, not plastic. Washing hands prior to eating, again, it's a simple thing.

The alcohol based hand sanitizer is great for killing germs. I really believe in it, but it's not going to remove whatever has made it onto your hands during the day. If you're going to eat, ideally, you actually wash with soap and water. Funny place to get exposure to phthalate or BPA is actually those carbonless receipts that you get at the store. Many of them contain phthalates and actually in that form, they can be absorbed through your skin. Furniture, it can expose people to flame retardants. This is less of a problem currently in San Francisco because it's banned to sell furniture with these chemical flame retardants. I'm sure some things still end up getting sold, but probably the risk is lower if you buy something in San Francisco than if you buy it out of state.

Fish can be really healthy, particularly for people who are planning pregnancy or who are pregnant, but we want to make sure that people are eating low mercury, low toxin fish. The FDA has some good, straightforward fish choices available. In general, if you think of the smaller fish, are less likely

to be contaminated than the fish at the other end of the food chain that have eaten smaller fish because they build up more mercury. Then in California, the state, through what's called OEHHA, the Office of Environmental Health Hazard Assessment, has fish advisories for bodies of water in California. If you're buying fish that somebody has fished locally or if you yourself are going fishing, you can look and see what's safe to eat versus what is not recommended or recommended in limited quantities.

Pesticides can be really dangerous for the developing brain in pregnancy, probably associated with a number of health conditions, neurodegenerative disorders, etc. Really trying to think about integrated pest management strategies or a way that you can decrease your use of any of these chemicals. Another simple inexpensive step is to clean dust frequently, particularly, again, if there's little kids, toddlers crawling around the house. We think of a damp mop or a HEPA vacuum as being better at getting rid of the dust than a broom or a vacuum that doesn't have a HEPA filter. It might just redistribute the dust. Then another simple inexpensive step is just to leave shoes at the door, so instead of wearing your outdoor shoes in, leaving them by the door so that there's less dust and toxins getting tracked into the house.

Lead continues to be an issue, even though it's been known for a long time to be a major poison. The risk overall is lower since we've gotten lead out of gasoline, so there's lead, less lead and dust in places, but we still see it from the legacy of lead paint or lead pipes. Then we still see it sometimes in imported foods or cosmetics, where somebody somewhere along the supply chain adds just a little bit of lead that makes everything way more and makes it more valuable at the other end. We recommend avoiding tobacco smoke, both for people who are trying to get pregnant as well as during pregnancy and when there are young children in the house. And e cigarettes probably aren't I mean, they may be safer in some ways, but they may be more dangerous in other ways.

You're inhaling a lot of chemicals that haven't been tested for their health impacts. We really recommend that when people are pregnant, that they try to quit completely if that's possible. Then lastly, for personal care products, a number of them contain some of these endocrine disruptors, so we recommend looking on the label for phthalates, parabens, something labeled as fragrance or triclosan. All these things ideally are avoided. There are a number of organizations that will search ingredient lists and give you safer choices. Skin Deep is one website from the environmental working group that has a lot of information about what's in your products. As far as advice around climate change, the Western States PEHSU or Pediatric Environmental Health Specialty Unit at UCSF has a lot of information on our website about extreme weather as we call it in the federal world, but so if you use this QR code, you can get access to some more of this information, and then just our website in general has lots of information.

We have specific information on how to protect pregnant people and kids when there's wildfire smoke in the air. That is important in the Bay Area. If anyone is interested in learning more, we have a multimedia eBook at the Western States PEHSU that has a lot of information to learn more about a number of topics of environmental health. Then for anybody interested in a clinical consultation, I'm happy to see referrals in my environmental health clinic as well. To sum up, I know that was a whirlwind tour, but petrochemicals, and climate change can impact reproduction in pregnancy. These are thorny problems with lots of things connected together, but really, we need to think about both addressing this on a societal level, especially for the bigger things, but there are things an individual can do to decrease their exposures.

Judith Cuneo: Thank you so much, Dr. Zlatnik, for that excellent talk. We have several questions for you. The first, Dr. Zlatnik, a questionnaire asks, you mentioned the importance of quitting tobacco in terms of exposures and health risks, and she asked if you could comment on marijuana or all cannabis products, really. Marya G. Zlatnik: Marijuana, even though it's natural, it is a drug. There are chemicals in it that can have impacts on the brain and body. Research in general, over the years has shown some risks in pregnancy, increased risk of preterm labor, and low birth weight with marijuana use. Not randomized control tile data, but certainly a number of studies suggesting that,

and so it's really something that in general, we don't recommend.

We have ways of managing morning sickness, nausea, vomiting pregnancy that are better studied and better safety data than marijuana. We don't recommend it to be used for morning sickness. Then as the baby's brain is developing over the course of the pregnancy, there are some concerning signals about marijuana, so it's really not ideal if people are able to discontinue use, that's really what we recommend. Judith Cuneo: Dr. Zlatnik, I have a question about, could you speak to any known associations between the cumulative environmental exposures that a woman experiences over decades and the diseases we commonly see later in life like reproductive cancers, breast and gynecologic, or even cardiac disease or neurodegenerative disease?

What do we know about that? Marya G. Zlatnik: I think much of the research that's been done so far has been, let me get some people in and measure chemicals in their blood or their urine, and then look in the short term and see what their health outcomes are. We have less information about, Let's look 30 years from now, 40 years from now, etc but certainly we know that, for example, a number of the cancers are hormone sensitive, breast cancer, uterine cancer, etc, and so probably there are some things that are increasing longer life health outcomes. We know, and I didn't really talk about the class of endocrine disruptors called obesogens, but there's a lot of growing research about the idea that some of these things are impacting our metabolism in ways that we gain weight.

We know that obesity is increasing across the country year over year, and it has so many health outcomes long term so that, people who gain more weight potentially because of chemical exposure then are at higher risk for heart disease, or at higher risk for certain cancers. They're at higher risk for diabetes, so that thinking about trying to be mindful of avoiding exposures potentially can lead to longer lives, but we don't really have the research to prove that yet. Judith Cuneo: Thank you. I would imagine for someone seeing your top ten tips for the first time ever, and even for me, who I've heard this data or been listening to this data for a long time, it can feel overwhelming in terms of, one, our individual exposure.

I think you quoted 30,000 pounds of chemicals a year per individual. If a person were to just decide to do one thing starting now to avoid exposures, is there something that you feel would be the most effective or the most important to begin with? Marya G. Zlatnik: Great question. For people living in the Bay Area where generally the air and water is not too bad, I think the one thing probably is to really try to avoid processed foods. With busy lifestyle, you know, I mean, sometimes it's hard to cook a meal, but the idea of eating fresh food that's really not ultra processed is probably going to be the best thing long term, but obviously, there are places where the water quality is really bad or air pollution is really bad, and so then thinking about how you're going to get a clean source of water or filter your air becomes more important.

Judith Cuneo: How concerned should individuals be about their drinking water in the home? Say if they're on a municipal water supply, which would be different than someone living in an agricultural area, for example, maybe living on a well? Marya G. Zlatnik: Those are great questions. You can actually get information from whoever is in charge of your water. If you are on a public water supply, so you can get information about the tests that it's been done. In San Francisco, the water is tested for more things than just the minimum list, and it's really very good quality water. If the good quality Hetch Hetchy water is getting to your house, and then you have an old faucet that has lead in it, well, then some of that lead may get into your water, so you can do testing for water.

The city and county of San Francisco have resources. Then for people who are in sort of the broader Bay Area elsewhere in California, looking on your county's public health website to see what resources are available to test your water. The Environmental working group has a national database of information in water, so if you really want to do a deep dive, they've got a lot of information about things from around the country. They also have links so that if there are questionable things in your water, they have links to give you advice on what water filter you need depending on what's in your water. [Music]