Hi, everyone, as we have long been waiting for this time, Dr. Ana Vicedo-Cabrera will talk about the most advanced sciences in how to attribute the health impacts to climate change. Also Vicedo-Cabrera’s current research develops along the intersection of epidemiology and climate sciences to understand how different climate factors and other related environmental stresses affect health in the context of climate change. So she has many, many excellent publications in the climate epidemiology field, including using the Multi-Country Multi-City Network data to look at the health impacts also, and the health impact to heat-related mortality including the one study that she will be sharing with us today. But before we hand it over to Dr. Ana Vicedo-Cabrera, I want to just mention that housekeeping rules I want to just mention that housekeeping rules that if you do have any questions, especially our online audience, please feel free to type in your question in the Chat box, and we will have all the questions answered at last. So thank you, and without further ado, Ana. So just give me a second, sorry. Do you hear me? Yeah, okay. Yes. Yeah, perfect, so welcome, everybody, and thank you very much.
for being here in this webinar.

And of course, thank you for the invitation to contribute to this event today.

It’s a great pleasure for me being here to talk about a topic that in a way, has been a bit of my nightmare, I must say, or a bit of my priority during the last, two, three years.

I would say, two, three years.

And I believe that it might be one of my main research fields in the coming years as well.

So I hope that basically, at the end of my presentation, you might have already some insights about this topic, and probably you might get inspired as well about the specific topic of attribution.

So as you could see from the title, we’ll talk about “Attribution of Health Impacts to Climate Change”, and now, you will see that mostly of my presentation will be focused on heat and health as an example.

So let’s start from there, from the very beginning.

Yeah, so basically, heat is considered nowadays an important environmental stressor.

Very recently, it was estimated that around 1% of all deaths globally can be attributed to heat.

That translates around seven deaths per 100,000 population per year.

And as well, it has been estimated that increase in morbidity, in particular, for cardiovascular, respiratory, and mental disorders.

And as well, it has been identified several,
let’s say, vulnerability populations such as elderly, pregnant women, chronic patients, and children, and finally, it has been estimated an important burden in terms of economic costs, and also reduction in labor productivity. So every signal is taken together is considered that heat is an important element to be assessed in our field of climate change, epidemiologic impact in particular with regards, let’s say, climate change research and what is gonna happen in the next decade? So let’s say, how heat affects health? In a way, we can see that first, the mechanism by which heat likely impacts human health are complex and understanding, let’s say, how the body reacts to heat has been the focus of decades of research in particular, in physiology. It stresses kind of the overarching term that is used for, let’s say, to describe the response of human body to the exposure to heat, and usually happens when the body is overwhelmed by metabolic heat production. You can see here from this diagram, basically, our body, what it has to do is kind of react to the exposure to heat in several mechanisms to try to dissipate, or let’s say, emit the overheating that we have in our body. And if in a way, this is not efficient,
what we can create or let’s say, can cost
or through different mechanisms that eventually
can damage different systems or organs in the body.
In this nice review that was recently published,
they summarized most of the areas,
so the different mechanisms they have seen
that actually, there are several,
let’s say, several organs that are directly
affected by heat exposure through different mechanisms
such as ischemia, heat cytotoxicity,
flammation, et cetera.
This is from, let’s say, physiological
mechanism important view.
But if we, let’s say, us, epidemiologists
working on climate change research,
we know that we assess heat in a kind of different way.
Basically, what we do is to have our wonderful,
so called exposure response functions,
that in a way summarizes the association
between the ambient temperature in this case,
we do focus on heat, and specific health outcome,
that is in this case, mortality.
That basically, you see here
in the y-axis is the relative risk,
in x-axis is the temperature.
In this case, representing this, let’s say,
association that usually is non-linear for the City of Rome,
and how we define heat is basically all temperatures
above a specific threshold that we call
temperature of minimum mortality
that is tightly-defined from the curve corresponds to the temperature for which the risk of dying is minimum. So every temperature above this threshold is considered heat.

And we know that risk increases steeply from this point onwards, as you could see here in the curve, up to a maximum. So basically, this is how we assess heat, the effect of heat on health.

But to make our life a little bit more complicated, we know that actually the effect of heat is very different across locations. I mean, we can assess this expression response function or curve from a specific population, but we know that we cannot extrapolate this curve to other locations because we know that vulnerability is very specific, very particular for a specific location. It’s mostly because of the different combination of factors, so vulnerability factors or resiliency factors that make this population more or less resilient to an ambient temperature, in this case, for heat.

So in a way, you could see that during the last years, there has been a lot of, let’s say, developments in the field of climate change epidemiology, and to clarify how heat affects health. But if we have to define specific moments in time in the past but in a way constitute an important, kind of turning points,
how we assess the effect of temperature on health,
in what particular in public health
is this event that happened in Europe in 2003
is this massive European 2003 heat wave
that affected very heavily Central Europe
on the Southeast in over the Mediterranean area.
And basically, what happened is that
it was so massive, so unique that made
that everybody turned their, let’s say,
focus, in particular, on public health on heat.
Actually, a few years after that,
there was an assessment in which they estimated
that around 70,000 deaths could happen
during this massive event.
So in a way, it gave a kind of very clear idea
about the severity of the event.
And more importantly, what’s at that time
is really to say, "Okay, if this is happening now,
what would happen in the future?"
So we know that probably due to climate change,
these events will be much more frequent.
So while the epidemiology is, let’s say,
as we were assessing what were the impacts
of that event at that time, in particular,
try to understand how we can implement,
probably, health measures,
how we can protect population from future events,
climate science community, they were more thinking,
"Okay, and what could have, in a way,
what was the role of climate change in this event?"
In a way, there’s this kind of very,
not very good question, or let’s say, an imposed question. Whether this 2003 heat wave was actually caused, in a very simplistic or deterministic sense, by a modification of external influences on climate. Basically, as we said it, due to the increase in concentration of greenhouse gases in the atmosphere. Because we know that almost any such weather event might have occurred by chance in our world. In a way, what we have to do is to think that in another perspective, or let’s say, to put that question in a different way. Basically, it’s how much did human activities increase the risk of occurrence or probability of this event? Or more specifically, did actually climate change alter the severity, frequency, or duration of the event? So this is exactly what attribution and detection studies does. It’s a field that it has been, in a way, developed in the last years, in a way, it’s more traditional from the climate science community, but not much on the epidemiological side. In a way, one of the first example was actually this study led by Peter Stott from the UK, in which actually they assessed what happened in this 2003 heat wave, and what they came up from this study.
is that it is very likely that human influence has at least doubled the risk of a heat wave, exceeding this threshold magnitude. So in a way, it’s already posting, putting a certain name into this event, saying that probably climate change have altered the, let’s say, probability of the occurrence of this event. So how this attribution and detection studies work? Basically, in a very simplistic way, what happens is that we model, let’s say, we compare our current climate in presence of climate change that we can actually, in a way, estimate or let’s say, mimic or get simulations based on these kind of climate models, in which they kind of try to mimic current conditions based on the what we know in terms of greenhouse gas emissions, and we compare it with a world without climate change. So basically, it’s what you can see here. We compare it, here is in this curve is kind of simulated data just for you to illustrate this comparison in which we have our warming climate that is increasing in red compared to a kind of climate-free, climate change-free environment or what they called a naturalized scenario, or let’s say, without anthropogenic forcing. So in a way, the difference
between these two scenarios would give us what is actually the contribution of anthropogenic forcing, that eventually is what we want to know, what is the human influence in the climate that actually might have altered the climate in current period or historically, during the last decades. So as I said, it’s a field that has been developing in the last years in particular for the climatological statistics because of course, we know what is happening now. I mean, we can see whether these simulations from these climate models really mimic what we are experiencing today based on observations, but we don’t have data what would have been the world without climate change. So in a way, we have to rely on these models let’s say, forcing, so these inputs in your model, you’re actually mimicking what would have been the world without climate change. So in a way, you can see that there are a lot of uncertainties. And of course, one thing that I would like you to put in your, kind of your front, in your forefront, is that when we talk about attribution and detection studies, we talk about, basically, probability. This is a term that you will say
that it’s very pivotal in this story because in a way, it’s not a matter of, okay, yes or no climate change have caused this event.

It’s whether climate change has altered the probability of this event. So basically, what we, let’s say, people working or researchers working in climate science, mostly on the part on attribution and detection studies, what they do is to compare probabilities. As you could see here in red, the probability of an event happening above a specific temperature threshold compared to the same, let’s say, threshold, what would have been the probability in a world without climate change in this counterfactual scenario. Let’s say, in this nice review, this researcher, Fredi Otto from Oxford, she very well described in this paper, in this review, in which basically, what she said is that out of this exercise, we would have four different outcomes. First, could have been made, let’s say, that this event could have been made more likely because of the anthropogenic climate change, let’s say, or it could have been made, let’s say, less likely, or there is no detectable influence from anthropogenic climate change.

And the last one, with our current understanding
and available tools, we are unable to analyze the role of external drivers in this event. So basically, as you could see, is to see whether climate change altered the probability to make this more or less likely. And then we have resources, or let’s say, our models can help us to really clarify whether these differences in probability is meaningful. So to understand the world, this work of attribution, is we have to talk about, and usually, you will see this plot in every study in this field. For us, epidemiologists, it’s basically something that we, I mean, honestly, when I saw it, I don’t know what the hell is this, but at some point, I found it very, very interesting. So I will try to guide you through this plot. You could see here in the y-axis is the monthly temperature equivalent. And basically, in the x-axis, you have what they call return time. It’s a measure of, let’s say, probability or severity of an event. It’s basically, you put in here in this point, what it’s saying is an event has a return kind of time, or basically, it already happens 1 in 10 years. If you go in here, it’s an event happening 1 in 100 years. So in a way, you could understand that the far you are from the origin, the more extreme an event could be.
or the less likely, as you could see here
on the other side of the axis,
less probable an event is.
So basically, what they do, in this case,
it’s an example of the 2010 heat wave in Russia.
And it’s basically to compare this blue line,
that in a way, is used based on this counterfactual world
in which you have, basically,
this is the probability of a specific,
let’s say, event happening at different times.
And in red, the same,
but in our world currently, in our world,
let’s say, in our world current conditions,
so we don’t have to worry.
So if you go in this line,
this line is basically corresponds to this threshold
that was, let’s say, defined during this heat wave.
But basically, this heat wave reached,
I think, it was 24.5 degrees.
So in a way, according to these dimensions,
what they say is that in current times,
this event corresponds to approximately 1-in-50-years event,
while in a world without climate change,
this event would have corresponded to 1 in a 100 years.
So basically, what has happened
is that climate change has made the event more likely,
let’s say, from an event in a hypothetical world,
1 in 100 years has become 1 in 50 years.
So as you could see again,
is the EDL changes in probability,
making a specific event or a specific temperature threshold, make it more probable, let’s say, going from 1 in 100 to 1 in 50 years. So as you could see, it’s kind of something that is not very, for us as epidemiologists, a little bit difficult because in a way, it’s just talking about probabilities, but for us, translating this into health impacts, it requires a bit of work. But let’s say that we’re working on it. The idea is that this work of attribution has gained kind of a lot of attention during the last years. In particular, thinking about what happened this last summer. Surely, you might have heard, or even lived there, or suffered this event, this massive heat wave that happened in last summer in West, North in America. So in a way, what happened, we know there were few days, the group came with temperatures above record, and it was a lot of attention in media, et cetera. So while all this was happening, let’s say, that there was an initiative from this World Weather Attribution initiative that’s a kind of, again, an initiative in which different researchers working on attribution studies put together and try to give answers about whether climate change
0:19:39.26 –> 0:19:41.29 might have had some role
0:19:41.29 –> 0:19:43.563 in a specific extreme weather events.
0:19:44.49 –> 0:19:47.63 Not saying that to provide this evidence
0:19:47.63 –> 0:19:49.15 a year or two years after,
0:19:49.15 –> 0:19:53.3 it’s really to provide this evidence in the coming weeks,
0:19:53.3 –> 0:19:55.46 because we know that times matter.
0:19:55.46 –> 0:19:58.47 If we have suffered a heat wave like this,
0:19:58.47 –> 0:20:00.33 it would have much more impact
0:20:00.33 –> 0:20:04.67 if this answer comes earlier in time
0:20:04.67 –> 0:20:07.93 rather than wait years ahead
0:20:07.93 –> 0:20:10.12 that people might completely forget
0:20:10.12 –> 0:20:11.86 about the severity of this event.
0:20:11.86 –> 0:20:14.71 So the idea is that this group of researchers
0:20:14.71 –> 0:20:16.26 and they did this analysis,
0:20:16.26 –> 0:20:18.89 and basically, what they came up with this
0:20:18.89 –> 0:20:22.42 is that it would be virtually impossible
0:20:22.42 –> 0:20:24.41 without human-induced climate change.
0:20:24.41 –> 0:20:26.52 At this event, it’s estimated to be about
0:20:26.52 –> 0:20:30.04 1-in-1000-year event in today’s climate.
0:20:30.04 –> 0:20:33.02 So you can have from this sentence,
0:20:33.02 –> 0:20:35.18 that this event was kind of unique,
0:20:35.18 –> 0:20:38.54 very extreme, 1 in 1,000 year, it’s a lot.
0:20:38.54 –> 0:20:40.28 And actually, they provided this plot.
0:20:40.28 –> 0:20:41.87 You will see that it’s very similar
0:20:41.87 –> 0:20:43.32 to what I just shown.
0:20:43.32 –> 0:20:47.07 And actually, this event that was in here
0:20:47.07 –> 0:20:49.73 around 40, almost 40 degrees,
0:20:49.73 –> 0:20:52.79 they saw that it was actually even outside
0:20:52.79 –> 0:20:56.52 the probable range of events within a year,
0:20:56.52 –> 0:20:59.76 within let’s say, in our current climate.
0:20:59.76 –> 0:21:01.73 So in a way, it’s saying already about
this huge severity of this event that happened. So this study and the savings they provide at this time, I said it was a couple of weeks after the event, very, very powerful because it’s giving clear, let’s say putting the finger into the idea of the role of climate change and the human influence in this event. So the message was very, very, very strong. At the same time, we have to bear in mind that surely you know that there was this, the new report of the IPCC, that part on “The Physical Science Basis” was already published in August. And the difference, let’s say, of this report compared to previous reports, really to put in more weight into the influence of the human activities on carbon, let’s say, extreme weather events happening in today’s world. So again, you can see that the idea of attribution is gaining much more attention lately, but more importantly, because we know that evidence from attribution studies can be used in lawsuits. Basically, has been used for a specific, let’s say, companies, individuals, et cetera, to kind of give some complaints, or let’s say, to ask for some compensations of a specific losses to, let’s say, governments or companies emitting greenhouse gases.
So the idea is that during the last years, it has been a tremendous increase in different lawsuits that have been implemented against climate change using evidence from attribution and detection studies. In this plot, you can see that it actually was mostly during the second half of the previous decade that actually went super up. And most of these, let’s say, these initiatives happened in the US. Most importantly, it’s like, okay, we know that there’s this tool, but we need scientific, robust scientific evidence that could help us to gain or let’s say, to win these different initiatives in the courts. At the same time, we know that, let’s say, that the idea of these initiatives is that beyond individual litigant, but it is seek to advance climate policies, drive behavioral shifts by key actors, and or create awareness, and or create awareness, and encourage public debate. So it goes beyond the idea of compensation. It’s really to gain more weight, to put more emphasis on the role of climate change on the different, events, extreme weather events that are happening. At the same time, it’s something that has been in a way highlighted.
That’s why that nowadays, it’s not an easy task. There are variants such as accessing to justice, and difficulties in dealing with scientific evidence, and the conservatism of many courts that eventually confronted the different policy issues.

So in a way, the idea is that there’s a lot of now, research, going on, putting together climate science and low, try to gain or let’s say, to create some synergies that eventually would help advance this field on climate litigation. And one important, let’s say, call that I take from a recent publication of a colleague of mine, of Rupert Stuart-Smith, they say that greater appreciation and exploitation of current methodologies in attribution science could address obstacles to causation and improve the prospects of litigation. So in a way, it’s really saying, "Okay, we know that we can do something. Law can be a very good path for doing that, but probably, science is we need to, in a way, advance knowledge in this field and try to provide better, let’s say, "scientific evidence that could help, let’s say, “winning on these different initiatives in courts." So let’s say that so far, we have been working more on the part on climate events, more on the weather events,
whether one weather event can be attributed, attributed or let’s say, how was the role of climate change. But what about health impacts? Okay, we know that one event might have been more frequent or more, let’s say, the probability has increased because of climate change, but at some point, we would like to know what this translates into health impacts. So, as I said, the idea is how much of the observed health burden during an extreme event can be attributed to human activities? Or more broadly, how much of the historical health burden of a climate-sensitive outcome can be attributed to climate change? So it’s not an easy task. I mean, we know that in there, there might be some kind of different, let’s say, developments in terms of methods, et cetera. And actually, one example, for example, you know that I found this article in The New York Times that was basically, they showed some calculations based on a recent report of the CDC, based on that, let’s say, what has happened in these massive heat waves in the Northwest in the US. And actually, they just did a very simple estimation on the let’s say, estimated the number of deaths that were kind of excess, or let’s say, more than normal.
0:26:53.05 – 0:26:56.15 during that period of time, during the heat wave.
0:26:56.15 – 0:26:57.403 Attributing that, let’s say,
0:26:57.403 – 0:26:59.39 that during this heat wave,
0:26:59.39 – 0:27:03.36 more than 600 people died because that in a way,
0:27:03.36 – 0:27:07.87 one could attribute to this heat wave.
0:27:07.87 – 0:27:10.28 But the other question is how much actually
0:27:10.28 – 0:27:13.6 of this burden can be attributed to human activities?
0:27:13.6 – 0:27:15.76 Again, talking about the probabilities,
0:27:15.76 – 0:27:19.07 not to say yes or no, is to how much of this burden
0:27:19.07 – 0:27:23.05 can be kind of attributed to these events.
0:27:23.05 – 0:27:27.66 So one of the first exercise that has been done
0:27:27.66 – 0:27:29.427 in terms of attribution of health impacts
0:27:29.427 – 0:27:32.92 was this study done by Dann Mitchell
0:27:32.92 – 0:27:35.5 in which they assessed what was the impact
0:27:39.36 – 0:27:40.35 And actually, what they found
0:27:40.35 – 0:27:41.577 is that anthropogenic climate change
0:27:41.577 – 0:27:44.35 increased the risk of heat-related mortality
0:27:44.35 – 0:27:49.11 in Central Paris by 70%, and by 20% in London.
0:27:49.11 – 0:27:51.33 So eventually, what is really in here
0:27:51.33 – 0:27:54.62 is saying that how much human
0:27:54.62 – 0:27:56.53 or anthropogenic climate change
0:27:56.53 – 0:28:00.123 has either the severity of this event
0:28:00.123 – 0:28:02.6 in terms of how much to really put the value,
0:28:02.6 – 0:28:06.05 a number on this contribution in terms of health impacts.
0:28:06.05 – 0:28:08.817 So in a way, you will see that
0:28:08.817 – 0:28:09.99 it’s clearly a different message
0:28:09.99 – 0:28:11.58 compared to what I said before.
0:28:11.58 – 0:28:14.54 It’s not about the excess debt during that period,
0:28:14.54 – 0:28:15.96 it’s really to say how much,
0:28:15.96 – 0:28:17.42 how many beds can be attributed
0:28:17.42 → 0:28:20.51 to anthropogenic climate change.
0:28:20.51 → 0:28:22.157 So let’s say that traditionally,
0:28:22.157 → 0:28:25 the way how we have assessed this
0:28:25 → 0:28:26.987 is more into the future.
0:28:26.987 → 0:28:30.94 Say compare in what has been there,
0:28:30.94 → 0:28:33.96 the health burden attributed to heat in current times
0:28:33.96 → 0:28:36.55 compared to what will be in the future
0:28:36.55 → 0:28:38.19 using climate change scenarios,
0:28:38.19 → 0:28:40.66 assuming that the difference between today
0:28:40.66 → 0:28:42.16 and the future can be attributed
0:28:42.16 → 0:28:44.12 to anthropogenic climate change.
0:28:44.12 → 0:28:46.55 But you will see that from this idea
0:28:46.55 → 0:28:49.09 of attribution studies is not about future,
0:28:49.09 → 0:28:51.23 it’s about present, okay?
0:28:51.23 → 0:28:53 This is something that you should be reminded,
0:28:53 → 0:28:55.35 is really to use historical events
0:28:55.35 → 0:28:57.58 and try to see what has to be the footprint
0:28:57.58 → 0:29:00.96 of human activities in historical events.
0:29:00.96 → 0:29:03.6 So when we talk about the tradition, as I said,
0:29:03.6 → 0:29:05.933 one could focus on, let’s say,
0:29:07.077 → 0:29:09.04 on a specific event to say,
0:29:09.04 → 0:29:10.46 what they call event attribution
0:29:10.46 → 0:29:12.3 for individual extreme weather events
0:29:12.3 → 0:29:14.65 as this example of Dann Mitchell,
0:29:14.65 → 0:29:18.68 but another example is more on the trend attribution.
0:29:18.68 → 0:29:20.89 Basically, for long-term changes
0:29:20.89 → 0:29:23.079 in the mean of climatological statistics.
0:29:23.079 → 0:29:24.9 So not really to assess specific events,
0:29:24.9 → 0:29:28.777 it’s to see how much the observed trend
0:29:28.777 → 0:29:32.47 can be attributed to human activities.
0:29:32.47 → 0:29:34.8 So basically, using this approach,
not really to focus on extreme events, but on the trend during a period of time.

I had the pleasure to lead together with my colleagues of the Multi-Country Multi-City Collaborative Research Network was recently published here.

And this is the reason why I’m talking today, because thanks to this opportunity, I had really the option to dig a bit into this topic.

So in a kind of general terms, this study like the general framework was about combining data and methods in epidemiology with modeling, let’s say, climate projections, climate, let’s say, simulations of the past years, we were able to estimate how much of the observed heat-related mortality can be attributed to human-induced climate change. So I will go step by step.

First, as I said, we used data from the Multi-Country Multi-City Collaborative Research Network in 732 locations in 43 countries in the world.

Here, you can see the different location of the different places. And the idea is that we combine, let’s say, we took all this data on observed temperature and mortality, and we derived this, the vulnerability function or the exposure response functions of each city.
You've seen the state of the art methods in climate change epidemiology. It's basically to a stage and serious analysis with distributed lag non-linear models and multivariate multilevel meta-regression. Yeah, it sounds super fancy, but in a way, it's not as complicated, and you'll have all the information on the methods in the paper. I invite you to have a look, review if you would like to learn more about the methodological part. So basically, what we did, as I said, is to estimate the vulnerability of each city, which in a way, was already kind of an advancement compared to previous assessments. Because again, here, the idea is that we clearly aim to assess the specific vulnerability of each population to have a better estimation of heat-related mortality in each location. And you see here that it was clearly heterogeneous. We saw as we found in previous assessment, that actually, most of higher risks are usually found in Europe, in the Mediterranean area, and other locations in Asia. So as I said, we combined these exposure response curves with moderate climate data that we got from our colleagues from there, the DAMIP Project, this is
the Detection Attribution Model Intercomparison Project

And idea is that for each location in this assessment,

we derive a series, let’s say, of moderate pairs

of moderate climate on daily temperature

under current conditions

and under our without climate change,

that is our counterfactual scenario.

Here, you have a kind of illustration of the trends.

Basically, in red, you have the observed trend

with a warming trend.

That it mimics current conditions with climate change

while the orange one mimics somewhere

without climate change in the absence of warming.

So basically, we focused in this period here

between 19, yeah, 1990, oh, 1990, oops,


Actually, sorry about the numbers,

I’m very bad with that.

And basically, what we did is as I said,

for each location, we obtained these pairs,

and we translated these observed,

or let’s say, simulated temperature

into hypothetical excess mortality

under these two scenarios.

And this is basically what you can see here

in this panel A.

In solid, you have the anthropogenic,

let’s say, the heat-related mortality

under current condition, let’s say,
0:34:02.53 –> 0:34:04.88 in presence of anthropogenic climate change,
0:34:04.88 –> 0:34:07.91 while in light here, these bars,
0:34:07.91 –> 0:34:11.37 you have what would have been heat the excess,
0:34:11.37 –> 0:34:13.57 or let’s say the heat-related mortality
0:34:13.57 –> 0:34:15.85 in a world without climate change.
0:34:15.85 –> 0:34:17.587 So basically, we estimated on this
0:34:17.587 –> 0:34:20.96 for each of the 700 something locations,
0:34:20.96 –> 0:34:23.03 and we aggregated by country,
0:34:23.03 –> 0:34:24.32 and this is what you see here.
0:34:24.32 –> 0:34:27.36 And eventually, we estimated the difference
0:34:27.36 –> 0:34:30.7 in terms of excess mortality between these two scenarios.
0:34:30.7 –> 0:34:33.23 That is basically what you find here.
0:34:33.23 –> 0:34:35.11 So what we saw overall
0:34:35.11 –> 0:34:40.11 is that 0.98% of excess mortality,
0:34:41.49 –> 0:34:43.198 heat-related excess mortality
0:34:43.198 –> 0:34:47.44 and of course, more excess mortality
0:34:47.44 –> 0:34:48.75 in the factor is null,
0:34:48.75 –> 0:34:51.091 that is with anthropogenic climate change
0:34:51.091 –> 0:34:54.103 that is currently slipping to 1.56%.
0:34:55.66 –> 0:35:01.01 that is basically, this number here is 0.58%.
0:35:02.531 –> 0:35:05.61 It represents the all-cause mortality
0:35:05.61 –> 0:35:08.19 that can be attributed to heat induced
0:35:08.19 –> 0:35:10.775 by anthropogenic climate change.
0:35:10.775 –> 0:35:13.473 So the idea is that in a final step,
0:35:13.473 –> 0:35:17.36 what we did is to kind of rescale this difference
0:35:17.36 –> 0:35:21.37 over the observed, or let’s say, the impact
0:35:21.37 –> 0:35:24.61 or the excess mortality in anthropogenic climate change.
0:35:24.61 –> 0:35:29.61 In a way to estimate what is the proportion of this,
the excess mortality happening today, that can be attributed to human-induced climate change. So it’s basically, what we try to illustrate here, and we found that overall, 37% of heat-related deaths can be attributed to human-induced climate change in this assignment, these locations that we included. And in a later step, what we did is to kind of extrapolate this and compute what would be the mortality rate attributed to heat-related or let’s say, heat-induced climate change. So in here, what we observed that on average, 2.2 deaths per 100,000 population per year can be attributed to heat induced in human influences, and let’s say, of climate change. So as you could see in this assessment, it had very powerful message. It’s really we provide evidence on the clear to tell the impacts of climate change over health burden that we observed today. And you can see that, of course, this evidence can be very, very useful for let’s say, to support policy-making processes. And more importantly, I think, it was about the key message about the relevance of these findings in terms of to put a little bit more attention to what is happening, saying that climate change is not something that will happen in the future, it’s already happening today.
We can talk about the projections, but we cannot focus on your projections in terms of impacts of climate change is really that already we are suffering. So it’s really to say, "Okay, we need to do, or put more emphasis in terms of implementing a strong mitigation policies to abate this warming in the future, but more importantly, to implement adaptation strategies that would help us to reduce our vulnerability, "in this case, for heat.” But of course, we had to acknowledge several limitations, and understood that, although it was one of the biggest, let’s say, assessment on this field in terms of attribution of health impacts, we know that for example, it was cannot be considered a worldwide study because we focused our assessment on the locations that were already included in the MCC, and we know that there are important regions in the world that were not covered. This is an important limitation that we have in our study environment directly because we are very much aware that vulnerability is very heterogenous and changes from one location to the other. So at some point, we can extrapolate risk that we observed in Europe into places like Africa or Asia.
So at some point, we need better data that would help us to better identify or let’s say, assess what is the vulnerability of these locations that currently, are unobserved or unexplored. On the other side as well, something that we have to bear in mind, we have to do a simplification in terms of risk. We assume that, in a way, we did a cultural adaptation in the sense that we assumed a kind of average risk across the 20 years, 30 years that we assessed. And the idea is that okay, it’s likely, and we know that as you could see here in this plot that actually, there might have been a partial adaptation of the population to heat. Though at some point, we don’t know which impact this could have had because probably, the idea is that probably, at the end of the period, the risk might have been lower compared with the beginning. So eventually, as you could see, we had to do a kind of group simplification and something as well that we have to bear in mind that the risks that we applied to both scenarios is the observed risk. That is the one that we estimated in our world with climate change. So we don’t know what would have been the risk without climate change. So again, it’s very difficult,
and I expected in the future, it’s something that we will implement in them, in this field or in climate change epidemiology. And finally, the lack of epidemiological causal basis. This is important because this assessment is purely based on an ecological design that as most of the climate change and epidemiological studies. So at some point, if we want to talk about the attribution, we have to improve our way, how we can assess causal links in this field. So just as a kind of final wrap-up on this subject, and as I said, I really want you to make it fun about this kind of a study, is first, because as we know, it can be a powerful tool for climate change policy, and as well, it can help understanding the mechanism by which climate change effects have. Can support in finding projections of future health effects of climate change, and as well, improve adaptation to climate change impacts. As well, it can increase motivation for climate mitigation, as I said, just learning about what is happening today and the urgency to really do that. And also, demonstrate causal links between greenhouse gas emissions and climate change impacts.
that serve as a basis of evidence
underpinning climate-related losses,
as I said, previously.
And finally, what I believe is also very, very attractive.
Its an excellent platform for interdisciplinary re-search,
really to put together experts from different fields,
climate science, working more on the modeling side,
climate epidemiologists, working
on the ascertain the health impacts.
And at the later stage, other experts in other fields
like the economy, law, et cetera,
can take part on these investigations.
So definitely, it’s an excellent platform
for latching our kind of research area,
grab information, address knowledge from other fields
and reach our risk portfolio,
which I think is also very relevant for young researchers.
And just as our final point,
something that I think it has to do, bear in mind,
and as I said for me, this research field
can be considered kind of very powerful research line
in the future in climate change epidemiology.
Let’s say, climate attribution
is something that has been developed
for years in climate science sphere,
but not much in epidemiology.
And if we really want to advance in climate litigation,
really advance on the fight against climate change,
we have to put a value on what is happening
in terms of extreme events, in terms of \( X \) is that burden, economic cost, et cetera.

And all this can help people change your mind, and as well, help, advancing or let’s say, winning different initiatives in courts, et cetera.

So as important elements that I believe we should focus in the future, is first assess causality, use advanced methods in environmental epidemiology that help us to clarify causal links.

Second point, to provide innovative frameworks as the world attribution initiative, they provided this evidence on the role of climate change.

If we can couple this with health impacts, that could be even much more powerful.

And finally, we have to think about how we can address this research question in a more broader perspective and provide probably, global estimates that are closer to the, let’s say, the real, what is happening today.

So yeah, that’s all.

Thank you very much for your attention, and I’m happy to take questions, thank you. Thank you, Ana.

Thank you for the wonderful presentation. I think you gave a superb view like an introduction from kind of science, how to tackle extreme weather events,
0:43:28.667 –> 0:43:31.68 and these type of extreme events attribution
0:43:31.68 –> 0:43:33.86 to the trend attribution,
0:43:33.86 –> 0:43:36.217 and to the landmark study that you have,
0:43:36.217 –> 0:43:38.32 the MCC quality you’ve been working on.
0:43:38.32 –> 0:43:39.94 So thank you very much.
0:43:39.94 –> 0:43:42.507 And I think there will be a lot
0:43:42.507 –> 0:43:44.71 of questions from our audience.
0:43:44.71 –> 0:43:48.03 So while our online audience is typing
0:43:48.03 –> 0:43:50.69 your questions in the Chat box,
0:43:50.69 –> 0:43:54.85 we do have already collect some questions from our
students.
0:43:54.85 –> 0:43:57.55 So there are several types of questions
0:43:58.648 –> 0:44:01.1 that students are particularly interested in.
0:44:01.1 –> 0:44:03.29 For example, the first type,
0:44:03.29 –> 0:44:06.17 I think for some of the students still wondering,
0:44:06.17 –> 0:44:08.712 you have given this great example
0:44:08.712 –> 0:44:11.64 of attributing heat-related mortality.
0:44:11.64 –> 0:44:14.15 So they’re wondering if this type of technique
0:44:14.15 –> 0:44:17.03 can be used to attribute other extreme weather events,
0:44:17.03 –> 0:44:18.773 like hurricanes or wildfires?
0:44:20.56 –> 0:44:23.44 Yeah, exactly, I mean, as I said,
0:44:23.44 –> 0:44:24.917 in this assessment, in this presentation,
0:44:24.917 –> 0:44:27.18 I focused on heat on health,
0:44:27.18 –> 0:44:28.45 because in a way, I mean, of course,
0:44:28.45 –> 0:44:30.541 it’s a bit biased because it has been
0:44:30.541 –> 0:44:33.59 my research field for already several years,
0:44:33.59 –> 0:44:38.21 but we know that within attribution science,
0:44:38.21 –> 0:44:39.72 it’s not only about heat waves.
0:44:39.72 –> 0:44:44.17 Actually, there’s also a very new report
0:44:44.17 –> 0:44:49.16 published by this Global Weather Attribution initiative
on the floods happening in Central Europe even this summer.

Again, put in, estimated that actually the role of climate change was very substantial in increasing the probability of this event. So definitely, this kind of framework can be extended to other extreme weather events. Of course, with some caveats and some limitations, but I believe that if we try to, it would be easy to adapt this framework to other extreme weather events if data, of course, is available.

Thank you, Ana. I think we have a typo from our online audience. Exactly, the same question some of the students are also asking. But Mona is asking, "Why is the A and B data missing environments from most of Africa?" And also, it’s kind of related to the question student’s asking in the Multi-Country Multi-City Multi-Country Multi-City is that they only have South Africa, doesn’t have much of Africa. And also, one of my students is asking, why there’s no data from the South Pacific, where she have experienced doing this one and like fuzzy.

So why there's no such coverage? Well, maybe I can give you a little bit of story about how the MCC started.

And basically, it was, I think in 2014
During a conference, with a group of researchers working on climate change epidemiology, mostly on the temperature-related health impacts. They had an informal meeting, and they were discussing the possibility of probably putting together some data from their countries. For example, one have data on temperature mortality in the UK, other have in Japan, the other one had in Spain. So eventually, they realized that, “Okay, maybe we can start putting all this data together instead of assessing our impacts or let’s say, our estimates in our country, it would be nice to compare different locations at the same time.” Because as I said, the idea of, the peculiarity in a way of temperature-related health impacts is that this, the effect is very dependent on the location. So it’s nice to compare these estimates across locations to understand vulnerabilities and potential vulnerability factors. So as I said, it started kind of informal way, and they started opening the door to other collaborators and colleagues to work in, and eventually, it grew, grew, grew, grew until nowadays that we are around, I think, 70 researchers from 43 countries with all these bunch of locations.
0:47:44.82 → 0:47:46.26 with different data sets.
0:47:46.26 → 0:47:48.29 And also, not only focusing
0:47:48.29 → 0:47:51.44 on the idea of temperature mortality,
0:47:51.44 → 0:47:54.54 but also, air pollution, on projections,
0:47:54.54 → 0:47:57.73 on I mean, in a way, it’s a project
0:47:57.73 → 0:48:02.73 that greatly grow in an exponential way.
0:48:03.64 → 0:48:07.71 But the idea how this, then the beauty of this project,
0:48:07.71 → 0:48:11.1 how it’s developed and how it started
0:48:11.1 → 0:48:13.34 is that it works in a very informal way
0:48:13.34 → 0:48:16.196 in the sense that the idea how you contribute,
0:48:16.196 → 0:48:20.19 you take part of this consortium by providing data
0:48:20.19 → 0:48:22.37 on a specific country that is missing
0:48:22.37 → 0:48:27.12 because you had it because of your research or whatever.
0:48:27.12 → 0:48:29.29 And it’s surprising that it is not directly funded.
0:48:29.29 → 0:48:30.59 I mean, it works, let’s say,
0:48:30.59 → 0:48:33.57 off each funds of each partner.
0:48:33.57 → 0:48:36.64 The reason why there are some places in the world
0:48:36.64 → 0:48:40.4 that is not, let’s say, covered within this spread
0:48:40.4 → 0:48:42.72 is basically, because so far,
0:48:42.72 → 0:48:46 we didn’t manage to get data from these locations.
0:48:46 → 0:48:48.81 And I mean, it’s a problem of course,
0:48:48.81 → 0:48:51.24 of places like in Africa,
0:48:51.24 → 0:48:53.95 where good quality on mortality,
0:48:53.95 → 0:48:57.77 daily mortality in specific locations in Africa
0:48:57.77 → 0:48:59.43 is very difficult to find.
0:48:59.43 → 0:49:00.45 Especially because at some point,
0:49:00.45 → 0:49:03.02 whether you need this data is somehow
0:49:03.02 → 0:49:07.22 comparable in terms of quality and temporal scale.
0:49:07.22 → 0:49:08.42 And especially, this idea
0:49:08.42 → 0:49:11.65 that it should be daily mortality, et cetera,
because the part on them, whether we know that is relatively easy to get it from the analysis data, et cetera,
but the main limiting factor here is the mortality data. And that’s why in a way, we didn’t manage too far to kind of get this information here in terms of observed mortality in this assessment. However, very recently, as I mentioned in my first slide, we performed a global assessment in which basically, based on information of the observed locations, our colleagues in Monash, they managed to extrapolate the risk in an observed location and eventually, provide kind of comprehensive assessment on the team, non-optimal temperature-related mortality across the globe. I invite you to have a look in, I think, it was recently published in (indistinct). Thanks, Ana, I think, if you collect it with the history and also development for MCC, why it’s not covered? And what’s the most recent that MCC predict in the temperature mortality association in places where you don’t have mortality data. There are always a lot of questions, but I do have one kind of question related to your answer.
This one student is kind of were astonished about since the heat-related mortality risk varies across places that you have shown me on slides. So the question is why do places have, even we have similar latitude, maybe even with the same organization level, why do we have different heat-related mortality risk? Well, it’s a very good question, and I must say, difficult to answer in a very clear way. In a way, we know that vulnerability to heat or let’s say, non-optimal temperature depends on a complex network of different factors that are highly interconnected. It’s not like we know so far that what makes one city more vulnerable to the other is not because of one unique factor. It’s because of combination of different factors that actually are very much dependent between each other. Thinking that, for example, we published, I think, it was in 2018, a study was led by our colleague, Francesco Sera, in which we tried to assess specifically this, to try to understand what were the contextual factors defined at city level that can give us some hints about which locations are more vulnerable in terms of higher excess mortality due to heat compared to others. And eventually, what we saw in this assessment is that it’s not only one factor,
it was a combination of probably cities that are more urbanized, but also more unequal are those with a higher heat-related burden compared to others with a lower level in this case. Well, for cold, the story was much more complicated with no clear patterns around. But again, the idea how all, let’s say, the main factors driving this difference is nowadays, have very important or very crucial point that we are trying to disentangle, especially because we know that if we understand what are the mechanism, let’s say, the reasons why one city is more resilient compared to other, this can help us to understand which mechanism in terms of adaptation we can apply to other places to try to protect to reduce our vulnerabilities in the future. So hopefully, if you ask me this question in a few years, I hope I will answer this question, but I think right now, it’s very difficult to say. Yeah, yeah, I think it’s excellent answer now. It’s kind of related to one, our online audience questions regarding the difference in the heat-related mortality, whether it is rural or regional kind of communities. I think it’s more related to Francesco Sera’s paper you mentioned. Yeah, in a way, I mean, it’s still that in this assessment, and I must say that in the MCC.
most of the locations that we have are cities. So in a way, the risks that we obtained are mostly represented for urban locations. This is one of our limitations in this assessment. And probably, if you don’t, you need to go a kind of national level assessment in which you can better disentangle the different patterns in terms of vulnerability to heat and cold in a rural versus urban. And as I said, it’s also it’s a story that needs to, we need to address in the next years. And I know there are initiatives in terms of nationwide assessments try to see patterns between urban and rural locations, et cetera.

Yeah, I think kind of the final group of questions students and also online audience is interested is adaptation. So I mean, the adaptation matters students are kind of wondering, how must immediate needs to deal with increasing temperature can be balanced against the long-term goals of emission reduction? Basically, asking using adaptation methods to talk to the long-term global warming paths. And also, if there are some studies like this, are there any practical suggestions on how local communities can do about the adaptation methods? Yeah, and I must say it was one of the key messages of this assessment that yeah, I presented today,
in this attribution study, because of course, we give a little bit, it gives them the message about the urgency in terms of abating or let’s say, reducing the warming in the future. But more importantly, what it is saying is that we really need to reduce our vulnerability because the idea is that with mitigation, we know that these benefits will come in the next decades while with adaptation, these benefits can come earlier. And probably, this can be even more efficient compared to just waiting for, let’s say, the mitigation strategies to have some impacts. And it’s true that we have to think about even in the best of the scenarios today, in which we set emissions to zero, we will be any way exposed to warmer climate in the next decades. So it’s about, really again, to put emphasis into the idea of adaptation that it might be the key on this story. And with regards on how we can counteract future warming in terms of how much we can decrease our vulnerability to counteract this warming. I know that there have been some initiatives of some studies published in the past. For example, there’s a study by our colleagues in Romania that they simulate what this kind of how much
we would need to reduce our vulnerability in the future to reduce or let’s say, to keep our heat-related deaths in the future constant despite the global warming. So in a way, this is a very nice exercise. That is certainly something that as well, I’m leading an initiative within the MCC to try to address this. Because as well, this can help us about them, how much we need to adapt to really do something, to have some impacts in terms of reduction of heat-related mortality. Because imagine that if warming continues, the pace at which we adapt is not quick enough, let’s say, to kind of counteract this warming, we eventually will have the same heat-related deaths today but in the future, which of course, it would be fine. But ideally, what we would like is that the heat-related deaths happening today won’t happen in the future anyway. Thank you, Ana. I think, I saw Tobias posts a comment, “A really fantastic talk.” So I think is there are any final questions? If there’s no final question, thank you, Ana, very much for this really amazing talk. And I think both the students learned a lot from you, but thank you so much.
Thank you, thanks a lot for the invitation, my pleasure.