

Welcome to econ sounds, the podcast series from the University of Warwick Economics Department. Today we're joined by Dr Ludovica Gazze, an Assistant Professor in the department, and she's very interested in the economics of the environment, public health, the geographic impact of toxins and how that impacts on society.

Thank you very much for joining us for the podcast and for giving us some of your time. Your research looks at the economics of the environment and public health, and you've done some papers recently on the impact of lead poisoning on children, both in short and long term. Could you tell us a bit about your work in this area, perhaps how you got interested in it, and some of the findings that are striking to you.

Yeah, absolutely. So, I'm interested in lead poisoning just as one particular example of all the things that we might encounter in our lives, and that end up affecting how we grow up, how we turn up, as human beings. And what I find really interesting about lead poisoning is that this is a particularly prevalent issue, even in a country like the United States, which we think of as pretty developed where air pollution levels have gone down tremendously in the past 20 years or longer. And yet, lead poisoning is still very prevalent, it is estimated at about half a million children get poisoned each year. And what I find fascinating is that most of the lead exposure that children have actually happens in their homes. So, lead used to be used very much as an additive to paint. It makes the white of the paint look whiter and shinier and actually helped to mix the paint, and be washable. So it was, it was thought to be great, especially in a children's room. Lead was also an additive in gasoline that was used before cars started having catalytic converters which thankfully actually doesn't do well with lead so that helped accelerate the phase out of leaded gasoline.

So even before that lead was used extensively in plumbing. Lead is a very malleable yet durable material, metal and so you know my ancestors, I'm Italian, the Romans, they started using it in plumbing, that's where the word plumbing actually comes from lead in Latin is called plumbum. And so, you know, because of all these reasons, it ends up being everywhere around us and specifically in private homes. And so that's why I find that it's particularly interesting to study it as an environmental toxin, because it's not as much something that the government can just clean up on their own. There needs to be kind of this, this conversation and this mutual support between government action and private families opening up their homes, wanting to do inspections and eradications. So, recently what I've studied is on the two sides of this which I think is kind of an epidemic, if you wish, just not as much in the news, not as much an emergency as other pandemic recently, which is on the one end, how do we learn about lead exposure and how do families learn that their kids might have been exposed and can take action, so that act of screening, which I think is really important and interesting in public health, and then sort of on the other side you know once children have been lead poisoned and lead exposed you know what are the consequences of that and specifically for society. And so on the first work what I find and I think is really interesting is that, you know, we know all parents love their children that's absolutely not in doubt, and yet even in areas I particularly was studying in Illinois and Chicago, which is the city I was living in where I did my postdoc, even in areas of Illinois, and the whole city of Chicago was considered high risk so every child should be screened by age two at least once. Even in those areas, about a third of children, never got a test for lead poisoning and these tests, I mean, you can get a capillary a finger prick, basically, you know, other types of tests might be a bit more invasive where you get a blood draw, but these can be done at the doctor's office, really easily. And yet what I found is that, over a third of children were not screened, and in particular what was interesting is that it was actually likely the highest risk children in the high risk areas already that were not making it to the doctor and what I found that was interesting was that I had very granular data. I knew where the child were living

when, when the children were living where they were born, and I knew where the doctors are and so I can compute the distance to the closest doctor, and what I find is that children who were farther away from the doctors they are the ones that are less likely to be screened and in particular if they are low income minority, higher risk

Are those groups more likely to be in older houses that are more likely to have the lead? Is it about the age of the properties and maybe they've got the lead pipes?

Yes, precisely. So, lead paint was banned in 1978, but even before then the use of lead paint started declining and the amount of lead in the paint had started declining so it's really homes that are built prior to 1930 I found in particular in that era that are the ones that have the most lead and what's important also is that really the way that kids absorbed the lead is by ingesting or inhaling the lead dust. And so, the better the house is maintained, you know, the less is the hazard for the child, but of course if one lives in an old house that that's decrepit that's not well kept, that maybe folks can't afford to keep it up, to do maintenance and repairs, that's where the kids are sort of most vulnerable. But what I thought was interesting with this analysis is that what resonated is that now there is recent research that's come out, also coming out of the US, that shows that rates for COVID vaccination, also decrease with distance to vaccination centres. And so what was interesting was that these researchers, they were suggesting that maybe what we should do is we should make vaccines available at General Stores like the Dollar Store, like places where folks already go for shopping places where folks already go for something and then, oh, look, we can also do this thing that's good for our health, which you know can be coming by just vaccination or could be like a you know a quick and dirty fingerprint to our kid to know whether, whether we need intervention, and so that's something that I also investigated in my paper.

You were testing out different ways that you might be able to change that pattern so perhaps it would be subsidies of travel cost or perhaps it would be incentivising the healthcare practitioners to actually reach out more to the missing families. Did you find that any of those in particular would make a difference?

Yeah, yes. What I found was really, it seemed to me that giving subsidies like you know, a voucher for maybe for Lift or Uber or a taxi ride those seem to be particularly effective and also they are somewhat easier to implement and target. On the other hand, also, you know, giving incentives to doctors saying look, you have all these children, the oldest children they are enrolled in, in the US it's called Medicaid, that's the insurance for low income folks, so it's suggested these kids should be tested, you should know their names, the phone numbers of families so call them up, try to get them tested and if you reach a quota, then you can get a bonus at the end of the year. That's something that's been tested in other contexts, and it's been found to potentially be useful depending of course, always the devil is always in the details, so yeah, I do kind of suggest that there might be potential policies that shouldn't be that difficult to implement and could really make a difference.

No, that's great. And you've also been looking in a different part of the US, that the longer term impact of this exposure to lead, the screening of the children when they're very young, who identify perhaps which children had lead exposure and that has impact on their own health and development, but you were also looking then at the wider consequences for what happens to their peer group in education situations. Did you find anything similar there in terms of patterns of inequality or which families which children were worse off as a result?

Yeah, I mean I think that's kind of another area that I find really fascinating. So we are now, you know, other researchers studying lead poisoning as well we're all coming to the same conclusion that lead poisoning can be really damaging, it can be alleviated with timely interventions, Cognitive Behavioural Therapy, nurse visits all of those things are really helpful. But what's striking about lead poisoning is that lead is really sneaky. it mimics calcium in our bodies, and so because of that the body is tricked to think that they're absorbing calcium and so they're starting to use the lead to call it up and that ends up clogging a lot of bodily functions and a lot of our systems and, in particular, it ends up damaging nerve cells with consequences both for cognitive skills, the way we learn, but also non-cognitive skills, it seems to be linked to impulse behaviour and our ability to be patient, to take a step back and take a breath. And so for this reason, lead exposure has been associated for example, in increased like propensity for criminal activity and disruptive behaviour as well. And so, you know, together with some co-authors, our idea was that well, if lead hinders your children and teenagers ability to learn for themselves, but also to sit quietly in a classroom, there seems to be the potential for consequences for everyone else in the classroom, even those kids who aren't themselves affected by lead. And so what we find is exactly this we use data from North Carolina: we know which children have been screened for lead, which ones had been found to be lead poisoned, and we know who they go to school with, from elementary school from grade three, through to graduation. And so what we find is that, first of all, lead is actually quite diffuse so we find that virtually every student in our sample ends up going to school, with at least one other kid who has been lead poisoned and in fact, over half of our sample ends up going to school with over 10% of their peers in their cohort who are lead poisoned, so this is pretty substantial. And what we find is that indeed going to school, even for those kids who themselves are not lead poisoned, going to school with a lead poisoned kid ends up affecting both their behaviour in the short run these kids are more likely to be suspended, they're more likely to be involved in a disciplinary incident with a lead poisoned kid, are more likely to be absent for over 20 days in a year, so kind of a definition of chronic absenteeism, and then later on they're also less likely to graduate high school, and they're less likely to take those college prep exams that are necessary.

This isn't just the child that has lead exposure, this is the peer group or the cohort around that child. I find that quite striking that the impact is so broad. And, again, was that disproportionate was it the young people who you might already expect to be less likely to go on to further education or further education, who were more impacted by this?

Yeah, so what we find is that, there's almost a compounding effect and so what we find is that low income and minority kids are more likely to be in neighbourhoods with high levels of lead exposure, so they're more likely to have peers who are lead exposed. And on top of that, they seem to be the ones that are most affected and maybe that's because they're already the ones that are at risk of not graduating and so this is the extra thing that pushes them off the cliff. And so yeah it really seems that what we think is that this seems to have pretty big implications in terms of inequality, and that links very well with some of what we know. We know that where somebody grows up really ends up shaping their future. I think we know much less about what it is, is it your friends, is it the air you breathe, is it the role models that you end up having and we think that all of these issues are intertwined, and in fact now we want to try to unpack this a bit more, even interested in trying to think about the teachers that end up interacting with these kids. Who are the teachers in those schools, and if somebody has just started out as a teacher and ends up having a bad class, if you wish, somebody, who has a lot of these kids that are disruptive, does that affect their career trajectory of the teacher?

Do they get a bad reputation because they have discipline problems that actually that they're not just discipline problems there's an underlying issue behind them? And I think you mentioned there about, the very long term effects and perhaps careers, of not just the teacher, but thinking about the students again. I think you calculated, that there might be as much as £8 billion in lost earnings for these young people who are almost held back from achieving their full potential. Did that strike you as a large number? Were you surprised by that? It seems huge to me.

Well so we were not surprised by it in fact if anything we actually thought it could be even larger. \$8 billion, it's about 4% of what we thought was the direct cost of lead poisoning so one can say is it big or is it small? But what we think is that we study, first of all, as always in economics we have to be careful as to the assumptions that we're making so this number is only calculated based on those not graduating high school. And so of course if we think that these other non-cognitive and disciplinary things can also carry through maybe these kids are less likely to be successful at their job because they're less likely to sit still, they're less likely to interact appropriately with colleagues and bosses and clients. There's a lot of things here that we might not be considering but we were not surprised and in fact we think that we studied lead poisoning because that's the data that we have, but we have no reason to believe that other forms of pollution might also have these spillover effects to folks that are not affected. And we study children, children might be more susceptible, based on the stages of their neurological development, but there's no reason to believe that adults aren't affected as well.

And by focusing these long term effects into dollars and really pragmatic consequences do you think that will make it easy for politicians to grasp what's going on and perhaps to be motivated to take action to introduce a travel subsidy or provide people with grants to fix up their homes? Do you see what you're doing, in economic terms, as something that will have an impact on politics or on actual lives?

I mean, absolutely. I wish in fact that my research, ends up informing policy. To me that is very much a goal. That's something I really like here at Warwick because I think that there is a lot of support for that. And I think ultimately as economists, we are really trained to think about trade-offs and to think about marginal costs and benefits and I think that policy is very much about that. And so, in general of course we say lead is bad and pollution is bad, but to beat pollution, to clean up the world has costs and so maybe a world with zero pollution is not the world that we want because to achieve zero pollution, we might have zero economic growth. And so really I think what we as researchers and I particularly try to do is sort of emphasise the trade-offs try to get the most rigorous and correct estimate I can of what I think are the benefits in this case of cleaning up lead, in terms of the kids that themselves are exposed, everyone else in their cohort that plays with them, learns with them, so that then policy makers can take those numbers and really think about what resources can be put towards achieving this goal.

What brought you into this field originally? Has that always been your focus as a researcher?

It's a great question. I think I went into grad school wanting to just in general sort of understand more what are the determinants of poverty. In particular, I thought I wanted to focus on low income countries, where maybe I thought we could make a difference, even more just because maybe the baseline is relatively low. But then, as I went through grad school, I think I started to understand a bit more about, again, the role that the environment plays precisely in this process of human capital accumulation, economic growth, human growth, wellbeing. And I think I realised that maybe we know less than we would want to know and so I thought it was really fertile ground for research and I think that, I mean there's definitely still, I'm still really interested in inequalities, I think there are

definitely inequalities in exposure to pollution, I think these kind of are also related to inequalities in accessing other resources, access to good healthcare. In the UK we have the NHS and everyone's supposed to be able to access it. There's questions still about the quality of the doctors, the waiting times, but in the US instead the fact that there is private insurance, I think it's really well documented that access to healthcare it's much more unequal. So then you have some folks are more likely to be breathing bad air and also they're less likely to have good doctors or even to have a doctor available close by and so how do these factors interplay. It's something that's really interesting. So for me it's still about this question of poverty, how can we create an environment, physical, but also metaphorical for folks to thrive, I think it's really interesting

One of the things that really struck me in the papers was the weight of data that you have to use to investigate the health of children, the educational trajectories, what happened to them at school. This was millions and millions of records wasn't it? Has this work only recently become possible with the amount of computer processing available? What sort of challenges do you have to face in terms of privacy or permission to actually have that really intimate detail about someone's life?

That's a very good question. Definitely, we are just starting to in the past few years there has been a growth of research that uses administrative data that are big data sets with a lot of information about individuals that can be linked, sort of throughout different sources, but of course it also has potentially sensitive information. I think we like these data because we used to go out in the field and try to survey people sometime it would take like half an hour of their time and then we would have to ask, 'when was your kid screened for lead poisoning?' and oh my god they would have to remember; 'I don't know, I thought it was last summer, but maybe it wasn't that hot so maybe it was May'. So you get all these data, that wasn't as good first of all, and it was also really costly to collect for both the researchers but also for the people that were putting in their time to answer our questions. This sort of data really opens up the door for research that can also study everyone that's representative. At the same time, yes, of course there are barriers in terms of computing times, in terms of software, I mean, everyone who's at a university also as a student, they will have access to software, to accounts, there are servers that can handle the weight of the data, still some of the simulations that we ran, you know in the papers they can take up to weeks. But that's kind of how much I've gone, sometimes the code would just stop running and in 14 days the analysis isn't done yet, but I mean it's definitely something that's doable, and I think that there is a sense in which maybe our profession as economists has become more and more sort of accustomed to being ready to learn new softwares to stay up to date with the newest commands some folks who are more tech savvy than me to put out. There's a lot of user written kind of experimentations with software that really can handle data, I think that's just great. To me, the biggest barrier is especially when working with health data, children's data, there's definitely privacy concerns are really important, I think it's also really important that we were able to study these phenomena. So balancing those needs are really hard. I think IT departments in universities are doing a great job. I think the government's local agencies are learning to work with researchers, learning that we can be of help in answering some of these questions, because sometimes if you think about it, government administration, the public administrations are sitting on this throve of data they themselves don't have the capacity or the software or the resources or the staff to analyse them. So one of the models that I've been using a lot that I learned as a postdoc in Chicago in working with governments, is really sort of offering technical assistance. Sometimes they come in I have my research question which I think is really important, but maybe the person on the other side of the phone that's not the question that they need to ask today, I want to know whether the distance to doctors affects screening rates for children. They maybe don't even know how many children they have screened in the past year.

Because, for example, what I learned in Chicago was, they had no idea, they had never done a cohort level analysis. So they knew they were screening, I don't know, 60,000 kids a year, I'm making the number up, but they didn't know of the children born in 2018 how many had been screened by today, because they didn't have the data set up they had never linked it to the birth records. And so really in order to answer my question. I had to link birth records and lead screening records and then what I did was run three lines of extra code that took me five minutes, to give them the answer that they wanted and that helped them do their planning better. And so I think that really we can be a resource for government, for better policymaking, even with very, very simple answers that we wouldn't even classify as research, just a simple number that they didn't know and so there are avenues for collaboration.

It sounds like a really collaborative way of working. And what's next on the list for you. You mentioned earlier on that you're thinking of looking at much more detail at some of those inequality drivers, is that the next project for you?

Yeah, I mean there's definitely a few projects continuing on this question of inequality, continuing on this question of, sort of, thinking about all the inputs, of all the interactions that children have, what are the most consequential for their growth. So that the careers of teachers, their interactions looking at, policies also, that could ameliorate damages from pollution from different pollution sources, policies for children with disabilities in school, how to help and support them. Do kids who have been lead poisoned but have access to extra support fare better, and so on, but also kind of thinking about what happens when we actually remedy and clean up some of these pollution sources, are we benefiting the residents or our spurring the incoming richer folks. I think we always hear this term of environmental gentrification it's something that's really difficult to define, it's really difficult to study but we are hoping actually to start a project in the UK, with UK data, where we would be able to follow children as they go throughout the school system and we have the residence address we can see after pollution sources are eliminated do they stay, do they benefit, do they get better or do they get pushed to other polluted areas, polluted neighbourhoods because house prices go up too much parents can't afford the rent.

Thank you very so much I think that has been a really fascinating insight into a really topical problem, but also how economics and how the work that you're doing and colleagues across the world really are doing to focus on what's happening and put numbers round it and really give politicians something to work with.

Thank you so much for your time, thank you for taking part in the podcast series.

Thank you very much, bye.