WEBVTT

NOTE duration:"00:20:13.8900000"

NOTE language:en-us

NOTE Confidence: 0.927285134792328

00:00:00.000 --> 00:00:01.805 I would now like to

NOTE Confidence: 0.927285134792328

00:00:01.805 --> 00:00:03.249 introduce our next speaker,

NOTE Confidence: 0.927285134792328

00:00:03.250 --> 00:00:05.200 doctor Virginia Pittser Doctor Pitts

NOTE Confidence: 0.927285134792328

00:00:05.200 --> 00:00:07.920 are joined the Yale School of public

NOTE Confidence: 0.927285134792328

00:00:07.920 --> 00:00:10.377 health as an assistant professor in 2012.

NOTE Confidence: 0.927285134792328

00:00:10.380 --> 00:00:13.688 Help you could see me, let's see yes um,

NOTE Confidence: 0.927285134792328

00:00:13.688 --> 00:00:15.348 her work focuses on mathematical

NOTE Confidence: 0.927285134792328

00:00:15.348 --> 00:00:17.390 modeling of the transmission dynamics

NOTE Confidence: 0.927285134792328

00:00:17.390 --> 00:00:19.445 of imperfectly immunizing infections and

NOTE Confidence: 0.927285134792328

00:00:19.445 --> 00:00:21.837 how interventions such as vaccination,

NOTE Confidence: 0.927285134792328

00:00:21.840 --> 00:00:23.436 improved treatments and progress

NOTE Confidence: 0.927285134792328

00:00:23.436 --> 00:00:25.032 in sanitation affect disease

NOTE Confidence: 0.927285134792328

00:00:25.032 --> 00:00:26.968 transmission at the population level.

NOTE Confidence: 0.927285134792328

00:00:26.970 --> 00:00:30.806 Doctor Pittser thank you for being here.

NOTE Confidence: 0.927285134792328

00:00:30.810 --> 00:00:31.944 Thank you, um,

NOTE Confidence: 0.927285134792328

00:00:31.944 --> 00:00:34.940 so hopefully everyone can see my slides now.

NOTE Confidence: 0.927285134792328

00:00:34.940 --> 00:00:37.564 Um, so I'm going to be talking about

NOTE Confidence: 0.927285134792328

00:00:37.564 --> 00:00:40.237 some of the recent work that we've

NOTE Confidence: 0.927285134792328

00:00:40.237 --> 00:00:43.086 been doing trying to look at how

NOTE Confidence: 0.927285134792328

00:00:43.086 --> 00:00:45.588 changes in testing practices may bias

NOTE Confidence: 0.927285134792328

00:00:45.588 --> 00:00:47.831 our ability to estimate important

NOTE Confidence: 0.927285134792328

00:00:47.831 --> 00:00:50.633 measures of transmission for Coed 19.

NOTE Confidence: 0.927285134792328

00:00:50.640 --> 00:00:52.782 Um and so just so that everyone

NOTE Confidence: 0.927285134792328

00:00:52.782 --> 00:00:55.293 is kind of familiar with some of

NOTE Confidence: 0.927285134792328

00:00:55.293 --> 00:00:58.165 the basic ways that we measure the

NOTE Confidence: 0.927285134792328

00:00:58.165 --> 00:01:00.775 transmission of any infectious disease.

NOTE Confidence: 0.927285134792328

00:01:00.780 --> 00:01:03.342 I'm going to introduce some of the

NOTE Confidence: 0.927285134792328

00:01:03.342 --> 00:01:05.583 two main measures of transmission

NOTE Confidence: 0.927285134792328

00:01:05.583 --> 00:01:07.188 that we're interested.

NOTE Confidence: 0.927285134792328

00:01:07.190 --> 00:01:09.872 The first measure that people may

NOTE Confidence: 0.927285134792328

00:01:09.872 --> 00:01:13.301 have heard about some of you I'm sure

NOTE Confidence: 0.927285134792328

00:01:13.301 --> 00:01:15.641 more familiar with is called the

NOTE Confidence: 0.927285134792328

00:01:15.723 --> 00:01:18.729 basic reproductive number or are not,

NOTE Confidence: 0.927285134792328

00:01:18.730 --> 00:01:21.523 and this is defined as the average

NOTE Confidence: 0.927285134792328

00:01:21.523 --> 00:01:23.587 number of secondary infections that

NOTE Confidence: 0.927285134792328

00:01:23.587 --> 00:01:26.331 are produced by a primary case in

NOTE Confidence: 0.927285134792328

00:01:26.331 --> 00:01:28.950 the fully susceptible population.

NOTE Confidence: 0.927285134792328

00:01:28.950 --> 00:01:31.614 So it's beginning of an epidemic

NOTE Confidence: 0.927285134792328

00:01:31.614 --> 00:01:33.390 when everyone is acceptable.

NOTE Confidence: 0.927285134792328

00:01:33.390 --> 00:01:35.610 How many people, on average,

NOTE Confidence: 0.927285134792328

00:01:35.610 --> 00:01:37.865 is that first case potentially

NOTE Confidence: 0.927285134792328

00:01:37.865 --> 00:01:39.218 going to infect?

NOTE Confidence: 0.927285134792328

00:01:39.220 --> 00:01:41.836 And the reason why this is an important

NOTE Confidence: 0.927285134792328

00:01:41.836 --> 00:01:44.155 measure is that it's closely related

NOTE Confidence: 0.927285134792328

00:01:44.155 --> 00:01:46.549 to the herd immunity threshold that

NOTE Confidence: 0.927285134792328

00:01:46.618 --> 00:01:48.843 is needed to completely interrupt

NOTE Confidence: 0.927285134792328

00:01:48.843 --> 00:01:51.068 transmission in the population and

NOTE Confidence: 0.927285134792328

00:01:51.070 --> 00:01:53.360 to eventually eliminate the pathogen

NOTE Confidence: 0.927285134792328

00:01:53.360 --> 00:01:56.103 from the population where you can

NOTE Confidence: 0.927285134792328

00:01:56.103 --> 00:01:58.728 get an estimate of that herd immunity

NOTE Confidence: 0.927285134792328

00:01:58.728 --> 00:02:01.340 threshold as 1 - 1 over are not,

NOTE Confidence: 0.927285134792328

00:02:01.340 --> 00:02:04.108 and so if you're randomly, for example,

NOTE Confidence: 0.927285134792328

00:02:04.108 --> 00:02:06.078 distributing vaccine within the population,

NOTE Confidence: 0.927285134792328

00:02:06.080 --> 00:02:08.474 then if you vaccinate 1 minus are

NOTE Confidence: 0.927285134792328

00:02:08.474 --> 00:02:10.440 not of the population.

NOTE Confidence: 0.927285134792328

00:02:10.440 --> 00:02:15.704 Then you should see the infection go away.

NOTE Confidence: 0.927285134792328

00:02:15.710 --> 00:02:17.354 Another important measure of

NOTE Confidence: 0.927285134792328

00:02:17.354 --> 00:02:18.998 transmission for infectious diseases,

NOTE Confidence: 0.927285134792328

00:02:19.000 --> 00:02:21.010 which is closely related to are

NOTE Confidence: 0.927285134792328

00:02:21.010 --> 00:02:23.474 not is the time varying affective

NOTE Confidence: 0.927285134792328

00:02:23.474 --> 00:02:25.566 reproductive number or RT,

NOTE Confidence: 0.927285134792328

00:02:25.570 --> 00:02:28.276 and this refers to the average

NOTE Confidence: 0.927285134792328

00:02:28.276 --> 00:02:30.080 number of secondary infections

NOTE Confidence: 0.927285134792328

00:02:30.159 --> 00:02:32.745 that are produced per primary case.

NOTE Confidence: 0.927285134792328

00:02:32.750 --> 00:02:34.892 Occurring through time at a particular

NOTE Confidence: 0.927285134792328

00:02:34.892 --> 00:02:38.062 time T and this accounts for both the

NOTE Confidence: 0.927285134792328

00:02:38.062 --> 00:02:40.570 buildup of munity within the population,

NOTE Confidence: 0.927285134792328

00:02:40.570 --> 00:02:43.069 which will serve to limit transmission as

NOTE Confidence: 0.927285134792328

00:02:43.069 --> 00:02:46.037 well as the impact of control measures,

NOTE Confidence: 0.927285134792328

00:02:46.040 --> 00:02:48.424 and so this is an important way in

NOTE Confidence: 0.927285134792328

00:02:48.424 --> 00:02:51.042 which we can kind of track transmission

NOTE Confidence: 0.927285134792328

00:02:51.042 --> 00:02:53.563 through time and see what impact

NOTE Confidence: 0.927285134792328

00:02:53.563 --> 00:02:56.599 control measures are having on transmission,

NOTE Confidence: 0.927285134792328

00:02:56.600 --> 00:02:59.036 and so both of these different measures

NOTE Confidence: 0.927285134792328

00:02:59.036 --> 00:03:01.543 and the methods that are available

NOTE Confidence: 0.927285134792328

00:03:01.543 --> 00:03:03.873 for estimating these different measures.

NOTE Confidence: 0.927285134792328

00:03:03.880 --> 00:03:06.316 Have been shown to be robust

NOTE Confidence: 0.927285134792328

00:03:06.316 --> 00:03:08.510 to under reporting of cases,

NOTE Confidence: 0.927285134792328

00:03:08.510 --> 00:03:10.724 and so it's generally assumed that

NOTE Confidence: 0.927285134792328

00:03:10.724 --> 00:03:13.529 only a fraction of true infections that

NOTE Confidence: 0.927285134792328

00:03:13.529 --> 00:03:16.037 are out there within the population

NOTE Confidence: 0.927285134792328

00:03:16.037 --> 00:03:18.620 are actually observed in detected.

NOTE Confidence: 0.927285134792328

00:03:18.620 --> 00:03:19.041 However,

NOTE Confidence: 0.927285134792328

00:03:19.041 --> 00:03:21.146 both methods for estimating both

NOTE Confidence: 0.927285134792328

00:03:21.146 --> 00:03:22.830 are not an arty.

NOTE Confidence: 0.927285134792328

00:03:22.830 --> 00:03:25.120 Assume that the fraction of

NOTE Confidence: 0.927285134792328

00:03:25.120 --> 00:03:27.410 infections that are detected and

NOTE Confidence: 0.920118570327759

00:03:27.495 --> 00:03:29.825 reported through time is constant

NOTE Confidence: 0.920118570327759

00:03:29.825 --> 00:03:33.231 such that there's no change in the

NOTE Confidence: 0.920118570327759

00:03:33.231 --> 00:03:35.219 reporting fraction through time.

NOTE Confidence: 0.920118570327759

00:03:35.220 --> 00:03:37.332 But we know particularly for the

NOTE Confidence: 0.920118570327759

00:03:37.332 --> 00:03:39.255 early stages of the COVID-19

NOTE Confidence: 0.920118570327759

00:03:39.255 --> 00:03:41.455 pandemic in the United States,

NOTE Confidence: 0.920118570327759

00:03:41.460 --> 00:03:43.735 that there has been a lot of

NOTE Confidence: 0.920118570327759

00:03:43.735 --> 00:03:45.751 variation in testing effort and

NOTE Confidence: 0.920118570327759

00:03:45.751 --> 00:03:47.695 reporting fractions through time,

NOTE Confidence: 0.920118570327759

00:03:47.700 --> 00:03:50.913 and this is just one example of data that

NOTE Confidence: 0.920118570327759

00:03:50.913 --> 00:03:53.939 comes from the Cove at tracking project,

NOTE Confidence: 0.920118570327759

00:03:53.940 --> 00:03:56.660 which was set up by.

NOTE Confidence: 0.920118570327759

00:03:56.660 --> 00:03:59.108 People at the Atlantic to digitize

NOTE Confidence: 0.920118570327759

00:03:59.108 --> 00:04:01.286 data coming from state public

NOTE Confidence: 0.920118570327759

00:04:01.286 --> 00:04:03.174 health Department websites on

NOTE Confidence: 0.920118570327759

00:04:03.174 --> 00:04:05.534 the confirmed number of code,

NOTE Confidence: 0.920118570327759

00:04:05.540 --> 00:04:08.174 19 cases in left in blue

NOTE Confidence: 0.920118570327759

00:04:08.174 --> 00:04:10.420 from Louisiana on in red.

NOTE Confidence: 0.920118570327759

00:04:10.420 --> 00:04:13.528 In the middle is the reported number

NOTE Confidence: 0.920118570327759

00:04:13.528 --> 00:04:17.121 of new tests per day in Louisiana and

NOTE Confidence: 0.920118570327759

00:04:17.121 --> 00:04:20.693 on the rights in purple and Gray is

NOTE Confidence: 0.920118570327759

00:04:20.693 --> 00:04:23.731 the fraction of those tests that are

NOTE Confidence: 0.920118570327759

00:04:23.740 --> 00:04:26.890 positive and you can see that there's.

NOTE Confidence: 0.920118570327759

00:04:26.890 --> 00:04:29.494 Some sort of important patterns that

NOTE Confidence: 0.920118570327759

00:04:29.494 --> 00:04:33.142 you're seeing in the data where early on

NOTE Confidence: 0.920118570327759

00:04:33.142 --> 00:04:35.884 when testing capacity was quite limited,

NOTE Confidence: 0.920118570327759

00:04:35.890 --> 00:04:39.314 the number of or the percentage of tests

NOTE Confidence: 0.920118570327759

00:04:39.314 --> 00:04:43.087 that were positive tended to be quite high,

NOTE Confidence: 0.920118570327759

00:04:43.090 --> 00:04:45.790 but Louisiana managed to ramp up

NOTE Confidence: 0.920118570327759

00:04:45.790 --> 00:04:48.085 its testing practices quite quickly

NOTE Confidence: 0.920118570327759

00:04:48.085 --> 00:04:51.025 in kind of mid March and eventually

NOTE Confidence: 0.920118570327759

00:04:51.025 --> 00:04:53.335 change their testing criteria sometime

NOTE Confidence: 0.920118570327759

00:04:53.335 --> 00:04:57.112 between March 15th and April 15th to go.

NOTE Confidence: 0.920118570327759

00:04:57.112 --> 00:04:59.200 Come from preferentially testing

NOTE Confidence: 0.920118570327759

00:04:59.200 --> 00:05:02.510 individuals who are health care workers.

NOTE Confidence: 0.920118570327759

00:05:02.510 --> 00:05:03.284 For example,

NOTE Confidence: 0.920118570327759

00:05:03.284 --> 00:05:06.380 or at high risk to allowing anyone with

NOTE Confidence: 0.920118570327759

00:05:06.458 --> 00:05:08.986 a fever to be eligible for a test.

NOTE Confidence: 0.920118570327759

00:05:08.990 --> 00:05:11.606 And you can see that this is potentially

NOTE Confidence: 0.920118570327759

00:05:11.606 --> 00:05:13.988 reflected in a drop in the percent

NOTE Confidence: 0.920118570327759

00:05:13.988 --> 00:05:15.653 of individuals that were testing

NOTE Confidence: 0.920118570327759

00:05:15.717 --> 00:05:17.629 positive within the population.

NOTE Confidence: 0.920118570327759

00:05:17.630 --> 00:05:19.586 And then there are other funny

NOTE Confidence: 0.920118570327759

00:05:19.586 --> 00:05:22.323 things in the data where they did an

NOTE Confidence: 0.920118570327759

00:05:22.323 --> 00:05:24.363 audit of the commercial labs that

NOTE Confidence: 0.920118570327759

00:05:24.430 --> 00:05:26.430 were testing for COVID-19 between

NOTE Confidence: 0.920118570327759

00:05:26.430 --> 00:05:28.430 April 20th and April 24th,

NOTE Confidence: 0.920118570327759

00:05:28.430 --> 00:05:30.704 and they revise their total test

NOTE Confidence: 0.920118570327759

00:05:30.704 --> 00:05:32.779 numbers down such that if you.

NOTE Confidence: 0.920118570327759

00:05:32.780 --> 00:05:35.006 Calculate a daily number of tests

NOTE Confidence: 0.920118570327759

00:05:35.006 --> 00:05:36.881 from the cumulative number of

NOTE Confidence: 0.920118570327759

00:05:36.881 --> 00:05:38.169 tests you actually see.

NOTE Confidence: 0.920118570327759

00:05:38.170 --> 00:05:39.960 A negative number of tests,

NOTE Confidence: 0.920118570327759

00:05:39.960 --> 00:05:42.466 which obviously we know is not true,

NOTE Confidence: 0.920118570327759

00:05:42.470 --> 00:05:44.696 and so given the data that’s

NOTE Confidence: 0.920118570327759

00:05:44.696 --> 00:05:46.430 available becomes very difficult to.

NOTE Confidence: 0.920118570327759

00:05:46.430 --> 00:05:48.635 Make this assumption that testing

NOTE Confidence: 0.920118570327759

00:05:48.635 --> 00:05:50.840 effort has been constant through

NOTE Confidence: 0.920118570327759

00:05:50.912 --> 00:05:53.117 time that we need to measure our.

NOTE Confidence: 0.920118570327759

00:05:53.120 --> 00:05:55.484 Estimates of the transmission

NOTE Confidence: 0.920118570327759

00:05:55.484 --> 00:05:57.257 rate for COVID-19.

NOTE Confidence: 0.920118570327759

00:05:57.260 --> 00:05:59.647 And so one way that we’ve tried

NOTE Confidence: 0.920118570327759

00:05:59.647 --> 00:06:02.168 to get at this question of,

NOTE Confidence: 0.920118570327759

00:06:02.170 --> 00:06:02.574 well,

NOTE Confidence: 0.920118570327759

00:06:02.574 --> 00:06:04.594 how could these differences and

NOTE Confidence: 0.920118570327759

00:06:04.594 --> 00:06:06.626 changes in testing practices affect

NOTE Confidence: 0.920118570327759

00:06:06.626 --> 00:06:08.720 our ability to measure the transmission

NOTE Confidence: 0.920118570327759

00:06:08.720 --> 00:06:11.300 rates of a new infection like COVID-19

NOTE Confidence: 0.920118570327759

00:06:11.300 --> 00:06:13.502 is to simulate what might happen

NOTE Confidence: 0.920118570327759

00:06:13.510 --> 00:06:16.023 in the population when we have a

NOTE Confidence: 0.920118570327759

00:06:16.023 --> 00:06:18.073 new infection being introduced and

NOTE Confidence: 0.920118570327759

00:06:18.073 --> 00:06:20.318 then simulate sort of different

NOTE Confidence: 0.920118570327759

00:06:20.318 --> 00:06:22.671 changes in testing practices and so

NOTE Confidence: 0.920118570327759

00:06:22.671 --> 00:06:25.248 to do this we can use what's called

NOTE Confidence: 0.920118570327759

00:06:25.248 --> 00:06:27.636 the basic essay are type model.

NOTE Confidence: 0.920118570327759

00:06:27.640 --> 00:06:28.876 In this model,

NOTE Confidence: 0.920118570327759

00:06:28.876 --> 00:06:31.348 is based on the assumption that

NOTE Confidence: 0.920118570327759

00:06:31.348 --> 00:06:33.640 whenever it when people are born,

NOTE Confidence: 0.920118570327759

00:06:33.640 --> 00:06:35.640 everyone is susceptible to infection,

NOTE Confidence: 0.920118570327759

00:06:35.640 --> 00:06:38.840 and so before a new infection is introduced,

NOTE Confidence: 0.920118570327759

00:06:38.840 --> 00:06:41.978 everyone in the population is susceptible.

NOTE Confidence: 0.920118570327759

00:06:41.980 --> 00:06:43.970 When the new infection gets

NOTE Confidence: 0.920118570327759

00:06:43.970 --> 00:06:45.562 introduced into the population,

NOTE Confidence: 0.920118570327759

00:06:45.570 --> 00:06:46.764 susceptible individuals can

NOTE Confidence: 0.920118570327759

00:06:46.764 --> 00:06:48.754 get infected at some rate,

NOTE Confidence: 0.920118570327759

00:06:48.760 --> 00:06:50.920 Lambda and in turn these individuals

NOTE Confidence: 0.920118570327759

00:06:50.920 --> 00:06:52.360 are infectious and can

NOTE Confidence: 0.932710826396942

00:06:52.424 --> 00:06:53.948 infect other individuals.

NOTE Confidence: 0.932710826396942

00:06:53.950 --> 00:06:56.260 So the rate Lambda here is dependent

NOTE Confidence: 0.932710826396942

00:06:56.260 --> 00:06:58.601 both on the number of susceptible

NOTE Confidence: 0.932710826396942

00:06:58.601 --> 00:07:01.157 individuals in the population as well

NOTE Confidence: 0.932710826396942

00:07:01.157 --> 00:07:03.929 as the number of currently infected.

NOTE Confidence: 0.932710826396942

00:07:03.930 --> 00:07:05.574 An infectious individuals

NOTE Confidence: 0.932710826396942

00:07:05.574 --> 00:07:07.218 within the population.

NOTE Confidence: 0.932710826396942

00:07:07.220 --> 00:07:09.740 But after a certain amount of time,

NOTE Confidence: 0.932710826396942

00:07:09.740 --> 00:07:11.930 we know that individuals stop being

NOTE Confidence: 0.932710826396942

00:07:11.930 --> 00:07:13.764 infectious and stop shedding the

NOTE Confidence: 0.932710826396942

00:07:13.764 --> 00:07:15.304 particular virus and may recover

NOTE Confidence: 0.932710826396942

00:07:15.304 --> 00:07:17.825 and build up some level of immunity

NOTE Confidence: 0.932710826396942

00:07:17.825 --> 00:07:19.457 that prevents further infection.

NOTE Confidence: 0.932710826396942

00:07:19.460 --> 00:07:21.920 And then finally individuals can die

NOTE Confidence: 0.932710826396942

00:07:21.920 --> 00:07:24.760 both of the disease or of natural

NOTE Confidence: 0.932710826396942

00:07:24.760 --> 00:07:27.004 causes from all of these states.

NOTE Confidence: 0.932710826396942

00:07:27.010 --> 00:07:29.285 And then all of this gets summarized

NOTE Confidence: 0.932710826396942

00:07:29.285 --> 00:07:31.561 into a series of differential equations

NOTE Confidence: 0.932710826396942

00:07:31.561 --> 00:07:34.021 in which the number of individuals

NOTE Confidence: 0.932710826396942

00:07:34.021 --> 00:07:36.678 in each state within the population

NOTE Confidence: 0.932710826396942

00:07:36.678 --> 00:07:38.858 changes through time in proportion

NOTE Confidence: 0.932710826396942

00:07:38.860 --> 00:07:40.892 to these particular parameters,

NOTE Confidence: 0.932710826396942

00:07:40.892 --> 00:07:43.940 and the current state of number

NOTE Confidence: 0.932710826396942

00:07:44.021 --> 00:07:46.356 of individuals in each state.

NOTE Confidence: 0.932710826396942

00:07:46.360 --> 00:07:50.194 And so we can use a model like this.

NOTE Confidence: 0.932710826396942

00:07:50.200 --> 00:07:52.744 Uhm, to simulate an epidemic where

NOTE Confidence: 0.932710826396942

00:07:52.744 --> 00:07:55.750 instead of using the basic Sir model,

NOTE Confidence: 0.932710826396942

00:07:55.750 --> 00:07:58.330 we add an additional E compartment

NOTE Confidence: 0.932710826396942

00:07:58.330 --> 00:08:00.538 which models individuals who are

NOTE Confidence: 0.932710826396942

00:08:00.538 --> 00:08:02.588 infected but not yet infectious.

NOTE Confidence: 0.932710826396942

00:08:02.590 --> 00:08:04.720 And we stochastically simulate an

NOTE Confidence: 0.932710826396942

00:08:04.720 --> 00:08:06.424 epidemic occurring through time,

NOTE Confidence: 0.932710826396942

00:08:06.430 --> 00:08:08.873 and this is just one example on

NOTE Confidence: 0.932710826396942

00:08:08.873 --> 00:08:11.957 the left here of the results of

NOTE Confidence: 0.932710826396942

00:08:11.957 --> 00:08:14.402 this stochastic simulation where we

NOTE Confidence: 0.932710826396942

00:08:14.402 --> 00:08:16.678 introduce one infected individual at

NOTE Confidence: 0.932710826396942

00:08:16.678 --> 00:08:20.008 Time zero in a population of a million.

NOTE Confidence: 0.932710826396942

00:08:20.008 --> 00:08:22.312 And allow the infection to kind

NOTE Confidence: 0.932710826396942

00:08:22.312 --> 00:08:25.113 of slowly take off and then in Day

NOTE Confidence: 0.932710826396942

00:08:25.113 --> 00:08:27.515 50 we decided we're going to come

NOTE Confidence: 0.932710826396942

00:08:27.515 --> 00:08:29.895 in and we're going to reduce the

NOTE Confidence: 0.932710826396942

00:08:29.900 --> 00:08:31.650 transmission rate by some amount.

NOTE Confidence: 0.932710826396942

00:08:31.650 --> 00:08:33.408 Such the epidemic starts to decline

NOTE Confidence: 0.932710826396942

00:08:33.408 --> 00:08:35.503 and then we can make assumptions

NOTE Confidence: 0.932710826396942

00:08:35.503 --> 00:08:37.227 about the reporting process,

NOTE Confidence: 0.932710826396942

00:08:37.230 --> 00:08:39.570 where we model both the.

NOTE Confidence: 0.932710826396942

00:08:39.570 --> 00:08:42.066 Probability that a true case is

NOTE Confidence: 0.932710826396942

00:08:42.066 --> 00:08:44.678 detected an tested and the observed

NOTE Confidence: 0.932710826396942

00:08:44.678 --> 00:08:47.270 cases are then some fraction of

NOTE Confidence: 0.932710826396942

00:08:47.270 --> 00:08:49.865 the overall number of infections

NOTE Confidence: 0.932710826396942

00:08:49.865 --> 00:08:52.069 times the reporting fraction.

NOTE Confidence: 0.932710826396942

00:08:52.070 --> 00:08:54.737 And that's plotted in blue here as

NOTE Confidence: 0.932710826396942

00:08:54.737 --> 00:08:57.668 well as the number of uninfected

NOTE Confidence: 0.932710826396942

00:08:57.668 --> 00:08:59.940 individuals who are tested,

NOTE Confidence: 0.932710826396942

00:08:59.940 --> 00:09:02.496 which we assume is some occurs

NOTE Confidence: 0.932710826396942

00:09:02.496 --> 00:09:05.291 in some proportion to the overall

NOTE Confidence: 0.932710826396942

00:09:05.291 --> 00:09:07.806 number of infections out there.

NOTE Confidence: 0.932710826396942

00:09:07.810 --> 00:09:11.200 As testing capacity starts ramping up.

NOTE Confidence: 0.932710826396942

00:09:11.200 --> 00:09:13.097 And then we also assume that individuals

NOTE Confidence: 0.932710826396942

00:09:13.097 --> 00:09:15.197 are tested and reported with some delay,

NOTE Confidence: 0.932710826396942

00:09:15.200 --> 00:09:16.976 where we assume a median of five and

NOTE Confidence: 0.932710826396942

00:09:16.976 --> 00:09:19.424 a half days between the time the new

NOTE Confidence: 0.932710826396942

00:09:19.424 --> 00:09:21.084 infection becomes symptomatic and the

NOTE Confidence: 0.932710826396942

00:09:21.084 --> 00:09:23.205 time they actually get tested and reported.

NOTE Confidence: 0.932710826396942

00:09:23.210 --> 00:09:25.706 And this was based on some

NOTE Confidence: 0.932710826396942

00:09:25.706 --> 00:09:28.040 early data out of China.

NOTE Confidence: 0.932710826396942

00:09:28.040 --> 00:09:29.960 And then to estimate the basic

NOTE Confidence: 0.932710826396942

00:09:29.960 --> 00:09:31.240 reproductive number or not.

NOTE Confidence: 0.932710826396942

00:09:31.240 --> 00:09:33.232 The way we do this is based on

NOTE Confidence: 0.932710826396942

00:09:33.232 --> 00:09:34.973 the rate of exponential growth

NOTE Confidence: 0.932710826396942

00:09:34.973 --> 00:09:37.319 at the beginning of the epidemic,

NOTE Confidence: 0.932710826396942

00:09:37.320 --> 00:09:39.608 where if you take this equation for the

NOTE Confidence: 0.932710826396942

00:09:39.608 --> 00:09:42.408 rate of change of the number of new

NOTE Confidence: 0.932710826396942

00:09:42.408 --> 00:09:44.580 infected individuals within the population.

NOTE Confidence: 0.932710826396942

00:09:44.580 --> 00:09:46.630 You assume that everyone is

NOTE Confidence: 0.932710826396942

00:09:46.630 --> 00:09:48.680 acceptable in the first place.

NOTE Confidence: 0.932710826396942

00:09:48.680 --> 00:09:51.046 And you do some math to solve

NOTE Confidence: 0.932710826396942

00:09:51.046 --> 00:09:52.060 this differential equation.

NOTE Confidence: 0.932710826396942

00:09:52.060 --> 00:09:54.556 What you find is that the number of

NOTE Confidence: 0.932710826396942

00:09:54.556 --> 00:09:56.260 new infections through time should

NOTE Confidence: 0.932710826396942

00:09:56.260 --> 00:09:58.619 be equal to the number of infected

NOTE Confidence: 0.932710826396942

00:09:58.689 --> 00:10:01.188 individuals initially times E to the RT,

NOTE Confidence: 0.932710826396942

00:10:01.190 --> 00:10:03.584 where this little R is equal to

NOTE Confidence: 0.932710826396942

00:10:03.584 --> 00:10:05.610 the growth rate of the epidemic

NOTE Confidence: 0.932710826396942

00:10:05.610 --> 00:10:07.752 or the slope of the log in

NOTE Confidence: 0.923668205738068

00:10:07.828 --> 00:10:10.628 the number of cases through time and is

NOTE Confidence: 0.923668205738068

00:10:10.628 --> 00:10:13.269 equal to are not minus one over D and

NOTE Confidence: 0.923668205738068

00:10:13.269 --> 00:10:16.021 so you can estimate are not based on

NOTE Confidence: 0.923668205738068

00:10:16.021 --> 00:10:18.800 this knowledge of what the growth rate.

NOTE Confidence: 0.923668205738068

00:10:18.800 --> 00:10:21.520 Through the epidemic is through time and D,

NOTE Confidence: 0.923668205738068

00:10:21.520 --> 00:10:23.902 which is the generational or the

NOTE Confidence: 0.923668205738068

00:10:23.902 --> 00:10:26.336 serial interval between one case and

NOTE Confidence: 0.923668205738068

00:10:26.336 --> 00:10:28.670 the case that that individual impacts.

NOTE Confidence: 0.923668205738068

00:10:28.670 --> 00:10:32.422 And then we can also estimate Artie

NOTE Confidence: 0.923668205738068

00:10:32.422 --> 00:10:35.678 by our knowledge of the sort of.

NOTE Confidence: 0.923668205738068

00:10:35.680 --> 00:10:38.152 Or inference of the underlying infection

NOTE Confidence: 0.923668205738068

00:10:38.152 --> 00:10:40.510 tree within the population where if

NOTE Confidence: 0.923668205738068

00:10:40.510 --> 00:10:42.750 you have one individual say he was

NOTE Confidence: 0.923668205738068

00:10:42.750 --> 00:10:44.857 infected on day four of the epidemic,

NOTE Confidence: 0.923668205738068

00:10:44.860 --> 00:10:46.695 they could have been infected

NOTE Confidence: 0.923668205738068

00:10:46.695 --> 00:10:48.740 by any individual on Day 3,

NOTE Confidence: 0.923668205738068

00:10:48.740 --> 00:10:50.858 two or one of the epidemic,

NOTE Confidence: 0.923668205738068

00:10:50.860 --> 00:10:52.805 and the probability that this

NOTE Confidence: 0.923668205738068

00:10:52.805 --> 00:10:55.128 individual on day one infected this

NOTE Confidence: 0.923668205738068

00:10:55.128 --> 00:10:57.263 individual on day four is just going

NOTE Confidence: 0.923668205738068

00:10:57.263 --> 00:11:00.042 to be a function of how likely the

NOTE Confidence: 0.923668205738068

00:11:00.042 --> 00:11:02.536 generation interval is to be 3 days

NOTE Confidence: 0.923668205738068

00:11:02.536 --> 00:11:04.708 compared to all the other possible

NOTE Confidence: 0.923668205738068

00:11:04.708 --> 00:11:06.344 generation intervals that could

NOTE Confidence: 0.923668205738068

00:11:06.344 --> 00:11:08.756 have given rise to this infection.

NOTE Confidence: 0.923668205738068

00:11:08.760 --> 00:11:11.424 And then we can look back to this

NOTE Confidence: 0.923668205738068

00:11:11.424 --> 00:11:13.691 infection occurring on Day One and ask

NOTE Confidence: 0.923668205738068

00:11:13.691 --> 00:11:15.680 well how many individuals did this

NOTE Confidence: 0.923668205738068

00:11:15.680 --> 00:11:18.368 person likely infect by summing up the

NOTE Confidence: 0.923668205738068

00:11:18.368 --> 00:11:20.259 probability that all the individuals

NOTE Confidence: 0.923668205738068

00:11:20.259 --> 00:11:22.497 on subsequent days was infected by

NOTE Confidence: 0.923668205738068

00:11:22.497 --> 00:11:24.145 this particular individual on day

NOTE Confidence: 0.923668205738068

00:11:24.145 --> 00:11:26.909 one on Day 2 on day three, etc.

NOTE Confidence: 0.923668205738068

00:11:26.909 --> 00:11:31.400 And so when you put all of this together.

NOTE Confidence: 0.923668205738068

00:11:31.400 --> 00:11:32.393 Oops, sorry. Um?

NOTE Confidence: 0.923668205738068

00:11:32.393 --> 00:11:35.238 What we can do here is to estimate

NOTE Confidence: 0.923668205738068

00:11:35.238 --> 00:11:38.332 the impact of either an increase or

NOTE Confidence: 0.923668205738068

00:11:38.332 --> 00:11:41.050 decrease in the testing probability

NOTE Confidence: 0.923668205738068

00:11:41.050 --> 00:11:43.328 through time. We're on the top.

NOTE Confidence: 0.923668205738068

00:11:43.328 --> 00:11:45.423 Here we are assuming that the testing

NOTE Confidence: 0.923668205738068

00:11:45.423 --> 00:11:47.253 probability through time is constant

NOTE Confidence: 0.923668205738068

00:11:47.253 --> 00:11:49.430 and the number of true cases.

NOTE Confidence: 0.923668205738068

00:11:49.430 --> 00:11:52.046 The number of tests in the number of

NOTE Confidence: 0.923668205738068

00:11:52.046 --> 00:11:54.018 confirmed cases is plotted in black,

NOTE Confidence: 0.923668205738068

00:11:54.020 --> 00:11:56.720 red and blue on the left.

NOTE Confidence: 0.923668205738068

00:11:56.720 --> 00:11:59.058 The percent of tests that are positive

NOTE Confidence: 0.923668205738068

00:11:59.058 --> 00:12:01.477 is plugged in purple in the middle,

NOTE Confidence: 0.923668205738068

00:12:01.480 --> 00:12:04.344 and our estimate of the real time time

NOTE Confidence: 0.923668205738068

00:12:04.344 --> 00:12:06.578 bearing reproductive number is in green here.

NOTE Confidence: 0.923668205738068

00:12:06.580 --> 00:12:08.280 Based on the observed number

NOTE Confidence: 0.923668205738068

00:12:08.280 --> 00:12:09.980 of cases and in black,

NOTE Confidence: 0.923668205738068

00:12:09.980 --> 00:12:12.020 based on the true number of

NOTE Confidence: 0.923668205738068

00:12:12.020 --> 00:12:13.040 infections through time,

NOTE Confidence: 0.923668205738068

00:12:13.040 --> 00:12:15.350 and generally what we find is that

NOTE Confidence: 0.923668205738068

00:12:15.350 --> 00:12:17.800 when the probability of a true case

NOTE Confidence: 0.923668205738068

00:12:17.800 --> 00:12:19.540 being tested is increasing slightly

NOTE Confidence: 0.923668205738068

00:12:19.540 --> 00:12:21.876 through time plotted in the middle here,

NOTE Confidence: 0.923668205738068

00:12:21.880 --> 00:12:24.029 you'd expect to see a slight increase

NOTE Confidence: 0.923668205738068

00:12:24.029 --> 00:12:25.897 in the percent of individuals

NOTE Confidence: 0.923668205738068

00:12:25.897 --> 00:12:27.669 testing positive through time.

NOTE Confidence: 0.923668205738068

00:12:27.670 --> 00:12:30.406 As well as a slight overestimation of the

NOTE Confidence: 0.923668205738068

00:12:30.406 --> 00:12:33.210 value of the basic reproductive number,

NOTE Confidence: 0.923668205738068

00:12:33.210 --> 00:12:35.556 because the number of observed cases

NOTE Confidence: 0.923668205738068

00:12:35.556 --> 00:12:38.227 is growing faster than the number of

NOTE Confidence: 0.923668205738068

00:12:38.227 --> 00:12:40.297 two infections through time as well

NOTE Confidence: 0.923668205738068

00:12:40.297 --> 00:12:42.900 as a slight overestimation of the

NOTE Confidence: 0.923668205738068

00:12:42.900 --> 00:12:45.090 real time time varying reproductive

NOTE Confidence: 0.923668205738068

00:12:45.090 --> 00:12:46.191 number through time.

NOTE Confidence: 0.923668205738068

00:12:46.191 --> 00:12:48.760 Whereas if the probability of detecting a

NOTE Confidence: 0.923668205738068

00:12:48.823 --> 00:12:51.427 true cases slightly decreasing through time,

NOTE Confidence: 0.923668205738068

00:12:51.430 --> 00:12:52.618 we slightly underestimate

NOTE Confidence: 0.923668205738068

00:12:52.618 --> 00:12:54.598 the value of are not,

NOTE Confidence: 0.923668205738068

00:12:54.600 --> 00:12:57.440 and we slightly underestimate again

NOTE Confidence: 0.923668205738068

00:12:57.440 --> 00:13:00.830 the value of Artie through time.

NOTE Confidence: 0.923668205738068

00:13:00.830 --> 00:13:01.278 Um,

NOTE Confidence: 0.923668205738068

00:13:01.278 --> 00:13:01.726 however,

NOTE Confidence: 0.923668205738068

00:13:01.726 --> 00:13:04.414 this increase or decrease in the

NOTE Confidence: 0.923668205738068

00:13:04.414 --> 00:13:06.759 percent positive through time might

NOTE Confidence: 0.923668205738068

00:13:06.759 --> 00:13:09.039 also be occurring because individuals

NOTE Confidence: 0.923668205738068

00:13:09.039 --> 00:13:11.672 who are not infected are being

NOTE Confidence: 0.923668205738068

00:13:11.672 --> 00:13:14.144 becoming more likely to be tested.

NOTE Confidence: 0.923668205738068

00:13:14.150 --> 00:13:16.222 Perhaps because there’s an

NOTE Confidence: 0.923668205738068

00:13:16.222 --> 00:13:18.294 increase in testing capacity.

NOTE Confidence: 0.923668205738068

00:13:18.300 --> 00:13:20.196 And so instead we assume that

NOTE Confidence: 0.923668205738068

00:13:20.196 --> 00:13:21.460 the number of individuals

NOTE Confidence: 0.923234760761261

00:13:21.521 --> 00:13:23.341 tested for every true cases

NOTE Confidence: 0.923234760761261

00:13:23.341 --> 00:13:24.797 just increasing through time.

NOTE Confidence: 0.923234760761261

00:13:24.800 --> 00:13:27.012 Again, we just expect to see potentially

NOTE Confidence: 0.923234760761261

00:13:27.012 --> 00:13:29.289 a decrease or an increase in the

NOTE Confidence: 0.923234760761261

00:13:29.289 --> 00:13:30.869 percent of the individuals that

NOTE Confidence: 0.923234760761261

00:13:30.869 --> 00:13:33.007 are testing positive through time.

NOTE Confidence: 0.923234760761261

00:13:33.010 --> 00:13:35.264 But in this case our estimates of

NOTE Confidence: 0.923234760761261

00:13:35.264 --> 00:13:38.138 are not an arty tend to be unbiased,

NOTE Confidence: 0.923234760761261

00:13:38.140 --> 00:13:40.165 so it’s really important to

NOTE Confidence: 0.923234760761261

00:13:40.165 --> 00:13:42.190 understand the context in which

NOTE Confidence: 0.923234760761261

00:13:42.266 --> 00:13:44.696 these increases or decreases in the

NOTE Confidence: 0.923234760761261

00:13:44.696 --> 00:13:47.080 percent positive may be happening.

NOTE Confidence: 0.923234760761261

00:13:47.080 --> 00:13:49.126 Another possibility is that there is

NOTE Confidence: 0.923234760761261

00:13:49.126 --> 00:13:51.687 a change to the testing criteria which

NOTE Confidence: 0.923234760761261

00:13:51.687 --> 00:13:54.305 could lead to a sudden increase or

NOTE Confidence: 0.923234760761261

00:13:54.379 --> 00:13:56.785 decrease in the testing probability or

NOTE Confidence: 0.923234760761261

00:13:56.785 --> 00:13:59.866 the probability that a true case gets tested.

NOTE Confidence: 0.923234760761261

00:13:59.866 --> 00:14:02.080 And if this is the case,

NOTE Confidence: 0.923234760761261

00:14:02.080 --> 00:14:04.166 and you see a large increase in

NOTE Confidence: 0.923234760761261

00:14:04.166 --> 00:14:06.094 the probability that a true cases

NOTE Confidence: 0.923234760761261

00:14:06.094 --> 00:14:07.709 actually getting to test tested.

NOTE Confidence: 0.923234760761261

00:14:07.710 --> 00:14:10.398 We in this case the model estimates

NOTE Confidence: 0.923234760761261

00:14:10.398 --> 00:14:12.576 that there should be a slight

NOTE Confidence: 0.923234760761261

00:14:12.576 --> 00:14:14.802 bias in the estimate of are not,

NOTE Confidence: 0.923234760761261

00:14:14.810 --> 00:14:16.966 and they larger bias in your estimate

NOTE Confidence: 0.923234760761261

00:14:16.966 --> 00:14:18.686 of the time bearing reproductive

NOTE Confidence: 0.923234760761261

00:14:18.686 --> 00:14:21.606 number such that you see this sort of

NOTE Confidence: 0.923234760761261

00:14:21.669 --> 00:14:24.057 large increase that is not consistent.

NOTE Confidence: 0.923234760761261

00:14:24.060 --> 00:14:27.546 Slow decline in the true number of

NOTE Confidence: 0.923234760761261

00:14:27.546 --> 00:14:29.520 infections occurring through time.

NOTE Confidence: 0.923234760761261

00:14:29.520 --> 00:14:30.322 And similarly,

NOTE Confidence: 0.923234760761261

00:14:30.322 --> 00:14:33.129 if you see a decrease in the

NOTE Confidence: 0.923234760761261

00:14:33.129 --> 00:14:35.580 testing probability through time,

NOTE Confidence: 0.923234760761261

00:14:35.580 --> 00:14:39.078 you see a similar bias occurring.

NOTE Confidence: 0.923234760761261

00:14:39.080 --> 00:14:39.487 Again,

NOTE Confidence: 0.923234760761261

00:14:39.487 --> 00:14:39.894 however,

NOTE Confidence: 0.923234760761261

00:14:39.894 --> 00:14:42.336 this increase or decrease in the

NOTE Confidence: 0.923234760761261

00:14:42.336 --> 00:14:44.055 percent positive through time could

NOTE Confidence: 0.923234760761261

00:14:44.055 --> 00:14:46.796 just be due to a change in the number

NOTE Confidence: 0.923234760761261

00:14:46.796 --> 00:14:48.908 of tests that are being performed,

NOTE Confidence: 0.923234760761261

00:14:48.910 --> 00:14:51.367 or a change in the testing capacity.

NOTE Confidence: 0.923234760761261

00:14:51.370 --> 00:14:52.078 For example,

NOTE Confidence: 0.923234760761261

00:14:52.078 --> 00:14:54.202 if a new private lab starts

NOTE Confidence: 0.923234760761261

00:14:54.202 --> 00:14:54.910 testing individuals.

NOTE Confidence: 0.923234760761261

00:14:54.910 --> 00:14:55.838 So in this case,

NOTE Confidence: 0.923234760761261

00:14:55.838 --> 00:14:57.570 you'd see a chart start changing the

NOTE Confidence: 0.923234760761261

00:14:57.570 --> 00:14:59.280 number of tests occurring through time,

NOTE Confidence: 0.923234760761261

00:14:59.280 --> 00:15:02.394 but you would not expect there to be any

NOTE Confidence: 0.923234760761261

00:15:02.394 --> 00:15:05.520 bias in your estimates of are not or RT.

NOTE Confidence: 0.923234760761261

00:15:05.520 --> 00:15:07.697 And then finally we also looked at

NOTE Confidence: 0.923234760761261

00:15:07.697 --> 00:15:09.934 what would happen if there was a

NOTE Confidence: 0.923234760761261

00:15:09.934 --> 00:15:11.800 change in the reporting delay through

NOTE Confidence: 0.923234760761261

00:15:11.861 --> 00:15:13.973 time within either an increase or

NOTE Confidence: 0.923234760761261

00:15:13.973 --> 00:15:15.671 decrease in the reporting delay.

NOTE Confidence: 0.923234760761261

00:15:15.671 --> 00:15:16.514 In this case,

NOTE Confidence: 0.923234760761261

00:15:16.514 --> 00:15:18.975 it would be harder to accept that by

NOTE Confidence: 0.923234760761261

00:15:18.975 --> 00:15:21.111 looking at the percent of individuals

NOTE Confidence: 0.923234760761261

00:15:21.111 --> 00:15:22.629 testing positive through time,

NOTE Confidence: 0.923234760761261

00:15:22.630 --> 00:15:24.325 but we could potentially see

NOTE Confidence: 0.923234760761261

00:15:24.325 --> 00:15:26.391 a relatively large bias in our

NOTE Confidence: 0.923234760761261

00:15:26.391 --> 00:15:28.547 estimates of both are not and Artie,

NOTE Confidence: 0.923234760761261

00:15:28.550 --> 00:15:31.336 so this is a potentially more problematic

NOTE Confidence: 0.923234760761261

00:15:31.336 --> 00:15:33.760 change in the testing process.

NOTE Confidence: 0.923234760761261

00:15:33.760 --> 00:15:36.231 And so now we're looking at applying

NOTE Confidence: 0.923234760761261

00:15:36.231 --> 00:15:38.107 these methods to learn something

NOTE Confidence: 0.923234760761261

00:15:38.107 --> 00:15:40.718 about how our estimates of the real

NOTE Confidence: 0.923234760761261

00:15:40.718 --> 00:15:42.626 time and basic reproductive number

NOTE Confidence: 0.923234760761261

00:15:42.626 --> 00:15:45.472 of COVID-19 in the US may or may

NOTE Confidence: 0.923234760761261

00:15:45.472 --> 00:15:47.398 not be biased by these different

NOTE Confidence: 0.923234760761261

00:15:47.398 --> 00:15:49.260 changes in testing practices.

NOTE Confidence: 0.923234760761261

00:15:49.260 --> 00:15:51.852 And this is data for all of the

NOTE Confidence: 0.923234760761261

00:15:51.852 --> 00:15:54.786 US in which we have the number,

NOTE Confidence: 0.923234760761261

00:15:54.790 --> 00:15:57.112 total number of tests in the

NOTE Confidence: 0.923234760761261

00:15:57.112 --> 00:15:59.073 number of positive tests plotted

NOTE Confidence: 0.923234760761261

00:15:59.073 --> 00:16:01.793 on the log scale on the left here,

NOTE Confidence: 0.923234760761261

00:16:01.800 --> 00:16:04.026 as well as the percent of.

NOTE Confidence: 0.923234760761261

00:16:04.030 --> 00:16:05.790 Individuals testing positive through

NOTE Confidence: 0.923234760761261

00:16:05.790 --> 00:16:09.194 time for both daily data as well as

NOTE Confidence: 0.923234760761261

00:16:09.194 --> 00:16:10.914 kind of cumulatively overtime on

NOTE Confidence: 0.923234760761261

00:16:10.914 --> 00:16:13.737 it in the middle and then our best

NOTE Confidence: 0.923234760761261

00:16:13.737 --> 00:16:16.222 estimate of the real time time varying

NOTE Confidence: 0.923234760761261

00:16:16.222 --> 00:16:17.746 reproductive number through time.

NOTE Confidence: 0.923234760761261

00:16:17.750 --> 00:16:19.615 Where overall what we estimate

NOTE Confidence: 0.923234760761261

00:16:19.615 --> 00:16:21.480 is that the basic reproductive

NOTE Confidence: 0.923234760761261

00:16:21.548 --> 00:16:23.080 number before March 24th,

NOTE Confidence: 0.923234760761261

00:16:23.080 --> 00:16:24.865 when things start to flatten

NOTE Confidence: 0.923234760761261

00:16:24.865 --> 00:16:26.650 out is estimated to be

NOTE Confidence: 0.909145653247833

00:16:26.720 --> 00:16:29.415 around 3 1/2 with a time varying

NOTE Confidence: 0.909145653247833

00:16:29.415 --> 00:16:31.416 reproductive number of starting off

NOTE Confidence: 0.909145653247833

00:16:31.416 --> 00:16:34.132 around 4:00 and then kind of quickly.

NOTE Confidence: 0.909145653247833

00:16:34.140 --> 00:16:37.941 Decreasing and then kind of has been

NOTE Confidence: 0.909145653247833

00:16:37.941 --> 00:16:42.090 hovering just at or below one since around

NOTE Confidence: 0.909145653247833

00:16:42.090 --> 00:16:46.038 early to mid April in the entire US.

NOTE Confidence: 0.909145653247833

00:16:46.040 --> 00:16:49.272 And then we can look at this, uhm,

NOTE Confidence: 0.909145653247833

00:16:49.272 --> 00:16:52.168 broken down for each of the states where

NOTE Confidence: 0.909145653247833

00:16:52.168 --> 00:16:55.744 we start to see kind of more an more

NOTE Confidence: 0.909145653247833

00:16:55.744 --> 00:16:58.447 inconsistencies in reporting as well as

NOTE Confidence: 0.909145653247833

00:16:58.447 --> 00:17:01.207 low probabilities of individuals kind of

NOTE Confidence: 0.909145653247833

00:17:01.210 --> 00:17:04.490 being tested early on in in the epidemic,

NOTE Confidence: 0.909145653247833

00:17:04.490 --> 00:17:06.912 where this starts to kind of emerged

NOTE Confidence: 0.909145653247833

00:17:06.912 --> 00:17:09.903 as a greater potential bias in some of

NOTE Confidence: 0.909145653247833

00:17:09.903 --> 00:17:12.429 these estimates of the time varying

NOTE Confidence: 0.909145653247833

00:17:12.429 --> 00:17:14.749 reproductive number through time.

NOTE Confidence: 0.909145653247833

00:17:14.750 --> 00:17:15.938 Particularly, for example,

NOTE Confidence: 0.909145653247833

00:17:15.938 --> 00:17:16.730 in Washington,

NOTE Confidence: 0.909145653247833

00:17:16.730 --> 00:17:18.705 where there's this strong day

NOTE Confidence: 0.909145653247833

00:17:18.705 --> 00:17:20.285 of the week effect,

NOTE Confidence: 0.909145653247833

00:17:20.290 --> 00:17:23.069 you can see within the testing process,

NOTE Confidence: 0.909145653247833

00:17:23.070 --> 00:17:25.236 which is probably causing some of

NOTE Confidence: 0.909145653247833

00:17:25.236 --> 00:17:27.606 these kind of Wiggles in their

NOTE Confidence: 0.909145653247833

00:17:27.606 --> 00:17:29.741 time varying estimate of the

NOTE Confidence: 0.909145653247833

00:17:29.741 --> 00:17:31.420 reproductive number through time.

NOTE Confidence: 0.909145653247833

00:17:31.420 --> 00:17:32.335 In in California,

NOTE Confidence: 0.909145653247833

00:17:32.335 --> 00:17:34.470 generally what we see these kind of

NOTE Confidence: 0.909145653247833

00:17:34.535 --> 00:17:36.712 large increases in the number of tests

NOTE Confidence: 0.909145653247833

00:17:36.712 --> 00:17:38.537 'cause they had some inconsistencies

NOTE Confidence: 0.909145653247833

00:17:38.537 --> 00:17:41.027 and particularly the reporting of the

NOTE Confidence: 0.909145653247833

00:17:41.027 --> 00:17:43.288 negative test through time, which we

NOTE Confidence: 0.909145653247833

00:17:43.288 --> 00:17:45.690 don't think will bias estimates of RT.

NOTE Confidence: 0.909145653247833

00:17:45.690 --> 00:17:47.808 But this sort of lack of.

NOTE Confidence: 0.909145653247833

00:17:47.810 --> 00:17:50.197 Slow ramp up and recording early on

NOTE Confidence: 0.909145653247833

00:17:50.197 --> 00:17:53.034 may have led to these sort of larger

NOTE Confidence: 0.909145653247833

00:17:53.034 --> 00:17:55.490 estimates of the RT value early on,

NOTE Confidence: 0.909145653247833

00:17:55.490 --> 00:17:57.926 and similarly in New York West testing

NOTE Confidence: 0.909145653247833

00:17:57.926 --> 00:18:00.367 capacity kind of was limited early on.

NOTE Confidence: 0.909145653247833

00:18:00.370 --> 00:18:02.302 We think that this sort of initial

NOTE Confidence: 0.909145653247833

00:18:02.302 --> 00:18:03.970 peak in the estimated real-time

NOTE Confidence: 0.909145653247833

00:18:03.970 --> 00:18:05.530 reproductive numbers is based

NOTE Confidence: 0.909145653247833

00:18:05.530 --> 00:18:08.050 on this sort of large increase,

NOTE Confidence: 0.909145653247833

00:18:08.050 --> 00:18:10.602 but you can then see kind of our

NOTE Confidence: 0.909145653247833

00:18:10.602 --> 00:18:12.900 estimates of the most recent measures

NOTE Confidence: 0.909145653247833

00:18:12.900 --> 00:18:15.282 of Artie are probably not going

NOTE Confidence: 0.909145653247833

00:18:15.353 --> 00:18:17.474 to be biased by these sort of,

NOTE Confidence: 0.909145653247833

00:18:17.480 --> 00:18:18.290 for example.

NOTE Confidence: 0.909145653247833

00:18:18.290 --> 00:18:20.720 Slow decrease in the percentage of

NOTE Confidence: 0.909145653247833

00:18:20.720 --> 00:18:23.015 individuals testing positive in New York

NOTE Confidence: 0.909145653247833

00:18:23.015 --> 00:18:25.520 because this is mostly been associated with,

NOTE Confidence: 0.909145653247833

00:18:25.520 --> 00:18:25.897 UM,

NOTE Confidence: 0.909145653247833

00:18:25.897 --> 00:18:28.536 a ramp up the testing capacity in

NOTE Confidence: 0.909145653247833

00:18:28.536 --> 00:18:31.288 the number of tests conducted through

NOTE Confidence: 0.909145653247833

00:18:31.288 --> 00:18:34.162 time and these slow changes didn't

NOTE Confidence: 0.909145653247833

00:18:34.246 --> 00:18:36.836 seem to bias our estimates of RT.

NOTE Confidence: 0.909145653247833

00:18:36.840 --> 00:18:38.001 And so finally,

NOTE Confidence: 0.909145653247833

00:18:38.001 --> 00:18:40.323 what we've been doing more recently

NOTE Confidence: 0.909145653247833

00:18:40.323 --> 00:18:42.934 is to work on kind of incorporating

NOTE Confidence: 0.909145653247833

00:18:42.934 --> 00:18:46.166 some of this data to develop now casts

NOTE Confidence: 0.909145653247833

00:18:46.166 --> 00:18:48.316 of the current COVID-19 epidemic,

NOTE Confidence: 0.909145653247833

00:18:48.320 --> 00:18:50.355 where we can take information

NOTE Confidence: 0.909145653247833

00:18:50.355 --> 00:18:52.874 about the observed number of cases

NOTE Confidence: 0.909145653247833

00:18:52.874 --> 00:18:55.316 occurring in blue here and deaths

NOTE Confidence: 0.909145653247833

00:18:55.316 --> 00:18:57.689 occurring in green here and infer

NOTE Confidence: 0.909145653247833

00:18:57.689 --> 00:19:00.195 back based on our prior knowledge of

NOTE Confidence: 0.909145653247833

00:19:00.200 --> 00:19:02.402 the reporting process to estimate the

NOTE Confidence: 0.909145653247833

00:19:02.402 --> 00:19:04.367 number of new infections occurring

NOTE Confidence: 0.909145653247833

00:19:04.367 --> 00:19:06.537 through time within the population.

NOTE Confidence: 0.909145653247833

00:19:06.540 --> 00:19:09.368 And this is just one example of.

NOTE Confidence: 0.909145653247833

00:19:09.370 --> 00:19:11.515 Data from Connecticut where you

NOTE Confidence: 0.909145653247833

00:19:11.515 --> 00:19:14.568 can see that the number of new

NOTE Confidence: 0.909145653247833

00:19:14.568 --> 00:19:16.633 infections here is peaking quite

NOTE Confidence: 0.909145653247833

00:19:16.633 --> 00:19:19.155 a bit earlier than the observed

NOTE Confidence: 0.909145653247833

00:19:19.155 --> 00:19:21.549 number of cases from the UM,

NOTE Confidence: 0.909145653247833

00:19:21.550 --> 00:19:23.650 Connecticut Department of Public health,

NOTE Confidence: 0.909145653247833

00:19:23.650 --> 00:19:26.149 and this allows for more accurate estimates

NOTE Confidence: 0.909145653247833

00:19:26.149 --> 00:19:29.108 of the time bearing reproductive number,

NOTE Confidence: 0.909145653247833

00:19:29.110 --> 00:19:31.245 which corrects for the reporting

NOTE Confidence: 0.909145653247833

00:19:31.245 --> 00:19:34.149 delays that we know are going on.

NOTE Confidence: 0.909145653247833

00:19:34.150 --> 00:19:36.105 And now these time varying

NOTE Confidence: 0.909145653247833

00:19:36.105 --> 00:19:37.669 reproductive numbers can allow

NOTE Confidence: 0.909145653247833

00:19:37.669 --> 00:19:39.929 for more accurate assessment of

NOTE Confidence: 0.909145653247833

00:19:39.929 --> 00:19:41.725 the impact of interventions.

NOTE Confidence: 0.909145653247833

00:19:41.730 --> 00:19:42.704 For example,

NOTE Confidence: 0.909145653247833

00:19:42.704 --> 00:19:44.652 these changes in mobility

NOTE Confidence: 0.909145653247833

00:19:44.652 --> 00:19:46.600 that sod was talking

NOTE Confidence: 0.894067525863647

00:19:46.684 --> 00:19:48.818 about earlier. And so finally,

NOTE Confidence: 0.894067525863647

00:19:48.818 --> 00:19:51.100 I'd just like to thank some of

NOTE Confidence: 0.894067525863647

00:19:51.173 --> 00:19:53.298 my collaborators on this work,

NOTE Confidence: 0.894067525863647

00:19:53.300 --> 00:19:55.841 including a series of a number of

NOTE Confidence: 0.894067525863647

00:19:55.841 --> 00:19:57.296 individuals, both PhD students,

NOTE Confidence: 0.894067525863647

00:19:57.296 --> 00:19:59.468 postdocs, as well as other faculty

NOTE Confidence: 0.894067525863647

00:19:59.468 --> 00:20:01.306 from the school, public health,

NOTE Confidence: 0.894067525863647

00:20:01.306 --> 00:20:02.758 public health modeling unit,

NOTE Confidence: 0.894067525863647

00:20:02.760 --> 00:20:04.872 as well as Nick Menzies from

NOTE Confidence: 0.894067525863647

00:20:04.872 --> 00:20:06.280 Harvard School of public

NOTE Confidence: 0.894067525863647

00:20:06.356 --> 00:20:08.216 health and funding from NIH.

NOTE Confidence: 0.915202021598816

00:20:12.250 --> 00:20:13.888 Thank you very much Doctor Pittser.