

Ruth Adewuya, MD:

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Ruth Adewuya, MD:

This episode is part of the COVID-19 mini series addressing up-to-date insights, and COVID-19. In today's conversation. I'm joined by Dr. Kari Nadeau. Dr Kari Nadeau is the Naddisy Foundation Endowed Professor of Medicine and Pediatrics, and the Director of the Sean N. Parker Center for Allergy and Asthma Research at Stanford University. For more than 30 years, she has devoted herself to understanding how environmental and genetic factors affect the risk of developing allergies and asthma. As one of the nation's foremost experts in adult and pediatric allergy and asthma, her research is laying the groundwork for a variety of potential future therapies to prevent and cure allergies and asthma. Four out of the five largest wildfires in California history happened this year, and it has coated the Bay area's skies in some of the worst air in the world. On top of this, we are dealing with COVID-19, which is caused by the severe acute respiratory syndrome coronavirus 2 or SARS-CoV-2. I am very pleased to have Dr. Nadeau here to share her insights. Thank you for chatting with me today.

Kari Christine Nadeau, MD, PhD:

Thank you for inviting me, Ruth. It's a pleasure to be here.

Ruth Adewuya, MD:

Wildfires seem to be trending up and have been in the news I feel, a lot more than prior years. In fact everything from Arctic wildfires to the Brazilian rainforest and even Australia, what do we know about the cause of the wildfires?

Kari Christine Nadeau, MD, PhD:

Well, I think you're absolutely right, Ruth. There is a trend and that trend is extremely worrisome. When you hear about even fires occurring in the Arctic, and you hear about fires that are going uncontrolled in so many areas around the world, those fires also create smoke that circumnavigates the world. So all of us are touched even if the countries are far away. And so this is a problem we need to address now. And the reason why we think this is increasing, and these are strong facts, it's just kind of like knowing about gravity. We now know that climate change is real. It is upon us and wildfires are one of those unfortunate results of climate change.

Kari Christine Nadeau, MD, PhD:

What happens is, as the earth warms, then the things on the earth warm up, including trees, including the ground, and because of the warming of the earth, not only now, but also in the future, we expect to see even worsening aspects of this problem, that that warming creates weather patterns that either lead to extreme drought or extreme flooding. And those extreme conditions can really create an imbalance in the earth and because of the heat and the fact that lightning, dry lightning occurred, we saw that just two months ago with the dry lightning strikes around the Bay area, all of a sudden it was literally the perfect storm.

Kari Christine Nadeau, MD, PhD:

The trees were already hot. It didn't take a lot to heat that ground, a lightning struck and then boom, it was perfect for the kindling to have the match light on fire. And you saw all the wildfires throughout the West. So these are very special conditions, and unfortunately that will get worse and we need to do something about it in terms of our health and also protecting the health of our planet.

Ruth Adewuya, MD:

Are there aspects of the wildfires that are man-made or are they mostly because of climate change and just the smallest percentage being man-made?

Kari Christine Nadeau, MD, PhD:

There are many reports now and many studies that have shown that most wildfires are man-made, not nature made. And that's really important. We saw the lightning strikes, which were really more of an anomaly, but they probably will happen more frequently as we go forward unfortunately with global climate change. But most wildfires are caused by either people not taking care of their forest fire in the forest when they're camping, or lighting the edge of the road, which has a lot of dry grass on our highways, and it just takes a little spark of a truck and then boom, that side of the road starts turning into a wildfire in the brush. And then it can catch on fire, especially on a windy day. So people have studied this, unfortunately, most are man-made. And so if we can mitigate those, we can also have a pretty dramatic effect on decreasing wildfires.

Ruth Adewuya, MD:

I think the New England journal of Medicine had an article about the potential loop between climate change and anomalies and air pollution. Can you give us some insight into that feedback loop?

Kari Christine Nadeau, MD, PhD:

This is a great article in the New England Journal that was just written about six weeks ago. And I would recommend anyone looking at that and really diving into some of their prediction maps, because they actually show how with the heating of planet, even if we cannot curtail it, but even within one degree or two degrees, it will substantially heat up parts of the world that we depend upon greenery for carbon sinks, like the rainforest for example, that they will get so hot that they will also catch on fire.

Kari Christine Nadeau, MD, PhD:

So we really need to make sure that we understand that. And part of your question Ruth, was what is this positive loop? As the earth warms, as our weather patterns change, as the wildfire is on top of the art existing air pollution, if we don't stop using diesel as well as petroleum products, we're going to expect to see air pollution. And air pollution already blankets the planet and causes with greenhouse gases, increased CO<sub>2</sub>, increase in temperatures. And then with the wildfires, in addition to that, you just have this huge positive feedback loop of warming the planet, CO<sub>2</sub> emissions, and the unfortunate destruction of our greenery, which helps absorb that carbon dioxide from the air pollution.

Kari Christine Nadeau, MD, PhD:

So things will just get worse and worse. And that's one of the things that they talk about in the positive feedback loop diagram in the New England Journal. In addition, the wildfires themselves create weather patterns and they can create tornadoes. And so with that, that type of extreme weather condition will make it worse for future wildfires, that we need to really think about how that converts to problems

around the planet. The minute that you have many areas that are burned, you're going to get more erosion. And that also leads to other issues in terms of flooding and health issues. So it is an unfortunate positive feedback loop, but I'm an optimist Ruth. I do believe that as people, with this knowledge in hand, we can do something about it now, so that this feedback loop is stopped and decreased.

Ruth Adewuya, MD:

And with wildfire smoke and air pollution, generally, what are the most concerning microscopic particles?

Kari Christine Nadeau, MD, PhD:

Great question. You know, we are just getting our hands on that information. And when I say we, I mean we at Stanford where we work with the Woods Institute, we work with the Lane Center for the West. We work with the [inaudible 00:07:58] center. We work with a lot of different places so that we can understand the impact of wildfires on the population as well as in the air. And so people with the Environmental Protection Agency, they've examined what's in the wildfire smoke. And unfortunately, because with wildfires, they're not so wild anymore with land use being right on the edge of the forest, with residential homes, we see that a lot of wildfires now consist of smoke that has been burned from residences or commercial buildings.

Kari Christine Nadeau, MD, PhD:

So you're seeing a lot of paint thinners in the area. You're seeing a lot of microplastics in the air. So the typical smoke includes small particles that are less than the diameter of your hair. And they can get right into the lungs right away. The typical smoke also includes bad chemicals like carbon monoxide that are very damaging to blood, but they also include micro particles that are from plastics that can imbed in our lungs. And then in addition to that, toxic things from paint thinners, and paint. So these are what we call volatile organic compounds, which are hard to measure with your typical purple air measurement tool.

Kari Christine Nadeau, MD, PhD:

So all of these things affect our health, and that smoke is a particular consistency and identity of toxicants. And the unfortunate thing is that the smoke gets up in the air and there's horizontal plumes, and there's also vertical plumes. And with that, it starts to then be captured by our atmosphere. And we saw that in the Bay area when our unfortunate, beautiful scenery turned orange, and what was happening there is there's chemistry that happens on the smoke. So during ultraviolet rays, as well as the air getting kind of mature over time, it changes in its chemistry and it becomes more toxic.

Ruth Adewuya, MD:

You had mentioned some of the health effects of the wildfire smoke. So you talked about it being damaging to the lungs and some of the particles and it being damaging to the heart as well. What other health risks are we seeing as a result of the fires?

Kari Christine Nadeau, MD, PhD:

Thankfully, we have access to the Stanford University Emergency Room database, and then we also looked at hospitalization rates before and during the fires. And this was just recently, but this is not anything new. People have published this from a public health standpoint unfortunately, because like

you said in the beginning of our talk Ruth, this is increasing over time. You look at the history in the past 20 years of California and the West, that these wildfires are getting worse and worse. And with that, we need to pay more attention in our public health database and our emergency room visits. So for example, the rate of admissions in asthma at Stanford went up by about fourfold during the fires, even after just five days of exposure, with air quality indices between 150 to 200. That's the equivalent of smoking about three to five cigarettes a day. So asthma rates increased, stroke increased, and heart attacks actually increased the most, by about 40% to 50%.

Kari Christine Nadeau, MD, PhD:

And we know that because we compare it against in the same hospital in the same area, the prior four weeks up to the wildfires. So these are the things we need to take very seriously because it does affect the heart and the lungs, but not just the heart and the lungs. The kidney, the brain, the stress, can also really impact how people function. So we need to be aware and compassionate about all the aspects of health and how an item like wildfires, a tragedy like wildfires, affect people because having been dealing with this now for a while, when people are asked to leave their homes or their homes burn down, it's quite tragic. And there's a lot of very important psychiatric and psychological aspects.

Ruth Adewuya, MD:

I can only imagine the trauma that people go through when they are told that they have to do that. But I want to also bring up a point about the fact that this season, this wildfire season, the overlap of the COVID-19 pandemic with this wildfire season in the United States, complicated the public health response to the wildfire smoke. And so I'm curious to get your thoughts around who else is really at risk from the wildfire smoke during the COVID-19 pandemic?

Kari Christine Nadeau, MD, PhD:

It's an excellent point Ruth. With the fact that COVID is such a smart virus and it also affects our lungs and our heart and our brain and our kidneys, the same things that wildfire smoke can affect, and pollution in general. So when you have these two things going on at once, it made it really tough for certain populations and we're dealing with the biology of the diseases and I'll talk about that in a second, but we're also dealing with access to healthcare and access to disaster relief. So put these two epidemics, wildfire epidemic increasing and COVID epidemic increasing, it really hit's hard for underserved populations. People that don't necessarily have the best access to healthcare, and we need to pay heed to that as well. So within the aspect of wildfires, we know that smoking, vaping, air pollution, if that's already going on in the background and you get COVID, your COVID will most likely be worse than it would have been if you did not suffer from those exposures. That we know, no matter what age you are.

Kari Christine Nadeau, MD, PhD:

So the fact that people had wildfires smoking, and if they were not careful and they got COVID, that wildfire, or if they were smoking, that would have worsened their COVID disease. Now, what about, did the wildfire smoke or tobacco smoke or vaping, does that make it more likely that you're going to catch COVID? And we don't know all the answers to that, but it is possible because we know that those exposures also reduce our immune system's ability to fight viruses. So most likely if you get exposed to wildfire smoke or you vape, or you smoke tobacco products, you will get more infections, period, not just with COVID, but it definitely increases your chance of getting COVID infection.

Ruth Adewuya, MD:

During the wildfire season when it was summer and it was hot, and then also with COVID and telling people to shelter in place, but then you have a lot of people who don't have air conditioning that do need to kind of open it up and may not be living in homes that allow for that social distancing, I imagine that complexity just really made it hard for clinicians to help those patients navigate the challenges of the wildfire and COVID-19. Would you agree?

Kari Christine Nadeau, MD, PhD:

You're absolutely right Ruth. On one side, we're telling everyone shelter in place, close your windows, and then on the other side, we're dealing with heat stroke and heat exhaustion from the fact that a lot of people don't have filters in their homes and aren't able to decrease the heat in their homes by air conditioning. And so if they're sheltering in place, but then they have no air conditioning and their house is just basically increasing with the heat, that's going to cause heat exhaustion, especially in the elderly where they don't have a lot of reserve and systems naturally to deal with heat. So these two items are like you're saying, pretty incompatible, and that's why I am hoping that in the future we will be better prepared. I think on one side we saw a lot of people come together and try to solve this, but solve it in a very reactive way, because this is happening on a day-to-day basis for us.

Kari Christine Nadeau, MD, PhD:

And it still might happen. We're not out of the woods yet, literally and figuratively. Hopefully as towns and councils and counties come together and think about establishing clean rooms and places that are safe to go, that even during a pandemic like COVID, are big enough so that people can shelter in place, within six feet away, wearing a mask, using hand sanitizer, but be in a place that's air conditioned and that's cool, and that we have ways to transport elderly and other communities there to this community clean room that can be used during the wildfire and appropriately during a pandemic like COVID.

Kari Christine Nadeau, MD, PhD:

So these are the things that hopefully will inspire people to make changes, to address the issues like you're mentioning that are seemingly incompatible, but okay let's rise to the challenge and think about how we're going to solve that.

Ruth Adewuya, MD:

Do we know right now, if there has been an amplification of COVID-19 due to the wildfires?

Kari Christine Nadeau, MD, PhD:

We do know that in populations like firefighters that are exposed to many fires over time, that relatively speaking in that population of firefighters compared to an age match control group, that firefighters had a higher chance of getting COVID, yes. Now, whether or not that's true for the general public, that's going to be a harder study to really do. But I think that on the molecular level, we are seeing that wildfire smoke reduces your immune system. That's something my lab does with Mary Prunicki who runs the wildfire research. And we're showing that the immune system is reduced even after four to five days of wildfire smoke, in all ages. And because of that, you are very likely to get a higher chance of getting COVID, but the epidemiological numbers aren't back yet, but at least on the molecular side, there's definitely strong evidence to suggest that would be the case.

Ruth Adewuya, MD:

So COVID-19 symptoms, as you mentioned before, are very similar to the symptoms that people suffer from with poor air quality. As a clinician, how would you encourage or advise other clinicians in terms of their ability to maybe differentiate between the two in a timely manner, maybe with or without the COVID-19, the rapid COVID-19 tests?

Kari Christine Nadeau, MD, PhD:

That's a great question because as physicians, as clinicians, as allied health professionals, we always need to think about how to be really careful and circumspect, but understand timing, understand what exposures are in our patients, and really understand from the patient's point of view, how did this all happen? What are your worries? So with COVID, there are some symptoms that are not exactly the same symptoms as wildfire. So anosmia, lack of taste, cognitive issues are somewhat similar with wildfire, coughing, cardiovascular issues like clots. These are all similar between COVID and wildfires. I think a clinician would want to make sure they understand the timing of it.

Kari Christine Nadeau, MD, PhD:

And there are other things that are associated with COVID, for example, fevers and things that don't necessarily happen during wildfire exposure, but any one person could be exposed to both the same time. So you could have wild fire exposure and COVID, and with that really think about how you need to manage that patient. I would suggest much more carefully, because the wildfire smoke can definitely make their disease and their COVID disease worse, but also probably lead to a protraction of their COVID viral shedding so that they're going to have more shedding over time.

Ruth Adewuya, MD:

You had mentioned earlier in our conversation that you're an optimist around the research that is happening in this field. Can you share with me some of what you and your team are doing right now in this area and what can we be watching out for?

Kari Christine Nadeau, MD, PhD:

I am an optimist. I think it's important to be that as we look forward to the future, I think that we as humans do have it within our hands to be able to think about how to address problems appropriately. And I know it's hard in the geopolitical climate, but we have to be citizens of the world to be able to protect our planet. And within that, starting locally, starting with our own wonderful groups here at Stanford, I think on our part, studying better about how wildfire affects health, which we're doing thanks to a lot of great teams and the firefighters as well are helping us understand what's happening, but then in addition, understand how are people protected from wildfires? How do we see the resiliency in a population as well as an individual? So we're studying how air filters affect the air. We're studying how people have worn masks and how that might help protect them. To what degree do you need to wear a mask? When do you need to wear a mask? When do you put an air filter in your home?

Kari Christine Nadeau, MD, PhD:

And if we're going to make sure we weatherize our houses better, how do we make sure that's democratized so that it's not just the wealthy that can be given that type of special protection. We need to make sure that that's available for community. So what I'm very optimistic about is we've already started those types of projects. We work very closely with the Woods Institute, Lane Center for the

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West, thinking about how to develop policies of the government and state level so that we can try to say, well, if this worked for this community, let's see if those types of approaches can work for a larger state level. So emergency preparedness and then also how do we adapt to wildfires like with filters and masks? So these are all the things that are in conversations right now.

Kari Christine Nadeau, MD, PhD:

So that's what keeps me optimistic about things. But we also need to worry about if we are going to be a population that suffers with wildfires consistently, are there medications that one can take right away, especially in those populations that are highly sensitive to wildfire effects, can we protect them? So we are studying if there are certain what we say, cytokines or inflammatory factors that come up right away during wildfires, and if there's a drug that can be used to decrease them, we're looking into that now.

Kari Christine Nadeau, MD, PhD:

So all of these factors allow me to become optimistic, but we need to do something about it. We just can't stay passive that's for sure. And I don't think anyone is hopefully, but we need to reach out and be active and be the change that we need to see to help.

Ruth Adewuya, MD:

Great. Thank you so much, Dr. Nadeau for talking with me today. It sounds like there's some really exciting and important work happening with your team and with your collaborators and with your partners. And so we look forward to hearing more about these projects as they happen. Again, thank you so much for your time today.

Kari Christine Nadeau, MD, PhD:

Thank you, Ruth. This was wonderful. Really appreciate it. Thanks for your great questions.

Ruth Adewuya, MD:

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