WEBVTT

1 00:00:00.000 --> 00:00:01.250 - Good morning, everyone.

2 00:00:03.400 --> 00:00:04.233 Noon.

3 00:00:04.233 --> 00:00:06.390 Welcome to the Yale Center on Climate Change

4 00:00:06.390 --> 00:00:07.890 and Health seminar.

5 00:00:07.890 --> 00:00:10.180 I'm your host today, Dr. Kai Chan,

6 00:00:10.180 --> 00:00:12.980 assistant professor at the Yale school of public health.

7 00:00:13.840 --> 00:00:17.350 During the presentation if you have any questions

8 00:00:17.350 --> 00:00:19.100 you can use the chat box

9 00:00:19.100 --> 00:00:23.530 and we will try to address them as the speaker finishes.

10 00:00:23.530 --> 00:00:27.380 As a reminder, today's seminar will be recorded.

11 00:00:27.380 --> 00:00:32.380 So, it is my great pleasure today to introduce our speaker

12 00:00:33.010 --> 00:00:36.580 professor Greg Wellenius from Boston university

13 00:00:36.580 --> 00:00:38.090 school of public health.

14 00:00:38.090 --> 00:00:40.770 So Greg is actually the 2019,

15 00:00:40.770 --> 00:00:45.770 recipient of the ISEE Tony McMichael award.

16 00:00:45.920 --> 00:00:50.370 So it is very exciting to have Greg here today because,

17 00:00:50.370 --> 00:00:53.840 everyone knows Tony McMichael was the pioneer

18 00:00:53.840 --> 00:00:55.810 that developed the connection

19 00:00:55.810 --> 00:00:58.870 between epidemiology and the global countries.

20 00:00:58.870 --> 00:01:00.810 So with that legacy,

21 00:01:00.810 --> 00:01:04.840 I would like to take it over to Greg and very much,

22 00:01:04.840 --> 00:01:06.290 looking forward to your talk.

23 00:01:08.020 --> 00:01:08.853 - Wonderful.

24 00:01:08.853 --> 00:01:10.017 Thank you, Kai.

25 00:01:10.017 --> 00:01:11.830 Thanks so much for the invitation to speak here.

26 00:01:11.830 --> 00:01:14.400 And I only wish we could meet in person,

27 00:01:14.400 --> 00:01:16.370 under better circumstances.

28 00:01:16.370 --> 00:01:17.740 I was telling Kai before

29 00:01:19.280 --> 00:01:22.440 a few minutes earlier that one of the great pleasures

30 00:01:22.440 --> 00:01:26.140 of giving seminars in places is visiting with the people

31 00:01:26.140 --> 00:01:27.681 in small groups.

32 00:01:27.681 --> 00:01:31.210 So hopefully we'll have the opportunity to do that,

33 00:01:31.210 --> 00:01:33.043 again shortly.

34 00:01:33.043 --> 00:01:34.343 So let me share my screen.

35 00:01:38.877 --> 00:01:39.710 Okay.

36 00:01:39.710 --> 00:01:41.900 So you should be able to see my slides,

37 00:01:41.900 --> 00:01:46.823 Kai, give me the thumbs up or somebody can see my screen.

38 00:01:48.229 --> 00:01:49.062 Okay, great.

39 00:01:49.062 --> 00:01:50.820 So we'll just go ahead and get started.

40 00:01:51.840 --> 00:01:54.190 So yeah, so feel free to stop me along the way.

41 00:01:55.065 --> 00:01:57.270 I will rely on Kai to flag me down

42 00:01:57.270 --> 00:01:59.950 if you wanna put questions in the chat window

43 00:01:59.950 --> 00:02:01.560 and then I can stop,

44 00:02:01.560 --> 00:02:02.750 I don't mind being interrupted

45 00:02:02.750 --> 00:02:05.660 and that way we can make it more interactive that's fine.

46 00:02:05.660 --> 00:02:07.248 I should mention that,

47 00:02:07.248 --> 00:02:10.980 I am currently a visiting scientist

48 00:02:10.980 --> 00:02:13.950 working with Google and, this

49 00:02:17.105 --> 00:02:18.760 nothing I say here should be interpreted

50 00:02:18.760 --> 00:02:21.740 as being the official position of Google.

51 00:02:21.740 --> 00:02:22.941 All right.

52 00:02:22.941 --> 00:02:24.223 So with that I will get started.

53 00:02:25.661 --> 00:02:28.740 So I wanted to talk today about the effects

54 00:02:28.740 --> 00:02:32.040 of heat on health, which is,

55 00:02:32.040 --> 00:02:34.990 very well described in the scientific literature

56 00:02:34.990 --> 00:02:37.190 and connect that to

57 00:02:37.190 --> 00:02:40.840 why we have sort of this disconnect between,

58 00:02:40.840 --> 00:02:43.620 what we know about heat and the fact that

59 00:02:43.620 --> 00:02:48.620 people continue to die of a heat related illness.

60 00:02:48.860 --> 00:02:51.200 So the problem, as I see it is that excess heat

61 00:02:51.200 --> 00:02:54.270 is a widely recognized threat to public health.

62 00:02:54.270 --> 00:02:57.010 It's often cited based on CDC statistics

63 00:02:57.010 --> 00:02:59.387 that in the U.S more people die

64 00:02:59.387 --> 00:03:00.470 of extreme heat each year

65 00:03:00.470 --> 00:03:02.930 than of any other meteorologic event.

66 00:03:02.930 --> 00:03:05.540 So despite all this knowledge,

67 00:03:05.540 --> 00:03:07.510 that we have about the risks of

68 00:03:08.900 --> 00:03:12.233 days of extreme and perhaps moderate heat,

69 00:03:12.233 --> 00:03:14.880 there seems to have been remarkably little progress

70 00:03:14.880 --> 00:03:16.930 towards preventing heat related illness and death.

71 00:03:16.930 --> 00:03:18.770 So we still see that heat waves

72 00:03:18.770 --> 00:03:21.906 are a major source of morbidity and mortality

73 00:03:21.906 --> 00:03:22.739 across the world.

74 00:03:22.739 --> 00:03:25.564 And so this got us thinking that

75 00:03:25.564 --> 00:03:26.950 this suggests a lack of translation

76 00:03:26.950 --> 00:03:29.620 of the abundance scientific knowledge about risks

77 00:03:29.620 --> 00:03:31.113 into public health action.

78 00:03:31.970 --> 00:03:34.770 And so just to highlight the point

79 00:03:34.770 --> 00:03:36.540 for those that may not be as familiar.

80 00:03:36.540 --> 00:03:41.024 So a Seminole study by Antonio Gasperini and colleagues,

81 00:03:41.024 --> 00:03:44.160 London school of hygiene, tropical medicine,

82 00:03:44.160 --> 00:03:45.250 published several years ago

83 00:03:45.250 --> 00:03:47.410 and have since published extensively,

84 00:03:47.410 --> 00:03:51.100 globally on the impacts of heat on health.

85 00:03:51.100 --> 00:03:54.820 And just to zoom in on a couple of locations,

86 00:03:54.820 --> 00:03:56.420 you could see that there's this,

87 00:03:57.802 --> 00:03:59.302 U shaped relationship between,

88 00:04:00.992 --> 00:04:01.825 daily maximum temperature,

89 00:04:01.825 --> 00:04:04.440 is typically used and the relative risk of

90 00:04:04.440 --> 00:04:07.210 some adverse outcome in this case mortality.

91 00:04:07.210 --> 00:04:10.617 And you can see that there is a temperature,

92 00:04:10.617 --> 00:04:12.320 what we'll call the temperature of minimum mortality,

93 00:04:12.320 --> 00:04:15.220 or the optimal temperature at which the fewest

94 00:04:15.220 --> 00:04:16.697 number of people die.

95 00:04:18.210 --> 00:04:20.730 And then as temperatures get warmer than that,

96 00:04:20.730 --> 00:04:24.140 you see a sharp increase, in,

97 00:04:24.140 --> 00:04:27.875 the relative risk of mortality and the shape of this curve,

98 00:04:27.875 --> 00:04:30.180 varies from location to location,

99 00:04:30.180 --> 00:04:35.180 but the pattern has been shown throughout the world,

100 00:04:35.203 --> 00:04:38.910 by Gasperini and colleagues, as well as

101 00:04:38.910 --> 00:04:40.630 other groups in specific locations.

102 00:04:40.630 --> 00:04:42.420 So this is pretty universal

103 00:04:42.420 --> 00:04:44.639 and pretty well understood at this point.

104 00:04:44.639 --> 00:04:48.182 In the U.S we additionally know,

105 00:04:48.182 --> 00:04:50.560 about the effects on morbidity.

106 00:04:50.560 --> 00:04:52.977 So as measured by hospital admissions.

107 00:04:52.977 --> 00:04:56.277 So this is some terrific work done by Jennifer Bob

108 00:04:56.277 --> 00:05:00.060 working with Francesca Dominici at Harvard and team.

109 00:05:00.060 --> 00:05:02.980 And, so this was in the Medicare population

110 00:05:02.980 --> 00:05:06.537 looking at millions of hospital admissions

111 00:05:07.956 --> 00:05:10.772 for a number of different causes and showing

112 00:05:10.772 --> 00:05:14.063 both the relative risk and the risk difference of,

113 00:05:14.063 --> 00:05:17.443 hospital admissions for different causes that you can see.

114 00:05:19.530 --> 00:05:21.860 Increased relative risk of fluid

115 00:05:21.860 --> 00:05:23.320 and electrolyte disorders, renal conditions,

116 00:05:23.320 --> 00:05:26.750 urinary tract infections, heat stroke,

117 00:05:26.750 --> 00:05:29.054 and other external causes.

118 00:05:29.054 --> 00:05:33.660 And, with the risk difference shown there as well.

119 00:05:33.660 --> 00:05:36.640 So, interestingly although heatstroke

120 00:05:36.640 --> 00:05:38.100 has the biggest relative risk

121 00:05:38.100 --> 00:05:41.420 because it's relatively uncommon as a diagnosis,

122 00:05:41.420 --> 00:05:45.240 the risk differences is smaller than for some other causes.

123 00:05:45.240 --> 00:05:46.590 So terrific work.

124 00:05:46.590 --> 00:05:47.830 So this is just a sampling.

125 00:05:47.830 --> 00:05:50.307 There's a huge literature now on this,

126 00:05:50.307 --> 00:05:52.220 and very large studies demonstrating

127 00:05:52.220 --> 00:05:54.930 that extreme heat is associated with higher rates of death

128 00:05:54.930 --> 00:05:57.690 and hospitalization all across the world.

129 00:05:57.690 --> 00:06:02.120 Moderate heat is associated with higher rates of death, and,

130 00:06:02.120 --> 00:06:04.930 building amounts of evidence suggesting also

131 00:06:04.930 --> 00:06:06.363 with hospitalization.

132 00:06:07.460 --> 00:06:10.270 And we know that the vulnerability of these effects

133 00:06:10.270 --> 00:06:11.870 varies by personal housing

134 00:06:11.870 --> 00:06:13.959 and neighborhood characteristics.

135 00:06:13.959 --> 00:06:16.935 Further we know that the U.S has already warmed

136 00:06:16.935 --> 00:06:19.623 more than a degree and is projected

137 00:06:19.623 --> 00:06:21.020 to warm further through the end of the century

138 00:06:21.020 --> 00:06:23.617 in substantially with that,

139 00:06:23.617 --> 00:06:27.401 regional substantial regional variation and how much,

140 00:06:27.401 --> 00:06:29.733 further warming we expect to see.

141 00:06:30.970 --> 00:06:35.020 So how do we translate this into action

142 00:06:35.020 --> 00:06:38.670 that actually saves lives and reduces the health impact?

143 00:06:38.670 --> 00:06:40.640 So local public health and emergency

144 00:06:40.640 --> 00:06:42.540 preparedness officials

145 00:06:42.540 --> 00:06:43.890 need to know something a little bit different.

146 00:06:43.890 --> 00:06:46.117 They need to know what are the health risks

147 00:06:46.117 --> 00:06:49.410 associated with a given climate hazard in my location,

148 00:06:49.410 --> 00:06:51.520 what local actions can I take

149 00:06:51.520 --> 00:06:53.250 to protect the public health

150 00:06:53.250 --> 00:06:55.470 and do these actions actually work?

151 00:06:55.470 --> 00:06:58.330 So I'm gonna walk you through some of the research

152 00:06:58.330 --> 00:07:01.652 that we've done in this domain.

153 00:07:01.652 --> 00:07:03.020 And I'll start with what are the health risks

154 00:07:03.020 --> 00:07:04.900 associated with a given climate hazard

155 00:07:04.900 --> 00:07:06.343 in a particular location?

156 00:07:07.480 --> 00:07:10.560 So I started this work when I was in Rhode Island,

157 00:07:10.560 --> 00:07:13.535 actually Julia Gold at the time

158 00:07:13.535 --> 00:07:14.990 at the Rhode Island department of health,

159 00:07:14.990 --> 00:07:15.990 came to me and said,

160 00:07:17.472 --> 00:07:18.850 we really wanna know how many people

161 00:07:19.687 --> 00:07:23.264 are dying of heat and Rhode Island and how many ed visits,

162 00:07:23.264 --> 00:07:24.925 we have in Rhode Island.

163 00:07:24.925 --> 00:07:26.516 We need to know how to prioritize this.

164 00:07:26.516 --> 00:07:28.192 And I said, well, there's lots of literature

165 00:07:28.192 --> 00:07:30.060 it's a big problem you should just be worried about it.

166 00:07:30.060 --> 00:07:32.380 And she said, no, can you give me a number?

167 00:07:32.380 --> 00:07:33.530 And so I said, okay sure

168 00:07:33.530 --> 00:07:35.615 let's try to give a number.

169 00:07:35.615 --> 00:07:38.810 And then it turned out that New Hampshire and Maine

170 00:07:38.810 --> 00:07:42.318 were also in interested in the same question.

171 00:07:42.318 --> 00:07:44.553 Public health officials in those States

172 00:07:44.553 --> 00:07:45.633 were interested in the same question.

173 00:07:46.853 --> 00:07:49.380 And because this was done at small,

174 00:07:49.380 --> 00:07:51.563 relatively smaller populations,

175 00:07:52.900 --> 00:07:54.120 we all had the challenge

176 00:07:54.120 --> 00:07:57.060 of having sufficient statistical power,

177 00:07:57.060 --> 00:07:58.670 to examine the associations

178 00:07:58.670 --> 00:08:01.840 between heat and either mortality or ed visits,

179 00:08:01.840 --> 00:08:03.590 in our own communities.

180 00:08:03.590 --> 00:08:08.590 So we partnered with between Rhode Island,

181 00:08:08.897 --> 00:08:11.970 New Hampshire and Maine to pull data,

182 00:08:11.970 --> 00:08:15.030 do the analysis in each of the community shown here

183 00:08:15.030 --> 00:08:19.420 and then pull the results to have enough statistical power.

184 00:08:19.420 --> 00:08:21.380 And we also engage with the regional offices

185 00:08:21.380 --> 00:08:24.900 of the national weather service, in order,

186 00:08:24.900 --> 00:08:28.730 they were interested to reconsider the

187 00:08:29.880 --> 00:08:33.170 threshold criteria at which the,

188 00:08:33.170 --> 00:08:35.340 heat advisories or heat warnings were issued

189 00:08:35.340 --> 00:08:37.020 based on local evidence.

190 00:08:37.020 --> 00:08:40.780 So we were trying to provide local actionable evidence,

191 00:08:40.780 --> 00:08:43.410 and in particular in communities outside of

192 00:08:43.410 --> 00:08:46.042 the large cities of the area that would otherwise,

193 00:08:46.042 --> 00:08:47.573 dominate the signal.

194 00:08:49.489 --> 00:08:51.927 And so we found what you'd expect is that the,

195 00:08:51.927 --> 00:08:54.470 here we were interested in heat index,

196 00:08:54.470 --> 00:08:56.576 'cause we were doing this in partnership

197 00:08:56.576 --> 00:08:58.060 with the national weather service and heat index is

198 00:08:58.060 --> 00:09:00.970 this combination of temperature and humidity that,

199 00:09:00.970 --> 00:09:03.310 they often use for issuing heat warnings

200 00:09:03.310 --> 00:09:04.603 and heat advisories.

201 00:09:05.474 --> 00:09:07.560 And we found approximately what we expected,

202 00:09:07.560 --> 00:09:10.010 that there was a monotonic relationship

203 00:09:10.010 --> 00:09:12.880 between increasing maximum daily heat index

204 00:09:12.880 --> 00:09:16.440 and relative risk of emergency department admissions

205 00:09:16.440 --> 00:09:17.910 that you see there on the left

206 00:09:17.910 --> 00:09:20.500 and deaths there as you see there on the right.

207 00:09:20.500 --> 00:09:23.640 And, these were about of the expected magnitude.

208 00:09:23.640 --> 00:09:26.920 And you can see that even pooling across these 15 locations,

209 00:09:26.920 --> 00:09:30.042 the confidence intervals around our estimates of,

210 00:09:30.042 --> 00:09:32.760 for mortality relative to some mortality

211 00:09:32.760 --> 00:09:34.860 were somewhat imprecise.

212 00:09:34.860 --> 00:09:39.690 So, the, I think the key part of this is,

213 00:09:39.690 --> 00:09:42.240 to translate sort of relative risks

214 00:09:42.240 --> 00:09:46.996 and smooth curves, which are available,

215 00:09:46.996 --> 00:09:49.321 with standard software now,

216 00:09:49.321 --> 00:09:54.321 thanks in large part to work by Gasperini and colleagues,

217 00:09:54.374 --> 00:09:57.110 is to translate that into real numbers.

218 00:09:57.110 --> 00:09:57.943 So, okay.

219 00:09:58.823 --> 00:10:02.030 So a curve is all good but how does that translate to

220 00:10:03.225 --> 00:10:07.330 number of excess ed visits or excess deaths

221 00:10:07.330 --> 00:10:11.264 attributable to days of different heat indices?

222 00:10:11.264 --> 00:10:13.830 So we created this table where the bottom row here

223 00:10:13.830 --> 00:10:16.860 shows you on all the days of 100 degrees

224 00:10:18.175 --> 00:10:19.760 with a heat index of 100 degrees or higher,

225 00:10:19.760 --> 00:10:21.200 how many excess deaths,

226 00:10:21.200 --> 00:10:24.526 excess CD visits were there on the same day, or,

227 00:10:24.526 --> 00:10:28.777 incorporating the lag effects up to seven days.

228 00:10:28.777 --> 00:10:31.350 And so, across these 15 new England towns,

229 00:10:31.350 --> 00:10:34.080 there were 39 additional ed visits

230 00:10:34.080 --> 00:10:37.133 on all days over 100 degrees and 232.

231 00:10:38.910 --> 00:10:41.790 If you incorporate the lag structure,

232 00:10:41.790 --> 00:10:43.663 the fact that the next day

233 00:10:43.663 --> 00:10:45.550 and the next day might also have some excess ed visits

234 00:10:45.550 --> 00:10:48.820 and about four to eight excess deaths

235 00:10:49.705 --> 00:10:52.200 for the days above 100 during this time period.

236 00:10:52.200 --> 00:10:55.490 And, obviously there's more days that are at,

237 00:10:55.490 --> 00:10:57.010 or above 95 degrees.

238 00:10:57.010 --> 00:11:01.218 And so then, those numbers are bigger and, at,

239 00:11:01.218 --> 00:11:02.051 or above 95 degrees,

240 00:11:02.051 --> 00:11:05.910 there's close to 200 to 700 depending on,

241 00:11:05.910 --> 00:11:10.688 how far out in the delay you want to incorporate,

242 00:11:10.688 --> 00:11:13.760 excess ed visits.

243 00:11:13.760 --> 00:11:16.540 So we took this information to the national weather service,

244 00:11:16.540 --> 00:11:18.540 to the regional office for the national weather service

245 00:11:18.540 --> 00:11:22.080 and said, look, we think that at temperatures below that,

246 00:11:22.080 --> 00:11:24.940 at which you currently issue heat advisories.

247 00:11:24.940 --> 00:11:26.960 So during this time heat advisories were

248 00:11:26.960 --> 00:11:29.680 issued by the national weather service for days

249 00:11:29.680 --> 00:11:32.750 with a heat index forecast to be above 100 degrees.

250 00:11:32.750 --> 00:11:36.570 We said, look at days as low as 95 or 90,

251 00:11:36.570 --> 00:11:39.550 we still see excess ed visits.

252 00:11:39.550 --> 00:11:41.820 And you can see that in the curves too, that,

253 00:11:41.820 --> 00:11:44.120 it's relatively monotonic so there's no reason

254 00:11:44.120 --> 00:11:46.360 to pick just 100 degrees as the threshold.

255 00:11:46.360 --> 00:11:48.933 It could be even at 95 degrees, you could,

256 00:11:50.400 --> 00:11:53.460 presumably warn or prevent

257 00:11:53.460 --> 00:11:56.100 some excess morbidity and mortality.

258 00:11:56.100 --> 00:11:59.020 And the national weather service said, okay

259 00:11:59.020 --> 00:11:59.900 that's great.

260 00:11:59.900 --> 00:12:03.790 And, so let me

261 00:12:04.655 --> 00:12:06.773 I'm gonna skip ahead to the national weather service.

262 00:12:07.940 --> 00:12:08.773 Okay, sorry.

263 00:12:09.656 --> 00:12:12.053 So before I get to the national weather service story,

264 00:12:12.941 --> 00:12:15.392 so 'cause I think that's really important, but then,

265 00:12:15.392 --> 00:12:17.855 so I want to shout out to Kate Weinberger,

266 00:12:17.855 --> 00:12:19.677 who was a postdoc in my group at the time.

267 00:12:19.677 --> 00:12:21.050 And what she said is, okay, this is great for New England,

268 00:12:21.050 --> 00:12:23.350 but how many people die of

269 00:12:24.359 --> 00:12:27.850 deaths attributable to heat across the country?

270 00:12:27.850 --> 00:12:32.090 And so using data that we had a mortality through 2006,

271 00:12:32.090 --> 00:12:37.090 she estimated that there were 5,000 or more excess deaths

272 00:12:39.029 --> 00:12:41.650 per year across the U.S attributable to heat.

273 00:12:41.650 --> 00:12:43.280 This number is really important because

274 00:12:43.280 --> 00:12:45.410 it's about an order of magnitude

275 00:12:45.410 --> 00:12:48.280 higher than what the CDC estimates

276 00:12:50.850 --> 00:12:54.290 report for heat related deaths that are those

277 00:12:54.290 --> 00:12:57.091 that are coded as being due to heat.

278 00:12:57.091 --> 00:12:58.520 And so when we think of sort of the,

279 00:12:58.520 --> 00:13:03.297 public health burden of disease of heat related illness,

280 00:13:03.297 --> 00:13:06.370 the CDC estimates, are important,

281 00:13:06.370 --> 00:13:08.640 but we think a likely an underestimate

282 00:13:08.640 --> 00:13:12.200 of the true excess mortality due to heat.

283 00:13:12.200 --> 00:13:14.529 The other important point here is

284 00:13:14.529 --> 00:13:17.680 that if we separate out the extreme heat days

285 00:13:17.680 --> 00:13:20.200 versus the moderate heat days,

286 00:13:20.200 --> 00:13:21.500 so we defined extreme heat

287 00:13:21.500 --> 00:13:23.960 as those days above the 95th percentile

288 00:13:23.960 --> 00:13:25.860 for a particular location.

289 00:13:25.860 --> 00:13:29.063 And these 297 counties across the U.S.

290 00:13:30.340 --> 00:13:33.530 The burden of disease is actually bigger for,

291 00:13:33.530 --> 00:13:35.330 deaths due to moderate heat.

292 00:13:35.330 --> 00:13:38.100 And that's been reported previously,

293 00:13:38.100 --> 00:13:41.240 across the world and in the U.S but it,

294 00:13:41.240 --> 00:13:44.270 this puts concrete numbers on that that

295 00:13:44.270 --> 00:13:48.870 moderate heat accounts for a substantial burden of disease.

296 00:13:48.870 --> 00:13:53.696 And the other key point from this study is that, the risk,

297 00:13:53.696 --> 00:13:58.260 or the excess mortality is not distributed uniformly

298 00:13:58.260 --> 00:14:01.420 across the U.S and there's parts of the country,

299 00:14:01.420 --> 00:14:03.563 that seem much more vulnerable to,

300 00:14:05.430 --> 00:14:07.790 heat-related mortality than others.

301 00:14:07.790 --> 00:14:10.240 Again, emphasizing the importance of local knowledge

302 00:14:10.240 --> 00:14:13.353 and local action to prevent these.

303 00:14:14.310 --> 00:14:17.490 Okay, so let's turn to local actions,

304 00:14:17.490 --> 00:14:19.720 that can be taken to protect the public's health

305 00:14:19.720 --> 00:14:24.467 and evaluating if these actions actually work.

306 00:14:24.467 --> 00:14:26.770 So in the U.S the national weather service issues,

307 00:14:26.770 --> 00:14:29.730 heat, advisories, and excess heat warnings

308 00:14:29.730 --> 00:14:33.080 when the heat index is forecast to be high.

309 00:14:33.080 --> 00:14:35.322 Now, and this is for most places,

310 00:14:35.322 --> 00:14:37.776 there's a handful of places

311 00:14:37.776 --> 00:14:39.563 that use the other criteria besides heat index.

312 00:14:39.563 --> 00:14:41.930 But these warnings that are issued,

313 00:14:41.930 --> 00:14:44.300 provide information that the public can take,

314 00:14:44.300 --> 00:14:48.217 of actions that the public can take to protect their health.

315 00:14:48.217 --> 00:14:51.630 And in some places the warnings may also trigger

316 00:14:51.630 --> 00:14:54.568 activation of local heat response plans,

317 00:14:54.568 --> 00:14:59.230 that may involve things like opening cooling centers, or,

318 00:14:59.230 --> 00:15:01.650 reaching out to particularly vulnerable communities

319 00:15:01.650 --> 00:15:04.689 in addition to targeted messaging,

320 00:15:04.689 --> 00:15:07.430 and the optimal thresholds for issuing

321 00:15:07.430 --> 00:15:09.473 these heat advisories or heat warnings,

322 00:15:10.871 --> 00:15:14.770 remain largely unknown or unstudied,

323 00:15:14.770 --> 00:15:17.906 refer to heat advisories and warnings together

324 00:15:17.906 --> 00:15:19.070 as heat alerts.

325 00:15:19.070 --> 00:15:23.890 So based on the work we did in that New England study,

326 00:15:23.890 --> 00:15:26.690 working with the national weather service regional office,

327 00:15:26.690 --> 00:15:30.890 they decided to partition the Northeast, which was,

328 00:15:30.890 --> 00:15:34.830 had one criteria for issuing heat advisories

329 00:15:34.830 --> 00:15:37.462 prior to this work starting in summer 2017,

330 00:15:37.462 --> 00:15:39.933 they changed it so that the,

331 00:15:40.880 --> 00:15:43.310 new way in New England was treated separately

332 00:15:43.310 --> 00:15:45.060 from the rest of the Northeast,

333 00:15:45.060 --> 00:15:47.450 acknowledging that the vulnerability

334 00:15:47.450 --> 00:15:52.450 to a heat related illness might be different in New England,

335 00:15:53.410 --> 00:15:54.810 not just based on our study,

336 00:15:56.027 --> 00:15:57.670 there's other studies that have shown that as well.

337 00:15:57.670 --> 00:15:59.970 So this felt like a major public health victory.

338 00:15:59.970 --> 00:16:04.100 So following this starting of the summer of 2017,

339 00:16:04.100 --> 00:16:06.980 the national weather service in the region,

340 00:16:06.980 --> 00:16:11.900 issued heat advisories when the heat index

341 00:16:11.900 --> 00:16:16.510 was forecast to be greater than 95 degrees.

342 00:16:16.510 --> 00:16:18.060 And there was some confusion as to whether

343 00:16:18.060 --> 00:16:20.010 that should be for one day or for two days,

344 00:16:20.010 --> 00:16:21.380 it was initially for two days.

345 00:16:21.380 --> 00:16:25.071 And, then they subsequently revised the criteria,

346 00:16:25.071 --> 00:16:28.910 to be consistent across the New England region.

347 00:16:28.910 --> 00:16:31.620 So essentially changing the heat advisory threshold

348 00:16:31.620 --> 00:16:35.133 from 100 degrees heat index to 95 degrees heat index.

349 00:16:36.188 --> 00:16:37.330 So this felt like, to me,

350 00:16:37.330 --> 00:16:41.440 a major public health victory, this was, one study,

351 00:16:41.440 --> 00:16:44.930 one paper that, and a series of conversations

352 00:16:44.930 --> 00:16:47.883 that ended up changing the criteria,

353 00:16:47.883 --> 00:16:50.720 at which heat advisories are issued for,

354 00:16:50.720 --> 00:16:53.360 a region with a substantial population.

355 00:16:53.360 --> 00:16:55.230 So that felt very impactful,

356 00:16:55.230 --> 00:16:57.270 but it leads to the question of okay,

357 00:16:57.270 --> 00:16:59.720 so we're issuing more heat advisories now

358 00:16:59.720 --> 00:17:01.870 than we were before,

359 00:17:01.870 --> 00:17:03.280 because we've changed the threshold.

360 00:17:03.280 --> 00:17:06.111 Does that actually save anybody's life?

361 00:17:06.111 --> 00:17:10.240 So, we weren't the first or the only ones

362 00:17:10.240 --> 00:17:12.490 to be having this type of conversation.

363 00:17:12.490 --> 00:17:16.830 We followed in that research some very nice work,

364 00:17:16.830 --> 00:17:18.440 from New York city,

365 00:17:18.440 --> 00:17:20.610 where they also informed local policy

366 00:17:20.610 --> 00:17:24.270 through evaluation of data in New York city.

367 00:17:24.270 --> 00:17:28.082 And so the question we were asking is,

368 00:17:28.082 --> 00:17:32.410 what is the optimal threshold for issuing heat alerts,

369 00:17:32.410 --> 00:17:34.811 heat warnings, and heat advisories.

370 00:17:34.811 --> 00:17:38.490 But these conversations assume that issuing

371 00:17:38.490 --> 00:17:40.480 heat advisories and warnings actually

372 00:17:40.480 --> 00:17:44.170 reduces heat-related morbidity and mortality.

373 00:17:44.170 --> 00:17:48.060 And there's been relatively few studies on that question.

374 00:17:48.060 --> 00:17:51.400 What, again, there's a handful of studies,

375 00:17:51.400 --> 00:17:55.163 but one that I particularly like is this study from,

376 00:17:56.050 --> 00:18:01.040 Tarik Benmarhina while he was still at McGill and looking,

377 00:18:01.040 --> 00:18:02.800 taking a very creative approach to looking

378 00:18:02.800 --> 00:18:05.610 at the effectiveness of the heat action plan that including

379 00:18:05.610 --> 00:18:09.563 included a new heat early warning system on,

380 00:18:11.170 --> 00:18:14.350 heat related mortality in Montreal.

381 00:18:14.350 --> 00:18:18.857 And, that team reported that the,

382 00:18:20.230 --> 00:18:24.850 that having this heat action plan implemented in Montreal,

383 00:18:24.850 --> 00:18:26.770 reduced mortality during hot days

384 00:18:26.770 --> 00:18:28.833 by about two and a half deaths per day,

385 00:18:29.780 --> 00:18:33.680 and with particularly larger effects amongst the elderly.

386 00:18:33.680 --> 00:18:36.915 So we wanted that's exactly the question

387 00:18:36.915 --> 00:18:39.010 we wanted to ask is the issuing of heat warnings,

388 00:18:39.010 --> 00:18:40.800 heat early warning system.

389 00:18:40.800 --> 00:18:44.343 How much does that benefit the population?

390 00:18:44.343 --> 00:18:48.790 So we built this study on the advantage

391 00:18:48.790 --> 00:18:52.400 that heat warnings are issued by people,

392 00:18:52.400 --> 00:18:53.940 and they're issued on forecasts.

393 00:18:53.940 --> 00:18:55.610 They're not completely algorithmic.

394 00:18:55.610 --> 00:18:57.580 They are issued by specialists

395 00:18:57.580 --> 00:18:59.606 at the national weather service

396 00:18:59.606 --> 00:19:02.310 that are focused on heat warnings.

397 00:19:02.310 --> 00:19:04.520 And, they,

398 00:19:04.520 --> 00:19:07.870 there's a collection of days where we forecast

399 00:19:07.870 --> 00:19:11.413 that there will be a high degree of heat.

400 00:19:12.620 --> 00:19:15.240 And then it turns out to be a little bit less,

401 00:19:15.240 --> 00:19:17.401 and then there's other days where we forecast,

402 00:19:17.401 --> 00:19:21.540 lower heat levels.

403 00:19:21.540 --> 00:19:23.290 And it turns out to be a little bit higher.

404 00:19:23.290 --> 00:19:26.440 So the forecast can be wrong even just a little bit.

405 00:19:26.440 --> 00:19:27.920 And because they're issued by people,

406 00:19:27.920 --> 00:19:30.750 there's some discretion in how much they think

407 00:19:30.750 --> 00:19:33.980 people need to know about the upcoming heat.

408 00:19:33.980 --> 00:19:37.370 So for instance, we were told that on the 4th of July,

409 00:19:37.370 --> 00:19:40.480 you might issue a heat alert at a slightly lower,

410 00:19:40.480 --> 00:19:42.920 forecast heat index, then on another day,

411 00:19:42.920 --> 00:19:44.680 because so many people are gonna be outside.

412 00:19:44.680 --> 00:19:47.910 So many people are going to be exposed that maybe,

413 00:19:47.910 --> 00:19:50.540 we can have the flexibility to change that threshold.

414 00:19:50.540 --> 00:19:53.530 And that was entirely built into the system.

415 00:19:53.530 --> 00:19:56.580 So there should be these days with a similar heat index,

416 00:19:56.580 --> 00:20:00.740 right around sort of the warning threshold,

417 00:20:00.740 --> 00:20:04.800 some of which have a heat warning some of which do not.

418 00:20:04.800 --> 00:20:05.910 And so that's the

419 00:20:08.870 --> 00:20:11.380 paradigm we were taking advantage of.

420 00:20:11.380 --> 00:20:16.123 And at the time we had data on heat warnings from 20 cities

421 00:20:17.450 --> 00:20:20.318 that issue heat warnings regularly.

422 00:20:20.318 --> 00:20:22.340 And, we matched us to the mortality data we had

423 00:20:22.340 --> 00:20:23.647 from the CDC.

424 00:20:24.910 --> 00:20:29.323 So the overlap between these two data sets is 2001 to 2006.

425 00:20:30.790 --> 00:20:35.790 And, again, comparing days of similar heat index,

426 00:20:36.671 --> 00:20:40.340 with versus without a heat alert,

427 00:20:40.340 --> 00:20:42.720 this is the relative risk of mortality,

428 00:20:42.720 --> 00:20:44.953 associated with having a heat alert.

429 00:20:46.002 --> 00:20:49.090 And so if he'd warnings or heat advisories were,

430 00:20:49.090 --> 00:20:50.590 protective of the population,

431 00:20:50.590 --> 00:20:54.370 you would expect to see a decreased,

432 00:20:54.370 --> 00:20:58.860 relative risk or a decrease in the rate of mortality

433 00:20:58.860 --> 00:21:01.340 on days with a heat alert compared to without.

434 00:21:01.340 --> 00:21:03.340 So interestingly, we did not see that

435 00:21:03.340 --> 00:21:05.090 across these 20 cities,

436 00:21:05.090 --> 00:21:08.300 overall there was a null association.

437 00:21:08.300 --> 00:21:11.323 And the one place where we did see an association was,

438 00:21:12.607 --> 00:21:14.657 Philadelphia with a reduction of about 4%

439 00:21:15.608 --> 00:21:17.387 in mortality of about 4% on days

440 00:21:17.387 --> 00:21:19.370 with a heat warning versus without.

441 00:21:19.370 --> 00:21:22.510 So this could be for a couple of reasons.

442 00:21:22.510 --> 00:21:26.730 One Philadelphia, we know has been very proactive about,

443 00:21:26.730 --> 00:21:28.910 having a robust heat early warning system

444 00:21:28.910 --> 00:21:33.910 and taking action on days expected to have high mortality.

445 00:21:35.190 --> 00:21:38.850 It could also be that this was 20 estimates,

446 00:21:38.850 --> 00:21:41.330 and that one out of 20 was,

447 00:21:41.330 --> 00:21:44.080 in the direction that we expected.

448 00:21:44.080 --> 00:21:48.430 So clearly needs a followup study,

449 00:21:48.430 --> 00:21:51.530 but then we played the thought experiment of

450 00:21:51.530 --> 00:21:54.510 so heat alerts were effective

451 00:21:54.510 --> 00:21:56.640 at reducing mortality in Philadelphia.

452 00:21:56.640 --> 00:21:59.410 And the number of deaths we estimated,

453 00:21:59.410 --> 00:22:03.080 that were averted in Philadelphia

454 00:22:03.080 --> 00:22:05.270 each time they issued a heat alert,

455 00:22:05.270 --> 00:22:09.260 was about four and a half or five lives per time.

456 00:22:09.260 --> 00:22:12.507 And so if you extrapolate that to the,

457 00:22:12.507 --> 00:22:15.660 typical year in Philadelphia during this time,

458 00:22:15.660 --> 00:22:18.280 that meant that the heat early warning system

459 00:22:18.280 --> 00:22:21.180 saved about 45 lives per year.

460 00:22:21.180 --> 00:22:23.420 Again, lots of assumptions of causality,

461 00:22:23.420 --> 00:22:28.420 but it gives us a starting point that if the,

462 00:22:28.992 --> 00:22:32.150 if heat warnings could be as effective

463 00:22:32.150 --> 00:22:35.110 as they were observed to be in Philadelphia

464 00:22:35.110 --> 00:22:38.197 during this time then a city like New York,

465 00:22:38.197 --> 00:22:41.064 or Dallas or Phoenix,

466 00:22:41.064 --> 00:22:46.064 could potentially save avert quite a few lives per year,

467 00:22:47.450 --> 00:22:49.440 depending on the effectiveness of the heat warning

468 00:22:49.440 --> 00:22:53.470 and how often the heat alerts are issued per year.

469 00:22:53.470 --> 00:22:55.466 So this provides,

470 00:22:55.466 --> 00:22:57.850 a rough for back of the envelope calculation as to

471 00:22:57.850 --> 00:23:02.850 how many lives could potentially be averted each year,

472 00:23:03.350 --> 00:23:08.350 across the country if heat warnings, reduced,

473 00:23:09.080 --> 00:23:13.363 mortality by the same magnitude as we saw in Philadelphia.

474 00:23:14.988 --> 00:23:15.940 Okay.

475 00:23:15.940 --> 00:23:16.773 And, again,

476 00:23:16.773 --> 00:23:19.173 I want to emphasize that we're not the only ones

477 00:23:19.173 --> 00:23:20.006 that have considered this question.

478 00:23:20.006 --> 00:23:22.600 This is some great work by Kristie Ebi

479 00:23:24.680 --> 00:23:29.680 15 years earlier, showing that in Philadelphia, exactly.

480 00:23:30.510 --> 00:23:33.226 The heat warning system, she estimated,

481 00:23:33.226 --> 00:23:35.520 each time that a heat warning

482 00:23:35.520 --> 00:23:39.920 was activated at saved two and a half lives per day.

483 00:23:39.920 --> 00:23:42.703 So, in the same ballpark of the estimates,

484 00:23:43.822 --> 00:23:46.671 we were seeing but in a very different time period.

485 00:23:46.671 --> 00:23:49.660 Okay, so there's lots of limitations to this study.

486 00:23:49.660 --> 00:23:52.481 One of them is that the data we were using

487 00:23:52.481 --> 00:23:56.110 at the time was old, was mortality data through 2006.

488 00:23:56.110 --> 00:24:00.603 So, Kate Weinberger has since been updating this,

489 00:24:01.529 --> 00:24:05.920 sorta with more recent mortality data from,

490 00:24:05.920 --> 00:24:07.250 nine Northeastern cities

491 00:24:07.250 --> 00:24:09.640 where we found the data readily available

492 00:24:09.640 --> 00:24:11.880 in collaboration with Joel Schwartz and team.

493 00:24:11.880 --> 00:24:16.810 And, there, we, she found, that perhaps,

494 00:24:16.810 --> 00:24:21.400 3% mortality benefit on heat warning days versus,

495 00:24:21.400 --> 00:24:23.560 days with versus without heat warnings.

496 00:24:23.560 --> 00:24:27.650 So maybe it's just that in 2006 and earlier,

497 00:24:27.650 --> 00:24:31.520 when most places did not yet have a heat action plan, then,

498 00:24:31.520 --> 00:24:33.983 we don't see very much of a benefit,

499 00:24:33.983 --> 00:24:35.100 but in more recent times where,

500 00:24:35.100 --> 00:24:38.173 many more communities do have heat action plans,

501 00:24:38.173 --> 00:24:41.923 tied to those heat alerts that we see,

502 00:24:42.783 --> 00:24:46.279 perhaps some signals so we're following that up

503 00:24:46.279 --> 00:24:47.470 in a broader population.

504 00:24:47.470 --> 00:24:49.573 And then the other question is of course,

505 00:24:50.419 --> 00:24:52.576 is that mortality is not the only outcome of interest that,

506 00:24:52.576 --> 00:24:56.430 we also want to prevent illness,

507 00:24:56.430 --> 00:24:58.750 as reflected through hospitalizations.

508 00:24:58.750 --> 00:25:03.090 And, here we saw in 97 counties

509 00:25:03.090 --> 00:25:06.260 in 2007 to 2012,

510 00:25:06.260 --> 00:25:10.230 using Medicare hospital admission data.

511 00:25:10.230 --> 00:25:12.903 We found no reduction

512 00:25:12.903 --> 00:25:16.450 in the risk of emergency hospitalization

513 00:25:16.450 --> 00:25:17.720 during this time point.

514 00:25:17.720 --> 00:25:20.913 So again, to works in progress that,

515 00:25:21.850 --> 00:25:23.320 we're following up on a larger scale

516 00:25:23.320 --> 00:25:24.853 and with more recent data.

517 00:25:27.248 --> 00:25:28.689 Okay,

518 00:25:28.689 --> 00:25:31.960 so our national weather service heat warnings effective,

519 00:25:31.960 --> 00:25:35.070 they may reduce the risk of death in some cities,

520 00:25:35.070 --> 00:25:37.010 but we don't yet see evidence of

521 00:25:37.010 --> 00:25:40.145 widespread health benefits.

522 00:25:40.145 --> 00:25:43.291 And if that's true and again it needs to be confirmed,

523 00:25:43.291 --> 00:25:47.220 but that would represent a missed opportunity

524 00:25:47.220 --> 00:25:50.093 to prevent heat-related morbidity and mortality.

525 00:25:51.050 --> 00:25:53.900 There's lots of limitations to the analysis I've shown here,

526 00:25:53.900 --> 00:25:58.900 and we're working to actively to address these limitations.

527 00:25:59.210 --> 00:26:00.833 So I just wanna emphasize the,

528 00:26:01.786 --> 00:26:05.130 that we're at the beginning of the road here not the end.

529 00:26:05.130 --> 00:26:08.820 Okay, so I wanna turn to talking about,

530 00:26:08.820 --> 00:26:12.940 how susceptibility to heat related illness

531 00:26:12.940 --> 00:26:14.190 might vary by age groups.

532 00:26:15.200 --> 00:26:19.935 And, so in one of the first studies we did in Rhode Island,

533 00:26:19.935 --> 00:26:23.176 we looked at emergency department visits,

534 00:26:23.176 --> 00:26:27.390 to the to Rhode Island over several years now,

535 00:26:27.390 --> 00:26:29.420 there's only a million people in Rhode Island.

536 00:26:29.420 --> 00:26:34.420 So again, there's an issue about statistical power.

537 00:26:35.070 --> 00:26:37.406 But the interesting thing is that, of course,

538 00:26:37.406 --> 00:26:39.460 we all think of the elderly as really vulnerable.

539 00:26:39.460 --> 00:26:43.580 And what we saw is that for heat related ed visits,

540 00:26:43.580 --> 00:26:47.570 in fact, the relative risk was a lot higher,

541 00:26:47.570 --> 00:26:49.952 so this is excess relative risk.

542 00:26:49.952 --> 00:26:50.785 So these are percents.

543 00:26:50.785 --> 00:26:55.785 So this would be an odds ratio of 1.6, approximately.

544 00:26:56.130 --> 00:26:59.420 So that the relative risk was actually higher in

545 00:26:59.420 --> 00:27:02.850 that study for population of adults of non elderly adults,

546 00:27:02.850 --> 00:27:07.210 18 to 64 and with significant for kids also

547 00:27:07.210 --> 00:27:10.980 or children and adolescents 18 and under,

548 00:27:10.980 --> 00:27:13.733 so what to follow that up.

549 00:27:14.610 --> 00:27:19.610 More recently we partnered with Ari Bernstein, the Harvard,

550 00:27:20.368 --> 00:27:25.310 center for climate health and the global environment,

551 00:27:25.310 --> 00:27:30.310 and using data from on ed visits from a network

552 00:27:30.877 --> 00:27:33.548 of standalone U.S children's hospitals.

553 00:27:33.548 --> 00:27:35.890 These are 47 hospitals and the recent Tara

554 00:27:36.728 --> 00:27:39.456 with a total of three point million ed visits,

555 00:27:39.456 --> 00:27:41.443 amongst children and adolescents.

556 00:27:42.304 --> 00:27:43.750 And you can see the location of the hospital here

557 00:27:43.750 --> 00:27:47.580 as well as the relative size and contribution.

558 00:27:47.580 --> 00:27:51.601 And so a little bit hard to see here,

559 00:27:51.601 --> 00:27:54.601 but so what we see is that the overall relationship between,

560 00:27:56.770 --> 00:28:00.200 maximum daily temperature and the relative risk

561 00:28:01.282 --> 00:28:03.493 of ed visits for all causes in

562 00:28:03.493 --> 00:28:07.430 this population is a 1.17 or about a 17% increase.

563 00:28:07.430 --> 00:28:09.630 And for heat related illness it's about

564 00:28:09.630 --> 00:28:10.830 a relative risk of 1.83.

565 00:28:12.450 --> 00:28:17.450 And again, you see it's interesting for all cause ed visits,

566 00:28:17.670 --> 00:28:20.528 there's not a lot of heterogeneity by age,

567 00:28:20.528 --> 00:28:21.670 but there does seem for heat related illness

568 00:28:21.670 --> 00:28:24.690 specifically seem to be somewhat of a stronger effect

569 00:28:24.690 --> 00:28:27.977 amongst the older adolescents.

570 00:28:27.977 --> 00:28:32.240 So that was really interesting.

571 00:28:32.240 --> 00:28:34.262 And then we wanted to sort

572 00:28:34.262 --> 00:28:35.690 of move beyond heat related illness

573 00:28:35.690 --> 00:28:39.484 to look at a number of potential causes.

574 00:28:39.484 --> 00:28:41.057 And this is a little bit hard to see.

575 00:28:41.057 --> 00:28:41.890 So I just wanna zoom in a little bit.

576 00:28:41.890 --> 00:28:44.790 So to the, we considered a number

577 00:28:44.790 --> 00:28:47.070 of different categories of disease,

578 00:28:47.070 --> 00:28:50.640 some of them that we sort of had prior hypotheses for,

579 00:28:50.640 --> 00:28:53.101 and some that seemed like we should just check.

580 00:28:53.101 --> 00:28:56.360 And these are adjusted for multiple comparisons

581 00:28:56.360 --> 00:28:58.940 in this sort of more agnostic analysis.

582 00:28:58.940 --> 00:29:01.630 And you can see that heat related illness of course

583 00:29:01.630 --> 00:29:04.390 comes up with a very high relative risk,

584 00:29:04.390 --> 00:29:06.330 but there's other interesting

585 00:29:06.330 --> 00:29:09.320 and much less explored associations

586 00:29:09.320 --> 00:29:11.180 between different causes of ed visits

587 00:29:11.180 --> 00:29:14.140 in children and adolescents and temperature.

588 00:29:14.140 --> 00:29:16.623 So, more to be done there,

589 00:29:17.470 --> 00:29:20.842 but we're quite excited by these results.

590 00:29:20.842 --> 00:29:23.880 I'll make the point as in the paper

591 00:29:23.880 --> 00:29:26.090 I showed you at the beginning by Jennifer Bob

592 00:29:26.090 --> 00:29:30.000 and colleagues that not all the,

593 00:29:30.000 --> 00:29:32.480 those conditions with the highest relative risk

594 00:29:32.480 --> 00:29:35.880 don't always have the biggest sort of numeric impact.

595 00:29:35.880 --> 00:29:38.847 So heat related illness here,

596 00:29:38.847 --> 00:29:40.739 you see the attributable fraction.

597 00:29:40.739 --> 00:29:41.710 So of the heat related illness

598 00:29:41.710 --> 00:29:44.810 a substantial proportion are due to heat.

599 00:29:44.810 --> 00:29:49.240 And, but heat related illnesses

600 00:29:49.240 --> 00:29:52.680 and in frequent or uncommon diagnosis.

601 00:29:52.680 --> 00:29:55.640 And so the out of 100,000 ed visits,

602 00:29:55.640 --> 00:29:58.223 it contributes a relatively small proportion.

603 00:29:59.190 --> 00:30:01.130 Whereas for injury and poisonings are very,

604 00:30:01.130 --> 00:30:03.413 very common diagnosis amongst kids, as,

605 00:30:04.453 --> 00:30:07.830 so even though the attributable fraction

606 00:30:07.830 --> 00:30:10.400 is smaller for them the attributable number

607 00:30:10.400 --> 00:30:12.660 per 100,00 ed visits total

608 00:30:12.660 --> 00:30:14.660 is much bigger because it's much common.

609 00:30:16.597 --> 00:30:19.610 Okay, so I wanna share with you some,

610 00:30:19.610 --> 00:30:23.600 very exciting work that Darren Son in my group is,

611 00:30:23.600 --> 00:30:24.950 leading and working on.

612 00:30:24.950 --> 00:30:29.950 So this is now turning to 18 to 64 year old individuals.

613 00:30:30.273 --> 00:30:32.410 And this is amongst an insured population,

614 00:30:32.410 --> 00:30:35.313 working with data from the Optum labs.

615 00:30:38.769 --> 00:30:41.503 And obviously here you have the number of sorry,

616 00:30:43.810 --> 00:30:45.980 the average summer maximum temperature.

617 00:30:45.980 --> 00:30:48.290 And then this just shows you sort of the distribution

618 00:30:48.290 --> 00:30:52.140 of where we have information on in this population.

619 00:30:52.140 --> 00:30:54.467 So it tends to follow,

620 00:30:54.467 --> 00:30:57.380 the distribution of population

621 00:30:57.380 --> 00:31:00.980 focused on obviously more urban locations.

622 00:31:00.980 --> 00:31:04.320 But, this particular data set has a more info

623 00:31:04.320 --> 00:31:06.350 tends to have more information in the Southeast

624 00:31:06.350 --> 00:31:07.983 and in the Southwest.

625 00:31:08.960 --> 00:31:12.670 And, you can see here is

626 00:31:12.670 --> 00:31:17.361 that overall there's a relative risk of ed visits,

627 00:31:17.361 --> 00:31:22.361 amongst these non elderly adults an odds ratio of 1.1,

628 00:31:24.090 --> 00:31:25.960 let's say about a 9% increase in risk

629 00:31:25.960 --> 00:31:27.700 and for heat related illness

630 00:31:27.700 --> 00:31:30.793 it's a relative risk of about 1.9.

631 00:31:31.670 --> 00:31:35.720 And again, you see some variation in,

632 00:31:35.720 --> 00:31:37.640 the relative risk by age,

633 00:31:37.640 --> 00:31:40.060 some heterogeneity by age that we'll explore

634 00:31:40.060 --> 00:31:43.050 a little bit further to see.

635 00:31:43.050 --> 00:31:45.470 It's interesting though that sort of repeatedly

636 00:31:45.470 --> 00:31:49.410 we're seeing that although elderly are known to be,

637 00:31:49.410 --> 00:31:50.300 and there's good evidence

638 00:31:50.300 --> 00:31:52.797 that they are a susceptible subgroup,

639 00:31:52.797 --> 00:31:55.580 that's by no means the only part of the age distribution,

640 00:31:55.580 --> 00:31:58.310 where we have sensitivities and in there's,

641 00:31:58.310 --> 00:32:01.260 we know of from other studies, outdoor workers,

642 00:32:01.260 --> 00:32:03.860 children that spend a lot of time outside,

643 00:32:03.860 --> 00:32:05.130 perhaps children's spending time

644 00:32:05.130 --> 00:32:07.355 in non-air conditioned schools,

645 00:32:07.355 --> 00:32:10.363 can also be quite a bit at risk.

646 00:32:12.430 --> 00:32:13.263 Okay.

647 00:32:13.263 --> 00:32:15.830 So turning back to the, the bigger, framework.

648 00:32:15.830 --> 00:32:18.090 So on a global and national scale,

649 00:32:18.090 --> 00:32:20.115 we think that we understand

650 00:32:20.115 --> 00:32:22.160 the adverse health impacts of heat.

651 00:32:22.160 --> 00:32:24.160 But there's been this lack of translation

652 00:32:24.160 --> 00:32:26.627 of abundance scientific knowledge on the risks

653 00:32:26.627 --> 00:32:30.300 and to public health action in terms of prevention.

654 00:32:30.300 --> 00:32:32.130 And so, again,

655 00:32:32.130 --> 00:32:34.690 this means that there's insufficient evidence

656 00:32:34.690 --> 00:32:36.200 to guide the public health response

657 00:32:36.200 --> 00:32:38.423 to present day or future heat.

658 00:32:39.320 --> 00:32:44.320 If we were designing, optimal response to heat,

659 00:32:44.370 --> 00:32:47.590 Jeremy Hess and Kristie Ebi have written nicely about this,

660 00:32:47.590 --> 00:32:50.420 you'd define dangerously hot weather,

661 00:32:50.420 --> 00:32:52.000 you'd forecast it well,

662 00:32:52.000 --> 00:32:54.670 you'd identify who's at greatest risk of these effects.

663 00:32:54.670 --> 00:32:57.850 You'd intervene to reduce those health impacts,

664 00:32:57.850 --> 00:33:00.650 and you'd evaluate the effectiveness of those interventions.

665 00:33:00.650 --> 00:33:02.590 And you do this on a continuous cycle.

666 00:33:02.590 --> 00:33:06.423 You'd do this repeatedly to continue to optimize.

667 00:33:07.307 --> 00:33:10.710 So, our broader research agenda

668 00:33:10.710 --> 00:33:14.210 follows mirrors these image.

669 00:33:14.210 --> 00:33:16.591 So, the vision that we have is that

670 00:33:16.591 --> 00:33:19.190 we could provide the evidence needed for any community

671 00:33:19.190 --> 00:33:22.080 in the U.S to mitigate the adverse health impacts

672 00:33:22.080 --> 00:33:23.320 of extreme heat.

673 00:33:23.320 --> 00:33:25.826 And I'd probably amend that now to say

674 00:33:25.826 --> 00:33:27.572 both extreme and moderate heat,

675 00:33:27.572 --> 00:33:28.732 although we recognize

676 00:33:28.732 --> 00:33:30.400 that they require different strategies,

677 00:33:30.400 --> 00:33:33.370 the same strategies won't be effective for both,

678 00:33:33.370 --> 00:33:36.228 thinking about moderate and extreme heat.

679 00:33:36.228 --> 00:33:38.900 The concrete sort of next steps in that is

680 00:33:38.900 --> 00:33:41.450 to identify optimal health based and location

681 00:33:41.450 --> 00:33:44.270 specific metrics for issuing heat alerts.

682 00:33:44.270 --> 00:33:49.270 We wanna follow up our work on the benefits of

683 00:33:49.360 --> 00:33:53.460 heat alert's heat warnings and heat advisories,

684 00:33:53.460 --> 00:33:54.646 because I think there's

685 00:33:54.646 --> 00:33:57.580 they're probably effective in some circumstances

686 00:33:57.580 --> 00:33:59.430 in some places and in some populations.

687 00:33:59.430 --> 00:34:01.670 And if we knew where they are effective

688 00:34:01.670 --> 00:34:03.400 and under what conditions,

689 00:34:03.400 --> 00:34:05.820 then we can presumably provide information

690 00:34:05.820 --> 00:34:08.920 that helps other communities replicate that effectiveness.

691 00:34:08.920 --> 00:34:11.178 I think there's a lot of potential benefit,

692 00:34:11.178 --> 00:34:14.123 to investigating that further.

693 00:34:15.403 --> 00:34:19.860 And you, one of the shortcomings in this line of research

694 00:34:19.860 --> 00:34:21.100 is that we don't actually have

695 00:34:21.100 --> 00:34:24.300 a centralized database of which,

696 00:34:24.300 --> 00:34:26.360 what local health departments are,

697 00:34:26.360 --> 00:34:29.040 what actions local health departments are taking

698 00:34:29.040 --> 00:34:30.650 in response and preparation for,

699 00:34:30.650 --> 00:34:33.030 and in response to days of extreme heat.

700 00:34:33.030 --> 00:34:35.989 And so one of our goals is to try to,

701 00:34:35.989 --> 00:34:39.916 catalog that we're working with Jeremy has and Nicole era,

702 00:34:39.916 --> 00:34:42.819 at university of Washington.

703 00:34:42.819 --> 00:34:45.210 And then if we can identify again,

704 00:34:45.210 --> 00:34:47.410 the key elements of these interventions and

705 00:34:48.418 --> 00:34:49.658 where they're most effective,

706 00:34:49.658 --> 00:34:51.092 then we can share this information back

707 00:34:51.092 --> 00:34:52.504 with local health departments and say,

708 00:34:52.504 --> 00:34:55.337 "hey, if you have limited resources and you,

709 00:34:55.337 --> 00:34:58.247 "here's what has worked in other settings

710 00:34:58.247 --> 00:34:59.717 "that are similar to your settings

711 00:34:59.717 --> 00:35:02.497 "in terms of whatever characteristics,

712 00:35:02.497 --> 00:35:04.593 "we wanna have about the community.

713 00:35:06.360 --> 00:35:08.850 Okay, so I wanna acknowledge also that,

714 00:35:08.850 --> 00:35:11.247 heat doesn't happen alone.

715 00:35:11.247 --> 00:35:14.223 This is some great work done by Keith Spangler,

716 00:35:14.223 --> 00:35:17.414 who is currently a post-doc in working in my group.

717 00:35:17.414 --> 00:35:19.290 And this was part of his doctoral dissertation at Brown.

718 00:35:19.290 --> 00:35:24.290 And what you see here is different hazards across different,

719 00:35:25.500 --> 00:35:27.290 across New England, sorry.

720 00:35:27.290 --> 00:35:31.660 So, this is a probability of one or more days

721 00:35:31.660 --> 00:35:34.747 with the heat index above 95 degrees.

722 00:35:34.747 --> 00:35:37.140 And so you could see the distribution of that.

723 00:35:37.140 --> 00:35:40.230 So there's parts of New England that are more prone

724 00:35:40.230 --> 00:35:42.470 to getting really hot days.

725 00:35:42.470 --> 00:35:46.310 The distribution of getting an inch or more of rainfall

726 00:35:46.310 --> 00:35:48.480 is quite different.

727 00:35:48.480 --> 00:35:50.550 And similarly, the distribution of the

728 00:35:50.550 --> 00:35:53.870 risk of high ozone days is again different.

729 00:35:53.870 --> 00:35:58.070 And we don't have high PM 2.5 levels in New England.

730 00:35:58.070 --> 00:36:01.710 But, if you were to look at where they are highest,

731 00:36:01.710 --> 00:36:04.510 you can see the distribution again is quite different.

732 00:36:04.510 --> 00:36:09.510 And so if you integrate those into the percent of days with,

733 00:36:09.950 --> 00:36:12.840 one or more hazards during this time period,

734 00:36:12.840 --> 00:36:16.539 you see that there's an interesting distribution where,

735 00:36:16.539 --> 00:36:19.140 parts of the Connecticut river Valley

736 00:36:19.140 --> 00:36:22.343 and Southern Connecticut are particularly,

737 00:36:23.390 --> 00:36:26.603 high risk of being exposed to one or more hazards.

738 00:36:28.261 --> 00:36:31.210 Interestingly, if you connect this with the

739 00:36:31.210 --> 00:36:33.344 social vulnerability index,

740 00:36:33.344 --> 00:36:35.130 this is the CDC social vulnerability index

741 00:36:35.130 --> 00:36:38.320 that is also not homogeneously distributed.

742 00:36:38.320 --> 00:36:43.237 And interestingly, those high vulnerability locations,

743 00:36:46.860 --> 00:36:51.450 also tend to have a higher probability

744 00:36:51.450 --> 00:36:54.580 of having more than one hazard.

745 00:36:54.580 --> 00:36:57.900 This is primarily driven by the distribution of,

746 00:36:57.900 --> 00:36:59.970 the hazard of excess heat,

747 00:36:59.970 --> 00:37:02.230 and somewhat by the excess ozone.

748 00:37:02.230 --> 00:37:06.141 So really interesting to think about

749 00:37:06.141 --> 00:37:09.750 how the hazards overlap with each other

750 00:37:09.750 --> 00:37:12.710 and with social vulnerability

751 00:37:12.710 --> 00:37:15.514 and Keith created a climate risk index,

752 00:37:15.514 --> 00:37:18.570 based on this which looks different

753 00:37:18.570 --> 00:37:20.970 depending on the spatial scale that you look at.

754 00:37:21.816 --> 00:37:23.888 So again, if you combine the hazards

755 00:37:23.888 --> 00:37:25.404 and the social vulnerability, again,

756 00:37:25.404 --> 00:37:28.410 the Connecticut river Valley at Southern Connecticut,

757 00:37:28.410 --> 00:37:33.410 coastal Connecticut show up as places of particularly,

758 00:37:33.800 --> 00:37:36.010 potential pretty high impact.

759 00:37:36.010 --> 00:37:38.840 And if you were to look instead at the,

760 00:37:38.840 --> 00:37:41.330 Boston metropolitan area here,

761 00:37:41.330 --> 00:37:43.930 you can see that on a very fine spatial scale.

762 00:37:43.930 --> 00:37:47.283 There's tremendous heterogeneity as well in this.

763 00:37:48.596 --> 00:37:50.680 Okay, so to close.

764 00:37:50.680 --> 00:37:54.570 So in order to adapt to current and future climate hazards,

765 00:37:54.570 --> 00:37:57.300 local officials need to know what's the current health risk

766 00:37:57.300 --> 00:37:59.480 associated with a given hazard,

767 00:37:59.480 --> 00:38:01.070 what local actions can be taken

768 00:38:01.070 --> 00:38:02.970 to protect the public health.

769 00:38:02.970 --> 00:38:06.865 Do these actions actually reduce the risk of the hazard?

770 00:38:06.865 --> 00:38:10.140 How has the risk likely to change into the future?

771 00:38:10.140 --> 00:38:11.200 I didn't go into that today,

772 00:38:11.200 --> 00:38:16.008 but obviously we have very good projections of future,

773 00:38:16.008 --> 00:38:20.960 temperature changes under different concentration pathways,

774 00:38:20.960 --> 00:38:24.532 so we can predict into the future

775 00:38:24.532 --> 00:38:26.700 under different potential alternative realities.

776 00:38:26.700 --> 00:38:28.630 And we can do this in a repetitive way

777 00:38:28.630 --> 00:38:30.623 to continue to optimize.

778 00:38:31.620 --> 00:38:33.810 And so this just Zooming way out,

779 00:38:33.810 --> 00:38:35.820 highlights the needs and challenges

780 00:38:35.820 --> 00:38:37.630 of translating scientific research

781 00:38:37.630 --> 00:38:39.293 into public health benefits.

782 00:38:40.308 --> 00:38:45.308 So, this none of this would be possible

783 00:38:45.410 --> 00:38:49.503 without a fantastic team local team in my group,

784 00:38:51.475 --> 00:38:53.420 as well as, fantastic collaborators.

785 00:38:53.420 --> 00:38:55.900 Kate Weinberger was a former post-doctoral fellow

786 00:38:55.900 --> 00:38:57.902 that worked with me and is now

787 00:38:57.902 --> 00:38:59.340 at the university of British Columbia.

788 00:38:59.340 --> 00:39:04.340 We have a terrific team at Boston university and formerly,

789 00:39:05.820 --> 00:39:07.720 people were still connected with at Brown

790 00:39:07.720 --> 00:39:10.360 and then fantastic collaborators at Harvard,

791 00:39:10.360 --> 00:39:11.400 university of Michigan,

792 00:39:11.400 --> 00:39:14.923 university of Washington and Mount Sinai.

793 00:39:15.839 --> 00:39:17.357 And of course we all need funding,

794 00:39:17.357 --> 00:39:19.620 and I'm very grateful to the funding from NHS

795 00:39:19.620 --> 00:39:21.270 and Wellcome trust.

796 00:39:21.270 --> 00:39:24.213 So I will stop there and a welcome your questions.

797 00:39:28.699 --> 00:39:33.080 - Great, thanks, Greg, for the very, insightful presentation

798 00:39:33.080 --> 00:39:36.253 and also sharing with us your latest research.

799 00:39:37.890 --> 00:39:41.270 Before we go to the question from the attendees,

800 00:39:41.270 --> 00:39:45.390 we actually, have already pre collected questions

801 00:39:45.390 --> 00:39:48.880 from the our students who attend the

802 00:39:48.880 --> 00:39:50.580 Climate Change and Health seminar.

803 00:39:51.460 --> 00:39:54.979 I'm happy to see actually doing your presentation.

804 00:39:54.979 --> 00:39:56.898 A lot of questions has been answered.

805 00:39:56.898 --> 00:39:59.923 So just, pick some of the questions remaining.

806 00:40:01.224 --> 00:40:04.330 One the heat topic that the students are wondering is

807 00:40:04.330 --> 00:40:07.930 about the effectiveness of the heat index system.

808 00:40:07.930 --> 00:40:09.500 So they're wondering,

809 00:40:09.500 --> 00:40:13.500 like why there's no standard index

810 00:40:13.500 --> 00:40:18.480 in different places, and why there can be some, action of,

811 00:40:21.400 --> 00:40:23.480 why there can be some other matrix

812 00:40:23.480 --> 00:40:28.480 that can be considered like the wet bulb temperature,

813 00:40:28.680 --> 00:40:33.680 which may shows, more spatial rate disperse,

814 00:40:33.940 --> 00:40:37.493 varied effect rather than that or temperature.

815 00:40:39.271 --> 00:40:40.894 - Yeah, it's a great question.

816 00:40:40.894 --> 00:40:43.880 So the national weather service sets up, actually

817 00:40:45.188 --> 00:40:46.560 the national level of the national weather service

818 00:40:46.560 --> 00:40:51.560 makes recommendations of criteria that could be used,

819 00:40:51.940 --> 00:40:56.102 to issue heat alerts and then encourages regional offices

820 00:40:56.102 --> 00:40:58.273 and even local offices to come up

821 00:40:58.273 --> 00:41:00.540 with their own criteria that,

822 00:41:00.540 --> 00:41:05.140 are most appropriate for the populations that they serve.

823 00:41:05.140 --> 00:41:08.370 And so there isn't exact, it's not,

824 00:41:08.370 --> 00:41:11.097 a top-down sort of you must use this,

825 00:41:11.097 --> 00:41:12.210 here's a standardized threshold, which,

826 00:41:12.210 --> 00:41:14.100 some countries have taken that approach.

827 00:41:14.100 --> 00:41:17.187 This is a much more decentralized approach.

828 00:41:17.187 --> 00:41:20.690 So many, many, locations do use the heat index.

829 00:41:20.690 --> 00:41:25.690 And for approximately, Northern location

830 00:41:26.090 --> 00:41:28.240 sort of Northern half of the country

831 00:41:29.262 --> 00:41:32.140 uses a heat index of 105 as a threshold for

832 00:41:32.140 --> 00:41:34.903 issuing heat warnings and,

833 00:41:37.400 --> 00:41:39.667 a threshold of 100 degrees heat index

834 00:41:39.667 --> 00:41:41.545 for issuing, heat advisories,

835 00:41:41.545 --> 00:41:44.994 and then the Southern half of the country, approximately,

836 00:41:44.994 --> 00:41:48.570 each of those is five degrees set at five degrees higher,

837 00:41:48.570 --> 00:41:50.460 but there's a number of locations,

838 00:41:50.460 --> 00:41:52.819 they use their own system, including,

839 00:41:52.819 --> 00:41:57.819 Philadelphia is notable for using

840 00:41:58.664 --> 00:42:01.210 a predictive model of sort of

841 00:42:01.210 --> 00:42:04.040 how many people are at risk from this heat.

842 00:42:04.040 --> 00:42:06.493 New York city has done some terrific work on,

843 00:42:07.550 --> 00:42:09.243 changing the threshold.

844 00:42:10.445 --> 00:42:12.633 So there a number of examples around the country where,

845 00:42:14.010 --> 00:42:17.330 local health departments have worked with the community

846 00:42:17.330 --> 00:42:22.200 to identify what's the most appropriate metric

847 00:42:22.200 --> 00:42:25.560 and threshold for issuing heat alerts.

848 00:42:25.560 --> 00:42:27.810 But the challenge with that approach is that,

849 00:42:29.105 --> 00:42:30.005 it's not a systematic investigation

850 00:42:30.005 --> 00:42:33.100 of what would be work the best.

851 00:42:33.100 --> 00:42:36.133 So one of our goals is to think of,

852 00:42:37.107 --> 00:42:39.006 well, let's look everywhere in the country

853 00:42:39.006 --> 00:42:41.810 and see what either by region or by community

854 00:42:41.810 --> 00:42:43.740 or by climate zones,

855 00:42:43.740 --> 00:42:47.640 what would be the optimal metric for predicting,

856 00:42:47.640 --> 00:42:52.249 which are the most dangerous days of extreme heat,

857 00:42:52.249 --> 00:42:57.249 keeping in mind that it's in nobody's interest to issue,

858 00:42:58.420 --> 00:43:00.530 a very high number of heat alerts each year.

859 00:43:00.530 --> 00:43:02.860 So you really wanna focus each summer on like,

860 00:43:02.860 --> 00:43:05.130 what are going to be the worst days,

861 00:43:05.130 --> 00:43:06.390 how do we identify those

862 00:43:06.390 --> 00:43:08.550 and sort of using a health based perspective

863 00:43:08.550 --> 00:43:10.440 rather than a weather based perspective?

864 00:43:10.440 --> 00:43:13.400 So it's not necessarily the hottest days, but rather,

865 00:43:13.400 --> 00:43:16.863 we know from the work of others that, the,

866 00:43:18.400 --> 00:43:21.620 vulnerability to heat varies by location,

867 00:43:21.620 --> 00:43:24.820 by population and by time of year,

868 00:43:24.820 --> 00:43:26.890 as well as it's been shifting over the years.

869 00:43:26.890 --> 00:43:29.320 And so taking all that into consideration,

870 00:43:29.320 --> 00:43:31.100 can we sort of have a health based metric

871 00:43:31.100 --> 00:43:35.598 for issuing heat alerts heat warnings,

872 00:43:35.598 --> 00:43:36.431 and heat advisory's.

873 00:43:36.431 --> 00:43:39.618 Wet bulb globe temperature is a really interesting one.

874 00:43:39.618 --> 00:43:41.463 There's,

875 00:43:43.290 --> 00:43:46.480 I think that it's potentially very interesting,

876 00:43:46.480 --> 00:43:49.320 and I know that in some occupational settings,

877 00:43:49.320 --> 00:43:54.320 a wet bulb globe temperature is used as the guiding metric.

878 00:43:55.130 --> 00:43:58.422 It has not been to my knowledge been widely used,

879 00:43:58.422 --> 00:44:03.422 in sort of population level, heat warning work.

880 00:44:03.970 --> 00:44:05.200 But I think it'd be really interesting

881 00:44:05.200 --> 00:44:06.400 to look at that as well.

882 00:44:08.021 --> 00:44:09.370 - Great, thanks.

883 00:44:09.370 --> 00:44:14.160 Another kind of very detailed technical question

884 00:44:14.160 --> 00:44:16.020 is one students is wondering,

885 00:44:16.020 --> 00:44:21.020 the previous paper,

886 00:44:21.130 --> 00:44:23.273 where you choose the control days,

887 00:44:24.600 --> 00:44:28.370 because if you have a very higher threshold,

888 00:44:28.370 --> 00:44:31.773 then it's likely that you don't have enough control days.

889 00:44:34.360 --> 00:44:35.220 - That's a great question.

890 00:44:35.220 --> 00:44:39.480 So this refers I believe to Kate's study

891 00:44:39.480 --> 00:44:43.439 of looking at the effectiveness of heat warnings.

892 00:44:43.439 --> 00:44:45.830 And so what we did is we compare days,

893 00:44:45.830 --> 00:44:48.220 of the similar heat index

894 00:44:48.220 --> 00:44:50.430 and with or without a heat warning.

895 00:44:50.430 --> 00:44:53.615 And you're right, that for very hot days,

896 00:44:53.615 --> 00:44:55.073 like if a day is 110 degrees, heat index,

897 00:44:55.073 --> 00:44:57.810 that there's not going to be any days

898 00:44:57.810 --> 00:45:00.480 in that same location of 110 degrees,

899 00:45:00.480 --> 00:45:02.520 that didn't have a heat warning.

900 00:45:02.520 --> 00:45:07.520 So, by so we had to limit ourselves to those days in which,

901 00:45:09.090 --> 00:45:12.950 we sometimes saw a heat warning but not always.

902 00:45:12.950 --> 00:45:16.174 And if, a 90 degree day,

903 00:45:16.174 --> 00:45:19.401 nobody's issuing heat alerts and on 110 degree day,

904 00:45:19.401 --> 00:45:20.234 everybody's issuing heat alerts.

905 00:45:20.234 --> 00:45:22.110 And so we had to focus on the middle.

906 00:45:22.110 --> 00:45:24.860 So one of the limitations of this work is that

907 00:45:24.860 --> 00:45:27.779 it is there's no counterfactual,

908 00:45:27.779 --> 00:45:30.950 there's no information about the counterfactual of like,

909 00:45:30.950 --> 00:45:33.450 what would have happened had we not issued a heat alert

910 00:45:33.450 --> 00:45:34.600 on a very, very hot day?

911 00:45:34.600 --> 00:45:38.170 There's just, there's no data is conditional on location.

912 00:45:38.170 --> 00:45:39.930 So that is one of the challenges.

913 00:45:39.930 --> 00:45:42.290 So we should, our results are generalizable

914 00:45:42.290 --> 00:45:44.740 to those days on which you might,

915 00:45:44.740 --> 00:45:46.710 or sometimes issue heat alerts.

916 00:45:46.710 --> 00:45:51.300 And not outside of that relatively narrow band

917 00:45:51.300 --> 00:45:52.203 of temperatures.

918 00:45:53.620 --> 00:45:54.750 - Thanks.

919 00:45:54.750 --> 00:45:59.642 I think we do have a question from the audience,

920 00:45:59.642 --> 00:46:01.757 one of the first, so,

921 00:46:01.757 --> 00:46:06.190 the question from Stephan Lessen is asking

922 00:46:06.190 --> 00:46:09.110 about one third of the Medicaid population

923 00:46:10.229 --> 00:46:11.610 has no access to the internet.

924 00:46:11.610 --> 00:46:16.610 So how, the heat alerts commonly distributed within cities.

925 00:46:16.680 --> 00:46:19.275 - Yeah, that's a really great question.

926 00:46:19.275 --> 00:46:21.760 And again, it varies a little bit by location.

927 00:46:21.760 --> 00:46:25.552 The several or many of the national weather service,

928 00:46:25.552 --> 00:46:28.523 local offices are actually on social media now, and you,

929 00:46:29.380 --> 00:46:31.723 you could follow them on Twitter, there's, also,

930 00:46:34.030 --> 00:46:36.830 you can sign up for their email newsletters,

931 00:46:36.830 --> 00:46:41.050 that'll warn you of particular, threats,

932 00:46:41.050 --> 00:46:43.550 and you're right that those channels,

933 00:46:43.550 --> 00:46:46.880 while they might reach some segments of the population,

934 00:46:46.880 --> 00:46:50.070 they, probably are focused

935 00:46:50.070 --> 00:46:52.000 on those segments of the population

936 00:46:52.000 --> 00:46:53.470 that are particularly engaged

937 00:46:53.470 --> 00:46:56.450 and maybe not particularly at risk,

938 00:46:56.450 --> 00:46:57.780 for heat specifically.

939 00:46:57.780 --> 00:47:02.780 So, traditionally this was all through TV and radio,

940 00:47:03.130 --> 00:47:05.976 where you would say, national weather service has

941 00:47:05.976 --> 00:47:09.040 issued a heat alert for the next two days, or for,

942 00:47:09.040 --> 00:47:13.150 this region for tomorrow and advises you to,

943 00:47:13.150 --> 00:47:16.270 drink lots of water avoid exposing yourself to

944 00:47:16.270 --> 00:47:19.205 your kids to high heat, et cetera.

945 00:47:19.205 --> 00:47:24.090 So I think they use a combination of traditional

946 00:47:24.090 --> 00:47:27.766 and digital media, channels,

947 00:47:27.766 --> 00:47:30.570 but I think it raises a good question of,

948 00:47:30.570 --> 00:47:33.106 are we reaching the most vulnerable populations,

949 00:47:33.106 --> 00:47:35.158 with these alerts?

950 00:47:35.158 --> 00:47:37.549 And even if we inform people that there's a risk

951 00:47:37.549 --> 00:47:41.220 that doesn't necessarily mean that people are able,

952 00:47:41.220 --> 00:47:44.280 to protect themselves from that risk.

953 00:47:44.280 --> 00:47:45.460 So for instance

954 00:47:45.460 --> 00:47:47.999 when we think of the most vulnerable populations,

955 00:47:47.999 --> 00:47:52.420 you're amongst them sort of perhaps outdoor workers,

956 00:47:52.420 --> 00:47:55.960 so outdoor workers, there are guidelines,

957 00:47:55.960 --> 00:47:59.738 in temperatures above which outdoor workers shouldn't work,

958 00:47:59.738 --> 00:48:02.840 but your roofers and landscapers and construction workers,

959 00:48:02.840 --> 00:48:05.440 they're not getting paid if they're not doing the work.

960 00:48:05.440 --> 00:48:09.580 So sort of the opportunity for not just

961 00:48:09.580 --> 00:48:11.834 reaching and informing people,

962 00:48:11.834 --> 00:48:13.290 but actually giving them options

963 00:48:13.290 --> 00:48:15.031 of how to protect themselves,

964 00:48:15.031 --> 00:48:17.720 is I think a really hard challenge.

965 00:48:17.720 --> 00:48:19.580 You see this also with agricultural workers

966 00:48:19.580 --> 00:48:21.010 and other settings.

967 00:48:21.010 --> 00:48:25.370 So I think that there's we have to move from a model

968 00:48:25.370 --> 00:48:27.180 where we're just trying to reach people,

969 00:48:27.180 --> 00:48:32.150 to give them information to discovering, understanding,

970 00:48:32.150 --> 00:48:34.870 and addressing the hurdles

971 00:48:34.870 --> 00:48:37.191 to actually protecting themselves,

972 00:48:37.191 --> 00:48:40.230 or helping them protect themselves,

973 00:48:40.230 --> 00:48:43.620 rather than sort of just an information deficit model.

974 00:48:43.620 --> 00:48:45.181 - Yeah thanks.

975 00:48:45.181 --> 00:48:49.930 I think, kind of follow up on these detailed questions

976 00:48:49.930 --> 00:48:53.215 one of the students is asking like,

977 00:48:53.215 --> 00:48:57.170 behind this (indistinct) system exactly.

978 00:48:57.170 --> 00:49:00.980 Kind of mixture of all multiple different intervention

979 00:49:00.980 --> 00:49:05.220 matters such as you said, some including TV,

980 00:49:05.220 --> 00:49:08.760 some including other informing approaches.

981 00:49:08.760 --> 00:49:13.760 So, kind of further question is how to,

982 00:49:13.770 --> 00:49:17.200 evaluate the cost and effectiveness

983 00:49:17.200 --> 00:49:19.890 of different approaches when people, when

984 00:49:19.890 --> 00:49:23.813 the public health officials want to inform,

985 00:49:24.787 --> 00:49:26.704 want to intervene.

986 00:49:26.704 --> 00:49:28.872 - Yeah, I think it's a really interesting question.

987 00:49:28.872 --> 00:49:30.412 And so there's two questions.

988 00:49:30.412 --> 00:49:32.150 There is sort of what,

989 00:49:32.150 --> 00:49:34.270 how do you evaluate the effectiveness

990 00:49:34.270 --> 00:49:36.750 of these different channels?

991 00:49:36.750 --> 00:49:39.292 And I think the broader question is,

992 00:49:39.292 --> 00:49:43.020 can we move away from thinking that

993 00:49:43.020 --> 00:49:46.849 a channel of communication or a series

994 00:49:46.849 --> 00:49:48.090 works on the population as a whole?

995 00:49:48.090 --> 00:49:49.313 So, for example, if we,

996 00:49:50.175 --> 00:49:53.910 if you wanna try to reach and protect outdoor workers,

997 00:49:53.910 --> 00:49:56.120 there's probably channels of communication

998 00:49:56.120 --> 00:49:58.440 and engagement that are different

999 00:49:58.440 --> 00:50:01.010 than if you're concerned about seniors

1000 00:50:01.010 --> 00:50:02.820 in institutional facilities,

1001 00:50:02.820 --> 00:50:04.810 or if you're thinking about kids in school

1002 00:50:04.810 --> 00:50:07.550 based environments or summer camp environments.

1003 00:50:07.550 --> 00:50:11.050 So I think we probably in our communication strategies

1004 00:50:11.050 --> 00:50:13.190 and engagement strategies need to move away

1005 00:50:13.190 --> 00:50:16.830 from thinking that if only we use channel X,

1006 00:50:16.830 --> 00:50:18.170 we'll reach more people,

1007 00:50:18.170 --> 00:50:19.590 it's not about reaching more people,

1008 00:50:19.590 --> 00:50:23.090 it's about reaching specific segments of the population

1009 00:50:23.090 --> 00:50:28.090 that in specific ways that are amenable to their needs

1010 00:50:28.662 --> 00:50:31.930 and the resources available to them.

1011 00:50:31.930 --> 00:50:34.258 So I think working with school nurses is a great way

1012 00:50:34.258 --> 00:50:35.870 to reach kids in school.

1013 00:50:35.870 --> 00:50:39.690 I think working with organized kids activities

1014 00:50:39.690 --> 00:50:42.920 is a great way to, reach again,

1015 00:50:42.920 --> 00:50:46.200 vulnerable children and adolescents.

1016 00:50:46.200 --> 00:50:48.550 But those strategies aren't gonna work in other settings.

1017 00:50:48.550 --> 00:50:50.800 So I think it has to be much more targeted

1018 00:50:50.800 --> 00:50:51.850 than we're doing now.

1019 00:50:54.177 --> 00:50:56.743 - Thanks, yes, those words are insightful.

1020 00:50:58.140 --> 00:51:00.560 I do have another question from the audience,

1021 00:51:00.560 --> 00:51:04.394 from Alexi, is asking,

1022 00:51:04.394 --> 00:51:07.250 is there evidence of political inference,

1023 00:51:07.250 --> 00:51:10.113 determining the implementation of the warning system?

1024 00:51:11.900 --> 00:51:13.150 - It's a great question.

1025 00:51:13.150 --> 00:51:15.730 I actually don't know enough to,

1026 00:51:15.730 --> 00:51:18.630 so I haven't seen political influence in that, but,

1027 00:51:18.630 --> 00:51:21.043 I haven't worked with,

1028 00:51:22.225 --> 00:51:27.225 too many national weather service offices directly.

1029 00:51:27.310 --> 00:51:29.950 So I think there's probably others involved

1030 00:51:31.510 --> 00:51:33.520 that can answer that more.

1031 00:51:33.520 --> 00:51:37.890 One of the interesting linkages is that sort of the

1032 00:51:37.890 --> 00:51:42.890 whether these heat alerts trigger local action

1033 00:51:43.654 --> 00:51:45.500 varies across locations.

1034 00:51:45.500 --> 00:51:47.260 So in New York city,

1035 00:51:47.260 --> 00:51:49.170 I understand that every time

1036 00:51:49.170 --> 00:51:52.230 the national weather service issues a heat warning,

1037 00:51:52.230 --> 00:51:54.110 that triggers a certain number of activities.

1038 00:51:54.110 --> 00:51:56.060 Like there's no intermediate decision,

1039 00:51:56.060 --> 00:51:58.610 whereas in the city of Boston I understand that

1040 00:51:58.610 --> 00:52:01.560 it's when the mayor declares a heat emergency,

1041 00:52:01.560 --> 00:52:04.200 which is informed by the national weather service forecast

1042 00:52:04.200 --> 00:52:05.140 and heat warnings,

1043 00:52:05.140 --> 00:52:07.100 but it's not automatically triggered by.

1044 00:52:07.100 --> 00:52:10.400 So I think there's some differences in,

1045 00:52:10.400 --> 00:52:12.790 or quite a bit of differences actually around the country

1046 00:52:12.790 --> 00:52:17.370 as to whether the national weather service heat alerts

1047 00:52:17.370 --> 00:52:19.170 automatically trigger action,

1048 00:52:19.170 --> 00:52:20.750 or are they informational,

1049 00:52:20.750 --> 00:52:23.440 but the action is triggered by some other mechanism.

1050 00:52:23.440 --> 00:52:25.717 And that's one of the things that we need

1051 00:52:25.717 --> 00:52:28.080 to get a better handle on across the country is

1052 00:52:28.080 --> 00:52:32.157 this the right trigger for local heat action plans to,

1053 00:52:32.157 --> 00:52:35.390 and heat responds plans to be activated.

1054 00:52:35.390 --> 00:52:38.270 And, I don't have a preconceived notion

1055 00:52:38.270 --> 00:52:40.440 as to what the right answer there is.

1056 00:52:40.440 --> 00:52:42.470 Maybe this is the optimal trigger

1057 00:52:42.470 --> 00:52:44.280 or maybe something that it's appropriate

1058 00:52:44.280 --> 00:52:46.350 to have an intermediate step of somebody else sort

1059 00:52:46.350 --> 00:52:49.940 of making a judgment call for that local population.

1060 00:52:49.940 --> 00:52:52.290 So I think that's an exciting area of research.

1061 00:52:53.320 --> 00:52:54.153 - Thanks.

1062 00:52:54.153 --> 00:52:56.810 We do have another question from, Rob Tuber.

1063 00:52:56.810 --> 00:52:58.382 He's asking,

1064 00:52:58.382 --> 00:53:00.120 have you ever looked into the effectiveness

1065 00:53:00.120 --> 00:53:01.663 of cooling centers?

1066 00:53:02.870 --> 00:53:04.300 - I love cooling centers

1067 00:53:04.300 --> 00:53:06.140 because they seem like such a great idea.

1068 00:53:06.140 --> 00:53:11.140 Oh, people are know dying or or being hurt by heat

1069 00:53:11.367 --> 00:53:12.560 let's provide them a cool place to go.

1070 00:53:12.560 --> 00:53:16.616 And the anecdotal evidence is that,

1071 00:53:16.616 --> 00:53:18.800 you open cooling centers and very few people go.

1072 00:53:18.800 --> 00:53:22.400 And so again, understanding the hurdles of that.

1073 00:53:22.400 --> 00:53:24.518 And I think, again,

1074 00:53:24.518 --> 00:53:27.790 I've worked somewhat with people in New York city

1075 00:53:27.790 --> 00:53:30.210 and I understand that they provide

1076 00:53:30.210 --> 00:53:34.590 transportation assistance for vulnerable populations,

1077 00:53:34.590 --> 00:53:39.590 because I think one of the hurdles they found was that,

1078 00:53:39.760 --> 00:53:42.896 not everybody can get themselves to a cooling center,

1079 00:53:42.896 --> 00:53:44.000 so you opened a cooling center and that assumes that

1080 00:53:44.000 --> 00:53:45.023 somebody can go.

1081 00:53:46.084 --> 00:53:49.210 Okay, so there's cultural barriers to or

1082 00:53:53.010 --> 00:53:55.331 barriers in terms of like, well,

1083 00:53:55.331 --> 00:53:56.630 what am I going to do there?

1084 00:53:56.630 --> 00:53:58.245 Is this a place where I'm actually welcome?

1085 00:53:58.245 --> 00:53:59.078 How do I get there?

1086 00:53:59.078 --> 00:54:01.414 Can I actually afford, like,

1087 00:54:01.414 --> 00:54:03.191 if I work, again,

1088 00:54:03.191 --> 00:54:05.190 can I take the time to go do that?

1089 00:54:05.190 --> 00:54:09.563 Or if I have, medication needs will I be able to,

1090 00:54:10.564 --> 00:54:12.732 treat my medical condition while I'm there?

1091 00:54:12.732 --> 00:54:15.431 So I think that cooling centers are really

1092 00:54:15.431 --> 00:54:17.425 intuitively attractive option.

1093 00:54:17.425 --> 00:54:20.616 And I think with so much of what we do in response to heat,

1094 00:54:20.616 --> 00:54:23.440 there is not a body of evidence as to what works.

1095 00:54:23.440 --> 00:54:26.142 And I think that's really where we need to

1096 00:54:26.142 --> 00:54:27.976 sort of move the field is starting to think

1097 00:54:27.976 --> 00:54:30.187 about what works in what settings and for whom,

1098 00:54:30.187 --> 00:54:33.400 so that we can really provide evidence-based guidance

1099 00:54:33.400 --> 00:54:35.883 for developing solutions.

1100 00:54:36.840 --> 00:54:38.770 - Thanks very well said.

1101 00:54:38.770 --> 00:54:41.220 We do need a lot of these evidence-based research

1102 00:54:41.220 --> 00:54:43.181 on these policy actions.

1103 00:54:43.181 --> 00:54:47.720 I do have another follow-up question from the students,

1104 00:54:47.720 --> 00:54:50.310 is that actually within your next steps?

1105 00:54:50.310 --> 00:54:54.340 So the students is kind of wondering

1106 00:54:54.340 --> 00:54:58.660 how do you actually verify the causal assumption

1107 00:54:58.660 --> 00:55:01.537 in evaluating the heater systems?

1108 00:55:02.770 --> 00:55:04.210 - Yeah, that's great.

1109 00:55:04.210 --> 00:55:09.210 So, the best we can do is use the data,

1110 00:55:11.810 --> 00:55:14.300 this isn't a randomized, these aren't randomized studies.

1111 00:55:14.300 --> 00:55:15.993 So the best we can do is,

1112 00:55:16.840 --> 00:55:19.820 use observational data to the best of our ability.

1113 00:55:19.820 --> 00:55:22.690 So, can we ever prove that we understand

1114 00:55:22.690 --> 00:55:24.060 the causal effect of heat alerts?

1115 00:55:24.060 --> 00:55:26.854 No, but I think we can do,

1116 00:55:26.854 --> 00:55:31.730 more detailed, more insightful analysis

1117 00:55:31.730 --> 00:55:33.780 of the existing observational data.

1118 00:55:33.780 --> 00:55:38.780 And I think this idea of there are a range of days.

1119 00:55:38.850 --> 00:55:40.790 So going back to the heat warnings,

1120 00:55:40.790 --> 00:55:42.170 there's these days where we say,

1121 00:55:42.170 --> 00:55:44.475 we're always going to issue a heat warning,

1122 00:55:44.475 --> 00:55:46.440 'cause it's just so hot that we just take it for granted

1123 00:55:46.440 --> 00:55:49.354 that it's dangerous and we need to do something,

1124 00:55:49.354 --> 00:55:50.454 so we're going to do it.

1125 00:55:50.454 --> 00:55:52.314 And then there's this other bucket,

1126 00:55:52.314 --> 00:55:55.219 a days on the other end where like, it's just,

1127 00:55:55.219 --> 00:55:57.290 issuing key warnings is just not likely to be effective,

1128 00:55:57.290 --> 00:55:59.200 but there's this middle range where you're like,

1129 00:55:59.200 --> 00:56:00.610 should I issue a heat warning?

1130 00:56:00.610 --> 00:56:01.890 Yes or no.

1131 00:56:01.890 --> 00:56:04.610 And so what we're doing is providing information

1132 00:56:04.610 --> 00:56:07.323 on that part, the spectrum, and where we say,

1133 00:56:08.890 --> 00:56:11.468 should we issue somewhat more heat alerts

1134 00:56:11.468 --> 00:56:13.990 because we can do it right around this threshold,

1135 00:56:13.990 --> 00:56:15.510 would that save lives?

1136 00:56:15.510 --> 00:56:20.230 And, that's it's not the entire picture.

1137 00:56:20.230 --> 00:56:22.350 It would be so interesting to know

1138 00:56:22.350 --> 00:56:25.470 on these very hot days when we issue heat warnings,

1139 00:56:25.470 --> 00:56:28.353 do they actually prevent deaths?

1140 00:56:29.314 --> 00:56:31.119 And the problem is as we said before,

1141 00:56:31.119 --> 00:56:33.480 that there's no data on the counterfactual,

1142 00:56:33.480 --> 00:56:35.295 like what would have happened

1143 00:56:35.295 --> 00:56:36.620 had you not issued a heat alert?

1144 00:56:36.620 --> 00:56:39.618 So, there's probably other creative ways to do it,

1145 00:56:39.618 --> 00:56:41.069 but we haven't figured that out yet.

1146 00:56:41.069 --> 00:56:44.060 So this is really about at the margin,

1147 00:56:44.060 --> 00:56:46.200 would you do better issuing say 10%

1148 00:56:46.200 --> 00:56:47.633 more heat alerts each year,

1149 00:56:48.601 --> 00:56:50.270 or 15% more heat alerts each year?

1150 00:56:50.270 --> 00:56:53.830 'Cause you don't wanna issue them if they're not,

1151 00:56:53.830 --> 00:56:55.812 there's risks of warning,

1152 00:56:55.812 --> 00:56:57.893 fatigue of people not taking it seriously.

1153 00:56:57.893 --> 00:57:00.680 Because there are too often and there's some costs

1154 00:57:00.680 --> 00:57:03.337 associated with each time you issue it,

1155 00:57:03.337 --> 00:57:04.514 if it triggers actions.

1156 00:57:04.514 --> 00:57:07.685 So it's again, it's like, no, should we issue a few more?

1157 00:57:07.685 --> 00:57:09.840 And in that question, we,

1158 00:57:09.840 --> 00:57:12.140 so far our evidence suggests

1159 00:57:12.140 --> 00:57:15.733 that there's not widespread benefit of them, but,

1160 00:57:17.030 --> 00:57:20.233 sort of with the asterisk that more work is needed on that.

1161 00:57:21.720 --> 00:57:23.521 - Okay, thanks, yeah.

1162 00:57:23.521 --> 00:57:27.730 I think we have the final comment or question

1163 00:57:27.730 --> 00:57:30.579 from Donna Spellman.

1164 00:57:30.579 --> 00:57:34.420 I've been struggling to see how implementation science

1165 00:57:34.420 --> 00:57:36.503 might promote environmental health.

1166 00:57:37.574 --> 00:57:39.720 This project is a perfect example of the connection.

1167 00:57:39.720 --> 00:57:41.153 Thanks.

1168 00:57:41.153 --> 00:57:42.123 - Thanks Donna.

1169 00:57:43.062 --> 00:57:44.230 I think that's a great point.

1170 00:57:44.230 --> 00:57:46.940 And I think that there I have not seen a large amount

1171 00:57:46.940 --> 00:57:48.400 on implementation science,

1172 00:57:48.400 --> 00:57:52.000 specifically oriented towards solutions

1173 00:57:53.310 --> 00:57:55.780 in environmental health.

1174 00:57:55.780 --> 00:57:57.510 We're really great at describing problems

1175 00:57:57.510 --> 00:58:02.510 and less good at figuring out and implementing solutions

1176 00:58:02.844 --> 00:58:04.525 and then evaluating their effectiveness.

1177 00:58:04.525 --> 00:58:06.702 So I think that this is right for that

1178 00:58:06.702 --> 00:58:07.970 because we know there's a risk there.

1179 00:58:07.970 --> 00:58:10.689 We just don't actually know exactly what to do about it.

1180 00:58:10.689 --> 00:58:12.430 And there are lots of good ideas,

1181 00:58:12.430 --> 00:58:15.007 but we need to move from good ideas to,

1182 00:58:15.007 --> 00:58:17.823 good evidence supporting specific ideas.

1183 00:58:20.093 --> 00:58:20.968 - Great.

1184 00:58:20.968 --> 00:58:24.570 I think with that we will conclude, this seminar

1185 00:58:24.570 --> 00:58:27.480 and thank you Greg, for this wonderful presentation

1186 00:58:27.480 --> 00:58:30.130 on the science-based actions.

1187 00:58:30.130 --> 00:58:34.320 And, this seminar will be recorded

1188 00:58:34.320 --> 00:58:36.540 and will be posted later.

1189 00:58:36.540 --> 00:58:40.200 So thank you all for coming and thanks again Greg.

1190 00:58:40.200 --> 00:58:42.440 - Wonderful thanks for the opportunity, bye bye.

1191 00:58:42.440 --> 00:58:43.273 - Bye.