[Harry Kennard 0:08 ]

Hello, and welcome to Episode Two of the climate change and health podcast from the UCL Energy Institute. I'm Harry Kennard and in this series, I'll be interviewing experts about the health co benefits of climate change mitigation. These are all the ways that our health can improve if we reduce greenhouse gas emissions. In this episode, I'll be taking a look at indoor air pollution. And I'll be talking to Lauren Ferguson of UCL Institute for Environmental design and engineering. Lauren is in the final stages of a PhD looking at how indoor air pollution varies across socio demographic groups in high income countries. Air Pollution both indoor and outdoor is a key cause of death and disease globally. The World Health Organisation estimates that around 4 million deaths a year due to stroke, heart disease, lung cancer and other respiratory diseases are caused by exposure to outdoor air pollution. And a similar number of deaths are attributable to household exposure to smoke and other pollutants. As with so many health issues, these deaths are structured by inequality. The world's poorest populations rely on dirty fuels for provision of basic household needs like cooking. But inequalities and air pollution exposures also impact richer countries. This is where Lauren's work comes in. I caught up with her to find out about the problem of indoor air pollution in the UK, and what we can do about it.

Hello, Lauren, welcome to the podcast. Could you give us some background about how you got interested in research in air quality?

[Lauren Ferguson 1:34]

Yeah, of course. Well, thanks for having me. First of all, so I wanted to work in research. And I knew I enjoyed like working on a project and kind of writing a story and seeing something through to the end. But specifically to air quality. I did my degree in biology. And I worked briefly as a bio infamous petition where I analysed data from cervical swabs really random. So there was huge data sets, and I analysed them in our software. So I knew I kind of wanted to work with those kind of skills. And I found the PhD and the skills matched, but I never worked in air quality or or any kind of Applied Physics area before. So I gave it a go. And I yeah, I've really enjoyed it the the inequalities aspect was a smaller part of the PhD originally, but that's kind of become a central focus, because that's where my interests have developed. Most I would say,

[Harry Kennard 2:39]

Excellent, what about what about sort of environmental issues? Were you interested in mine prior to the PhD, or?

[Lauren Ferguson 2:44]

I know, to be honest, I wasn't. But I always had an interest in buildings. But as like a hobby never thought I would work in them as a career. So if I ever went on holiday, I would. That would be a big thing for me going to see buildings and watch a lot of TV shows on buildings, but I never considered working with them. So not necessarily environmental issues. Like I wasn't always interested in but I always had an interest in buildings. And I knew I kind of wanted to say research in something health related, not necessarily medical, but maybe epidemiological. So it did fit but just not how I would have expected.

[Harry Kennard 3:24]

It's very rare that it perfectly follows a very linear plan. So yeah, so you said that your work specifically focuses on indoor air pollution? Could you give the listeners a bit of a background about what that means about what the differences between indoor and outdoor air pollution and what kinds of air pollution you focus on?

[Lauren Ferguson 3:39]

Yeah, sure. So, indoor air will consist of a portion of outdoor air due to infiltration. And there are lots of common air pollutants found in both indoor and outdoor environments. I focus on combustion generated pollutants, so particulate matter and nitrogen dioxide and carbon monoxide. And these are produced by activities such as like cooking and smoking. And so they're found in most households, you can get other pollutants such as volatile organic compounds or VOC's. So they're produced by household products, so personal care items or hairspray cleaning products, so they're more commonly found in the indoor environment and they generally don't reach high enough concentrations outside to be considered high risk. And the main reason indoor and outdoor air need a different approach is that for a given source, emitting air pollutants at a certain rate, so say somebody smoking a cigarette, the pollutant will become indoors the pollutant will become contained within the indoor space and reach a higher concentration faster than the equivalent source in the outdoor environment. So the indoor environment can reach a higher concentration quicker and therefore the risk increases and also people spend Especially in the UK around 90% of their time indoors. So indoor air actually contributes to our personal exposure more than outdoor.

[Harry Kennard 5:10]

Okay, so then in terms of your, your latest paper, you've you, you've mentioned them before, but you talk about the role of systemic inequalities. Yeah, in terms of how people are exposed and what the impacts could be. So could you walk us through a little bit how you found that out and what the method is behind it, and then sort of eventually what that means, and you know, what that shows us about what's going on?

[Lauren Ferguson 5:32]

That paper like built on some work that I did earlier in my PhD, where I carried out a review, there's a lot of research on outdoor air pollution, and how it's distributed across different social groups you might have seen, you know, in London, it's generally worse in deprived neighbourhoods, but there's not sort of an equivalent amount of interest or literature in the indoor environment. So firstly, this is like two years ago, now I did a review which looked at the the evidence, it was like a scoping review. And I found that indirect pollution is worse in low income household. And this, this most recent paper was to establish the mechanisms of why that was. So we we explored five factors to the quality of outdoor environments. So we looked at how outdoor air pollution is distributed in neighbourhoods of different levels of deprivation. We looked at things like the distance of the like neighbourhood centroid to roads with heavy goods, vehicle access.

[Harry Kennard 6:40]

Okay, so that's basically how far away everyone's living from a big road.

[Lauren Ferguson 6:43]

Yeah, so the average distance so we looked at lower layer super output areas. It's the first bit on the first letter of the postcode we calculated on average. So we aggregated each LSOA, according to its deprivation level, and calculated what the average distance was of each LSOA, two roads with heavy goods vehicle access, and it's quite striking, you can see as deprivation increases, the distance reduces. So what that means is explicitly poorer neighbourhoods live significantly closer to really busy roads. So we explored Yeah, so factors of the outdoor environment, housing quality, so we looked at things like housing quality things that would make indoor concentrations worse. So things like floor areas, infiltration rates, a number of adjoining neighbours, generally things like flats, which have smaller floor areas, and they share a number of adjoining walls with neighbours, they have lower background ventilation, they might, they might get a degree of protection from the infiltration of outdoor concentration. But if there's indoor sources, they'll struggle to escape through normal background ventilation.

[Harry Kennard 8:02]

Right. Okay, so that that gives you the idea that in less deprived areas, people are living in bigger houses and

[Lauren Ferguson 8:09]

..draughtier houses.

[Harry Kennard 8:12]

Draughtier, right, so they, they end up being better ventilated. And as a result, people are less exposed. Yeah, average. That's fascinating. There will also be this component, presumably that people who are living in more deprived areas would have more burden of diseases.

[Lauren Ferguson 8:25]

Yeah, so the five factors, we looked at the outdoor environment, the urban farm, so the housing quality, we looked at occupant behaviours. So we looked at things like smoking prevalence across income groups. And smoking is something that's really socially part. And we looked at the amount of time people spend indoors as well. So things like low perceptions of the surrounding environment. So if you live in an environment where that you perceive there's like high neighbourhood crime, you're more likely to stay inside. And that helps your exposure to indoor air pollution. And yeah, we look to as you say, the fifth, the fifth factor was health, different health status across different social groups, and how it all acts as a system to make indoor air pollution, kind of a systemic inequality. And, and not something that many times is within the control of the people in these deprived areas in these low income groups. That's usually thing. You know, they might not have the resources or the political power to demand change. So we consider it an area of systemic inequality.

[Harry Kennard 9:38]

Yeah, that makes a lot of sense. And presumably, there'll be other sources of exposure, like I'm thinking of London City Airport. Right. So that's in a particularly deprived part of London. Yeah, it's done correctly. So presumably, that contributes as well to sort of increased background.

[Lauren Ferguson 9:54]

Yeah, and I think the airport is we didn't actually that was one thing we didn't really Explore but I know there is this somewhere that looks up inequalities to noise pollution with that. So it's not just yeah, air pollution. But actually, any qualities in noise pollution is also a factor that comes with living right near an airport.

[Harry Kennard 10:16]

I would relate very nicely to the last episode we had with Keisha Huebner who told us about mental health and climate change? Okay, so sort of zooming out a little bit. It's, it sounds like there are degrees of intractability with this problem, because it's so multifaceted. But

can you see any ways that some of these inequalities might be remedied? And how and how that might relate to fixing climate change in more general terms?

[Lauren Ferguson 10:40]

Yes, so we proposed in the paper like a systems-based approach with which not only target indoor air pollution, but because they target the system as a whole, they remedy more than more else. So, the three main ways we recommended remedying these inequalities was by improving outdoor environments, improving housing quality, and changing the behaviour of occupants. So, by an example of improving outdoor environments would be to reduce car dependence there, which can reduce outdoor air pollution and cut greenhouse gas emissions from the car fleet. It also does things like improve neighbourhood safety and can encourage more physical activity among residents, which has wider reaching benefits for population health. So in the paper, we suggested interventions, which have more which can improve health and wellbeing.

[Harry Kennard 11:42]

Right, and alongside that, there are probably other ways that improving housing quality can have co benefits of health.

[Lauren Ferguson 11:48]

Yeah, so things like providing Clean Fuels for cooking and heating can improve indoor air quality, and as benefits for climate change. Building modifications, which improve household energy efficiency can help to remedy indoor air pollution by reducing the infiltration of outdoor air pollution. There is the caveat with that, that you have to provide purpose provided ventilation because tightening the building envelope will reduce the background levels of ventilation. But there's research which says that when background ventilation compensated with ventilation is provided at these kinds of modifications have benefits for indoor air quality, thermal comfort, and general health and wellbeing. And things like certainly in like multi-unit housing. If you increase the compartmentalization to to reduce the heat loss, you get less pollution from neighbouring dwellings as well. So they're like a double Miko benefit if you like.

[Harry Kennard 12:50]

Right. I mean, that's, that's exactly what we're interested in, in multiple benefits. Okay, so then zooming out even further, we have COP 26. Coming out, is there a message that you'd like to get to the world leaders attending the conference, with respect to these observations that you've made?

[Lauren Ferguson 13:06]

There are so many ways to look at buildings like it's where people live, it's where people work. It's where children go to school. It's where people are cared for when they're sick. The way buildings are designed can attract people to an area, and they can deter people from an area, they can cut buildings can contribute to greenhouse gases. And they can also take co2 out of the atmosphere by certain carbon sequestration techniques. So if I had to say something, it would be a shame to just consider using buildings alone as like an avenue to mitigate climate change. And that's it because if designed Well, they can really transform the quality of life for the population. And all these different ways to look at them, can lead to so many different benefits that they can have if they're designed well, properly through like urban planning and sustainable building. So that's what I would say to keep in mind that you can really change how people live now and forever through building just to see them as something that would is going to help to benefit climate change seems like a waste. I do think it's one of the main avenues to mitigate climate change. But that's not all that a building stock has to be.

[Harry Kennard 14:28]

Thanks very much for joining us today. Lauren. It's been really interesting to hear about your work. I hope the rest of the PhD goes well. You've been listening to the climate change and health podcast that was Lauren Ferguson talking about her work on inequality and household air pollution. If you'd like to know more about her work, you can search for her latest paper, entitled systemic inequalities in indoor air pollution exposures in London UK. Finally, I'd like to thank Kevin MacLeod who wrote the music which appeared in his podcast. I found it on free pd.com if you'd like to get in touch, you can find me on Twitter at Harry Kennard. Please join me next time. Thanks very much for listening