

Good afternoon. My name is Kim Harley. I am a professor of public health at UC Berkeley and I am a lead researcher on the CHAMACOS study, which is the longest running longitudinal cohort study of the health of children in California farmworker communities. I have spent the last 20 years of my career researching how mothers and children in agricultural regions are exposed to pesticides and how this impacts their health. I am also a member of two different DPR working groups – I served on the Chlorpyrifos Alternatives Work Group and I am now on the Sustainable Pest Management Work Group, which is a collaborative effort to develop a roadmap for safer, sustainable pesticide practices in California while still supporting our vibrant agricultural industry.

I have been asked to talk to you about why we should care about pesticide regulation in California. I will give you a few reasons:

First – The pesticides that we use in the fields don't stay there. They end up washing into surface water like rivers and streams, where they can impact aquatic life and our drinking water. They also drift into the air, inside people's homes, and even into our bodies. Air monitoring systems tell us that after pesticides are used on fields, they can later be detected in the air up to 2-5 miles away, depending on the compound and how it was applied. In our research in the Salinas Valley, we found that 98% of homes had detectable pesticide residues in house dust – and the levels were higher when people lived closer to fields where these pesticides were used. We have also detected pesticides in people's bodies – for example, we took urine samples from pregnant women and children living in a farmworker community and found that all of them had detectable pesticides. We also found pesticides in their blood samples and even in breast milk.

The second (and I think most critical) reason that pesticide regulation is important is that we have very strong evidence that pesticide use impacts brain development of children living in agricultural communities. One of the classes of pesticides that our CHAMACOS Study has been researching for many years is organophosphates, which are potent neurotoxins. Chlorpyrifos – the pesticide that was banned by DPR in 2019 – is an organophosphate. The way organophosphates work is they effectively shut down the nervous system of insects – and can do the same thing in mammals, including humans. We know what happens when an adult is poisoned by organophosphate pesticides – it causes central nervous system damage that can lead to paralysis and even death. But when we started our research 20 years ago, we had no idea what the effects of chronic, low-dose, on-going exposure to organophosphate pesticides was on the developing brain of children.

- So, in 1999-2000, we enrolled 600 pregnant women living in farmworker communities in the Salinas Valley of California.
- We have followed those women and their children for more than 20 years – the kids are young adults now.

- We see the children every 1-2 years and conduct detailed health exams and neurodevelopmental test batteries on them.

What we found was that mothers who had higher levels of organophosphate metabolites in their urine during pregnancy had children with:

- More abnormal reflexes at birth
- Poorer verbal abilities at age 3 and 5
- Lower IQ at age 7 -- specifically when we compared kids whose moms' had the highest levels of organophosphates in their bodies to those with the lowest levels, we saw a difference of about 7 IQ points. To give you context, this is similar to what we see with lead -- kids with childhood lead poisoning score about 7 IQ points lower on average, so you can see this is a serious concern.

We also saw that the mothers' exposure to organophosphates in pregnancy was associated with:

- ADHD
- Autism-like behaviors
- Decreased brain activation on brain imaging

All of these findings controlled for other factors like parent's education, maternal IQ, and the home learning environment. At this point there is a very strong body of literature (from our study and others) showing associations of organophosphate pesticides with delays in brain development in children -- which is why California banned Chlorpyrifos in 2019, about 18 months before the federal EPA banned it. But Chlorpyrifos is just one of an entire class of organophosphate pesticides and we haven't banned the others and they can still be used in agriculture -- even though they have all the same health concerns as chlorpyrifos.

On the plus side, the use of organophosphate pesticides has decreased considerably in California over the last decade. Over that time, organophosphates have been replaced by newer classes of pesticides like pyrethroids that are less acutely toxic to humans. But it takes a while for the research to catch up. We are now starting to see evidence that pyrethroids may also harm children's neurodevelopment. In our study, we saw lower IQs in children whose mothers lived close to fields where pyrethroid pesticides were applied during their pregnancy. And other research is starting to support these findings. So even as we replace one pesticide class with another, we have reasons to be concerned about the health impacts of the new compounds.

Over the past 70 years, we have seen broad trends in pesticide use -- the DDT of the 1950s and 60s which was highly persistent in the environment and almost made our bald eagles extinct, was replaced by organophosphates -- that didn't persist in the environment but were neurotoxic to humans and animals. As organophosphates have fallen out of favor we have seen the rise of pyrethroids and now the neonicotinoids.

Which brings me to the third reason we should care about pesticide regulation, which is impacts on our ecosystems. Although neonicotinoids appear to have fewer human health impacts -- they are very persistent in the environment, build up systemically inside plants, and are very toxic to insects. Most notably, neonic insecticides have been linked to crashes in honey bee and other pollinator populations. They also get in our streams and rivers, leading to decreases in the diversity and abundance of aquatic invertebrates, which can then impact fish and bird populations that rely on them for food. And even though we thought they were safe for humans, now we are starting to have concerns that neonicotinoids may also impact human health, including increased risk of birth defects. The human research on neonicotinoids is still new and we are only just starting to learn the full implications.

Lastly, I just want to point out, in case you are not aware, that a lot of the best research in the world on pesticides and their impact on health and the environment is being done here in California. And one of the main reasons for this is because of the rich pesticide use reporting data that DPR collects. In California we are able to map all pesticide use down to the square mile and the day it was applied – which is a huge resource to researchers – because we can't learn about the effects of pesticides if we don't have the data about what is being used and where.

Regulating pesticides is an extremely challenging balance of protecting human health and ecosystems, while also supporting and protecting our vital agriculture industry in California.

I hope as you hear more over the next few months about how pesticide regulation is conducted in California, you continue to think about why it is important – because we are protecting the brains and health of children living near our fields, the farmworkers that are picking our food, and biodiversity in our state.