

WEBVTT

1 00:00:00.930 --> 00:00:03.720 <v ->Okay, welcome everyone to</v>
2 00:00:03.720 --> 00:00:07.560 the Yale Center of Climate Change and Health
seminar series.
3 00:00:07.560 --> 00:00:09.930 I'm Dr Kai Chen, assistant professor
4 00:00:09.930 --> 00:00:11.650 at the Yale School of Public Health
5 00:00:11.650 --> 00:00:14.590 and also the Yale Center on Climate Change
and Health.
6 00:00:14.590 --> 00:00:18.060 So this is my great pleasure today to introduce
7 00:00:18.060 --> 00:00:21.490 our today's speaker Professor Michelle Bell.
8 00:00:21.490 --> 00:00:25.880 Professor Bell is the Mary E Pinchot Health
Professor
9 00:00:25.880 --> 00:00:29.640 of Environmental Health at the Yale School of
Environment.
10 00:00:29.640 --> 00:00:32.903 She's a recipient of many awards,
11 00:00:33.910 --> 00:00:37.660 including the Rosenblith New Investigator
Award
12 00:00:37.660 --> 00:00:40.030 from the Health Effect Institute,
13 00:00:40.030 --> 00:00:44.400 the NIH Outstanding New Environmental Sci-
entists Award
14 00:00:44.400 --> 00:00:45.730 the ONES award.
15 00:00:45.730 --> 00:00:47.950 Last year she was selected
16 00:00:47.950 --> 00:00:51.010 to the National Academy of Medicine.
17 00:00:51.010 --> 00:00:54.210 And I think there's no better coating
18 00:00:54.210 --> 00:00:58.130 for introduce her work from the National
Academy
19 00:00:58.130 --> 00:01:01.570 of Medicine for her global latest
20 00:01:01.570 --> 00:01:05.410 in environmental health addressing critical top-
ics
21 00:01:05.410 --> 00:01:08.100 such as air pollution and climate change,
22 00:01:08.100 --> 00:01:11.640 and introducing large-scale models that have
23 00:01:11.640 --> 00:01:13.640 advanced environment research
24 00:01:13.640 --> 00:01:17.110 at both global and local levels.

25 00:01:17.110 --> 00:01:21.113 So without further ado, I would turn the mic to Michelle.

26 00:01:23.120 --> 00:01:25.560 <v ->Great, thank you for that kind introduction Kai.</v>

27 00:01:25.560 --> 00:01:27.880 I'm gonna share my screen

28 00:01:27.880 --> 00:01:32.260 and if someone could give me a thumbs up to let me know

29 00:01:32.260 --> 00:01:34.313 if it works in presentation mode.

30 00:01:36.600 --> 00:01:38.890 Went to the bottom of the presentation for some reason.

31 00:01:38.890 --> 00:01:40.190 Is it working?

32 00:01:40.190 --> 00:01:41.220 <v ->Yes, it works.</v>

33 00:01:41.220 --> 00:01:43.020 <v ->Okay, great, thank you.</v>

34 00:01:43.020 --> 00:01:45.260 So thank you so much for spending some of your day

35 00:01:45.260 --> 00:01:47.360 with me here to let me share my work.

36 00:01:47.360 --> 00:01:50.010 I'm very excited to share this research with you.

37 00:01:50.010 --> 00:01:52.140 And I want to thank Professor Chan

38 00:01:52.140 --> 00:01:54.800 and Professor Dubrow for this invitation.

39 00:01:54.800 --> 00:01:56.300 I also wanna let you know I'm suffering

40 00:01:56.300 --> 00:01:58.470 from major COVID vaccine side effects.

41 00:01:58.470 --> 00:02:02.160 So, just be kind with me today (laughing),

42 00:02:02.160 --> 00:02:03.420 but I'm very happy to be here.

43 00:02:03.420 --> 00:02:07.070 So I'm gonna talk about some work we've done on wildfires,

44 00:02:07.070 --> 00:02:09.977 air pollution and health with a special emphasis on climate

45 00:02:09.977 --> 00:02:12.580 given the the sponsor of this seminar.

46 00:02:12.580 --> 00:02:14.250 And this is an outline of the talk

47 00:02:14.250 --> 00:02:15.210 I've prepared for you today.

48 00:02:15.210 --> 00:02:17.890 I'm gonna give some general background on wildfires,

49 00:02:17.890 --> 00:02:19.690 air pollution and climate.

50 00:02:19.690 --> 00:02:21.740 I wanna share with you some research studies
51 00:02:21.740 --> 00:02:25.360 that we have conducted looking at how air
pollutions,
52 00:02:25.360 --> 00:02:28.410 or smoke from wildfires can impact human
health,
53 00:02:28.410 --> 00:02:30.030 and some of the work we've done
54 00:02:30.030 --> 00:02:32.320 in the context of climate change as well.
55 00:02:32.320 --> 00:02:33.380 I wanna briefly share
56 00:02:33.380 --> 00:02:35.640 with you some ongoing and planned research
57 00:02:35.640 --> 00:02:37.330 and then I'll have a few concluding thoughts.
58 00:02:37.330 --> 00:02:40.000 So let me start with some background.
59 00:02:40.000 --> 00:02:42.510 So this is a slide that I've had for many years.
60 00:02:42.510 --> 00:02:44.362 Some of my students may recognize this
61 00:02:44.362 --> 00:02:47.910 and I update it every year just to show the
number
62 00:02:47.910 --> 00:02:50.180 of peer reviewed journal articles
63 00:02:50.180 --> 00:02:51.850 on climate change in health.
64 00:02:51.850 --> 00:02:54.860 And you can see this just incredible growth.
65 00:02:54.860 --> 00:02:56.620 This is updated through 2020,
66 00:02:56.620 --> 00:03:01.010 where we have this incredibly strong scientific
interest
67 00:03:01.010 --> 00:03:01.843 in climate change in health.
68 00:03:01.843 --> 00:03:03.810 And I would argue a public interest
69 00:03:03.810 --> 00:03:06.830 and perhaps, political interest as well.
70 00:03:06.830 --> 00:03:11.190 If we look at the major laws and regulations
worldwide
71 00:03:11.190 --> 00:03:13.060 for the environment, not all of them
72 00:03:13.060 --> 00:03:15.070 but most of them relate to human health.
73 00:03:15.070 --> 00:03:16.930 And human health has been missing
74 00:03:16.930 --> 00:03:19.420 from much of the climate change debate.
75 00:03:19.420 --> 00:03:22.090 And so I think that this is actually
76 00:03:22.090 --> 00:03:24.890 really critically important in that

77 00:03:24.890 --> 00:03:28.620 this Yale Center that Kai and Rob run is really critical

78 00:03:28.620 --> 00:03:30.750 to advancing that effort.

79 00:03:30.750 --> 00:03:33.060 This is a figure, it's a bit complicated.

80 00:03:33.060 --> 00:03:35.050 I'm gonna walk you through parts of it

81 00:03:35.050 --> 00:03:38.800 but this is from a recent review article that we published.

82 00:03:38.800 --> 00:03:40.510 I'm gonna talk more about this article in a minute

83 00:03:40.510 --> 00:03:41.630 but we talk about the links

84 00:03:41.630 --> 00:03:44.560 between climate change, wildfire smoke and health.

85 00:03:44.560 --> 00:03:47.570 And my point for this figure is just to show

86 00:03:47.570 --> 00:03:49.660 that there are so many different pathways

87 00:03:49.660 --> 00:03:52.230 through which climate change could impact wildfires.

88 00:03:52.230 --> 00:03:54.930 It's not just that there's an overall warming.

89 00:03:54.930 --> 00:03:58.790 And so are you able to see my cursor maybe?

90 00:03:58.790 --> 00:04:02.220 Well, if you look in the upper right-hand side

91 00:04:02.220 --> 00:04:05.090 under climate change, you'll see there's high temperatures

92 00:04:05.090 --> 00:04:07.350 possibly lightening making a role,

93 00:04:07.350 --> 00:04:08.990 changes in precipitation,

94 00:04:08.990 --> 00:04:11.350 changes in wind patterns and so on.

95 00:04:11.350 --> 00:04:14.220 And then you see greenhouse gas emissions is combustion

96 00:04:14.220 --> 00:04:17.410 of fossil fuels leading down to impacts on human health.

97 00:04:17.410 --> 00:04:19.530 So my key point here being that there are a lot

98 00:04:19.530 --> 00:04:22.550 of really complex pathways through which climate change

99 00:04:22.550 --> 00:04:25.283 could impact wildfires, could impact human health.

100 00:04:26.120 --> 00:04:29.240 And this is from an article that not one of my articles,

101 00:04:29.240 --> 00:04:31.840 another researcher's article showing an increased

102 00:04:31.840 --> 00:04:34.320 in forest fires in the Western United States.

103 00:04:34.320 --> 00:04:35.660 And I wanna draw your attention

104 00:04:35.660 --> 00:04:38.550 to that lower figure with the red dots.

105 00:04:38.550 --> 00:04:42.160 And that's showing from 1984 to 2017

106 00:04:42.160 --> 00:04:47.160 this enormous change in wildfires, this is area burn.

107 00:04:47.260 --> 00:04:48.360 So this is not the smoke.

108 00:04:48.360 --> 00:04:50.310 This is the fire.

109 00:04:50.310 --> 00:04:54.500 I also wanna point out these kind of cyclical up and down,

110 00:04:54.500 --> 00:04:56.640 how we have this variation that goes up

111 00:04:56.640 --> 00:04:58.540 but in this zigzag pattern.

112 00:04:58.540 --> 00:05:01.490 This makes it very easy for someone either innocently

113 00:05:01.490 --> 00:05:05.840 or intentionally to downgrade or downplay

114 00:05:05.840 --> 00:05:09.790 the role that climate change has on wildfires.

115 00:05:09.790 --> 00:05:12.897 If they just pick off two or three points from this

116 00:05:12.897 --> 00:05:15.797 and there it looks like it's going down or not increasing.

117 00:05:18.120 --> 00:05:21.690 And I thought it might be useful today to take a step back

118 00:05:21.690 --> 00:05:24.060 to what I was thinking when I first started looking

119 00:05:24.060 --> 00:05:27.080 at wildfires and human health several years ago.

120 00:05:27.080 --> 00:05:29.390 And so I just was interested in this topic

121 00:05:29.390 --> 00:05:31.830 and started reading some publications

122 00:05:31.830 --> 00:05:33.790 from the United States government.

123 00:05:33.790 --> 00:05:35.570 And I just wanna point out two of them.

124 00:05:35.570 --> 00:05:38.570 One is from the US Forest Service, which noted

125 00:05:38.570 --> 00:05:41.180 that forest fire smoke was hazardous to human health.

126 00:05:41.180 --> 00:05:43.540 Even though there really has not been very many studies

127 00:05:43.540 --> 00:05:47.340 at the time, but they felt the US FS felt that

128 00:05:47.340 --> 00:05:49.630 given the overwhelming strong evidence

129 00:05:49.630 --> 00:05:51.450 that particulate matter from other sources

130 00:05:51.450 --> 00:05:53.700 is harmful to human health, we really should think

131 00:05:53.700 --> 00:05:56.660 that wildfire smoke is harmful to human health as well.

132 00:05:56.660 --> 00:06:00.310 And then I saw lots and lots of economic damages

133 00:06:00.310 --> 00:06:01.143 associated from wildfires.

134 00:06:01.143 --> 00:06:03.920 And I'm just pulling out one example here.

135 00:06:03.920 --> 00:06:07.510 So this is from NOAA, a US government agency

136 00:06:07.510 --> 00:06:11.350 and they estimated almost \$7 billion in property damage

137 00:06:11.350 --> 00:06:13.770 and \$58 million in crop damage

138 00:06:13.770 --> 00:06:17.070 over that period of about a decade.

139 00:06:17.070 --> 00:06:18.849 What's really interesting to me

140 00:06:18.849 --> 00:06:21.300 was part of why I got studied in this research

141 00:06:21.300 --> 00:06:24.200 is none of the estimates I found at that time

142 00:06:24.200 --> 00:06:25.270 considered human health.

143 00:06:25.270 --> 00:06:27.360 It's like nobody coughed, right?

144 00:06:27.360 --> 00:06:30.990 So my argument is that the damages from wildfires

145 00:06:30.990 --> 00:06:34.510 are grossly underestimated because they're not incorporating

146 00:06:34.510 --> 00:06:36.210 this change in human health.

147 00:06:36.210 --> 00:06:38.050 And that we had compelling evidence

148 00:06:38.050 --> 00:06:40.330 that wildfire smoke harms human health,
149 00:06:40.330 --> 00:06:42.333 but there's really a lot of uncertainty.
150 00:06:43.880 --> 00:06:45.650 And just wanna give a little more background
151 00:06:45.650 --> 00:06:46.740 about particulate matter.
152 00:06:46.740 --> 00:06:48.000 So particularly matter is
153 00:06:48.000 --> 00:06:50.510 the primary air pollutant we're concerned
about.
154 00:06:50.510 --> 00:06:52.170 I just wanna give some background.
155 00:06:52.170 --> 00:06:54.860 I think many people on this seminar will know
156 00:06:54.860 --> 00:06:56.220 a lot about particulate matter,
157 00:06:56.220 --> 00:06:58.620 but in case you're not familiar maybe you
work in water
158 00:06:58.620 --> 00:07:01.130 or some other field, it's really just exactly
159 00:07:01.130 --> 00:07:01.963 what it sounds like.
160 00:07:01.963 --> 00:07:04.360 It's particles in the air that can be made up
161 00:07:04.360 --> 00:07:06.040 of different chemical composition,
162 00:07:06.040 --> 00:07:08.930 they can have different sizes and different
shapes.
163 00:07:08.930 --> 00:07:12.670 And then really the size matters a lot.
164 00:07:12.670 --> 00:07:16.000 So this is a schematic from EPA
165 00:07:16.000 --> 00:07:17.530 showing the width of a human hair
166 00:07:17.530 --> 00:07:20.113 and then showing how small these particles
can be.
167 00:07:21.112 --> 00:07:22.080 I wanna draw your attention
168 00:07:22.080 --> 00:07:24.150 to what's (indistinct) the pink particles.
169 00:07:24.150 --> 00:07:25.330 Of course, they're not pink
170 00:07:25.330 --> 00:07:27.340 but in this figure of the pink particles
171 00:07:27.340 --> 00:07:29.940 showing that the PM 2.5 particles
172 00:07:29.940 --> 00:07:32.130 from combustion are very, very small.
173 00:07:32.130 --> 00:07:34.640 They penetrate deeper into the respiratory
system
174 00:07:34.640 --> 00:07:35.790 than do larger particles.

175 00:07:35.790 --> 00:07:37.075 And this is what we're having
176 00:07:37.075 --> 00:07:39.733 from combustion from wildfires.
177 00:07:41.840 --> 00:07:43.900 Okay, I wanna go back to this review article
178 00:07:43.900 --> 00:07:45.170 that we published recently in
179 00:07:45.170 --> 00:07:46.610 the "New England Journal of Medicine,"
180 00:07:46.610 --> 00:07:48.500 and throughout the talk, I'm gonna highlight
181 00:07:48.500 --> 00:07:50.310 some of the researchers and collaborators.
182 00:07:50.310 --> 00:07:52.130 And so this photo is Rongbin Xu,
183 00:07:52.130 --> 00:07:54.610 who was the lead author on this paper.
184 00:07:54.610 --> 00:07:59.290 And so this is an article that's a review article
185 00:07:59.290 --> 00:08:01.780 that gives some kind of synthesis of what do
we know
186 00:08:01.780 --> 00:08:04.710 about wildfires, global climate change and
human health.
187 00:08:04.710 --> 00:08:06.900 I have a slide on some of our references
188 00:08:06.900 --> 00:08:08.360 at the end of this, if you're interested.
189 00:08:08.360 --> 00:08:10.390 So if you wanna know more about this topic
190 00:08:10.390 --> 00:08:14.140 and wanna read one article or small number
of articles
191 00:08:14.140 --> 00:08:16.130 this might be one you wanna check out.
192 00:08:16.130 --> 00:08:18.300 And I wanna highlight that we went through
193 00:08:18.300 --> 00:08:19.610 and looked at the characteristics
194 00:08:19.610 --> 00:08:21.480 and health risks of wildfires.
195 00:08:21.480 --> 00:08:22.800 Like what's the state of the science.
196 00:08:22.800 --> 00:08:25.150 So let me blow up part of our table.
197 00:08:25.150 --> 00:08:27.030 So for mortality, we concluded
198 00:08:27.030 --> 00:08:29.290 there was consistent evidence.
199 00:08:29.290 --> 00:08:31.940 Those of you who have taken my class know
that I
200 00:08:31.940 --> 00:08:34.700 and other people in public health are very
cautious
201 00:08:34.700 --> 00:08:38.560 about using words like cause or proven or
things like that.

202 00:08:38.560 --> 00:08:41.060 So we use a lot of this couched language,
203 00:08:41.060 --> 00:08:45.120 consistent evidence but that should by no
means
204 00:08:45.120 --> 00:08:48.330 be considered that we don't have very strong
evidence.
205 00:08:48.330 --> 00:08:50.550 It's just scientists being really careful.
206 00:08:50.550 --> 00:08:52.720 So we have consistent evidence that there's
an increase
207 00:08:52.720 --> 00:08:55.180 in mortality from wildfire smoke
208 00:08:55.180 --> 00:08:58.470 and a real critical question is,
209 00:08:58.470 --> 00:09:00.710 are the particles from wildfire more
210 00:09:00.710 --> 00:09:03.600 or less harmful than particles from other
sources?
211 00:09:03.600 --> 00:09:05.980 This is a broader question where we could
look at particles
212 00:09:05.980 --> 00:09:08.330 from vehicles versus particles from coal com-
bustion
213 00:09:08.330 --> 00:09:10.830 versus all combustion versus agriculture
214 00:09:10.830 --> 00:09:12.600 and now versus wildfires.
215 00:09:12.600 --> 00:09:15.760 And the evidence on this it's not perfectly
consistent.
216 00:09:15.760 --> 00:09:17.060 So we said that for mortality
217 00:09:17.060 --> 00:09:19.890 wildfire particles may have a stronger effect.
218 00:09:19.890 --> 00:09:21.620 Now why would different sources
219 00:09:21.620 --> 00:09:23.730 of particles have different impacts?
220 00:09:23.730 --> 00:09:26.190 Well, as I mentioned, the particles have dif-
ferent sizes
221 00:09:26.190 --> 00:09:28.320 but they also have different chemical compo-
sitions.
222 00:09:28.320 --> 00:09:29.600 So if you have a particle
223 00:09:29.600 --> 00:09:31.970 that's coming a lot from oil combustion
224 00:09:31.970 --> 00:09:33.620 it's gonna have a lot of nickel vanadium.
225 00:09:33.620 --> 00:09:34.960 If it's coming from coal combustion,

226 00:09:34.960 --> 00:09:37.460 it's gonna have a lot of ammonium sulfate and so on.

227 00:09:37.460 --> 00:09:39.740 So different particles have different chemical structures.

228 00:09:39.740 --> 00:09:42.320 And we know these chemical structures matter

229 00:09:42.320 --> 00:09:43.500 for human health impacts.

230 00:09:43.500 --> 00:09:45.880 Although none of the particles are good for you.

231 00:09:45.880 --> 00:09:48.910 So this is why this is a critical question.

232 00:09:48.910 --> 00:09:52.700 We concluded consistent evidence of respiratory impacts

233 00:09:52.700 --> 00:09:57.050 maybe a stronger effect on asthma related events.

234 00:09:57.050 --> 00:09:59.170 So the basic summary of this table

235 00:09:59.170 --> 00:10:02.240 and my wording would be that we have very strong evidence

236 00:10:02.240 --> 00:10:03.610 that there is something happening

237 00:10:03.610 --> 00:10:05.820 for wildfire smoke harming human health,

238 00:10:05.820 --> 00:10:07.680 but there are a lot of unanswered questions

239 00:10:07.680 --> 00:10:10.810 that we could continue to investigate as well.

240 00:10:10.810 --> 00:10:12.850 So for example, the long-term health effects

241 00:10:12.850 --> 00:10:15.650 I've highlighted here we said they were largely unknown.

242 00:10:16.890 --> 00:10:19.510 So let me move to the second part of this talk

243 00:10:19.510 --> 00:10:21.778 where I really wanna highlight some of the research studies

244 00:10:21.778 --> 00:10:25.233 that my team has done looking at wildfire smoke.

245 00:10:26.160 --> 00:10:28.380 I wanna highlight my two key collaborators

246 00:10:28.380 --> 00:10:29.213 for this project.

247 00:10:29.213 --> 00:10:32.010 They're both at Harvard University, Francesca Dominici

248 00:10:32.010 --> 00:10:34.480 who's a biostatistician and Loretta Mickley

249 00:10:34.480 --> 00:10:37.410 who is a wildfire modeler amongst other things,

250 00:10:37.410 --> 00:10:39.500 amongst other types of air quality modeling.

251 00:10:39.500 --> 00:10:41.470 So I know there's a lot in this slide

252 00:10:41.470 --> 00:10:43.210 but let me just through some key features.

253 00:10:43.210 --> 00:10:45.800 So the first upper left,

254 00:10:45.800 --> 00:10:47.900 we started with forest fire emissions.

255 00:10:47.900 --> 00:10:49.640 And by we, this is Loretta Mickley

256 00:10:49.640 --> 00:10:52.160 who's an expert in this, and we have information

257 00:10:52.160 --> 00:10:54.590 on forest fires, on anthropogenic emissions,

258 00:10:54.590 --> 00:10:57.490 meteorological data we're using the GEOS-Chem model.

259 00:10:57.490 --> 00:10:58.760 And then as you move to the right,

260 00:10:58.760 --> 00:11:00.000 I don't know if you can see my cursor

261 00:11:00.000 --> 00:11:02.395 but these two orange blocks in the upper right.

262 00:11:02.395 --> 00:11:04.050 We have daily estimates of PM 2.5

263 00:11:04.955 --> 00:11:09.670 from all sources and from wildfire and from non fires.

264 00:11:09.670 --> 00:11:12.210 And then we can estimate the PM 2.5

265 00:11:12.210 --> 00:11:14.610 from wildfires specifically,

266 00:11:14.610 --> 00:11:17.040 This is an enormous advancement over

267 00:11:17.040 --> 00:11:19.410 some of the previous studies that look at satellite imagery

268 00:11:19.410 --> 00:11:21.203 and so on to really look at,

269 00:11:22.270 --> 00:11:25.440 does there appear to be a wildfire here, yes, no.

270 00:11:25.440 --> 00:11:27.290 Here we're actually estimating

271 00:11:27.290 --> 00:11:29.570 the actual level of wildfire pollution.

272 00:11:29.570 --> 00:11:31.960 And we're able to distinguish between particles

273 00:11:31.960 --> 00:11:34.870 from wildfires and particles that aren't.

274 00:11:34.870 --> 00:11:37.440 In the second aim, we're linking these estimates

275 00:11:37.440 --> 00:11:41.940 to Medicare data for the United States

276 00:11:41.940 --> 00:11:44.180 or for urban areas in the United States,

277 00:11:44.180 --> 00:11:47.350 trying to see if these wildfire smoke is associated

278 00:11:47.350 --> 00:11:48.960 with increase in hospitalizations

279 00:11:48.960 --> 00:11:50.600 and I'll show you some results later.

280 00:11:50.600 --> 00:11:52.530 And then in the third aim, we wanna look

281 00:11:52.530 --> 00:11:55.783 at what wildfires might look like under a changing climate.

282 00:11:57.500 --> 00:12:01.040 So in my talks, I like to give you a little peek

283 00:12:01.040 --> 00:12:03.380 behind the curtain of what's happening in the research.

284 00:12:03.380 --> 00:12:06.170 So this is what I'm gonna do right now.

285 00:12:06.170 --> 00:12:07.858 Sometimes I just don't like when I do this,

286 00:12:07.858 --> 00:12:10.290 you're giving away our secrets, but let me tell you

287 00:12:10.290 --> 00:12:12.460 some things that happened for wildfire smoke.

288 00:12:12.460 --> 00:12:15.124 So when I first started working on wildfires,

289 00:12:15.124 --> 00:12:17.387 the wildfire modelers, including Loretta Mickley

290 00:12:17.387 --> 00:12:20.580 and others kept talking about the validation of their model.

291 00:12:20.580 --> 00:12:24.070 This is what they were talking about is area burned, right?

292 00:12:24.070 --> 00:12:26.200 The models did very, very well for area burned,

293 00:12:26.200 --> 00:12:28.340 but I wasn't interesting area burned.

294 00:12:28.340 --> 00:12:30.100 I'm interested in this.

295 00:12:30.100 --> 00:12:32.710 So this is something really important for climate change

296 00:12:32.710 --> 00:12:34.490 human health research more broadly.

297 00:12:34.490 --> 00:12:37.190 And while we need interdisciplinary research,

298 00:12:37.190 --> 00:12:40.300 it's not good enough to just say my model was validated,
299 00:12:40.300 --> 00:12:42.210 validated for what?
300 00:12:42.210 --> 00:12:45.400 Validated to accurately estimate area burned,
301 00:12:45.400 --> 00:12:48.150 doesn't mean you're getting accurate estimates of smoke
302 00:12:49.040 --> 00:12:51.300 thousands of kilometers away.
303 00:12:51.300 --> 00:12:54.590 Alright, Loretta Mickley who's my favorite wildfire modler,
304 00:12:54.590 --> 00:12:55.423 one of my favorites.
305 00:12:55.423 --> 00:12:57.030 She got this very, very quickly.
306 00:12:57.030 --> 00:12:58.970 And so she went and did some validation
307 00:12:58.970 --> 00:13:01.240 of the wildfire smoke and we found
308 00:13:01.240 --> 00:13:03.253 that the models work well for that too.
309 00:13:05.360 --> 00:13:07.690 Next, I wanna highlight some of the research we've done
310 00:13:07.690 --> 00:13:09.930 looking at wildfire PM 2.5.
311 00:13:09.930 --> 00:13:13.010 So these are small particles fine particles in health.
312 00:13:13.010 --> 00:13:14.700 In the photo there is a one of
313 00:13:14.700 --> 00:13:16.390 the lead researchers for this work.
314 00:13:16.390 --> 00:13:19.093 She's a former PhD student Coco Liu.
315 00:13:20.380 --> 00:13:23.340 And so in this research, we had several challenges
316 00:13:23.340 --> 00:13:25.180 and I wanna highlight two of the key challenges
317 00:13:25.180 --> 00:13:27.510 to give you again a little peek behind the curtain.
318 00:13:27.510 --> 00:13:29.850 The first one is we really were interested
319 00:13:29.850 --> 00:13:34.620 in estimating wildfire smoke, the PM 2.5 from wildfires
320 00:13:34.620 --> 00:13:37.410 not just PM 2.5 during a wildfire.
321 00:13:37.410 --> 00:13:40.593 And we use that with our wildfire modeling and GEOS-Chem.

322 00:13:41.540 --> 00:13:44.090 The second challenge is one that we didn't really
323 00:13:44.090 --> 00:13:48.130 anticipate is that the day-to-day structure
324 00:13:48.130 --> 00:13:52.080 of how wildfire smoke varies in concentration
325 00:13:52.080 --> 00:13:54.380 is very different from other pollutants.
326 00:13:54.380 --> 00:13:56.460 So you can think of ozone is kind of low,
327 00:13:56.460 --> 00:13:58.370 it's high in summer, and it comes back down
328 00:13:58.370 --> 00:13:59.990 or it has a diurnal pattern
329 00:13:59.990 --> 00:14:02.230 and particles kind of do like this.
330 00:14:02.230 --> 00:14:03.920 Wildfires it's radically different.
331 00:14:03.920 --> 00:14:06.190 It's nothing, nothing, nothing crazy, crazy high,
332 00:14:06.190 --> 00:14:08.200 nothing nothing, nothing.
333 00:14:08.200 --> 00:14:12.170 So the traditional air pollution by statistical models
334 00:14:12.170 --> 00:14:16.290 to look at air pollution didn't function as well.
335 00:14:16.290 --> 00:14:18.560 So what we did and actually Coco
336 00:14:18.560 --> 00:14:21.230 came up with this new concept called a smoke weight.
337 00:14:21.230 --> 00:14:23.350 It's really analogous to a heat wave.
338 00:14:23.350 --> 00:14:28.220 So it's a series of contiguous days that have a high level
339 00:14:28.220 --> 00:14:32.080 of PM 2.5 specifically from wildfires.
340 00:14:32.080 --> 00:14:35.550 And we use this to characterize wildfire pollution episodes
341 00:14:35.550 --> 00:14:37.450 and compare the risk of different health events
342 00:14:37.450 --> 00:14:41.450 during that episode to non wildfire episodes
343 00:14:41.450 --> 00:14:44.420 that were not right up against that wildfire episode.
344 00:14:44.420 --> 00:14:47.530 So we used a variety of different definitions
345 00:14:47.530 --> 00:14:48.970 to categorize the smoke wave.
346 00:14:48.970 --> 00:14:50.400 I'm gonna show you some results,

347 00:14:50.400 --> 00:14:53.160 but you could really think of it too similar to a heat wave

348 00:14:53.160 --> 00:14:54.830 where you might have a heat wave defined

349 00:14:54.830 --> 00:14:58.070 as two or more consecutive days with temperature

350 00:14:58.070 --> 00:15:00.060 over the 95th percentile, or you could have three

351 00:15:00.060 --> 00:15:01.090 or more consecutive days,

352 00:15:01.090 --> 00:15:03.523 or you could use the 96 percentile and so on.

353 00:15:06.220 --> 00:15:08.000 So here's some of our results

354 00:15:08.000 --> 00:15:09.700 were published a few years ago.

355 00:15:09.700 --> 00:15:11.540 For this particular result I'm showing you

356 00:15:11.540 --> 00:15:13.540 it's a smoke web definition of two or more days

357 00:15:13.540 --> 00:15:17.050 with wildfire specific PM 2.5 greater than 37.

358 00:15:17.050 --> 00:15:18.750 That should be microgram per cubic meter.

359 00:15:18.750 --> 00:15:22.550 That's a typo, I'll fix it later, my apologies.

360 00:15:22.550 --> 00:15:27.210 And so what we've found or Coco's paper is that there was

361 00:15:27.210 --> 00:15:30.810 over 7% increase in respiratory hospital admissions

362 00:15:30.810 --> 00:15:33.470 for people 65 and older in the United States.

363 00:15:33.470 --> 00:15:35.110 Let's just the Western United States

364 00:15:35.110 --> 00:15:38.670 during smoke waves compared to non-smoker wave events.

365 00:15:38.670 --> 00:15:40.410 I wanna highlight another point here

366 00:15:40.410 --> 00:15:42.800 about epidemiological public health research.

367 00:15:42.800 --> 00:15:45.130 Sometimes when I'm talking to decision makers

368 00:15:45.130 --> 00:15:47.000 and people in Congress and so on,

369 00:15:47.000 --> 00:15:49.470 7% might seem like a big number to them

370 00:15:49.470 --> 00:15:51.800 or it might seem like a small number to them.

371 00:15:51.800 --> 00:15:54.260 And my students know that I caution us

372 00:15:54.260 --> 00:15:58.550 against using words like only 72.2% or trying
373 00:15:58.550 --> 00:16:00.750 to make the number sounded bigger, sound
small.
374 00:16:00.750 --> 00:16:03.100 I prefer to let the numbers speak for them-
selves.
375 00:16:03.100 --> 00:16:06.440 I do wanna point out that this number,
376 00:16:06.440 --> 00:16:11.230 the 7.2% increase is on everybody exposed to
the event.
377 00:16:11.230 --> 00:16:14.670 So a 7% increase that only affected 100 people
378 00:16:14.670 --> 00:16:16.260 might have one public health burden,
379 00:16:16.260 --> 00:16:20.440 but a 7% increase that affects huge swaths
380 00:16:20.440 --> 00:16:22.750 of population in the Western United States
381 00:16:22.750 --> 00:16:25.023 is in much much larger public health burden.
382 00:16:27.260 --> 00:16:29.490 And next I wanna share with you some results
383 00:16:29.490 --> 00:16:32.250 where we looked at different types of smoke
waves
384 00:16:32.250 --> 00:16:36.990 looking at intensity and also timing.
385 00:16:36.990 --> 00:16:38.740 So let's just look at the left-hand side.
386 00:16:38.740 --> 00:16:40.930 So this is again, the percent increase
387 00:16:42.160 --> 00:16:45.110 of respiratory hospitalizations in this case,
388 00:16:45.110 --> 00:16:46.480 looking at smoke wave intensity.
389 00:16:46.480 --> 00:16:48.960 And what you find here is that with as you
move
390 00:16:48.960 --> 00:16:51.420 to the right-hand side of that left panel,
391 00:16:51.420 --> 00:16:52.433 the effect estimates go up.
392 00:16:52.433 --> 00:16:55.520 What this means is is that when smoke waves
are more intense
393 00:16:55.520 --> 00:16:58.640 by which I mean a wildfire with higher levels
of pollution,
394 00:16:58.640 --> 00:17:00.950 the risk goes up and you see a very clear trend.
395 00:17:00.950 --> 00:17:02.450 And that makes a lot of sense.
396 00:17:03.780 --> 00:17:04.800 On the right-hand side,

397 00:17:04.800 --> 00:17:08.220 I'm looking at the days within the smoke wave.

398 00:17:08.220 --> 00:17:10.520 Again, this is really kind of analogous to a heat wave.

399 00:17:10.520 --> 00:17:13.250 So the first and second day is not where we see

400 00:17:13.250 --> 00:17:14.790 the largest health impact.

401 00:17:14.790 --> 00:17:17.700 It was really on a week,

402 00:17:17.700 --> 00:17:20.030 but really the third to seventh day of the week.

403 00:17:20.030 --> 00:17:21.430 And then the effect went down later.

404 00:17:21.430 --> 00:17:23.610 So there's really some interesting things that we need

405 00:17:23.610 --> 00:17:26.980 to start thinking about for when in a smoke wave

406 00:17:26.980 --> 00:17:30.190 to the highest health impacts for respiratory causes occur.

407 00:17:30.190 --> 00:17:32.440 You can imagine this would be really critically important

408 00:17:32.440 --> 00:17:33.750 if you were trying to do some type

409 00:17:33.750 --> 00:17:35.250 of public health intervention.

410 00:17:38.840 --> 00:17:42.590 Now, let's take these estimates of wildfire smoke

411 00:17:42.590 --> 00:17:43.840 and start thinking about them

412 00:17:43.840 --> 00:17:45.440 in the context of climate change.

413 00:17:45.440 --> 00:17:47.610 And here again, I wanna give you another

414 00:17:47.610 --> 00:17:48.900 little peek behind the curtain.

415 00:17:48.900 --> 00:17:52.290 So we generated this map at the County level

416 00:17:52.290 --> 00:17:53.780 showing changes in different smoke

417 00:17:53.780 --> 00:17:56.080 with characteristics under climate change.

418 00:17:56.080 --> 00:17:57.810 This is what I call a middle

419 00:17:57.810 --> 00:17:59.500 of the road climate change policy.

420 00:17:59.500 --> 00:18:02.320 So it's not everybody goes crazy

421 00:18:02.320 --> 00:18:03.720 lowering greenhouse gas emissions

422 00:18:03.720 --> 00:18:05.590 and it's not everybody goes crazy
423 00:18:05.590 --> 00:18:06.760 raising greenhouse gas emissions.
424 00:18:06.760 --> 00:18:09.230 It's a middle of the road scenario.
425 00:18:09.230 --> 00:18:11.670 And we're looking at the change in the number
426 00:18:11.670 --> 00:18:16.420 of smoke waves from 2046 2051 representing
the future.
427 00:18:16.420 --> 00:18:18.310 And this is really only for the fire season,
428 00:18:18.310 --> 00:18:22.300 to 2004 to 2009 representing the current day.
429 00:18:22.300 --> 00:18:23.610 And everything I'm showing you today
430 00:18:23.610 --> 00:18:25.370 is using state-of-the-art models.
431 00:18:25.370 --> 00:18:27.950 There's no reduced four models here.
432 00:18:27.950 --> 00:18:31.410 And what I want to just know before he went
to the details
433 00:18:31.410 --> 00:18:33.770 of this map is that we generated
434 00:18:33.770 --> 00:18:35.210 an online version of this map,
435 00:18:35.210 --> 00:18:38.510 where you can click on your County or County
of interests
436 00:18:38.510 --> 00:18:39.780 and look at different features.
437 00:18:39.780 --> 00:18:41.570 Look at the demographics of that County,
438 00:18:41.570 --> 00:18:44.870 look at the anticipated future demographics
of the County,
439 00:18:44.870 --> 00:18:47.120 look at different features of a smoke wave and
so on.
440 00:18:47.120 --> 00:18:50.260 And we spend a lot of time developing this
map.
441 00:18:50.260 --> 00:18:52.060 And then we just hired a Yale undergraduate
442 00:18:52.060 --> 00:18:56.150 who did it in like a weekend, super quick.
443 00:18:56.150 --> 00:18:58.250 And then I asked him,
444 00:18:58.250 --> 00:19:00.070 can I hire you to do some more work?
445 00:19:00.070 --> 00:19:02.370 And he was like, no, I'm going to work at
Google.
446 00:19:02.370 --> 00:19:04.770 So we lost our great map builder.

447 00:19:04.770 --> 00:19:08.200 But I think that my point I'm trying to make here

448 00:19:08.200 --> 00:19:10.330 is that this type of interactive map

449 00:19:10.330 --> 00:19:13.790 or some way are really helping get the results

450 00:19:13.790 --> 00:19:18.210 to a digestible usable format for decision makers

451 00:19:18.210 --> 00:19:20.870 in the general public is really critically important.

452 00:19:20.870 --> 00:19:23.410 And in some cases, it's very difficult.

453 00:19:23.410 --> 00:19:26.940 And in some cases there might be some easier solutions

454 00:19:26.940 --> 00:19:27.773 than we had thought of.

455 00:19:27.773 --> 00:19:31.470 Like in my case, hiring a undergrad computer genius

456 00:19:31.470 --> 00:19:33.520 to do it so that we didn't do it.

457 00:19:33.520 --> 00:19:35.760 So we have this map and we're looking at the difference

458 00:19:35.760 --> 00:19:37.150 in the number of smoke waves.

459 00:19:37.150 --> 00:19:39.320 And in green that shows that those counties

460 00:19:39.320 --> 00:19:42.890 will have fewer smoke waves in the future than they do now.

461 00:19:42.890 --> 00:19:44.460 And then going up to red where they

462 00:19:44.460 --> 00:19:46.320 have many, many more smoke waves.

463 00:19:46.320 --> 00:19:48.530 And we're gonna look at some other maps as well.

464 00:19:48.530 --> 00:19:51.380 And I want you to look at whatever section

465 00:19:51.380 --> 00:19:53.500 is of interest to you, but perhaps draw your attention

466 00:19:53.500 --> 00:19:55.270 to Northern California.

467 00:19:55.270 --> 00:19:57.660 So we see there that there's really

468 00:19:57.660 --> 00:19:59.770 either goes down for the number of smoke waves

469 00:19:59.770 --> 00:20:01.410 or perhaps it goes up a little bit,

470 00:20:01.410 --> 00:20:03.750 we don't have a whole lot in Northern California.

471 00:20:03.750 --> 00:20:04.940 I'm just using this as an example.

472 00:20:04.940 --> 00:20:05.773 In Northern California

473 00:20:05.773 --> 00:20:07.660 where we go to this really high level,

474 00:20:09.240 --> 00:20:11.030 but maybe those smoke waves last longer.

475 00:20:11.030 --> 00:20:12.290 So this is looking at the difference

476 00:20:12.290 --> 00:20:14.410 in the length of smoke ways where the previous one

477 00:20:14.410 --> 00:20:16.280 looked at the number of smoke waves.

478 00:20:16.280 --> 00:20:18.540 And here we see a different picture

479 00:20:18.540 --> 00:20:20.980 where we see again in Northern California,

480 00:20:20.980 --> 00:20:23.040 the smoke waves are not lasting as long.

481 00:20:23.040 --> 00:20:24.560 They're gonna be shorter, but for many

482 00:20:24.560 --> 00:20:27.840 many parts of the Western United States, in Colorado,

483 00:20:27.840 --> 00:20:31.170 Washington, Montana, Idaho and central California,

484 00:20:31.170 --> 00:20:34.530 the smoke waves are anticipated to last longer.

485 00:20:34.530 --> 00:20:37.140 And then finally looking at the intensity.

486 00:20:37.140 --> 00:20:39.050 So this is how much pollution is

487 00:20:39.050 --> 00:20:42.517 being generated by all these wildfires.

488 00:20:42.517 --> 00:20:45.450 And here, if we'd been looking at Northern California,

489 00:20:45.450 --> 00:20:48.210 we see that there really is a dramatic increase

490 00:20:48.210 --> 00:20:51.060 with Northern California having much more pollution

491 00:20:51.060 --> 00:20:54.060 from wildfires than they did previously.

492 00:20:54.060 --> 00:20:56.750 So another reason I wanted to show these maps is to show

493 00:20:56.750 --> 00:20:59.890 that these different characteristics of smoke waves

494 00:20:59.890 --> 00:21:03.980 or air pollution from wildfires, what metric you use

495 00:21:03.980 --> 00:21:05.720 in environmental health research more broadly
496 00:21:05.720 --> 00:21:10.720 can really dictate what the impression is to
policymakers.
497 00:21:11.690 --> 00:21:14.105 And again, the false impression could happen
innocently
498 00:21:14.105 --> 00:21:15.730 or it can happen on purpose
499 00:21:15.730 --> 00:21:18.570 but you could imagine someone looking at
this map
500 00:21:18.570 --> 00:21:20.760 and just saying, smoke waves are gonna last
501 00:21:20.760 --> 00:21:23.180 a shorter period of time in Northern Califor-
nia.
502 00:21:23.180 --> 00:21:25.010 So perhaps doesn't look like a big problem
503 00:21:25.010 --> 00:21:27.350 but really things are much more complex.
504 00:21:27.350 --> 00:21:30.440 And overall, our results found that under
climate change
505 00:21:30.440 --> 00:21:33.670 we anticipate the wildfires to occur more often,
506 00:21:33.670 --> 00:21:35.660 we anticipate them to last longer
507 00:21:35.660 --> 00:21:37.623 and we anticipate them to burn hotter.
508 00:21:39.850 --> 00:21:43.150 I wanna raise the issue of environmental justice
509 00:21:43.150 --> 00:21:46.480 which I'm using in the framework that envi-
ronmental justice
510 00:21:46.480 --> 00:21:49.140 is the concept and the reality
511 00:21:49.140 --> 00:21:50.990 that certain subpopulations suffer
512 00:21:50.990 --> 00:21:52.760 a disproportionate public health burden
513 00:21:52.760 --> 00:21:54.610 from environmental conditions.
514 00:21:54.610 --> 00:21:55.900 And I wanna talk about this
515 00:21:55.900 --> 00:21:59.590 in the context of wildfires under a changing
climate.
516 00:21:59.590 --> 00:22:01.960 And again, Loretta Mickley was our wildcard
modeler
517 00:22:01.960 --> 00:22:03.800 on this project you see there.
518 00:22:03.800 --> 00:22:05.640 And then the other photo is Lucio Woo
519 00:22:05.640 --> 00:22:07.200 who's a former master student.

520 00:22:07.200 --> 00:22:08.770 She's graduated master's student
521 00:22:08.770 --> 00:22:10.030 from the Yale School of the Environment.
522 00:22:10.030 --> 00:22:13.050 And this was part of her master's research
project.
523 00:22:13.050 --> 00:22:14.223 She did an amazing job.
524 00:22:15.150 --> 00:22:18.130 And so Lucio was interested in estimating
525 00:22:18.130 --> 00:22:21.460 what wildfire smoke looked like in Alaska.
526 00:22:21.460 --> 00:22:23.760 And so just to show you what that looked
like,
527 00:22:24.850 --> 00:22:27.770 there's a map showing that we see an increase
528 00:22:27.770 --> 00:22:30.950 in smoke from PM 2.5 from wildfires
529 00:22:30.950 --> 00:22:33.540 by the 2050s compared to the present day.
530 00:22:33.540 --> 00:22:36.870 But we also see a very distinct geographical
pattern
531 00:22:36.870 --> 00:22:39.757 where some parts of Alaska see a very small
increase
532 00:22:39.757 --> 00:22:42.023 and some parts see a larger increase.
533 00:22:43.370 --> 00:22:47.110 Well, Lucio was also interested in thinking
about
534 00:22:47.110 --> 00:22:50.770 which populations we're going to experience
this increase.
535 00:22:50.770 --> 00:22:53.670 And she presented her work at a conference
and meeting
536 00:22:53.670 --> 00:22:56.740 that involved many native American tribes in
Alaska.
537 00:22:56.740 --> 00:22:59.910 And they gave her guidance on how to define
538 00:22:59.910 --> 00:23:02.350 the native American tribes for her research.
539 00:23:02.350 --> 00:23:07.240 So we followed their guidance, their self defi-
nitions
540 00:23:07.240 --> 00:23:09.730 of how they wanted this work done.
541 00:23:09.730 --> 00:23:11.550 And one of the things that Lucio notice is
542 00:23:11.550 --> 00:23:16.010 that the Alaskan Athabaskan tribe was really
concentrated
543 00:23:16.010 --> 00:23:17.850 in certain parts of Alaska.

544 00:23:17.850 --> 00:23:20.950 And you see there that six to 13%.

545 00:23:20.950 --> 00:23:23.080 And here what we're plotting here

546 00:23:23.080 --> 00:23:24.660 are different native American tribes.

547 00:23:24.660 --> 00:23:29.330 Each tribe is a different color showing you the change

548 00:23:29.330 --> 00:23:33.040 or the smoke PM 2.5 exposure going

549 00:23:33.040 --> 00:23:34.700 from May to September,

550 00:23:34.700 --> 00:23:38.160 and is a function of where the tribes are located

551 00:23:38.160 --> 00:23:40.640 and where we anticipate wildfire smoke.

552 00:23:40.640 --> 00:23:43.050 You can see that this one tribe is really

553 00:23:43.050 --> 00:23:45.020 suffering a disproportionate burden

554 00:23:45.020 --> 00:23:48.030 of this anticipated increase in wildfire smoke

555 00:23:48.030 --> 00:23:49.830 under a changing climate.

556 00:23:49.830 --> 00:23:52.880 So large areas of Alaska would be anticipated

557 00:23:52.880 --> 00:23:55.070 to experience a double or tripling

558 00:23:55.070 --> 00:23:56.500 of monthly smoke exposure.

559 00:23:56.500 --> 00:24:00.500 So this is air pollution from wildfires by the 2050s,

560 00:24:00.500 --> 00:24:02.080 but there are very strong implications

561 00:24:02.080 --> 00:24:03.920 for indigenous people where these effects

562 00:24:03.920 --> 00:24:07.280 will not be experienced uniformly

563 00:24:07.280 --> 00:24:09.423 even across indigenous people in Alaska.

564 00:24:12.015 --> 00:24:13.050 All right, next I wanna share

565 00:24:13.050 --> 00:24:15.650 with you some ongoing and planned research

566 00:24:15.650 --> 00:24:17.900 that we have for the future related

567 00:24:17.900 --> 00:24:21.280 to wildfires and human health and climate change.

568 00:24:21.280 --> 00:24:23.950 And I put this figure here just 'cause I think it's neat.

569 00:24:23.950 --> 00:24:27.380 So anyone guess where my project is gonna be?

570 00:24:27.380 --> 00:24:29.307 You all know it's Australia (chuckles).

571 00:24:30.550 --> 00:24:33.240 So let me just start with these two projects
572 00:24:33.240 --> 00:24:35.530 that we have one ongoing and one's about to
get started.
573 00:24:35.530 --> 00:24:38.540 So on the left, there's a project led by Yuming
Guo.
574 00:24:38.540 --> 00:24:40.844 His photo is the far left of that photo
575 00:24:40.844 --> 00:24:43.880 right at the bottom, his photo is kind of in
the middle.
576 00:24:43.880 --> 00:24:47.100 And Yuming is leading a project with many
researchers
577 00:24:47.100 --> 00:24:49.680 around the world, including me and many,
many others,
578 00:24:49.680 --> 00:24:51.660 but we're looking at wildfires and air pollution
579 00:24:51.660 --> 00:24:54.780 in relation to a variety of human health end
points.
580 00:24:54.780 --> 00:24:57.570 And this was sponsored by the Australian
Research Council.
581 00:24:57.570 --> 00:24:58.745 So some of the advantages of this project
582 00:24:58.745 --> 00:25:01.560 is we're really trying to go global
583 00:25:01.560 --> 00:25:04.620 and look at wildfires in different parts of the
world.
584 00:25:04.620 --> 00:25:07.050 And then the second project which is planned
585 00:25:07.050 --> 00:25:09.530 and we hope to start out into this summer
586 00:25:09.530 --> 00:25:10.700 is looking at bushfires
587 00:25:10.700 --> 00:25:12.837 which is the Australian term for wildfires,
588 00:25:12.837 --> 00:25:16.320 and air pollution and risk of birth outcomes
in Australia.
589 00:25:16.320 --> 00:25:18.090 And then I've listed the names there
590 00:25:18.090 --> 00:25:21.600 of the different collaborators, including Josh
Warren
591 00:25:21.600 --> 00:25:23.990 who's a biostatistician here at Yale,
592 00:25:23.990 --> 00:25:27.830 and then several collaborators from Australia
593 00:25:27.830 --> 00:25:30.810 from multiple three different universities in
Australia.

594 00:25:30.810 --> 00:25:32.120 And Yuming is in the middle there
595 00:25:32.120 --> 00:25:33.990 because he's in both projects.
596 00:25:33.990 --> 00:25:36.720 And so for this project, as you all know,
597 00:25:36.720 --> 00:25:41.660 Australia experienced devastating wildfires in
recent years.
598 00:25:41.660 --> 00:25:43.610 And for this project, what we're really inter-
ested
599 00:25:43.610 --> 00:25:46.920 in looking at is how mothers exposure to air
pollution
600 00:25:46.920 --> 00:25:49.090 from wildfires during pregnancy
601 00:25:49.090 --> 00:25:51.380 impacts risks of adverse birth outcomes,
602 00:25:51.380 --> 00:25:54.240 looking at things like low birth weight,
preterm birth
603 00:25:54.240 --> 00:25:58.040 and a variety of other adverse birth outcomes.
604 00:25:58.040 --> 00:25:59.870 And we will be able in this project,
605 00:25:59.870 --> 00:26:03.180 we plan I should say, we plan to also look at
differences
606 00:26:03.180 --> 00:26:05.690 for the indigenous population as compared
607 00:26:05.690 --> 00:26:07.910 to the general population overall,
608 00:26:07.910 --> 00:26:11.630 and also to look at differences by socioeco-
nomic position
609 00:26:11.630 --> 00:26:15.450 and other types of factors that could be effect
modifiers
610 00:26:15.450 --> 00:26:19.260 and mean that some subpopulations might
respond differently.
611 00:26:19.260 --> 00:26:21.980 So I wanna highlight here again, the earlier
work I showed
612 00:26:21.980 --> 00:26:24.300 from Alaska with Lucio Woo was looking
613 00:26:24.300 --> 00:26:27.050 at environmental justice with relation to ex-
posure.
614 00:26:27.050 --> 00:26:29.610 In this work, we're also looking at environ-
mental justice
615 00:26:29.610 --> 00:26:32.560 in relation to response to a given health out-
come.
616 00:26:32.560 --> 00:26:34.240 So they're really multiple pathways

617 00:26:34.240 --> 00:26:35.760 through which some populations could have
618 00:26:35.760 --> 00:26:37.263 a disproportionate burden.
619 00:26:38.970 --> 00:26:40.750 Given the sponsor of the seminar,
620 00:26:40.750 --> 00:26:43.890 I wanna talk a little bit more about some
621 00:26:43.890 --> 00:26:46.050 our ongoing work looking at air pollution
622 00:26:46.050 --> 00:26:47.400 health and climate change.
623 00:26:47.400 --> 00:26:49.240 This work is not wildfire specific
624 00:26:49.240 --> 00:26:53.070 although, we may look at wildfires in here as
well
625 00:26:53.070 --> 00:26:54.310 but this is work that was funded
626 00:26:54.310 --> 00:26:56.940 by the Wellcome Trust Institute that has Yuq-
jang Zang
627 00:26:56.940 --> 00:26:58.870 and Northeastern University.
628 00:26:58.870 --> 00:27:01.030 And then you'll see our collaborators
629 00:27:01.030 --> 00:27:03.730 from multiple universities in Brazil as well.
630 00:27:03.730 --> 00:27:06.280 And here we're really focusing on two major
cities,
631 00:27:06.280 --> 00:27:09.270 San Paulo and Rio de Janeiro.
632 00:27:09.270 --> 00:27:11.730 And these slides are kind of wordy so I apol-
ogize.
633 00:27:11.730 --> 00:27:14.500 But I'm gonna walk through our ongoing work
634 00:27:14.500 --> 00:27:15.740 and our plans for that.
635 00:27:15.740 --> 00:27:18.227 So we're gonna use state of the science air
quality
636 00:27:18.227 --> 00:27:20.680 and climate change modeling to look at what
637 00:27:20.680 --> 00:27:22.390 different types of air pollutants might look
638 00:27:22.390 --> 00:27:24.200 like in the future for these cities.
639 00:27:24.200 --> 00:27:26.310 And for those of you who work with air quality
modeling,
640 00:27:26.310 --> 00:27:29.520 that's our proposed triple nested modeling
domain.
641 00:27:29.520 --> 00:27:30.853 For those of you who don't work with that,
642 00:27:30.853 --> 00:27:32.290 what that means is we start

643 00:27:32.290 --> 00:27:35.090 off with a coarser spatial resolution domain
644 00:27:35.090 --> 00:27:37.790 and then use the results from that modeling
brand
645 00:27:37.790 --> 00:27:39.410 as the inputs and boundary conditions
646 00:27:39.410 --> 00:27:41.160 of a smaller domain and so on.
647 00:27:41.160 --> 00:27:43.100 And this is a technique that's been used for
a very
648 00:27:43.100 --> 00:27:46.580 long time to get higher spatial resolution of
estimates.
649 00:27:46.580 --> 00:27:49.890 We couldn't computationally run the high
spatial resolution
650 00:27:49.890 --> 00:27:52.460 for the whole country of Brazil, for example.
651 00:27:52.460 --> 00:27:54.710 So just to summarize, we really wanna under-
stand
652 00:27:54.710 --> 00:27:56.803 air pollution and weather today and in the
future.
653 00:27:56.803 --> 00:27:59.550 Whether the levels of air pollution and
weather
654 00:27:59.550 --> 00:28:02.110 throughout these cities today will have
655 00:28:02.110 --> 00:28:05.390 very high spatial resolved estimates
656 00:28:05.390 --> 00:28:07.230 beyond what we could get from monitors.
657 00:28:07.230 --> 00:28:09.330 And we'll also know what they're anticipated
to look
658 00:28:09.330 --> 00:28:11.730 like in the future for air pollution or climate.
659 00:28:12.770 --> 00:28:15.810 Next, we wanna link those exposures to human
health.
660 00:28:15.810 --> 00:28:17.403 And we're looking at mortality.
661 00:28:18.520 --> 00:28:22.110 Brazil as many of know is suffered greatly
662 00:28:22.110 --> 00:28:25.750 under the pandemic, and so we have had some
struggles
663 00:28:25.750 --> 00:28:27.530 getting the health data from the government.
664 00:28:27.530 --> 00:28:30.350 This is not a criticism of them because they're
busy.
665 00:28:30.350 --> 00:28:33.100 So the public health departments in Brazil

666 00:28:33.100 --> 00:28:35.580 are very busy dealing with more pressing issues.

667 00:28:35.580 --> 00:28:36.890 So that has slowed us down,

668 00:28:36.890 --> 00:28:39.370 but we still are getting mortality data

669 00:28:39.370 --> 00:28:40.780 for one of our two cities

670 00:28:40.780 --> 00:28:43.195 and we'll hopefully get the other city soon.

671 00:28:43.195 --> 00:28:46.150 So we really wanna look at how mortality changes

672 00:28:46.150 --> 00:28:49.300 from air pollution, heat waves, and also single days

673 00:28:49.300 --> 00:28:52.580 of heat and cold under the current climate,

674 00:28:52.580 --> 00:28:54.010 and then we'll estimate what

675 00:28:54.010 --> 00:28:56.820 those concentration response functions

676 00:28:56.820 --> 00:28:59.400 or exposure response functions might imply under

677 00:28:59.400 --> 00:29:02.040 future conditions where we've estimated those exposure.

678 00:29:02.040 --> 00:29:05.360 So we're linking air pollution or weather and health today,

679 00:29:05.360 --> 00:29:06.710 and then we're using this estimates

680 00:29:06.710 --> 00:29:08.210 to look at this in the future.

681 00:29:09.730 --> 00:29:11.740 Just another point I wanna make

682 00:29:11.740 --> 00:29:14.380 is I'm kind of peppering this talk with some

683 00:29:14.380 --> 00:29:17.280 of my thoughts on climate change research in general.

684 00:29:17.280 --> 00:29:19.400 I believe that it is critically important

685 00:29:19.400 --> 00:29:21.990 to understand these systems in the present day,

686 00:29:21.990 --> 00:29:24.300 before we start estimating what they look

687 00:29:24.300 --> 00:29:25.230 like in the future.

688 00:29:25.230 --> 00:29:28.960 So for example, I would like to know how people respond

689 00:29:28.960 --> 00:29:30.140 to heat waves in the present day,

690 00:29:30.140 --> 00:29:31.890 before we start estimating how people

691 00:29:31.890 --> 00:29:33.610 will respond to heat waves in the future.
692 00:29:33.610 --> 00:29:36.290 This is not a universally shared position
693 00:29:36.290 --> 00:29:38.240 amongst all climate change researchers,
694 00:29:38.240 --> 00:29:40.240 climate change and health researchers.
695 00:29:40.240 --> 00:29:42.940 And then there's two more tasks of this work
696 00:29:42.940 --> 00:29:44.950 I wanna share with you that are really excit-
ing.
697 00:29:44.950 --> 00:29:47.690 One is looking at sector specific simulations.
698 00:29:47.690 --> 00:29:49.870 So by this, I just mean that we're gonna be
able
699 00:29:49.870 --> 00:29:53.550 to distinguish between the air pollution com-
ing from traffic
700 00:29:53.550 --> 00:29:55.560 the air pollution coming from industry,
701 00:29:55.560 --> 00:29:57.570 the air pollution coming from other sources.
702 00:29:57.570 --> 00:30:02.570 And so we'll be able to discuss and evaluate
which types
703 00:30:02.630 --> 00:30:06.380 of sources of air pollution are more or less
harmful.
704 00:30:06.380 --> 00:30:08.500 And this relates to the comment I made earlier
705 00:30:08.500 --> 00:30:10.610 about wildfire particles could potentially
706 00:30:10.610 --> 00:30:13.680 be more or less harmful than other types of
particles
707 00:30:13.680 --> 00:30:14.700 given the different source
708 00:30:14.700 --> 00:30:16.550 and the different chemical structure.
709 00:30:16.550 --> 00:30:19.350 So here just to summarize what sources are
most harmful.
710 00:30:20.340 --> 00:30:23.430 And then finally, we wanna look at co-benefits.
711 00:30:23.430 --> 00:30:25.820 So we're gonna analyze what would be
712 00:30:25.820 --> 00:30:28.720 some potential greenhouse gas emission poli-
cies
713 00:30:28.720 --> 00:30:31.870 that could take place today, and what would
be their impact
714 00:30:31.870 --> 00:30:34.300 on not greenhouse gas emissions
715 00:30:34.300 --> 00:30:36.770 but on air quality in the short-term.

716 00:30:36.770 --> 00:30:39.790 So if we had something that, for example
717 00:30:39.790 --> 00:30:41.470 change transportation patterns
718 00:30:41.470 --> 00:30:43.460 or increased public transportation
719 00:30:43.460 --> 00:30:45.550 that might be a policy for greenhouse gas
emissions
720 00:30:45.550 --> 00:30:48.850 but it would also likely lower particulate mat-
ter
721 00:30:48.850 --> 00:30:51.570 ozone, carbon monoxide and other pollutants
722 00:30:51.570 --> 00:30:55.460 in the near term, unlike the one to 10 year
timeframe.
723 00:30:55.460 --> 00:30:59.440 So this term is really most accurately called
co-impacts
724 00:30:59.440 --> 00:31:01.500 but it's commonly called co-benefits
725 00:31:01.500 --> 00:31:03.727 because they tend to be positive benefits.
726 00:31:03.727 --> 00:31:05.630 And so we really wanna estimate what are
the
727 00:31:05.630 --> 00:31:09.250 short-term improvements in air quality from
climate change.
728 00:31:09.250 --> 00:31:11.710 So next, I've allowed a lot of time for questions.
729 00:31:11.710 --> 00:31:12.760 I hope many of you are coming
730 00:31:12.760 --> 00:31:14.982 up with some questions or comments,
731 00:31:14.982 --> 00:31:18.460 but I just wanna give a few more just conclud-
ing thoughts.
732 00:31:18.460 --> 00:31:19.993 I just have a few more slides.
733 00:31:21.090 --> 00:31:22.870 So these are just some summary of the points
734 00:31:22.870 --> 00:31:23.950 that I tried to make today
735 00:31:23.950 --> 00:31:26.240 that they're multiple complex pathways
736 00:31:26.240 --> 00:31:29.570 through which climate change and wildfires
interact.
737 00:31:29.570 --> 00:31:32.390 There's changes in the type of fuel,
738 00:31:32.390 --> 00:31:36.400 so that's what the wildfire modelers call trees
is fuel.
739 00:31:36.400 --> 00:31:39.150 So there's changes in the type of fuel that
could happen

740 00:31:39.150 --> 00:31:40.850 due to climate precipitation,
741 00:31:40.850 --> 00:31:43.600 as well as our anthropogenic management of
forest,
742 00:31:43.600 --> 00:31:45.230 there's changes in the overall warming,
743 00:31:45.230 --> 00:31:46.390 there's changes in drought.
744 00:31:46.390 --> 00:31:48.830 It's really quite complex.
745 00:31:48.830 --> 00:31:52.350 And so we really take these estimates of wild-
fires
746 00:31:52.350 --> 00:31:56.040 in the future as kind of an overall estimate.
747 00:31:56.040 --> 00:31:58.190 We wouldn't look at like, what we think is
gonna happen
748 00:31:58.190 --> 00:32:00.763 on July 5th, 2051 or something like that.
749 00:32:01.800 --> 00:32:04.640 But the state of the science models from
Loretta Mickley
750 00:32:04.640 --> 00:32:07.280 and others show that wildfires are increasing
751 00:32:07.280 --> 00:32:09.420 in frequency, duration, and intensity.
752 00:32:09.420 --> 00:32:12.410 You'll notice, I didn't say is anticipated to
increase.
753 00:32:12.410 --> 00:32:13.630 So that was done deliberately.
754 00:32:13.630 --> 00:32:17.760 So it was believed that the wildfires are already
755 00:32:17.760 --> 00:32:20.020 due to climate change increasing in frequency,
756 00:32:20.020 --> 00:32:22.990 we're having more wildfires, they're overall
lasting longer
757 00:32:22.990 --> 00:32:24.803 and they're overall burning hotter.
758 00:32:25.850 --> 00:32:28.700 I wanna re-emphasize the point that exposure
patterns
759 00:32:28.700 --> 00:32:30.980 due to where people live and where these
760 00:32:33.662 --> 00:32:35.230 smokes with fire takes place,
761 00:32:35.230 --> 00:32:37.850 the some populations are particularly vulner-
able.
762 00:32:37.850 --> 00:32:40.110 Populations can also be vulnerable in other
ways.
763 00:32:40.110 --> 00:32:42.850 One is one group might have a higher health
response

764 00:32:42.850 --> 00:32:45.130 to exposure from smoke than others.

765 00:32:45.130 --> 00:32:48.160 Another is people might have different capacity to mitigate

766 00:32:48.160 --> 00:32:50.550 or adapt to these conditions like

767 00:32:50.550 --> 00:32:52.190 who can afford to move,

768 00:32:52.190 --> 00:32:54.560 who can afford filtration systems and so on.

769 00:32:54.560 --> 00:32:57.240 So there's really a lot of complex

770 00:32:57.240 --> 00:33:01.293 interesting aspects of vulnerability for wildfire smoke.

771 00:33:02.760 --> 00:33:04.840 And even though, as I showed in that review article,

772 00:33:04.840 --> 00:33:07.370 there are uncertainties and a lot of research to be done,

773 00:33:07.370 --> 00:33:09.590 like looking at birth outcomes and so on,

774 00:33:09.590 --> 00:33:12.300 there is overwhelming evidence that wildfire smoke

775 00:33:12.300 --> 00:33:14.710 does have a substantial public health burden.

776 00:33:14.710 --> 00:33:16.097 And as we anticipate wildfires

777 00:33:16.097 --> 00:33:18.900 and wildfire smoke to be higher in the future,

778 00:33:18.900 --> 00:33:23.060 we anticipate that burden to go even higher.

779 00:33:23.060 --> 00:33:24.880 And we still have some remaining questions.

780 00:33:24.880 --> 00:33:26.300 So some of the remaining questions

781 00:33:26.300 --> 00:33:27.810 and these are by no means all of them,

782 00:33:27.810 --> 00:33:30.470 but some of them are looking at other health outcomes.

783 00:33:30.470 --> 00:33:32.660 Most of the work to date has been done for mortality

784 00:33:32.660 --> 00:33:34.470 or hospital admissions, but you can imagine there

785 00:33:34.470 --> 00:33:36.593 many other health outcomes as well,

786 00:33:36.593 --> 00:33:38.990 looking at vulnerabilities, which populations

787 00:33:38.990 --> 00:33:42.300 are most vulnerable from a variety of pathways

788 00:33:42.300 --> 00:33:44.190 such as ability to adapt,

789 00:33:44.190 --> 00:33:47.303 such as baseline health status and so on.
790 00:33:48.140 --> 00:33:49.830 There's a lot of work to be done on links
791 00:33:49.830 --> 00:33:53.110 to chemical composition is the particles from
wildfires
792 00:33:53.110 --> 00:33:54.640 will have different chemical structures
793 00:33:54.640 --> 00:33:57.620 than particles from other sources, as different
sources
794 00:33:57.620 --> 00:34:00.070 have different chemical structures and many
more.
795 00:34:00.940 --> 00:34:05.080 And then I wanna re-highlight this point of
of co-impacts,
796 00:34:05.080 --> 00:34:06.810 which is commonly called co-benefits
797 00:34:06.810 --> 00:34:08.610 with climate change policy.
798 00:34:08.610 --> 00:34:13.010 So air quality policies are typically designed
to
799 00:34:13.010 --> 00:34:14.680 well some of them can be designed for visibil-
ity,
800 00:34:14.680 --> 00:34:16.870 but they're most air quality policies are de-
signed
801 00:34:16.870 --> 00:34:19.230 to protect human health in the short term.
802 00:34:19.230 --> 00:34:21.030 And then we have climate change policies
803 00:34:21.030 --> 00:34:24.120 that are designed to lower greenhouse gas
emissions,
804 00:34:24.120 --> 00:34:29.120 but really many of the pathways through
805 00:34:29.130 --> 00:34:32.040 which these different policies take place can
be similar.
806 00:34:32.040 --> 00:34:33.410 As I mentioned one earlier like
807 00:34:33.410 --> 00:34:35.130 changes to public transportation,
808 00:34:35.130 --> 00:34:36.920 changes to vehicle miles per gallon,
809 00:34:36.920 --> 00:34:38.340 lots of things like that.
810 00:34:38.340 --> 00:34:41.560 So many of the policies to improve air quality
811 00:34:41.560 --> 00:34:43.784 would actually lower greenhouse gas emissions,
812 00:34:43.784 --> 00:34:47.020 and many policies to avoid or mitigate climate
change

813 00:34:47.020 --> 00:34:49.460 would actually improve air quality in the short term.

814 00:34:49.460 --> 00:34:53.010 So I believe firmly that both air quality policies

815 00:34:53.010 --> 00:34:55.690 and climate change policies typically,

816 00:34:55.690 --> 00:34:57.870 have both short-term health consequences

817 00:34:57.870 --> 00:34:59.970 and long-term health consequences.

818 00:34:59.970 --> 00:35:01.930 This has been known for a very long time

819 00:35:01.930 --> 00:35:05.140 but still to this day, they tend to be studied separately

820 00:35:05.140 --> 00:35:08.740 and even bigger, they tend to be analyzed

821 00:35:08.740 --> 00:35:10.870 in policy domains separately.

822 00:35:10.870 --> 00:35:13.330 Not always, there's a growing trend to look at this

823 00:35:13.330 --> 00:35:17.080 but overall, these policies tend to be looked at separately.

824 00:35:17.080 --> 00:35:18.990 And the point I'm trying to make here is that

825 00:35:18.990 --> 00:35:21.130 if we're looking at climate change policies

826 00:35:21.130 --> 00:35:22.780 and we wanna think about, for example

827 00:35:22.780 --> 00:35:25.460 the cost benefits of a given climate change policy,

828 00:35:25.460 --> 00:35:29.480 if we are missing the links to improve air quality

829 00:35:29.480 --> 00:35:31.190 in the short term and those health benefits,

830 00:35:31.190 --> 00:35:34.000 then we do not have an accurate estimate of the implications

831 00:35:34.000 --> 00:35:36.780 of that policy and are not making an informed decision.

832 00:35:36.780 --> 00:35:39.420 This links back to my earlier slide about studies

833 00:35:39.420 --> 00:35:41.970 looking at the economic impacts of wildfires

834 00:35:41.970 --> 00:35:43.060 if we're not incorporating

835 00:35:43.060 --> 00:35:45.430 the public health burden from wildfires,

836 00:35:45.430 --> 00:35:47.720 then we're grossly underestimating that as well

837 00:35:47.720 --> 00:35:50.780 and perhaps not making the most effective decisions.

838 00:35:50.780 --> 00:35:52.580 There's some references.

839 00:35:52.580 --> 00:35:54.810 So if you asked me for a copy of the slides,

840 00:35:54.810 --> 00:35:56.127 I'll be glad to share them with

841 00:35:56.127 --> 00:35:58.440 and you can see some of our references.

842 00:35:58.440 --> 00:36:00.030 And then finally, I wanna thank the people

843 00:36:00.030 --> 00:36:02.283 who really do the work which are my team,

844 00:36:02.283 --> 00:36:03.516 and you see many of them there.

845 00:36:03.516 --> 00:36:04.520 And so thank all of you

846 00:36:04.520 --> 00:36:07.020 and I look forward to your questions and comments.

847 00:36:09.390 --> 00:36:10.440 <v ->Thank you, Michelle.</v>

848 00:36:10.440 --> 00:36:12.025 This is a wonderful presentation

849 00:36:12.025 --> 00:36:16.150 and I'm sure the audience all enjoyed like I did

850 00:36:16.150 --> 00:36:18.520 and I'm sure there will be a lot of questions.

851 00:36:18.520 --> 00:36:21.840 But just a reminder everyone, if you have questions,

852 00:36:21.840 --> 00:36:24.130 please type it in the chat box.

853 00:36:24.130 --> 00:36:27.253 We have roughly 20 minutes for the Q and A section.

854 00:36:28.315 --> 00:36:30.923 But before that, I will start with some questions

855 00:36:30.923 --> 00:36:34.543 that we have already collected from the students actually.

856 00:36:36.110 --> 00:36:39.110 So one of the question is kind of related to

857 00:36:39.110 --> 00:36:41.540 Michelle you mentioned that we should really

858 00:36:41.540 --> 00:36:44.320 try to understand better our present day

859 00:36:44.320 --> 00:36:47.210 before we try to protect the future.

860 00:36:47.210 --> 00:36:49.262 So one of the questions from students

861 00:36:49.262 --> 00:36:53.390 they notice that that a lot of mechanisms
862 00:36:53.390 --> 00:36:56.600 are behind the climate change and wildfire
863 00:36:56.600 --> 00:36:59.340 is not very well understood.
864 00:36:59.340 --> 00:37:03.330 So how can we consider these unknown con-
ditions
865 00:37:03.330 --> 00:37:06.950 or mechanisms when people want to do
866 00:37:06.950 --> 00:37:09.780 the future projection of wildfires?
867 00:37:09.780 --> 00:37:12.253 So how to consider this type of uncertainty?
868 00:37:13.580 --> 00:37:15.050 <v ->Yeah, so this is something,</v>
869 00:37:15.050 --> 00:37:18.130 so I'm not a wildfire modeler.
870 00:37:18.130 --> 00:37:20.810 And I also believe that people who have some
caveat
871 00:37:20.810 --> 00:37:23.270 in my question right away, and I also believe
872 00:37:23.270 --> 00:37:27.530 that people who do that work well, really
focus on that.
873 00:37:27.530 --> 00:37:30.590 So I wish Loretta Mickley or Yuqiang Zang
were here
874 00:37:30.590 --> 00:37:31.930 to answer that question.
875 00:37:31.930 --> 00:37:34.560 So we know that there's some aspects
876 00:37:34.560 --> 00:37:36.460 but notice I'll still answer it.
877 00:37:36.460 --> 00:37:38.980 There there's some aspects of the wildfire
modeling
878 00:37:38.980 --> 00:37:40.220 that we know work really well,
879 00:37:40.220 --> 00:37:43.250 and there other aspects that don't work as
well,
880 00:37:43.250 --> 00:37:46.340 the same thing for estimating PM 2.5 more
generally.
881 00:37:46.340 --> 00:37:49.610 So we can get pretty good estimates of PM
2.5 total mass,
882 00:37:49.610 --> 00:37:51.070 but we don't do as well and we try to look
883 00:37:51.070 --> 00:37:53.070 at the different chemical components.
884 00:37:53.070 --> 00:37:55.070 So there's really a lot of work
885 00:37:55.930 --> 00:37:59.020 looking at validating the models

886 00:37:59.020 --> 00:38:01.830 and seeing where it does well and where it doesn't do well.

887 00:38:01.830 --> 00:38:03.180 And where does well and doesn't do well

888 00:38:03.180 --> 00:38:04.510 could be in a literal where,

889 00:38:04.510 --> 00:38:08.290 like it may do well in some topographies than others,

890 00:38:08.290 --> 00:38:11.360 it may do well under some conditions than others.

891 00:38:11.360 --> 00:38:13.410 And really my understanding from working

892 00:38:13.410 --> 00:38:15.690 with the wildfire modelers is that we really wanna think

893 00:38:15.690 --> 00:38:19.380 of these as kind of large-scale estimates.

894 00:38:19.380 --> 00:38:24.040 So one of the things that we're looking at

895 00:38:24.040 --> 00:38:27.040 for the project we hope to get started

896 00:38:28.060 --> 00:38:30.670 that we'll be looking at wildfires in Australia,

897 00:38:30.670 --> 00:38:33.330 it does improve the underlying emissions inventory.

898 00:38:33.330 --> 00:38:35.880 So Loretta and her team have gone through

899 00:38:35.880 --> 00:38:38.610 the different pathways and trying to identify

900 00:38:38.610 --> 00:38:43.470 which ones are contributing the most to our uncertainty,

901 00:38:43.470 --> 00:38:45.140 and which ones are perhaps

902 00:38:45.140 --> 00:38:46.930 not perfectly captured by the model,

903 00:38:46.930 --> 00:38:49.720 but still maybe not making

904 00:38:49.720 --> 00:38:51.890 this big an impact on our estimates.

905 00:38:51.890 --> 00:38:54.380 And they have found that the underlying

906 00:38:54.380 --> 00:38:58.410 emissions of wildfires, this incorporates things like

907 00:38:58.410 --> 00:39:00.570 the fuel, the type of fuel by which I mean trees

908 00:39:00.570 --> 00:39:02.490 and vegetation, that that's really critical.

909 00:39:02.490 --> 00:39:05.360 So one of the main contributions that we're gonna make,

910 00:39:05.360 --> 00:39:07.110 and I really should say that Loretta and her team

911 00:39:07.110 --> 00:39:08.220 are gonna make to Australia is

912 00:39:08.220 --> 00:39:10.520 to improve those underline emissions inventories.

913 00:39:10.520 --> 00:39:12.430 And then we will be making those publicly available

914 00:39:12.430 --> 00:39:14.300 for other people as well.

915 00:39:14.300 --> 00:39:16.500 I just wanna highlight that some people have asked

916 00:39:16.500 --> 00:39:20.510 for a copy of my slides and I put my email in the chat.

917 00:39:20.510 --> 00:39:23.030 So if you're interested in a copy of the slides,

918 00:39:23.030 --> 00:39:24.100 I'd be glad to send them to you

919 00:39:24.100 --> 00:39:26.000 please just shoot me an email, thanks.

920 00:39:27.150 --> 00:39:28.440 <v ->Thank you Michelle.</v>

921 00:39:28.440 --> 00:39:33.440 I think your talk illustrated the complexity

922 00:39:33.480 --> 00:39:35.710 of this multidisciplinary work.

923 00:39:35.710 --> 00:39:38.660 So another question from the students

924 00:39:38.660 --> 00:39:43.130 they're more interested in how the local communities

925 00:39:43.130 --> 00:39:47.570 can do about it in the short term kind of mitigation's way.

926 00:39:47.570 --> 00:39:50.250 So can you share some of your suggestions

927 00:39:51.360 --> 00:39:55.240 the local community when they're facing the danger

928 00:39:55.240 --> 00:39:58.160 from climate change health can they do about it?

929 00:39:58.160 --> 00:40:01.083 <v ->Yeah, I wanna share a slide actually.</v>

930 00:40:02.980 --> 00:40:04.680 Can you see my slide, did it work?

931 00:40:04.680 --> 00:40:06.290 <v ->Yeah, okay.</v>

932 00:40:06.290 --> 00:40:09.130 <v ->So this is a figure that I just didn't include</v>

933 00:40:09.130 --> 00:40:11.060 an individual level protective measures

934 00:40:11.060 --> 00:40:12.303 from our review article.

935 00:40:13.434 --> 00:40:18.070 And here you can see we've kind of started at the top

936 00:40:18.070 --> 00:40:20.557 with most effective which is to eliminate the exposure.

937 00:40:20.557 --> 00:40:22.500 And so this is all based on the individual.

938 00:40:22.500 --> 00:40:26.130 This is not based on a like a federal policy.

939 00:40:26.130 --> 00:40:28.020 There's many other things they could do as well.

940 00:40:28.020 --> 00:40:33.020 So the first one, the biggest impact is to relocate, right?

941 00:40:35.700 --> 00:40:37.930 That could be permanent or temporary,

942 00:40:37.930 --> 00:40:40.350 but like to temporary relocate when there's wildfires

943 00:40:40.350 --> 00:40:41.850 and then there's engineering controls

944 00:40:41.850 --> 00:40:43.657 that can reduce exposure by 20 to 90%,

945 00:40:43.657 --> 00:40:45.900 depending on the quality of builders,

946 00:40:45.900 --> 00:40:46.840 none of them are perfect.

947 00:40:46.840 --> 00:40:49.600 You cannot get away from this with filters.

948 00:40:49.600 --> 00:40:51.250 Filtering industry doesn't like me to say that,

949 00:40:51.250 --> 00:40:52.950 but it's true.

950 00:40:52.950 --> 00:40:57.123 And then what we call administrative controls.

951 00:41:01.172 --> 00:41:02.803 So I'm gonna take a little bit of water.

952 00:41:06.030 --> 00:41:07.230 This vaccine is no joke.

953 00:41:09.040 --> 00:41:10.420 But yay science, I'm happy for it.

954 00:41:10.420 --> 00:41:13.390 So the third level down to shown in the kind of page

955 00:41:13.390 --> 00:41:14.580 is administrative controls.

956 00:41:14.580 --> 00:41:16.630 So that's things like staying indoors,

957 00:41:16.630 --> 00:41:19.550 avoiding heavy activity outside and so on,

958 00:41:19.550 --> 00:41:21.210 and then personal protective equipment

959 00:41:21.210 --> 00:41:24.100 like wearing a face mask and so on.

960 00:41:24.100 --> 00:41:27.010 And so you can see if we were to unpack
961 00:41:27.010 --> 00:41:30.420 this a little bit further, some of these activities
962 00:41:30.420 --> 00:41:33.200 are easier than others like wearing a face mask,
963 00:41:33.200 --> 00:41:34.260 it's not that hard.
964 00:41:34.260 --> 00:41:35.460 Some of them are harder than others,
965 00:41:35.460 --> 00:41:37.290 like to literally leave your home.
966 00:41:37.290 --> 00:41:38.770 Some of them may be more feasible
967 00:41:38.770 --> 00:41:41.450 for some people than others, like the financial
cost
968 00:41:41.450 --> 00:41:44.430 of relocating, financial cost of filters.
969 00:41:44.430 --> 00:41:46.300 And some of them have other implications
970 00:41:46.300 --> 00:41:48.700 like social and cultural implications.
971 00:41:48.700 --> 00:41:50.640 Like, what does it mean if children
972 00:41:50.640 --> 00:41:53.943 can't play outside for months?
973 00:41:54.830 --> 00:41:58.233 So all of these things are really,
974 00:41:59.587 --> 00:42:00.590 I don't wanna say bandaid solutions,
975 00:42:00.590 --> 00:42:03.420 but none of them are fully satisfactory.
976 00:42:03.420 --> 00:42:05.110 But there are a variety of things
977 00:42:05.110 --> 00:42:07.810 that we've come up with to kind of highlight
978 00:42:07.810 --> 00:42:10.310 some things that an individual can do.
979 00:42:10.310 --> 00:42:12.910 But really what we'd love to do for exposure
980 00:42:12.910 --> 00:42:14.780 is everyone who works environment exposure
knows
981 00:42:14.780 --> 00:42:17.820 is to stop the exposure itself from happening,
982 00:42:17.820 --> 00:42:19.700 rather than trying to address
983 00:42:19.700 --> 00:42:21.350 the public health on the backend.
984 00:42:23.210 --> 00:42:24.300 <v ->Thanks, Michelle.</v>
985 00:42:24.300 --> 00:42:27.620 There's a question from the audience from
Glenn Homan,
986 00:42:27.620 --> 00:42:30.813 are children more vulnerable to the effects of
wildfires.
987 00:42:32.440 --> 00:42:34.830 <v ->So that's a really great question.</v>

988 00:42:34.830 --> 00:42:36.860 And so I'm gonna couch it in two parts.

989 00:42:36.860 --> 00:42:39.130 So the first answer is we really don't know

990 00:42:39.130 --> 00:42:41.640 because there hasn't been as much research.

991 00:42:41.640 --> 00:42:45.020 The second part of my question is I would suspect yes.

992 00:42:45.020 --> 00:42:48.080 So children tend to be more vulnerable than healthy adults

993 00:42:48.080 --> 00:42:50.530 to air pollution in general, to particles in general.

994 00:42:50.530 --> 00:42:52.180 And there's a variety of reasons.

995 00:42:53.366 --> 00:42:55.740 Their systems are still under development.

996 00:42:55.740 --> 00:42:58.740 They breathe in more air per body weight than do adults

997 00:42:58.740 --> 00:43:02.160 and they historically spend more time outside.

998 00:43:02.160 --> 00:43:05.200 Although that's actually changed in the last few generations

999 00:43:05.200 --> 00:43:06.330 but historically they spend more time outside.

1000 00:43:06.330 --> 00:43:08.040 So there's a variety of reasons why children

1001 00:43:08.040 --> 00:43:11.160 are more susceptible to air pollution

1002 00:43:11.160 --> 00:43:14.140 writ large than are like other healthy adults.

1003 00:43:14.140 --> 00:43:17.550 Now, much older populations are also susceptible as well.

1004 00:43:17.550 --> 00:43:20.080 And so while we don't have the evidence

1005 00:43:20.080 --> 00:43:22.890 the strong evidence for this for wildfire smoke,

1006 00:43:22.890 --> 00:43:25.420 I think it's certainly very plausible

1007 00:43:25.420 --> 00:43:26.970 and I would argue likely

1008 00:43:26.970 --> 00:43:28.410 that some of those same mechanisms

1009 00:43:28.410 --> 00:43:33.020 would take place for children in wildfire smoke as well.

1010 00:43:33.020 --> 00:43:34.050 But this is certainly an area where

1011 00:43:34.050 --> 00:43:36.450 we need some more studies to really pinpoint it.

1012 00:43:37.920 --> 00:43:38.760 <v ->Thanks, Michelle.</v>

1013 00:43:38.760 --> 00:43:43.740 So I know we talk a lot about short-term effects here

1014 00:43:43.740 --> 00:43:47.210 and the students are also wondering

1015 00:43:47.210 --> 00:43:52.210 like what can the policymakers do to better report

1016 00:43:54.080 --> 00:43:58.930 or even do research on the long-term health consequences

1017 00:43:58.930 --> 00:44:00.403 of the wildfire exposure?

1018 00:44:01.290 --> 00:44:05.500 <v ->Yeah, so I didn't mean to talk over you.</v>

1019 00:44:05.500 --> 00:44:08.530 <v ->No, no, no, the student's question is just,</v>

1020 00:44:08.530 --> 00:44:11.130 do you have any suggestions?

1021 00:44:11.130 --> 00:44:13.920 What would be the important pieces to focus on

1022 00:44:13.920 --> 00:44:15.760 such public health (indistinct)

1023 00:44:15.760 --> 00:44:18.123 and how can we collect those data?

1024 00:44:19.460 --> 00:44:20.850 <v ->Yeah, so there's a lot there.</v>

1025 00:44:20.850 --> 00:44:23.570 And in the review article,

1026 00:44:23.570 --> 00:44:24.590 I think I may have mentioned this

1027 00:44:24.590 --> 00:44:26.990 that we categorized the health impacts

1028 00:44:26.990 --> 00:44:30.255 of long-term exposure to wildfires as being more uncertain.

1029 00:44:30.255 --> 00:44:33.360 So again, I'm gonna kind of answer

1030 00:44:33.360 --> 00:44:34.360 this in a few different parts.

1031 00:44:34.360 --> 00:44:37.860 So the first is it's more uncertain for longterm effects,

1032 00:44:37.860 --> 00:44:40.310 much much more is known about short-term effects.

1033 00:44:41.550 --> 00:44:44.540 Again, it seems very plausible that both will play a role

1034 00:44:44.540 --> 00:44:48.270 because they do for particles more broadly, right?

1035 00:44:48.270 --> 00:44:51.680 Short-term exposure and so by this I mean my exposure today

1036 00:44:51.680 --> 00:44:54.193 and over the past few days, maybe to a week,
1037 00:44:55.220 --> 00:44:56.053 my exposure to air pollution or
1038 00:44:56.053 --> 00:44:57.840 in that timeframe matters for my human
health
1039 00:44:57.840 --> 00:45:00.840 but my exposure over the past several years
matters.
1040 00:45:00.840 --> 00:45:03.390 And actually my exposure in neutral matters,
1041 00:45:03.390 --> 00:45:05.290 like everything matters.
1042 00:45:05.290 --> 00:45:08.270 We don't know as much about that for wild-
fires.
1043 00:45:08.270 --> 00:45:10.320 Some reasons why it's important to study
1044 00:45:10.320 --> 00:45:14.250 and difficult to study is that the concentra-
tion levels
1045 00:45:14.250 --> 00:45:17.840 for wildfire smoke are very different from
other pollutants.
1046 00:45:17.840 --> 00:45:19.020 As I mentioned, it's like nothing
1047 00:45:19.020 --> 00:45:21.770 nothing crazy high, nothing, nothing.
1048 00:45:21.770 --> 00:45:24.290 So what does it mean if you're getting
1049 00:45:24.290 --> 00:45:27.310 those stressors or those crazy high?
1050 00:45:27.310 --> 00:45:28.160 That's my scientific term
1051 00:45:28.160 --> 00:45:30.430 the crazy high wildfire pollution.
1052 00:45:30.430 --> 00:45:32.800 If you're getting it several times a year
1053 00:45:32.800 --> 00:45:35.810 or every year, year after year,
1054 00:45:35.810 --> 00:45:38.790 as opposed to just the impact from getting
it once.
1055 00:45:38.790 --> 00:45:41.280 And that's very different from kind of like
my exposure
1056 00:45:41.280 --> 00:45:44.970 to traffic particles, which is just going up
and down,
1057 00:45:44.970 --> 00:45:48.070 changes day to day of the week and so on
1058 00:45:48.070 --> 00:45:50.430 but really is not having these strong events.
1059 00:45:50.430 --> 00:45:52.690 So it's really these kinds of like huge stressors
1060 00:45:52.690 --> 00:45:55.230 that come and go away and come and go
away.

1061 00:45:55.230 --> 00:45:57.050 So to understand that we need things
1062 00:45:57.050 --> 00:45:59.920 like knowing where people have been for
several years.
1063 00:45:59.920 --> 00:46:02.210 We need really good estimates of wildfire
exposure
1064 00:46:02.210 --> 00:46:04.200 over several years, and I predict
1065 00:46:04.200 --> 00:46:06.740 that some of the future areas of research for
this
1066 00:46:06.740 --> 00:46:10.050 will deal with some of the things on that
previous slide
1067 00:46:10.050 --> 00:46:11.290 relating to the other good question
1068 00:46:11.290 --> 00:46:13.070 about individual level protective measures.
1069 00:46:13.070 --> 00:46:17.020 So, this group of people
1070 00:46:17.020 --> 00:46:18.640 had a pec major filtration systems
1071 00:46:18.640 --> 00:46:19.640 and trying to stay inside,
1072 00:46:19.640 --> 00:46:21.750 and these people were not able to.
1073 00:46:21.750 --> 00:46:24.230 There's a lot of things there that we really
need
1074 00:46:24.230 --> 00:46:25.930 to parse out to really try to get
1075 00:46:25.930 --> 00:46:27.803 a handle of long-term exposure.
1076 00:46:30.226 --> 00:46:33.500 <v ->Thanks, Michelle, there are many other
questions</v>
1077 00:46:33.500 --> 00:46:35.310 from the students regarding
1078 00:46:35.310 --> 00:46:37.943 especially on the review paper.
1079 00:46:39.580 --> 00:46:41.650 But I also encourage the audience
1080 00:46:41.650 --> 00:46:45.290 if you have questions to the whole talk,
1081 00:46:45.290 --> 00:46:48.210 so please feel free to type in your questions.
1082 00:46:48.210 --> 00:46:50.370 Or if you like, you can unmute yourself
1083 00:46:50.370 --> 00:46:52.410 and ask the questions.
1084 00:46:52.410 --> 00:46:55.593 I would just ask them one more question
from the students.
1085 00:46:57.670 --> 00:47:01.150 Kind of related to the individual level
1086 00:47:01.150 --> 00:47:03.200 what the local communities can do,

1087 00:47:03.200 --> 00:47:06.630 one of the ways is prescribed burning
1088 00:47:07.640 --> 00:47:09.610 to mitigate the wildfires.
1089 00:47:09.610 --> 00:47:12.411 So several students are kind of interesting,
1090 00:47:12.411 --> 00:47:15.358 as a policymaker, how can you determine
whether,
1091 00:47:15.358 --> 00:47:20.358 just let it burn or do something additional
about it.
1092 00:47:20.500 --> 00:47:25.500 And students are wondering if there are any
studies
1093 00:47:25.600 --> 00:47:29.280 to look at this prescribed burning
1094 00:47:29.280 --> 00:47:33.603 can we see does it cost effectively prevented
the wildfires?
1095 00:47:35.960 --> 00:47:37.820 <v ->Yeah, so the prescribed burning ques-
tion</v>
1096 00:47:37.820 --> 00:47:39.480 is very interesting.
1097 00:47:39.480 --> 00:47:42.500 There have not been as much study
1098 00:47:42.500 --> 00:47:44.260 on the health impacts of prescribed burn,
1099 00:47:44.260 --> 00:47:46.080 but air pollution is air pollution.
1100 00:47:46.080 --> 00:47:48.490 So prescribed burn which is being done
1101 00:47:48.490 --> 00:47:52.630 is a forest management strategy
1102 00:47:52.630 --> 00:47:54.610 is also producing air pollution.
1103 00:47:54.610 --> 00:47:57.140 And so it's very interesting talking to com-
munities
1104 00:47:57.140 --> 00:48:00.787 and decision-makers on their different, en-
forced managers
1105 00:48:00.787 --> 00:48:05.400 on their different perspectives and the differ-
ent angles
1106 00:48:05.400 --> 00:48:07.665 at which they're coming at this issue.
1107 00:48:07.665 --> 00:48:08.610 So for many people in the community
1108 00:48:08.610 --> 00:48:12.110 like all fires are bad in their perception,
1109 00:48:12.110 --> 00:48:15.440 whether it be prescribed burn to stop a larger
fire leader
1110 00:48:15.440 --> 00:48:17.120 or whether it be a wildfire

1111 00:48:17.120 --> 00:48:19.750 because they're getting the smoke of it regardless.

1112 00:48:19.750 --> 00:48:22.210 And from a forest management perspective,

1113 00:48:22.210 --> 00:48:24.130 you often will have prescribed burns

1114 00:48:24.130 --> 00:48:26.720 deliberately to try to avoid that things later on.

1115 00:48:26.720 --> 00:48:29.920 And I'm not a forest manager, but like these are done

1116 00:48:30.780 --> 00:48:33.051 based on scientific research that

1117 00:48:33.051 --> 00:48:36.370 we need to do this to control our forest.

1118 00:48:36.370 --> 00:48:40.750 And then from a climate change perspective, we have to think

1119 00:48:40.750 --> 00:48:42.737 about what does this mean for prescribed burns

1120 00:48:42.737 --> 00:48:44.320 and the changing in vegetation patterns.

1121 00:48:44.320 --> 00:48:45.720 Are we gonna have more prescribed burns?

1122 00:48:45.720 --> 00:48:47.450 Are we gonna have fewer prescribed burns,

1123 00:48:47.450 --> 00:48:48.650 but like what should we do

1124 00:48:48.650 --> 00:48:51.524 for prescribed burns is very delicate,

1125 00:48:51.524 --> 00:48:54.790 especially in terms of the research for air pollution.

1126 00:48:54.790 --> 00:48:56.160 And I think that's part of why most

1127 00:48:56.160 --> 00:48:59.253 of the research has really focused on wildfires.

1128 00:49:00.530 --> 00:49:02.830 I think Rob may have been trying to chime in

1129 00:49:02.830 --> 00:49:05.120 and then I also see a question in the chat.

1130 00:49:05.120 --> 00:49:07.481 Rob, were you trying to chime in?

1131 00:49:07.481 --> 00:49:11.720 <v ->Yeah, the first great, great talk, Michelle.</v>

1132 00:49:11.720 --> 00:49:14.760 Yeah, I know your research focuses

1133 00:49:14.760 --> 00:49:18.230 on the wildfire smoke and air pollution,

1134 00:49:18.230 --> 00:49:20.840 but there's another element that I wonder

1135 00:49:20.840 --> 00:49:23.210 if it's something that you've considered

1136 00:49:23.210 --> 00:49:28.210 which is the help that when there are wild-fires,
1137 00:49:28.440 --> 00:49:31.540 people are displaced sometimes short term,
1138 00:49:31.540 --> 00:49:34.800 sometimes longer term, you know people lose their homes
1139 00:49:35.840 --> 00:49:38.150 and their lives are disrupted
1140 00:49:38.150 --> 00:49:40.643 and there are potential health effects of that
1141 00:49:40.643 --> 00:49:43.820 that could be disruption in medical care.
1142 00:49:43.820 --> 00:49:48.370 And from what I've gathered, those longer term effects,
1143 00:49:48.370 --> 00:49:51.370 those types of effects have really been understudied.
1144 00:49:51.370 --> 00:49:52.260 And I'm just wondering
1145 00:49:52.260 --> 00:49:55.930 if you have any thoughts about that aspect.
1146 00:49:55.930 --> 00:49:58.010 <v ->Yeah, this is a really great question</v>
1147 00:49:58.010 --> 00:49:59.790 and I wanna kind of unpack several things.
1148 00:49:59.790 --> 00:50:04.790 So there's a lot to learn about
1149 00:50:04.950 --> 00:50:07.210 our response to environmental disasters.
1150 00:50:07.210 --> 00:50:09.670 And what does that mean in respect to human health?
1151 00:50:09.670 --> 00:50:12.880 And what does that mean for respect to physical health?
1152 00:50:12.880 --> 00:50:14.590 What does that mean with respect to mental health?
1153 00:50:14.590 --> 00:50:19.340 What does it mean in respect to disruption of healthcare?
1154 00:50:19.340 --> 00:50:21.060 There's some really great work that was done
1155 00:50:21.060 --> 00:50:23.320 by a former master student, Leo Goldsmith
1156 00:50:23.320 --> 00:50:25.230 who looked at a variety of ways
1157 00:50:25.230 --> 00:50:28.940 in which the LGBTQ community has disproportionate impacts
1158 00:50:28.940 --> 00:50:29.910 from environmental hazards.
1159 00:50:29.910 --> 00:50:31.820 But one of them is disaster response

1160 00:50:31.820 --> 00:50:36.820 where LGBTQ+ individuals are turned away at shelters,

1161 00:50:37.106 --> 00:50:39.683 don't have access to their medication and so on.

1162 00:50:40.900 --> 00:50:41.733 And then there's the

1163 00:50:41.733 --> 00:50:43.190 also the issue of who can afford to move.

1164 00:50:43.190 --> 00:50:44.670 There's also some great work being done

1165 00:50:44.670 --> 00:50:49.100 by my PhD student Kate Burroughs, looking at displacement

1166 00:50:49.100 --> 00:50:51.900 and migration from landslides in Indonesia

1167 00:50:51.900 --> 00:50:54.610 and looking at the mental health

1168 00:50:54.610 --> 00:50:56.610 and wellbeing aspects there's as well.

1169 00:50:56.610 --> 00:50:58.727 But there hasn't been as much for wildfires.

1170 00:50:58.727 --> 00:51:01.440 And I think it's something that probably

1171 00:51:01.440 --> 00:51:04.050 needs to be looked at and I'm expanding it out

1172 00:51:04.050 --> 00:51:05.470 to disasters more broadly.

1173 00:51:05.470 --> 00:51:09.010 So like hurricanes, wildfires just

1174 00:51:09.010 --> 00:51:11.440 the environmental disasters that we anticipate

1175 00:51:11.440 --> 00:51:14.130 to be growing under climate change to happen more

1176 00:51:14.130 --> 00:51:16.420 often to happen in a more intense way,

1177 00:51:16.420 --> 00:51:18.890 what does this mean for the economic

1178 00:51:18.890 --> 00:51:21.380 and health costs of relocation?

1179 00:51:21.380 --> 00:51:23.320 What does it mean for the economic disruption

1180 00:51:23.320 --> 00:51:25.880 of that community if people have to get up and leave?

1181 00:51:25.880 --> 00:51:28.420 I mean there's all sorts of things that communities

1182 00:51:28.420 --> 00:51:30.890 have talked about with me and wildfires in terms of things

1183 00:51:30.890 --> 00:51:32.323 like my housing price.

1184 00:51:35.140 --> 00:51:38.230 And there's designs of homes where you can like

1185 00:51:39.340 --> 00:51:42.640 try to make sure you don't have brush near the house

1186 00:51:42.640 --> 00:51:43.700 so that if it's a wildfire

1187 00:51:43.700 --> 00:51:46.123 it doesn't zoom up on your house and so on,

1188 00:51:47.040 --> 00:51:50.070 these things, it was very clear to me that these things

1189 00:51:50.070 --> 00:51:52.810 are taking a mental toll as well.

1190 00:51:52.810 --> 00:51:55.960 So I think this is a very understudied issue

1191 00:51:55.960 --> 00:51:59.100 and I think there are multiple facets to it

1192 00:51:59.100 --> 00:52:01.140 where different populations are affected differently.

1193 00:52:01.140 --> 00:52:04.253 And this is something we really should be looking into.

1194 00:52:06.800 --> 00:52:08.620 Can I answer the question in the chat next?

1195 00:52:08.620 --> 00:52:09.840 Kai, is that okay?

1196 00:52:09.840 --> 00:52:11.646 <v ->Yeah, please go on.</v> <v ->Okay, great.</v>

1197 00:52:11.646 --> 00:52:14.369 Do you want me to read it?

1198 00:52:14.369 --> 00:52:17.270 <v ->No, no, no, please go ahead.</v>

1199 00:52:17.270 --> 00:52:18.537 <v ->Okay, I'm gonna read it.</v>

1200 00:52:18.537 --> 00:52:20.540 And this is from Evan Brockman.

1201 00:52:20.540 --> 00:52:21.810 As the climate health researcher,

1202 00:52:21.810 --> 00:52:23.020 what changes would you like to see

1203 00:52:23.020 --> 00:52:25.130 in data collection in regards to air quality?

1204 00:52:25.130 --> 00:52:27.790 We are discussing what to add to our EHR as clinicians

1205 00:52:27.790 --> 00:52:28.740 who directly see patients

1206 00:52:28.740 --> 00:52:31.270 who suffer after exposure, thank you.

1207 00:52:31.270 --> 00:52:36.270 So with respect to data, I'm not sure if the person

1208 00:52:36.990 --> 00:52:39.550 that's in the question is thinking of health data

1209 00:52:39.550 --> 00:52:41.050 or air pollution data.

1210 00:52:41.050 --> 00:52:43.480 It kind of seems that maybe health data

1211 00:52:44.600 --> 00:52:47.200 but I'm gonna answer all those questions (laughing).

1212 00:52:48.330 --> 00:52:50.100 So with respect to air quality,

1213 00:52:50.100 --> 00:52:54.330 we really need more monitors in rural areas,

1214 00:52:54.330 --> 00:52:56.770 not just to try to study those populations

1215 00:52:56.770 --> 00:52:58.780 'cause they're different but also the air pollution

1216 00:52:58.780 --> 00:52:59.670 could be different as well.

1217 00:52:59.670 --> 00:53:00.730 We are really hindered.

1218 00:53:00.730 --> 00:53:03.170 This is worldwide by having our monitors

1219 00:53:03.170 --> 00:53:05.780 being predominantly located in urban areas.

1220 00:53:05.780 --> 00:53:07.140 With respect to human health,

1221 00:53:07.140 --> 00:53:09.360 I think that there's some types of data sources

1222 00:53:09.360 --> 00:53:12.090 for human health that we can get a pretty good handle on,

1223 00:53:12.090 --> 00:53:16.380 like hospital emissions, mortality and other things

1224 00:53:16.380 --> 00:53:18.420 that it's much harder to get a handle on.

1225 00:53:18.420 --> 00:53:21.550 And just to get back to Professor Dubrow's point,

1226 00:53:21.550 --> 00:53:23.820 like mental health and wellbeing.

1227 00:53:23.820 --> 00:53:28.240 And so I think that some of those

1228 00:53:28.240 --> 00:53:31.570 perhaps under the surface types of health outcomes

1229 00:53:31.570 --> 00:53:33.410 that could have an enormous public health burden

1230 00:53:33.410 --> 00:53:36.110 are ones that we really probably should start looking at

1231 00:53:36.110 --> 00:53:38.230 more in relation to air pollution.

1232 00:53:38.230 --> 00:53:39.430 I hope I've answered your question.

1233 00:53:39.430 --> 00:53:41.790 I'm not sure if I misunderstood it, thank you.

1234 00:53:45.410 --> 00:53:47.620 <v ->Michelle, I think there's another, yeah.</v>

1235 00:53:47.620 --> 00:53:50.250 <v ->Okay, I'm gonna ask this, is the dense network</v>

1236 00:53:50.250 --> 00:53:51.860 of low cost air quality sensors

1237 00:53:51.860 --> 00:53:54.300 good enough to serve as input to your models.

1238 00:53:54.300 --> 00:53:57.830 Well, it depends on the model and on the monitor.

1239 00:53:57.830 --> 00:54:01.770 So we're often modeling at a nation level.

1240 00:54:01.770 --> 00:54:06.050 So we would need like a huge network.

1241 00:54:06.050 --> 00:54:08.520 And the low cost air quality centers,

1242 00:54:08.520 --> 00:54:12.280 so cost and quality are associated in air quality monitors.

1243 00:54:12.280 --> 00:54:15.430 So a low cost monitor can measure very, very well

1244 00:54:15.430 --> 00:54:17.570 depending on what it's measuring or it might not,

1245 00:54:17.570 --> 00:54:20.420 that's not a negative comment on those monitors.

1246 00:54:20.420 --> 00:54:23.680 Sometimes that's perfectly good for your purposes.

1247 00:54:23.680 --> 00:54:25.970 So I guess my short answer would be,

1248 00:54:25.970 --> 00:54:27.583 it really kind of depends.

1249 00:54:31.080 --> 00:54:33.420 <v ->Michelle, I have a question, all right?</v>

1250 00:54:33.420 --> 00:54:38.340 You mentioned that I think why you initiated this study

1251 00:54:38.340 --> 00:54:41.286 to look at the wildfires because when you look

1252 00:54:41.286 --> 00:54:44.090 at previous reports on almost no damage

1253 00:54:44.090 --> 00:54:47.420 was taking into account with the health burden,

1254 00:54:47.420 --> 00:54:49.060 I think it speaks true for all

1255 00:54:49.060 --> 00:54:53.060 the other extreme weather and climate change.

1256 00:54:53.060 --> 00:54:57.240 So would you like to share more source more broadly

1257 00:54:59.213 --> 00:55:00.800 the economy burden on climate change

1258 00:55:00.800 --> 00:55:04.373 and how as a researcher, what we should do about it?

1259 00:55:05.220 --> 00:55:08.750 <v ->Yeah, so I think that is, I alluded to</v>

1260 00:55:08.750 --> 00:55:11.230 I think that human health is missing

1261 00:55:11.230 --> 00:55:13.200 from part of the climate change discussion.

1262 00:55:13.200 --> 00:55:17.790 And by the discussion I mean, in political decisions

1263 00:55:17.790 --> 00:55:21.090 and in the general press and the mass media

1264 00:55:21.090 --> 00:55:23.470 and in community discussions.

1265 00:55:23.470 --> 00:55:28.470 And so there's a very different response to learning

1266 00:55:29.190 --> 00:55:32.350 that sea level rise might impact a country halfway

1267 00:55:32.350 --> 00:55:36.090 around the world, as opposed to learning that asthma rates

1268 00:55:36.090 --> 00:55:38.320 in your community are likely to go up.

1269 00:55:38.320 --> 00:55:41.970 We can discuss the ethics of that, but that's a reality.

1270 00:55:41.970 --> 00:55:44.940 And I showed that slide at the beginning

1271 00:55:44.940 --> 00:55:46.480 of the climate change human health articles

1272 00:55:46.480 --> 00:55:49.670 have really been skyrocketing, but I personally believe

1273 00:55:49.670 --> 00:55:51.400 it hasn't really caught up

1274 00:55:51.400 --> 00:55:54.610 with the kind of the general discussion.

1275 00:55:54.610 --> 00:55:57.350 So still when people talk about climate change

1276 00:55:57.350 --> 00:56:01.800 they're often not talking about human health or not as much.

1277 00:56:01.800 --> 00:56:03.540 And if you look at the predominant reasons

1278 00:56:03.540 --> 00:56:06.300 that people have moved on environmental issues,

1279 00:56:06.300 --> 00:56:08.410 the number one reason people care about the environment

1280 00:56:08.410 --> 00:56:10.623 in most surveys is human health,

1281 00:56:11.570 --> 00:56:12.890 although other things matter.

1282 00:56:12.890 --> 00:56:15.210 So I think that's why Yale center

1283 00:56:15.210 --> 00:56:18.150 and other work on the human health impacts of climate

1284 00:56:18.150 --> 00:56:20.470 are really important for people to really understand

1285 00:56:20.470 --> 00:56:24.020 the full magnitude of what climate change means.

1286 00:56:24.020 --> 00:56:26.050 We're not just talking about loss of species,

1287 00:56:26.050 --> 00:56:27.550 were not just talking about loss of land,

1288 00:56:27.550 --> 00:56:29.860 we're not just talking about ecosystem changes

1289 00:56:29.860 --> 00:56:32.990 but we're talking about actual changes in human health,

1290 00:56:32.990 --> 00:56:37.283 which will be a huge driver for many people.

1291 00:56:39.140 --> 00:56:42.210 <v ->Thanks Michelle, for the very insightful comments.</v>

1292 00:56:42.210 --> 00:56:44.910 And I think we do have the last comment

1293 00:56:44.910 --> 00:56:48.380 from a Pin Wom, thanks for the informative talk.

1294 00:56:48.380 --> 00:56:51.440 How was the threshold for smoke we've determined.

1295 00:56:51.440 --> 00:56:53.160 As you mentioned the smoke pollution

1296 00:56:53.160 --> 00:56:56.430 is like non-crazy high num pattern.

1297 00:56:56.430 --> 00:57:00.840 How important was the definition of threshold in this study?

1298 00:57:00.840 --> 00:57:04.740 <v ->Yeah, similar to how you might do with heat waves,</v>

1299 00:57:04.740 --> 00:57:08.130 we used a variety of thresholds, so we varied it.

1300 00:57:08.130 --> 00:57:10.670 And we saw results that you would anticipate.

1301 00:57:10.670 --> 00:57:13.810 So as we made the requirement more stringent,
1302 00:57:13.810 --> 00:57:17.640 meaning we're forcing those smoke waves to be more extreme
1303 00:57:17.640 --> 00:57:19.470 we saw higher health impacts.
1304 00:57:19.470 --> 00:57:21.620 And then if we lax the response
1305 00:57:21.620 --> 00:57:24.060 and allow the smaller smoke waves
1306 00:57:24.060 --> 00:57:25.710 like you still have walked our air pollution,
1307 00:57:25.710 --> 00:57:26.670 but it's not as high,
1308 00:57:26.670 --> 00:57:28.420 we still saw an effect and it was lower.
1309 00:57:28.420 --> 00:57:32.650 So I guess the short answer is it matters in terms
1310 00:57:32.650 --> 00:57:37.650 of your specific numerical health effect estimate.
1311 00:57:38.060 --> 00:57:39.830 But it didn't matter in the sense
1312 00:57:39.830 --> 00:57:44.770 that we found effects at different types of definitions.
1313 00:57:44.770 --> 00:57:45.810 And this makes sense too
1314 00:57:45.810 --> 00:57:48.320 because there's nothing like magical,
1315 00:57:48.320 --> 00:57:51.100 like two days matters, but three days doesn't,
1316 00:57:51.100 --> 00:57:52.230 two and a half to, you know what I mean?
1317 00:57:52.230 --> 00:57:54.200 So these are all like approximations.
1318 00:57:54.200 --> 00:57:57.120 They're just trying to capture the smoke wave period.
1319 00:57:57.120 --> 00:57:58.990 <v ->Wonderful, thank you Michelle.</v>
1320 00:57:58.990 --> 00:58:00.270 I think I can speak
1321 00:58:00.270 --> 00:58:02.280 for the whole center and all the audience.
1322 00:58:02.280 --> 00:58:06.620 Thank you for giving us a wonderful and informative talk.
1323 00:58:06.620 --> 00:58:10.330 And thank you all the audiences attending today.
1324 00:58:10.330 --> 00:58:13.693 I think at a peak, we have almost 90 audiences.
1325 00:58:14.950 --> 00:58:15.970 <v ->Oh great, thank you so much</v>

1326 00:58:15.970 --> 00:58:17.770 for the invitation to share my work.