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PROFESSOR: So now we're ready to synthesize our knowledge of airborne transmission in a well-mixed room and epidemiological models to arrive at a safety guideline to limit the indoor airborne spread of COVID-19, or, more generally, other respiratory pathogens.

Existing guidelines limit one parameter that might be important.

For example, social distancing limits the spacing between people, which can be defined by the average area per occupant for example, to a minimum of, say, 6 feet or 1 meter.

Other rules, for example, adopted here in the state of Massachusetts, limit all gatherings to be no larger than 25 persons indoors.

There also are recommendations from heating and ventilation societies that may recommend we increase the fresh air change rate to six or higher.

In the UK, for example, the fresh air flow rate might be prescribed to 10 liters per second per person or other such numbers.

Also the time that an infected person is in the presence of susceptible people might be limited to say, 15 minutes.

That's involved in the definition of a contact here in the United States.

So what we will see is that it's really not possible to write down a realistic guideline that bounds any one quantity, because there will always be situations where you either are too conservative or are not careful enough in bounding that quantity, because these qualities are all related.

So, for example, 25 persons might be perfectly safe in a very large space for a very short amount of time with very high ventilation.

But take those 25 persons and seal them into a small tent, breathing each other's air for 24 hours with very little ventilation, it's a completely different situation.

And the same holds for the distance, or the time, or the flow rates, everything is mixed.

And then what about other variables that we don't explicitly control?

Like relative humidity or filtration efficiency, if you're using filters to filter the air.

Or if you're wearing masks.

The quality of the masks, how well does that come in?

How about the volume of the space?

It's not just the flow rate, but it's also the geometry, even the area, or the length of the space.

So somehow all these variables must be related, and the goal of this chapter is to derive that relationship for the case of a well-mixed room, where it's a unique universal guideline.

And to parameterize this specifically for COVID-19, by looking at a variety of superspreading events for which enough data is available that we can make a reasonable and consistent inference of the infectiousness of exhaled breath.