Full Transcript – Interview: Measuring Air Quality to Improve Health Equity with Dr. Kelly Jones

September 24, 2021

Hello, and welcome to this audio interview from the National Socio-Environmental Synthesis Center, also known as, SESYNC. SESYNC is supported by an award from the National Science Foundation to the University of Maryland. Join us as we bring together the science of the natural world with the science of human behavior to find solutions to complex environmental problems. I'm your host, Erin Duffy.

Breath. It gives us life. From the moment we enter the world and throughout our days we take in the air around us. But for some of us taking each breath is not always easy. Asthma affects approximately one in eight individuals in the United States. And with the exact causes yet unknown, solutions remain elusive.

In this segment, we talk with Dr. Kelly Jones, who is a registered nurse and former postdoctoral research fellow at SESYNC about her research into the role of the neighborhood environment on children's respiratory health outcomes. Join us as we discuss how technology, in this case—air quality monitors—have the potential to provide a clearer picture of what individuals are exposed to—moment-to-moment, neighborhood-to-neighborhood, and even street-to-street. We'll also delve into the factors that contribute to these variations in air quality; the developments needed to harness the power of this data; and how this type of granular information can improve decision making for better, more equal health outcomes.

Erin: Kelly, so nice to be with you today.

Kelly: Thanks, Erin. It's nice to be here.

Erin: I wanted to start off by talking a little bit about your career progression, which I think is pretty unique and I know was influenced by your time in the Peace Corps. Could you tell us a little bit about that?

Kelly: I started out as an engineer. I was a groundwater engineer and I was really interested in clean-water access for people in communities that didn't have it. So, I didn't know it at the time, but I was already actually in environmental health when I was doing that work. As a ground water engineer, I joined the Peace Corps and I went with the Peace Corps to Mali, West Africa, which is a land-locked country—a lot of it is in the Sahara, a lot of it is Sub-Saharan. I was working with small communities there on a variety of projects. The interesting thing that came out of that time for me is that I saw that as far as clean water goes, the engineering solutions—which are the solutions that I thought that my life was going to be about—they're absolutely critical, they're really, really important. But what the engineer does is not the part that makes the water accessible to people. And the people that make clean water accessible and make clean water part of the community's life are the nurses that are on the

ground—that are working with hospitals, that are working with schools, that are working with families, that are working with mothers' groups. They're making these changes and these possibilities parts of people's lives.

So, then when I came home from the Peace Corps... I went to nursing school.

I decided at that point that what I needed to do was to take the engineering background that I had—that skills, the ability to see the whole system and to understand how the different parts of a complex system can work together—and apply that to making sure that the decisions that we make outside of the healthcare setting are really serving the health of the population that's living in those systems, in those settings, in those communities.

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Erin: Let's talk a little bit about what you're working on at SESYNC, specifically.

Kelly: I proposed to do a project looking at the relationship between local air quality and children's respiratory health conditions. In particular, we're interested in asthma and the way that asthma impacts kids' ability to go to school.

So asthma itself and asthma-related conditions is the number one reason that kids are absent from school. We know from a lot of education research that the more absent children are, especially in elementary school, the more likely that they are going to have behavioral problems in later school; that they are going to have poor grades; that they're not going to graduate from high school.

And we got access to an incredible dataset of all the hospitalizations and all the ER visits associated with respiratory health and asthma in Washington, DC. Then we looked at where these kids were living and what the conditions around them were.

Erin: Interesting. What did you and your collaborators find?

Kelly: We saw associations that we expected to see—that those kids who were living in more green areas had less asthma exacerbation—that the kids living in the areas with the highest density of traffic, so average annual, daily, traffic counts—the higher that you had that in your neighborhoods—the more likely you were to be experiencing a visit or a hospitalization due to asthma.

And then we found that the strongest predictor of whether or not someone was going to end up with one of these visits was their race and their socioeconomic status. African Americans are multitudes of times more likely to have hospital visits and hospitalizations. And the lower your income, the lower your immediate income of your neighborhood, the more likely that we're going to see kids from that neighborhood in the hospital at some point.

Erin: So, it sounds like you found that while environmental conditions have a part to play in terms of respiratory health, an even stronger risk factor for asthma was race and socio-economic status. Can you talk a little bit more about that?

Kelly: So, it really was a confirmation at a very, very small scale that these environmental conditions are really important, but we can't address the environmental conditions without also addressing the socioeconomic conditions. And this is a double-barreled sword because we know from a lot of the EJ—the environmental justice work that's been done over the past couple decades—that majority minority

communities are the communities that are most likely to have less access to green space, more traffic in the area, more likely to have toxic polluters in the area, more likely to have historic legacy of bad soils. So, we know that these communities where they have social and economic conditions that are setting these kids up for respiratory issues are also the places where they are the most likely to find the environmental conditions that are setting them up for respiratory conditions. So, it's a huge systemic problem that we need to address all parts of it, but we also have to understand what those parts are.

Erin: Right, and I don't know, it's not like you guys have all the answers, but have you come to some conclusions about interventions?

Kelly: The most important conclusion that our study showed—and ours was the first that definitively said that this was the case—is that the measurement of exposure that we have available to us now is not good enough. But the thing is, is that it doesn't have to be. We have the tools, we have the resources, we have the technologies that we could have much better measurements of individuals' exposures.

(**Erin:** Quick aside: when we're talking about exposures we are referring to the amount and type of air pollution a person is exposed to, as well as the duration. Examples of pollutants that influence the air quality include: carbon monoxide, lead, ozone, particulate matter, and certain chemicals.)

Kelly: So, there are obviously very real complications, and we're never going to have perfect measurements of people's exposures. Because to perfectly measure your exposure, we would have to instrument you so heavily that you would have trouble functioning in the world. But we can instrument the world around us in such a way that we can understand the variability across both space and time of these things that people are being exposed to. We can understand how not only—temperature and storms vary across urban spaces, but also how that relates to the different air quality across urban spaces. Not just across the whole region—not just across three square kilometers—but between neighborhoods, between streets, across streets that have different traffic patterns and different street tree species living there. What exactly is going on there? We have the ability to instrument in that detailed of a fashion, we just haven't done it.

Erin: Do you have any partnerships that could turn that dream into a reality?

Kelly: The ongoing work that we have going on between MACCHE and myself (**Erin:** Which, side note, means: The Mid-Atlantic Center for Children's Health and the Environment) and various places throughout the city has been really heartening because what we've found is that we have so much support at basically the grassroots level. We have a collaboration with the National Association of School Nurses, which has been really instrumental in getting us in front of school nurses' groups, in front of principals, in front of parent-teacher groups, and everybody is super interested in saying, "Yeah! We can put an air quality monitor on our school—we can put 16 air quality monitors on our school if you would like to," and my goal going forward is that we're going to get more groups—the libraries, the rec centers—so the park and rec department, and all of these places, and if we can instrument all of these places, then we're going to have a better understanding of how these exposures change across space.

Once we have that kind of more solid measure of exposure, then we're going to be able to relate that to what we're seeing in the health outcomes, in the health behaviors—in the behaviors where people are modifying what they'd originally liked to be doing because of poor air quality, because of extreme heat,

because of all of these things. And we're going to take that information and hopefully be able to come up with a different set of solutions than we would be able to if we were applying the same exposure to everybody in the region.

Erin: So, it sounds like once there are more detailed measurements of exposure available, then healthcare providers can use that information to create more targeted and beneficial interventions. But to get those measurements, I'm sure there has to be more monitors—if the technology is available and you have community support, why aren't there more monitors around?

Kelly: Yeah, so I can tell you that the smaller, affordable, high-quality, portable (sometimes), and user-friendly sensors—is the thing right now in environmental health. And in kind of behavioral health.

So, the EPA has a network of air quality monitors deployed across the country and across the world, actually, where each of the monitors costs upwards of $40,000 dollars; so it's obviously not realistic at all for say a school district to buy three $40,000 monitors for every school in the district and then maintain them and then put them in places where like sixth graders are playing basketball and high schoolers are building model rockets and stuff like that. That's just not a thing that's going to happen.

There are all sorts of different lower-cost and increasingly high-quality, air quality monitors that are available. It's more feasible that either a grant—from say, The Gates Foundation or Robert Wood Johnson or some of these other groups that are really focused on kind of the broader environmental context of people's health conditions—can help groups and individuals to instrument the places, children especially, but adults also, are spending time.

As we go on and as people are getting more and more interested in this, these technologies are becoming more available and more affordable. At Georgetown, the School of Foreign Service is actually developing a low-cost, air quality monitor that they're hoping to deploy across... to send with the State Department to embassies all across the world—to deploy in schools, in underserved areas—to help understand air quality conditions across the world. Their goal is to keep the cost of the air quality monitor under $500 to have it sort of open access, so that people can access the data without having to go through any proprietary software and to have it available within the next couple of years.

So, there are projects like that that are happening all over the world, and it's really, really exciting.

Erin: So, let's say in some eventuality, there are enough monitors to outfit all of these key places and we really have a fairly holistic view of what someone is experiencing in terms of air quality almost every second of every day. That sounds to me like lot of data. Do you have a vision of how that data might be managed or analysed and by whom?

Kelly: Managing that much data and managing what that means and then having the capacity to make it meaningful in a health context is a whole different problem.

I mean there's so many really, really great kinds of analysis that we can do—that we already know, but the possibility that we have just terabytes of data is really asking for a different way to understand this exposure in a real-time situation. Because what we want with these monitors is that we want to be able to say, "We have two playgrounds on this school—right now because of the prevailing wind conditions, this playground is the better playground for us to have morning recess in, so let's make sure that our kids are going there." Or, for the P.E. teacher to be able to say—to predict even into two days into the

future, “I’ve got one day of volleyball and one day of soccer—it looks like tomorrow would be a better day to be in the well-ventilated gym, and today is going to be the better day for us to be outside.” And put your soccer on day one and volleyball on day two. And so we do need to come up with better platforms and interfaces for people to be interacting with their data that’s happening right now—but that data having been trained by the data that we’ve collected prior to that. So we need really, really strong engineering and strong mathematics to be able to drive the kind of use that hopefully this intensive instrumentation can get out of these new technologies that we’re developing.

Erin: Right, we have so much info. that could really tell us a lot, but we need a way to get through it all and understand it.

Kelly: Yeah, and it’s the kind of thing where like academics, like me, we run on such a different time schedule. I collect the data and then over the course of the next year and a half, I’m going to tell you a little bit about your experience a year and a half ago. But, that’s too late—recess is over. So we need to make this more timely—a more timely situation where the data can really inform day-to-day practice.

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Erin: Having access to healthcare is obviously a huge part of promoting healthy outcomes among individuals and communities. But what are some other factors that contribute to unequal health outcomes, and can you give us an example of how this plays out in real life?

Kelly: There are 365 days in a year and there’s 24 hours in each day, so there’s almost 8,000 hours in a year. And so, let’s take a healthy 11-year-old kid. He goes in for an annual doctor’s visit—so that’s about an hour that he’s spending with a doctor. He’s going to go in for two dentist appointments—every six months all of us are getting our teeth cleaned and checked by the dentist, right? Yes. So, there’s another hour there. At school he’s getting some mandated screenings—he’s getting his vision, his hearing, his basic mobility tested. And as a healthy kid, he’s going to take a couple of trips to the pediatrician, and let’s give him an ER visit. If we add this up, this is about 11 hours across the course of a year that he’s interacting with the actual healthcare community—with the actual medical community. So that’s 0.1 percent of the year that this kid is interacting with what we consider to be healthcare. So this 0.1 percent of this kid’s time that’s affected by these things that we are calling health, but, it’s 99.9 percent of the time that this kid is out there in the wild. Health happens then. That’s when health happens—health happens every single day in every single place that we’re going. So when we think about health equity and justice—what we’re actually thinking about is every decision that we make that affects that other 99.9 percent of that kid’s time—those also have health consequences. If we’re looking at why certain neighborhoods have higher incidence of obesity or a higher incidence of cancer—then it doesn’t make sense that that’s just about the screening. And it doesn’t make sense that that’s just about health insurance—it has to do with the way we design neighborhoods. It has to do with where we put jobs and what that means for people who live in certain neighborhoods. It has to do with how we fund schools and what that means for the kids today and their parents and what their possibilities are going forward in the future. So, when we think about health equity and justice, it’s about so, so, so much more.

Erin: Since health is influenced by so many factors—what do you think is a beneficial way to approach issues of health equity?

Kelly: That's really why I wanted to come here to SESYNC. Because, I know that all of these things are very complex systems and I know that it's about how these communities work together. But, we're a little bit behind that understanding in the health sciences. We're so focused on "health outcomes" of the people and we are in such in the medical model of what we're thinking about that I wanted to come to a place like SESYNC and work with all the various people here to learn from them about how they understand communities. And to learn from them—how they understand systems. All of this stuff that is happening outside is relating to these things that we think of as just health consequences. The historical impacts of redlining, how that's impacted the distribution of parks across cities…(**Erin:** To clarify, redlining is the systematic denial of various services to residents of specific, often racially associated, neighborhoods or communities, either explicitly or through the selective raising of prices.) There's so much that we don't know the answers to, but thinking about these spaces as such complex systems and having the opportunity to include health outcomes in every single one of these means that now we have the opportunity to have that conversation going forward in all of these different sectors.

Erin: So, you came to SESYNC because you could see the systems thinking that was going on—of environment and society and how really, they're one. I think usually the lens from SESYNC is if we're going to help the environment—we really need to think about people; but in your case, it is kind of like—if we're going to help people we really need to think about the environment.

Kelly: Yeah, it's been really interesting being here too because I needed to learn the language from the other direction. I needed to be able to talk with my naturalist friends, my ecologist colleagues, and stuff, and I just didn't have the language to talk with them. So SESYNC really gave me a set of tools that I didn't have beforehand to work with colleagues from such a broad spectrum because we're all working on the same thing. We all recognize that what we want is a healthy world for our children, and it's not just on the social side and it's not just on the environment side—it has to be on both sides. When one is healthier, the other is healthier. When one is healthier, the other is healthier. So being able to find intersections and find ways to work together is the only way that either side is going to achieve its goals. And so it's been really, really useful to have that—that education for me.

Erin: How were those collaborations? How did it go? I mean sometimes people talk about it being difficult to talk across disciplinary boundaries—what did you learn in terms of how to make that happen?

Kelly: Yeah, so I mean it's definitely challenging just from purely a linguistics standpoint—we have different languages that we use. But also learning how to navigate seemingly different value sets. If I'm always going to ground my work in the value of human life and somebody else is going to ground their work in the value of a complex and healthy, natural environment—those feel initially like they might be in conflict with one another. So, learning how to expand my interpretation of my own value set—so that there's space for us to find the places that they are the same value set—that was definitely a challenge. But I'd say that it's definitely been successful.

Erin: Well, thanks again, Kelly. I mean this has been really insightful, and I appreciate you taking the time to speak with us. And I hope your time at SESYNC carries with you!

Kelly: Thank you so much.

Erin: Thanks for listening and be sure to join us next time as we talk with Dr. Varsha Vijay about the effectiveness of protected areas in meeting ecological and socio-economic goals of conservation.