Eric Schiff:

Good morning. Welcome to this Syracuse Center of Excellence and today's research and technology forum. I'm Eric Schiff, Interim Director of the Center and the moderator for today.

Eric Schiff:

Many schools are preparing today for students and teachers to return to classrooms this fall after six months of hiatus. Education experts recommend that classroom teaching resume as soon as possible and as soon as it's safe. But how safe will reopening be? How safe is safe enough? Scientists are now confident that COVID-19 spreads through the air when an infected person breathes, coughs or mostly unfortunately sings. Infected non symptomatic students are going to be in our classrooms. How can we minimize the risk?

Eric Schiff:

The first line of defense is going to be masks and social distancing. If perfectly implemented, these two measures very substantially reduce the risk of transmitting COVID-19, but perfection with students is an elusive goal. So today's forum is concerned with the second line of defense, how can we keep the amount of airborne virus in classrooms low even in the presence of an infected person?

Eric Schiff:

So I'm going to ask a series of questions to three expert panelists. One panelist, Brandon Hall, is unfortunately unable to join us today due a family emergency. Afterwards, after the series of questions that sort of set the stage for asking our panelists to respond to your our listeners questions. Please send us in to us at any time during the forum, using the online connection you have to the forum.

Eric Schiff:

So first of all, joining us today is Jianshun Zhang, Professor of engineering at Syracuse University. Jianshun is known around the world as an expert on indoor air quality. So Jianshun, can you just start us off with an example of airborne transmission of the virus, particular example where one person carrying COVID-19 has infected many other healthy people? Jianshun?

Jianshun 'Jenson' Zhang:

Thank you, Eric. There's a couple of examples that like in a bus, in the choir, and in the restaurants, I think the most convincing example to me are airborne isolation of the virus live in the restaurant. This is a restaurant in the Guangzhou city of China. And there is total of 18 tables and three of them getting infected. These three table and the middle table has a one virus carrier, the original virus carrier that he not only infected people the four people on the same table, but also infect the five people to other table, one on the left and one on the right.

Jianshun 'Jenson' Zhang:

Now, the three tables, the people in the three tables are all coming from different families. So they have no contact before, during and after the incidence. So I think, and the researchers went back to the restaurant to see what's happening to those [inaudible 00:03:29]. It turned out in this particular space had very low ventilation. And typically, will require four liters, at least four liters per second and that place has only less than one liters per second of ventilation. And they also look at the air distribution, so they're actually using the computational fluid dynamics and to simulate airflow patterns. So the spread of the virus appears to be consistent with the airflow pattern.

Jianshun 'Jenson' Zhang:

I think this is one of the case that I will say it's fairly convincing, that It's quite probable that this virus can transmit through the airborne locked. And of course, we know in [inaudible 00:04:20], we know that when people talk and when people cough, [inaudible 00:04:28] also. We are talking about and also these are the fine particles which are less than a five microns. So these particles transfer can stay in air for a long time. Anything that flows in the air, therefore if you don't have enough ventilation, diluting the airborne transmission is quite possible.

Eric Schiff:

Thanks very much Jianshun, that's excellent. Our second panelist is Michael Wessel, who's the president and CEO of air innovations. Air innovations is a Syracuse company that designs and manufactures systems for managing ventilation and air quality, in hospitals, biotech laboratories and other industries. Mike, we've heard a lot from Governor Cuomo and others that COVID transmission is much lower outside than inside buildings, which is why restaurants in Syracuse are now serving customers outdoors as much as they can. What's your explanation for the difference in infection risk when you're indoors versus outdoors?

Michael Wetzel:

Thank you. Thank you Eric. The data and the guidance from the CDC and Department of Health, always talk about proximity and duration to an infected person. Your likelihood of contracting the disease will always come down to proximity and duration. I actually know from personal experience, I had exposure to somebody who was tested positive. Very first question department health asked me is, were you within six feet for 15 minutes or more unprotected without masks. And so it really comes down to how much you get exposed to a direct concentration of the contagion.

Michael Wetzel:

Indoor air quality since the 1970s, the energy crisis of the 1970s, we've worked really hard about making our buildings extremely energy efficient. And as a result, we make them tighter and tighter and tighter. There's very little leakage anymore In a modern building. Many modern office buildings don't even have windows that open that could otherwise leak. And so we have a high reliance on our mechanical systems now to ventilate our spaces, both to give us adequate air exchanges through the room, mixing of the air running it through filters, and also to bring in fresh air to dilute gases and contagions like COVID-19.

Michael Wetzel:

Just a typical indoor air is going to, how many air exchanges you have is going to be dependent on when your building was built. But it's sufficient to say it's probably in the five to 10 air changes an hour. It might even be less if you're in a really old building, you might not have any air changes an hour to help control and disperse particles, including COVID. And fresh air exchange is only going to be a fraction of that.

Michael Wetzel:

Take that to the outside. And even in a light breeze, you could have hundreds of air exchanges per hour. Even in no breeze because you're not confined, your plume is going to rise. And it's going to dissipate into the atmosphere. And so very quickly COVID is dissipated in an outdoor environment radically different than an indoor contained environment that we could ever make in an indoor environment.

Michael Wetzel:

And the data from China, even shows that there are very few cases of transmission outdoors. And I suspect those cases people were extremely close to each other for a prolonged period of time, like at a concert or at a rally or something like that, whereby you can be that close to somebody in such a... You almost create your own confined space by a significant population. As long as you've got even adequate[inaudible 00:08:06] and movement of air, especially in outdoor rural environments like upstate New York, you would expect significantly improved results outdoors.

Eric Schiff:

I see. So outdoors is literally hundreds of times better than many buildings?

Michael Wetzel:

Yeah literally.

Eric Schiff:

All right. Thanks, Mike. And our third panelist is Cliff Davidson, also a professor of engineering at Syracuse University. Among other subjects Cliff is a well known expert on aerosols, which are tiny particles or droplets that float in the air for long periods of time. So Cliff, what's your recommendation about one response, a teacher might have to indoor air quality, which is opening windows in their classrooms to try to dilute virus particles that are floating around in there?

Cliff Davidson:

Thanks very much, Eric. So I think that one can think about opening windows as a means of getting closer to the way the situation is outdoors. When you have a lot of air flowing past, you've got air motions, and therefore you have dilution occurring. As Mike just mentioned, anything that you can do in order to dilute the concentration of the virus is a good thing. Now, of course, there are a number of caveats, If your classroom has windows that will open, there may be other problems that develop for example, if there're loud noises outside, opening up the windows can in fact help the airflow in the room, but the noise from outside might be a distraction to the students.

Cliff Davidson:

In addition, if there's a lot of traffic right outside the classroom windows, then you may be getting a lot of vehicle exhaust. And while that's certainly not Coronavirus, and in fact, any kind of outdoor air is likely to dilute the Coronavirus, you nevertheless might be bringing in air that is loaded with vehicle exhaust and is and is therefore, unhealthful. And sometimes opening up the windows can just be a distraction for students.

Cliff Davidson:

Another point that can be made is that, if your classroom is on the corner of a building, and you can open up windows that are on two walls, rather than opening up windows just on one wall, that's going to enhance the air flow. Because you'll have the cross flow, air going in through one set of windows and going out through another set of Windows. If you just have windows on one side of the room, you may want to open the windows, but in addition, if you're able to open the door to the classroom, that may also allow cross flow of air.

Cliff Davidson:

So those are the kinds of things that you can do to take advantage of the fact that when you open windows, you can in fact have dilution of the virus. And that's always a good thing.

Michael Wetzel:

Eric, we can't hear you. There we go. Now we can hear you.

Eric Schiff:

All right, any case. Thanks very much. Let's now enter into the more complex subject of how heating ventilation and air conditioning systems in buildings can affect airborne transmission of COVID-19. This is complicated for a variety of reasons, one of which is no two schools or buildings have the same systems. And most of us really don't know a lot about this. So I'm going to direct a related question to Mike Wessel. So Mike, what are a couple of the questions a teacher could ask a building manager or a school administrator about a building's heating ventilation and air conditioning system that would help them appreciate the situation regarding COVID-19?

Michael Wetzel:

Yeah, thanks. I guess the first and most fundamental question that I would have a teacher asked their building management, is what kind of HVAC do I have in my room? [inaudible 00:13:01] fundamental types. What I'm going to call forced air, which means there's diffusers. You can actually see in my screen behind me a small diffuser. There's diffusers in the ceiling and you actually have an air movement, so the heating and the air conditioning is accomplished by conditioning air that then is recirculated through the room. That's called a forced air system.

Michael Wetzel:

The other system that you might have is radiant. And radiant was more typical in older buildings. I know the school that I grew up in, we didn't have any air conditioning, we only had radiant heat. Radiant, you might know as baseboard, it can be hot water, it can be steam. They'll usually be some kind of large unit underneath a window or along the wall wrapping around the room. And that is going to be a heating only system managed by water or steam. So I'd ask the question, forced air or radiant? If they answer forced air, that means you will have some options. You could ask them then if we can increase the filtration that's on that system. Any forced air system will have some filtration on it, it'll be a fairly coarse level filtration standard. And what you're going to want to do is increase it to the level that the system can tolerate it. We can't just stick a HVAC filter in an existing system, it will never push the air through it and you will have you will create other issues because you'll reduce airflow so much.

Michael Wetzel:

But if you could get to a MERV 13, or a MERV 14, that would be very significant and have a significant improvement. One thing to know about viruses is they're extremely small, but you don't have to have a filtration of the size of the virus to catch it because for the most part, viruses move attached to other particles. And so people sort of miss that nuance often. They talk about oh COVID is so tiny. It is, but it's going to float through the air attached to a larger particle. And so by reducing particle concentration in the space, you're going to be reducing the number of COVID particles. COVIDs are also floating around attached to those particles. So getting up to even a MERV 14 would be fantastic increasing in filtration.

Michael Wetzel:

The other thing I would then ask them is, can we increase fresh air? It's going to be the same problem. Is you're not going to go wide open and have a 100% fresh air into an existing system, it won't be able to tolerate it. But if you've got to make a mechanical forced air system, there will be a fresh air path. And it's very likely they can open up those damper some and help you increase fresh air. The third thing I might ask them is, what about humidification? A lot of forced air systems are centered on just cooling and heating. And that's it. Very few people went and bought and put humidification in. And there are a lot of data that shows that a virus is much stronger in dry conditions than it is in normal humid conditions, keeping humidity at 40 to 50% is worse for the virus, the virus will die off quicker than if you're at 20%.

Michael Wetzel:

And you get into winter around here in upstate New York and it can be very dry. And so adding humidification, trying to get to 40% of relative humidity. Again, if you're in a forced air system, you can usually add that to it and improve the indoor air quality. If you're on a radiant system, you're going to have to look for other solutions. A radiant system, you're not going to be able to do any modifications to a radiant heating system that are going to help indoor air quality, you're going to be reliant on adding devices or opening windows, you're going to be left with not being able to modify that particular piece of mechanical equipment to improve indoor air quality. Can't hear you again.

Eric Schiff:

Questions Mike, I have to remember to unmute myself. Those are great questions. And MERV 13 is the technical question we should ask about filters. Okay, let's move on then. So, of course, most, as Mike just said, most buildings now have central forced air systems that draw air from each room, hopefully filter it and then blow it back into the building. So I'm going to address the next question to Jianshun. What's known about whether a virus particle is sucked out of a room through the central air ventilation system will still remain infectious after it's passed the system and then re entered the building?

Jianshun 'Jenson' Zhang:

Well, I think this is a legitimate concern. And if you look at the airborne transmission, you have air recirculation, if you don't have filters. In a typical building, it will take 12 to 15 minutes for the contaminants generally to form in one room that can transmit to another room in the same building, in the same central air conditioning system. But fortunately, we have some filtration. It's not enough, but we have MERV 6 and 7 filters. They still filter out some particles. So it has a chance to reduce the virus concentration space when it travels through the system.

Jianshun 'Jenson' Zhang:

In terms of the data that you're asking about, whether is any actual data that shows, there's a [inaudible 00:18:32] actually transfer the virus by one [inaudible 00:18:36]. And so far, I haven't seen such data. And one piece of information from the Diamond Princess, the cruise ship in Tokyo, I think everyone probably knows that. And then the people there after the passengers has been quarantined and during that period, there's a number here, there's a 552 people out of 2666 passengers has been infected. But all these people, the infected people are from the same room, like infection happens in the same state. So which is indication, that particular instance, HVAC did not help spread the virus. So it's more about the in room person to person spread.

Jianshun 'Jenson' Zhang:

So I think what it means is that, that particular ship, they still have a fair amount of ventilation, outdoor ventilation and therefore the HVAC itself did not spread the virus. Now, of course, the situation we are now reopening the schools and just following the minimum standards is not sufficient. I think as Mike mentioned earlier, if you have a central air conditioning, with circulation, we need to use a higher grade features like, well, I recommend Merv 14 or have a filter set up. Of course, you have to really let that be air flow rate. How much air flow rate the system can drive through. It is not only the efficiency. The efficiency of the filter times the air flow rate through the filter that give you all the ventilation.

Eric Schiff:

Thanks very much Jianshun. So, the good news, at least in certain conditions is the HVAC systems are not spreading the virus, at least in that particular case. Now, another option for buildings and in particular, for ones with radiant heating, such as Mike described earlier, would be to install small portable air purifiers. They vary in price a lot, but to install these small ones that would just be in one room in a classroom. So I'm going to address this question to Cliff. What's known about the potential value of these purifiers for protecting students and teachers in classrooms?

Cliff Davidson:

Sure, I think that's an important question, particularly as we move from the summer and early fall season to the winter season, when it's going to be a lot colder outside and the teachers do not have the option of opening windows. And so perhaps a portable air purifier could be used. There are a number of air purifiers available that can do quite a bit of good. But there are also some caveats along with those. As we just heard from both Mike and from Jianshun, filters can be effective in removing the coronavirus from the air. Particularly, Mike mentioned that the coronavirus actually attaches itself to other particles and oftentimes those particles are large enough that they can be easily removed by filters, efficiently removed by filters.

Cliff Davidson:

However, these portable air purifiers need to be located in the classroom, where they can be most efficient in removing the virus. And in general in a classroom setting, you do not have uniform concentrations of the coronavirus throughout the whole classroom. You've got higher concentrations close to any sources of the Coronavirus.

Cliff Davidson:

And in this case, if you have students in the class, and one or more of those students has a coronavirus, infection, then they will be a source of those viruses. And as a result, you want to put the portable air purifier not way in the back of the room away from people, but rather in the vicinity of students who may be a source of that virus. And of course, that could be a challenge because the air purifier might be noisy, there's always some kind of an active fan to move air through the filter. There's usually a pressure drop across the filter and that requires a fan that has a certain amount of power associated with it to make sure that the air as it's moving can overcome the pressure drop and get through the filter. So as a result, these air purifier fans can be noisy. So that could be one problem.

Cliff Davidson:

But you also want to think about the fact that the air purifier needs to process as much air as possible in a short period of time and therefore you probably want to use it on a relatively high setting if you can, and that's where it's most likely to produce a lot of noise. So, there may have to be a compromise between having a high flow rate, but yet making sure that the noise is still tolerable. Another issue is that these air purifiers have various attachments or ways that you can use them. Definitely, air purifiers with HEPA filters would be the best idea, or at least any kind of high efficiency filter.

Cliff Davidson:

And there're also air purifiers that have ultraviolet treatment with UV energy. And a lot of them even advertise that this can kill viruses. However, the difficulty is that there has not really been enough research to know things like, gee, how long does the ultraviolet exposure have to be focused on the coronavirus before it can kill a large majority of those Corona viruses. And so as a result, there's a lot more uncertainty associated with say ultraviolet treatment or UV treatment. While with filters, at least we know that the filters are able to remove the coronavirus. So if the noise problem can be kept in control, and if the purifiers can be placed in the vicinity of where the students and teachers are, then it can do some good.

Eric Schiff:

Thanks very much Cliff. Okay, let's move on. But yeah, so there's an option if you can manage the noise and other issues. So I think we're running a little short on time. But I did want to ask the last couple of questions. So Jianshun, plastic partitions are being used in stores to separate customers and employees working cash registers from their customers. What's your view about the use of these partitions in classrooms? And try to be brief, we're running a little short on time now.

Jianshun 'Jenson' Zhang:

Personally, I would recommend the use of partitions to provide a physical barrier to reduce the cross contamination between people. And however it has to be used integration. I mean, we say air distribution, so the room should be well ventilated, and have good air distribution to make sure each partitioned space still have sufficient ventilation. So I think one message I'd like to get across here is that, we should not be looking at a single measure, we should look at the integrated measure.

Jianshun 'Jenson' Zhang:

Like we talked about outdoor ventilation, good air distribution with the partitions. I think another advantage using partition is, now the student do not need to be six feet apart. If you have partitions, a single partition is more effective than six feet, it can be three, four feet apart. And as long as you have the partition and have sufficient ventilation flow rate and for each cubicle.

Eric Schiff:

Okay, great. And then the last of our pre prepared questions, I'm going to ask Mike in just a second. But do send in, the listeners, do send in your questions. We'll be selecting as many as we can to answer, to ask the panelists to answer. And we may be able to answer some of those offline after the forum is over. So the final question that we prepared in advance is for Mike Wessel. But just beyond the sort of things we've been discussing, what are a couple of other simple things teachers could do that you'd recommend for classrooms beyond the more difficult error management problems we've been discussing?

Michael Wetzel:

So we're an essential manufacturer, which means that we've been able to stay open this entire time since COVID broke out in our country. And early on, we sort of teamed up with several other essential manufacturers here in upstate New York, to sort of put together procedures and policies of how do we keep our employees safe? How do we actually stay open with this disease running rampant through our communities and keep our employees safe. And collect, I think there was 10 or 11 of us in total companies that band together to develop procedures and processes.

Michael Wetzel:

Collectively, we oversee a couple 1000 employees. And I should say knock on wood to this date, we don't have a single secondary transmission amongst our employees, base of a couple 1000 employees. And all of us have been operating straight through since March. And so I'm not going to talk about masks and social distancing because that gets a lot of press. I think the one that gets the least amount of press that we really had to think about was eliminating common touch points. That's a big one. And in a school, you're going to have a ton of them if you really start to think about it.

Michael Wetzel:

So for example, one of the things we did in our facilities, we blocked open every door, we could block open. Every door that wasn't a fire hazard or a bathroom door, something like that, we blocked it open. And instead of allowing it to close so that you didn't have people repeatedly touching the same door handle to open or close the door, or to open and close a cupboard.

Michael Wetzel:

So I would think about that, think about anything you can do. Maybe a teacher is the one that has to open the door, all the students leave between classes, and all those come in, and then the teacher closes it. So there's only one person touching the door. Then think about shared items, shared pens, shared whiteboard markers, lab equipment, in your chemistry lab, musical instruments in that area of the building, samples. I remember in school we used to pass samples around the room, oh, look at this, right? You've got to eliminate that. Anything where someone's going to repeatedly touch something, if they were to sneeze on it, or breathe heavy on it, or cough on it or sing toward it, they're going to laden it up with a virus potentially, and then just move that to the next person. And so I would really think about those common touch points.

Michael Wetzel:

Drinking fountains, we need to shut down all of our drinking fountains because you've got people touching them again and again. So you really take some thinking and walking around. I mean, we take salt and pepper shakers out of our cafeteria. I mean, you don't really recognize them until you really start looking for things that people are going to commonly touch. I would say that's a big one. And then the other one, I would urge schools to do because the rotation of the desk, is you're going to have to clean the desks every single time the students leave, and you turn over to a new class. I mean, here at least in an office, our desk is our personal space. And so I'm the only one that will sit at that desk and so we can be less sensitive to it. in a classroom environment, you're going to have to really pay attention to that.

Eric Schiff:

All those seem like very practical suggestions. So thanks very much. Okay, that pretty much ends the pre prepared questions. So we're now going to switch to questions which have been coming in from listeners. So I'm going to pick one, let's see, this one I'm going to send to Cliff. I think it's similar to one we already answered, but we'll go ahead and just let you reprise. Have there been studies that demonstrate that the COVID-19 virus can be transmitted through a centralized ventilation system, room to room transmission? So maybe you could answer that quickly. I think we already touched on that previously. I'm going to ask Cliff to answer that one.

Cliff Davidson:

Okay. Sure. So, actually, I believe that it was Jianshun, who discussed an example of a ventilation system that did not carry the Coronavirus effectively from one room to another. And there obviously are a lot of details that one has to pay attention to here. Like, are there filters in the HVAC system? Or is the path of the HVAC system a very long and torturous path as opposed to just a direct connection? If it's a long and torturous path, and if there are filters present, then that all basically decreases the chances that the coronavirus will be able to pass through the HVAC system.

Eric Schiff:

All right, since we'd already addressed that question, in our previous discussion, I'm going to have to cut that one a little bit short. So here's an interesting one. So this is addressed to Jianshun. I sit in a lobby area, will it helps to keep the virus away from me as students are walking by, If I had a fan behind me blowing air away from my desk? Just a simple ventilation fan, sold at stores everywhere.

Jianshun 'Jenson' Zhang:

Yes, I think this is like a local, assuming that you've been where the airflow coming from. If you have a fan, with a filter, they actually filter out any possible virus, yes, that will help you reduce your chance of getting infected when someone passing by. So it has the dilution effect. When this virus comes, if you don't have a filter, you don't know, because you don't know who has the virus.

Eric Schiff:

Right, so a fan without a filter is questionable. Let's put it that way. Let's see. This one was addressed to Mike from an audience member. We get contacted by salespeople daily offering all sorts of air cleaner systems. Ionizer, ultraviolet, electrostatic and others. How do I decide what works and what doesn't? And what does a salesman have to be able to show me to demonstrate that the system will actually prevent COVID-19? So you must have been dealing with lots of that at Air Innovations.

Michael Wetzel:

Yeah, and that's a hard one, I'll be honest. I recognize there's a lot, as Cliff mentioned, there's a lot of solutions out there. And some involve just electrostatic as a means for enhancing a medium to act like a HEPA filter. Unfortunately, as far as I understand, all of those have to be tested too. And so there isn't a common standard that you can point to and say, well, they all meet or exceed standard XYZ. And so in particularly with air cleaners, that's a bit of a problem in the market. I would tend to lean toward those that are based on more traditional technologies, such as HEPA filters, HEPA filters have been around, they were invented for the gas mask initially. I mean, they've been around for a long time, it's very well known, it's very well documented, we know what they do, we know they're going to remove very small particles, we know the virus travels attached to those particles. And I would give preference to those that have HEPA filter and a UV. Yes, it's questionable, how much exposure you have to have to a UV, but if the UV is resonant in with the HEPA filter, the HEPA filter might slow down the particle for a long enough time where it gets exposure to sterilize the particle.

Michael Wetzel:

So I think, there's a lot of discussion on electrostatic filters, some of them create ozone. And ozone has its own problem, it's a controlled substance. And so you've got to be very careful. I think when you go down the electrostatic path with the technology, because unfortunately, there isn't a standard that they have to be certified to. And the other thing I would make sure that you ask is what kind of airflow are we talking about. If it's in a large classroom, and it's only generating 200 CFM, you might not be getting enough air exchanges to make it worth your while. And so you're going to really want to get the air to start rotating in that room. And it might take several units. I mean, classrooms are big, they're not tiny. So just taking one little unit of a couple 100 CFM in the corner, will make you feel comfortable, but isn't going to improve the air quality. And so it might take several, and I'd be looking to try to get five or 10 air changes an hour. And you just have to do the math, the size, and see the amount of air it's producing.

Michael Wetzel:

Unfortunately, I don't have a great answer for you. But you do have to be careful with that because there are a lot of things out there that may not do that much good.

Eric Schiff:

Okay, that's very helpful. Let's see another question. Well, here's a very simple one. The audience member wants to address this declipse. So how often should HEPA filters be changed?

Michael Wetzel:

Ah, okay. So this is a good question because eventually, a HEPA filter is going to have particles of all kinds, not just Corona virus particles, but any kind of dust will build up on the HEPA filter, and then the pressure drop across that filter will go way up. And that means that the air flow rate will go down, so you won't be filtering as much air. However, the reason that this question is not a simple one to answer is that it depends where and what kind of environment you're using that HEPA filter. If you are in a dusty environment, where there are a lot of particles present, this could be any kind of particle, It can just be dust particles, it could be pollen, any particles at all. That HEPA filter is going to become filled up, you might say or at least develop a high pressure drop much more quickly than if you are in a location where the particle concentrations overall are much lower.

Michael Wetzel:

And in fact I can also bring up the fact that, one thing you have to be very careful about is when you are changing HEPA filters. Because there is data available that suggest that the corona virus can remain alive on a HEPA filter for hours or even days. And therefore you want to make sure that when you're changing the HEPA filter you are wearing a good mask and you are also wearing gloves so that you don't get a lot of the corona virus laden particles on your hands and so forth. So one has to be very careful about this.

Eric Schiff:

We are back on. Okay thanks very much, that's helpful and good practical advice. The next question coming in was directed for Jianshun. What about ceiling fans?

Jianshun 'Jenson' Zhang:

Ceiling fans is okay.

Eric Schiff:

Yeah, the kind that just blow air around the room.

Jianshun 'Jenson' Zhang:

I think it has a impact. It can help mix the air. And in a way, so most air distributions in the design has a mixing ventilation. Where you have ceiling fan doing highest mixing. So in average, one would reduce the concentration and that however is for everyone. It's also, it's a sort of, because of the mixing if there is one person infected in the room, a virus can be mixed in the air and then spread very quickly to the rest of them. So you looking at positive side as a good dilution for everyone, but the negative side you have is to spread. So from infection to [inaudible 00:42:45] I will suggest not using the mixing. And that's why I recommended partition. When you open partitions, you create the cubicles for individual, and you try to introduce air from the below is the best.

Eric Schiff:

Okay. The next question is coming in for Mike. This have to do with ultra violet. And the listener wants to know if indirect upward pointing or at the ceiling UV light is wise in an occupied space. So you use a high level of UV in a room, but try and keep it out of everybody's eyes I guess. Anyway, do you have an opinion on that Mike?

Michael Wetzel:

Yes, that's a great question actually. And you see a fair bit of that now in some environments. Something to know about UV. UVC, in particular has to be UVC right? And it is very harmful to humans. It will burn your retina's, you'll have one heck of a tan in a couple of minutes. It's very dangerous to have direct exposure to UV. Which is the reason why it can be used to kill viruses. But for it to work, it's all about intensity and direct exposure. So if you were to shine a UV bulb on a round surface, only the surface that saw the UV is going to be sterilized. Anything in the shadows underneath, is not going to be sterilized.

Michael Wetzel:

So one of the challenges with using a ceiling UV system is, it's only going to help what it sees. So if it's shadowed from the majority of the room and somebody has this confidence that well we have this UV and therefore all of our desks are now sterilized, they won't be. And so you have to be very careful inducing a sense of self confidence that we've got this UV system in here and its doing everything it can.Because it can only sterilize a virus if it has prolonged and direct light exposure to it. Anything indirect, it won't have any efficacy.

Eric Schiff:

Okay. Let's see, one final question I think. Here we go. This is sent to any panelist, but I will randomly pick Jianshun, I think let's see, who had the most recent question? Jianshun, Mike... No, I'm going to pick Cliff. So is there any recommended air exchange rate of flow for moving virus loaded air out of a room and fresh filtered air back in? Which I think amounts to how many air changes per hour is good, better and best?

Cliff Davidson:

Well, I mean the easy way to answer that question is that you want to get rid of the virus as quickly as possible and that means that you want as high of an air change rate as possible. I believe that Mike referred to a value of five to 10 air changes per hour as being reasonable. And I would agree. I think that if you are in a classroom and you can increase the air exchange rate to five to 10 air changes per hour, then you probably doing a reasonable job of exchanging the virus laden air with fresh air. But in fact, if you can get even more air changes per hour, and you are sure that fresh air coming in does not have to be coronavirus, then there's to reason not to [inaudible 00:46:43]. So you want as high of a number of air changes per hour as you can possibly get.

Eric Schiff:

[crosstalk 00:46:53]

Jianshun 'Jenson' Zhang:

I think the five air changes per hour is equivalent, clean air delivery rate of five air changes per hour would be sufficient assuming that everybody is wearing a mask. So I have to emphasize the, because wearing the mask reduce the source, it's very important. If you don't do that, even if you have 10 air changes per hour, it will not be sufficient. Now this is based on the analysis, a similarity between a corona virus and influenza. They have a very similar, what we call the [inaudible 00:47:41] our own number is between two and three. And based on that analysis, if you can reduce the source by wearing a mask, and with five air changes per hour that will give sufficient reduction in the risk of infection.

Eric Schiff:

I think that's it for the questions. I just will throw in one, using my privileges, the moderator. You'd mention the importance of masks, so five air changes per hour is probably fine, as long as the infected person in the room is wearing mask. Roughly speaking, how much do you think a mask helps reduce the virus load in a room, roughly speaking. I know there's no one number you can...

Jianshun 'Jenson' Zhang:

Yeah, it's a, so depending again there's a different type of mask. If you just cross, there's a study shows if you cloth covering there's a 50% efficiency for the small particles. The surgical mask give you a 75%, and N-95 mask would give you 95%. So if you look at that number, you'll basically say okay no more mask will reduce the risk factor by a fact of, risk of infection by a fact of two. And then the surgical mask will reduce by a factor of five. And so...

Eric Schiff:

Right. So from the point of view of air management, if people will wear a mask, we can reduce the number of air changes per hour through a good filtering system by an amount two for a cloth mask, maybe 10 for an N-95 mask or something like that.

Jianshun 'Jenson' Zhang:

Right. So this is so integrative, I look at this issue as a system problem, another single measure. Let's say you look at a couple things wearing the mask to reduce the risk at least by a factor of two by just common mask, 50% and you double your ventilation rate, outdoor ventilation rate and you reduce the number of occupancy and that you basically, let's say by half, which means you increase the ventilation rate per person. Supposing ventilation rate is specify based on [inaudible 00:50:15] and then if you have the circulated air, you apply those filters, that gives you another reduction by a factor of two. So you put all this together, my assessment is that will be a very huge, very quickly get to the risk reduction by a factor of 10. If we can reduce the risk by a factor of 10, from the existing standard, the existing standard already have certain ventilation by using integrative source control ventilation and air filtration techniques which are typical of indoor air quality then we can reduce the risk of infection by a factor of 10 and that give us some confidence to say [inaudible 00:51:12].

Eric Schiff:

Okay. Thanks very much Jiashun. Okay, we are pretty much out of time for today's Syracuse event center of excellence research technology forum. We are planning that the forum has been recorded and will be posted as a podcast and we'll be sending a link to the registrants for today's forum. So I want to thank Jiashun, Mike and Cliff our distinguished panelist. And behind the scenes, Kerrie Marshall, Tamara Rosanio, Loral Wilson and Paul McCarthy, all been working behind the scenes to bring this off. So thanks very much to our panelists, thank to all of you as listeners, have a good day and good health to all of us in this extraordinary times.