Air Pollution, Depression, and Pregnancy

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SPEAKERS

Maggie Fox, Jun Wu

Maggie Fox 00:01
Hello and welcome to One World, One Health where we take a look at some of the biggest problems facing our world. I'm Maggie Fox. This podcast is brought to you by the One Health Trust with bite-sized insights into ways to help address challenges, such as infectious diseases, climate change, and pollution. We take a One Health approach that recognizes that everything on this planet — the animals, plants and people, and the climate and environment — are all linked.

We all know that air pollution is bad. It killed or helped kill 6.7 million people in 2019. According to a commission sponsored by The Lancet medical journal, it helps drive climate change. Air pollution can cause cancer, heart disease, and worsen asthma. And now, researchers say it can contribute to depression during and after pregnancy.

In this episode, we're chatting with Dr. Jun Wu, a Professor of Environmental and Occupational Health at the University of California, Irvine, whose team has linked air pollution with pre and postnatal depression.

Dr. Wu, thanks so much for joining us.

Jun Wu 01:08
Thank you, Maggie. It's my pleasure to be here.

Maggie Fox 01:11
Dr. Wu, you study environmental health as a big subject, tying in climate change, pollution, health disparities, and other factors. What are some of the surprising things you found?

Jun Wu 01:23
So, one thing that really popped out is that multiple environmental stressors, such as air pollution and climate-sensitive exposures like heat, as well as a lack of green space, are associated with various pregnancy outcomes. Additionally, we found from multiple studies that more adverse impacts are observed in minority and disadvantaged populations.

Maggie Fox 01:52
You have just been part of a team that found air pollution can be linked with depression during and after pregnancy. Can you tell us a little bit about what you found?

Jun Wu 02:00
So, we've conducted a retrospective pregnancy cohort study with electronic medical records that were collected from our collaborators at Kaiser Permanente, Southern California. Based on over 340,000 records of pregnant women. We examined antenatal and postpartum exposure to common air pollutants, such as ozone and particulate matter with aerodynamic diameters of less than 10 micrometers or less than 2.5 micrometers. And those are very fine particles, as well as the constituents in the particles, such as organic matter and black carbon, were associated with an increased risk of postpartum depression.

We found that the risk of postpartum depression associated with air pollution exposure was higher among mothers aged 25 to 34 years, African American or Hispanic mothers, mothers with higher education, and mothers with underweight conditions.

Maggie Fox 03:08
What could cause this? How do you know that it's not just being depressed because you live in an area where there's a lot of pollution?

Jun Wu 03:15
The reason why air pollution can cause depression, particularly in the case of mothers with newborns, is unknown, but there are multiple mechanisms that can explain such an association between air pollution and the depression we observed. So, one of the reasons is that there could be oxidative stress caused by air pollution, and that further leads to inflammation. Inflammation starts from the respiratory tract and leads to systemic inflammation, and further, that leads to neuroinflammation.

Breathing in air pollution activates the inflammation chain of actions. When air pollution enters the body, our body initiates immune responses, which lead to the production of cytokines and other molecules that produce inflammation to fight off the invader, in this case, air pollution, and also for the oxidative stress that can directly damage the neuro cells in our body. And there are other associated potential mechanisms such as the influence on our stress-responsive systems from air contamination.

Maggie Fox 04:43
So, in other words, what you're saying is the body sees the pollution as an invader and responds with these cytokines, which are like little immune system soldiers that go on the attack. This can cause collateral damage in the form of nerve cells, but also, you're saying that some of the factors in the pollution could directly damage nerve cells, including those in the brain.

Jun Wu 05:07
Yes.

Maggie Fox 05:09
You also noted some interesting socioeconomic factors that might be surprising to some people that were linked with a higher risk of depression. Can you talk about those?

Jun Wu 05:19
There are multiple reasons why some of the lower socioeconomic populations experience a higher risk of environmental exposures. So, people know this as a double jeopardy or triple jeopardy for these populations. They may bear a higher burden of environmental exposures, not only from one stressor such as air pollution, but they may also be exposed to higher levels of extreme heat and a lack of green space, as well as other environmental burdens.

So overall, they have higher environmental stressor exposures due to multiple sources. And they may be more vulnerable to the exposure; even with the same level of exposure, they're more affected because of the other factors that may be more stressful, and they may not have the good nutrition to fight off the potential adverse impact of environmental exposures. Also, they may not have the proper resources to mitigate exposure impacts.

For instance, under extreme heat conditions, those populations may not have (an) air conditioner at home, or if they even have it, they may not want to turn it on due to electricity costs, or because of the lack of green space, their neighborhood may experience higher temperatures locally than other neighborhoods with more green space. So, all these conditions contribute to the potential higher risk in these lower socioeconomic status and minority populations. And in our study, we found a higher risk among mostly African American, or Hispanic mothers.

Maggie Fox 07:19
You also conversely found that kind of mothers who might be considered in the middle zone What 25 to 34 years old, and those with higher education were also at a higher risk. And to me, that was a little surprising!

Jun Wu 07:32
Yeah, that is a little surprising! So, in our study, we found ozone is one of the major pollutants that is associated with adverse effects of air pollution. So, we think that the location of where those mothers live plays a critical role in how the pollutants have an impact. And those mothers with higher education and also in the middle zone of age may live in areas where you observe higher ozone exposure.

Maggie Fox 08:08
Remind me what causes the ozone exposure?

Jun Wu 08:13
So, ozone is a secondary air pollutant caused mainly by photochemistry. That means ozone is not directly emitted by combustion sources or direct emissions from industrial sources, but rather formed through photochemistry. Therefore, it takes time for ozone to form. So, you observe higher ozone concentrations in the downwind area of the big city, where you have a lot of primary emissions. So, in our case, we have higher ozone concentrations in the inland area compared to coastal areas.

Maggie Fox 08:58
Let's talk about why pregnancy is such an important and vulnerable period in a woman's life. Why are we worried about women becoming depressed at that time?

Jun Wu 09:07
I think there are multiple reasons why the pregnancy period is so important. The main reason is that pregnancy is a very sensitive period for both the fetus and the mother. And for the mother, they undergo many changes during pregnancy.

Those include physiological changes to support fetal growth and development, (as well as) changes in the maternal brain in preparation for motherhood. There are a lot of changes related to stress, physiology, and immune function. And for the mother, there are also dramatic hormonal changes during pregnancy that are very large in comparison to other phases of the mother's lifespan during pregnancy.

So, in addition to all of those physiological and maternal brain changes, there are also lifestyle changes to have a baby and changes in their relationship with their family and support systems, (as well as) balancing work and family life with a newborn. All of this adds stress to pregnant women. And also, importantly, the mother's condition can directly impact the baby. Depression among pregnant women has been found to be associated with preterm birth, low birth weight, and other adverse outcomes in babies.

So, these outcomes may not only be happening right after delivery but may also influence the babies throughout infancy, childhood, and likely into adulthood. The impact on the women, babies, and the entire family is huge.

I think our ultimate goal is to influence policy. So, in this case, we would want to advocate, first of all, for attention to postpartum depression. Because this is an outcome that people do not pay much attention to; a lot of times, they pay attention to physiological outcomes such as gestational diabetes and hypertension during pregnancy, but depression among pregnant women and postpartum women is so important. So, we just want to call for more attention to postpartum depression.

And also in this case, the environmental influence on postpartum depression. So, we looked at our approach in this paper. And earlier, we also published a paper on green space and its part in (postpartum) depression, and we did find other benefits showing an association of green space with postpartum depression.

So basically, we're saying, okay, air pollution is bad, but green spaces are good for postpartum depression outcomes. So, we would want to advocate for communities to get more green space and to reduce air pollution, and how this turns into policies ultimately to reduce their pollution levels. For instance, the US EPA (United States Environmental Protection Agency) is considering lowering the fine particulate matter standard. So, definitely such types of evidence would support taking action to lower the fine particulate matter standard.

Maggie Fox 12:47
Dr. Wu, thanks so much for spending some time with us. This has been very interesting.

Jun Wu 12:53
Thank you.

Maggie Fox 12:55
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