Welcome to *Public Health On Call*, a new podcast from the Johns Hopkins Bloomberg School of Public Health. Our focus is COVID-19, the novel coronavirus. I'm Josh Sharfstein, a faculty member at Johns Hopkins and also a former Secretary of Maryland's Health Department.

Our goal with this podcast is to bring evidence and experts to help you understand today's news about the novel coronavirus and what it means for tomorrow. If you have questions, you can email them to publichealthquestion@jhu.edu. That's publichealthquestion@jhu.edu for future podcast episodes.

Today, I'm talking to Dr. Justin Lessler, associate professor of epidemiology at the Johns Hopkins Bloomberg School of Public Health. Dr. Lessler is one of the world's experts on how viruses move through populations. And in this discussion, he speaks about how he sizes up the novel coronavirus. Let's listen.

Tell me a little bit about what you do as an infectious disease epidemiologist.

**JUSTIN LESSLER:** Yeah. So I study how infectious diseases move through populations. Specifically what I do is I study infectious disease dynamics, which is the study of how diseases transmit, how they develop in people over time and space.

**JOSHUA**

So give me a few infectious diseases that you've studied over time.

**SHARFSTEIN:**

**JUSTIN LESSLER:** So I started out working mostly on influenza, the flu, which I still studied today. And I've also worked a lot on cholera, which is the biggest part of my current work. But then also I tend to get involved in emerging infections as they come along. So the current novel coronavirus, of course. I worked on pandemic H1N1 back in 2009. So I have a very intense interest in emerging infections.

**JOSHUA**

Great. So governments might call you, for example.

**SHARFSTEIN:**

**JUSTIN LESSLER:** Yes. We've worked with governments. We've worked with public health agencies. Worked with other institutions.
JOSHUA: Both national and global?

SHARFSTEIN:

JUSTIN LESSLER: Yes.

JOSHUA: So let's talk about coronavirus. You hear that there is a new infection out there. Everybody hears that news and reacts a little bit differently. You're an expert in new infectious diseases. What do you want to know about this new disease?

JUSTIN LESSLER: Yeah. So we sort of have a toolkit of things that sort of help us really quickly assess, or that we want to know to really quickly assess how big of a threat the disease is and what we can do to control it. One thing we want to know-- and people might have heard of it because it shows up in movies like *Contagion* and stuff like that-- is the reproductive number. And how tells us how many cases, each case of the disease is expected to cause in a naive population, or a population that hasn't seen the disease. And so if that number is greater than 1, so it's like 2, 3, the disease is going to grow and cause an epidemic. If it's less than 1, the disease will die out even if we get stuttering chains.

So like avian influenzas that pop up occasionally you might hear about in the news, those have r less than 1. They die out. The current coronavirus, which in Wuhan looked like it had an r from 2 to 3, it's growing. It's spreading globally.

JOSHUA: And what else besides the r?

SHARFSTEIN:

JUSTIN LESSLER: So the next thing we want to know is how quickly subsequent generations of infection happen. If they happen really close together, like the flu-- like if I infect somebody, they get sick and can infect somebody else in a couple of days. Then the disease is going to move really fast because you're going to get, you can just do the math. 2, 4, 8, 16. In just a few days, you can have a huge number of cases.

For something like HIV or tuberculosis, there is months or years in between subsequent generations of cases. So even though each individual will ultimately infect a lot of people, and you'll have a big epidemic, that epidemic is going to move a lot slower.

JOSHUA: And when it's a slower epidemic, what are the implications for the response?

SHARFSTEIN:
JUSTIN LESSLER: I mean, in terms of an emerging infectious disease, it just buys you time in a way. Because it’s going to get to you slower. You have more time to prepare. You have more time to think about what’s going to happen.

Conversely, slower epidemics pop up on your radar slower. It takes longer to do. Like how long did it take HIV or AIDS for people to realize that was a problem. I mean, given, the world was much different then, but it took a really long time. And part of the reason it took a long time was because it was taking people so long to get sick.

Whereas something like the novel coronavirus, we had a big epidemic pretty quick. And it’s clear we had a problem right off.

JOSHUA: So compare the new virus with influenza in terms of its transmission time.

SHARFSTEIN:

JUSTIN LESSLER: So the new virus has, the novel coronavirus has about eight day or week long serial interval. That's the generation time. And influenza is a little less than half that, like usually around 2.5 days, two days.

JOSHUA: So we have a little bit more time as this is moving, it's moving a little slower than fluid move but it's still moving pretty fast compared to something like--

SHARFSTEIN:

JUSTIN LESSLER: Our best estimates is it's a little more transmissible than flu in the sense that the r is a little bit higher. But it moves about half to a third the speed in terms of the generations of infection.

JOSHUA: Any other characteristics of the virus you’re focused on?

SHARFSTEIN:

JUSTIN LESSLER: The asymptomatic rate. That's the 100 pound--

JOSHUA: The asymptomatic rate. So tell me about that.

SHARFSTEIN:

JUSTIN LESSLER: The 900 pound gorilla. How many people have the disease and aren't getting sick and aren't showing symptoms? And then do those people transmit? That's one of the biggest questions, open questions about this virus. And I think it's critical to how we think about what we can do for control.
So let's take a couple scenarios. Let's say it turns out that there is a big asymptomatic rate and people can transmit. What does that mean?

Let's start with the other way. Because it's easier.

OK. That's good.

So if everybody's sick, I can go out and find sick people. Or I can just tell sick people, I can say, hey, you got a cough. Stay home. And I can cut down the disease transmission there.

Like if you think about that r number I said. Let's say r is two. And you get into your house within a quarter of your infectious period. Your r is now 0.5.

I see.

And you're not going to cause, you're not going to replace yourself in the population as a case.

And then the infections will go down.

--pass up. Will die out. And so if I can make that happen by focusing on people with symptoms, that's great. Whether it's them focusing on themselves by self isolating or stuff like that, us doing screening at like travel on the train or things like that. Or even if we do develop a treatment, like going and being really quick to go treat people who start looking sick. Right at the doctor. So that's great. Now on the flip side, imagine 80% of the people who have the disease don't show symptoms. Then all of those things don't work.

I see.

Because I cannot use symptom based interventions that target people with the disease and the symptoms to reduce the transmission. The one little nuance there is sometimes you have large asymptomatic rates, like a lot of people don't develop symptoms, but they don't transmit as much. Because if you're sick with the disease, you cough and stuff like that.

You're spewing viral particles in all directions.
JUSTIN LESSLER: You're spewing viral particles. But it's not clear. And that's one of the things that's not clear about it.

JOSHUA SHARFSTEIN: So sounds like this asymptomatic rate issue is very important for coronavirus. What do we know right now?

JUSTIN LESSLER: We know some people are asymptomatic. We are pretty sure people, there is at least some asymptomatic transmission. We don't know much more.

JOSHUA SHARFSTEIN: I've been reading that some people seem to think it's a relatively modest or minor cause of transmission, but--

JUSTIN LESSLER: Yeah. But we don't know. Right. And that's a big question.

JOSHUA SHARFSTEIN: So what kinds of studies would help answer that question?

JUSTIN LESSLER: I think, well, there's two kinds of studies. One is kind of technical. It's something I did on the Middle Eastern respiratory syndrome. Whereas if we capture people through proactive surveillance-- that means like going and testing people because of like who they've contacted or where they've been rather than testing them because they have symptoms. We can use that information to figure out what the profile of the average case looks like. Or average infected person looks like, and whether or not they develop symptoms. So that can help us figure it out.

So that's one way. The other way is serological surveys, or serological tests. So whenever you get infected with an infectious disease, your body responds to that disease. You sort of change forever because your adaptive immune system adapts to respond to it. And we can go draw some blood and see--

JOSHUA SHARFSTEIN: Who has been exposed, who might have been infected.

JUSTIN LESSLER: Right, who's been exposed.

JOSHUA SHARFSTEIN: Even if they didn't have symptoms.
And so this is a pretty important question. Because on the one hand, if there isn't that big of an issue of asymptomatic individuals passing the virus, on it's much easier to control.

Right.

On the other hand, if there is a problem, it becomes much more complicated. When do you think we'll really start to have more definitive answers to that?

I think probably one way or another in a month or two. Hopefully sooner. We're working, like that's one thing our group's doing is trying to figure that out. Yeah.

And I also want to make one more sort of note on the asymptomatic proportion. And also it's critical for calculating how bad the disease is. So what you usually see reported is something called the case fatality rate. That's how many people who actually get sick end up progressing to death. And that's important. But what you really want to know if you really want to know how bad it is, is the infection fatality rate. That means if you get infected, regardless of whether or not you get sick, will you die?

So if there are a lot of asymptomatic cases out there and those aren't, people aren't dying, then the infection fatality rate is quite low. And then even if this spreads widely, it's probably going to be a relatively modest in terms of fatality. We can talk about all the reasons why that's not the only thing to worry about in a second.

Plus if you're the one who's dying, the rate is--

It's one for you.

Immaterial, right.

Right, immaterial.

But your point being that if we find a lot of asymptomatic individuals, that may illustrate that most people aren't getting very sick from it. On the other hand, what's really critical is whether they can keep passing it on when they're asymptomatic.

Yeah. In terms of the overall spread.
JOSHUA SHARFSTEIN: So the good news scenarios would be either there aren't that many asymptomatic people, or more likely there are asymptomatic people but they can't really pass it on. That would be a good news scenario. The not so good news scenario would be there are a lot of asymptomatic people who can pass it on quite effectively.

JUSTIN LESSLER: Well, right. And then once again, it's a balance. The more efficiently the disease is spreading, the lower the case fatality rate probably is, or the infection fatality rate probably is. The less efficiently it's spreading, the higher the CFR probably is. And I can sort of tell--

JOSHUA SHARFSTEIN: That's the case fatality rate?

JUSTIN LESSLER: Case fatality rate. Yeah. Or the higher the infection fatality.

JOSHUA: Yeah.

JUSTIN LESSLER: So I can sort of tell you just based on the r knot that like somewhere between 40% and 70% of the world's population likely will have this disease at some point, just based on the r knot. Like we might have to get a vaccine. We might, maybe it'll die out in the summer. Maybe we'll have a drug. Not definitive but if it like sort of cruises on, based on how transmissible it is, that's just where the math shoots, hits you.

JOSHUA: Right. So that infection fatality rate will determine how many people die?

JUSTIN LESSLER: Right. Yeah. So if it's really low, I mean, it's still a giant problem when you do the, when we start multiplying where you're starting with nearly 8 billion people, you get big numbers even at fairly low infection fatality rates. But if the infection fatality rate is high, then that translates into a lot more death.

JOSHUA: Well thank you so much for helping to explain sort of some of these basic issues with infectious diseases. And we wish you the best with your work, to really characterize this particular infectious disease, and be able to give the best advice based on the dynamics and modeling you can do once you know these dimensions to help with the response.

JUSTIN LESSLER: Thank you. It was great talking to you.
JOSHUA  SHARFSTEIN: Thank you for listening to Public Health On Call, a new podcast from the Johns Hopkins Bloomberg School of Public Health. Please send questions to be covered in future episodes to publichealthquestion@jhu.edu. That’s publichealthquestion@jhu.edu. This podcast is produced by Owen McCusker, Chip Hickey, Josh Sharfstein, and Lymari Morales. Thank you for listening.