Reopening Schools: How States Can Ensure Safe Buildings, Testing Capacity, and Contact Tracing Programs for Students and Staff

March 18, 2021

Margaret Bourdeaux - Welcome everyone to our third policy practice seminar for state and local COVID responders. This one on reopening schools. I'm Doctor Margaret Bourdeaux, the research director for the program in global public policy at Harvard Medical School. And co-chair of the Berkman Klein Centers' digital pandemic response working group. The purpose of these seminars is to delve into COVID response issues that really sit at the intersection of policy, science and delivery. And that is to say, how do you take the policy, the science and the resources at your disposal to implement effective COVID response strategies. Today, we're talking about reopening schools as safely as possible. We will be focusing on two strategies that require, do require overcoming operational challenges to implement. In the first half hour we will discuss modifying the indoor environment of schools to decrease the risk of transmission in the school building. Doctor Joe Allen, the director of the healthy buildings program at the Harvard T.H. Chan School of Public Health will lead us through a discussion of this issue. And the second half of the program, we will turn to setting up screening testing at school to be able to detect and prevent outbreaks quickly. Doctor Anthony Monaco, president of Tufts University will present his experience and helping stand up one of the first school screening programs in the country in Somerville, Massachusetts. We will then turn to a panel discussion about school screening testing moderated by Doctor KJ Seung, chief of strategy and policy for Partners in Health's Massachusetts COVID-19 response. Panelists will include the vice provost of Tufts, Doctor Caroline Attardo Genco and the honorable Joe Curtatone, the mayor of Somerville, Massachusetts. I would like to say from the outset that while I like many and very optimistic about vaccinations and the current shape and trajectory of the epidemic curve in the country we still do need to maintain an aggressive offensive posture against the virus. It is critical that we invest in making indoor spaces as safe as possible and stand up widespread screening testing to prevent a resurgence of the epidemic. So with those two things in mind I would love to turn it over to Doctor Allen.

Joseph G. Allen - Hey, thanks so much, Doctor Bourdeaux I appreciate the introduction and the invitation. Nice to join you all. And I'm gonna try and set the stage here and talk about the critically important question of how to keep kids and adults safe in school. And importantly, as new stimulus funds flow what we think are good strategies and maybe even some pitfalls to avoid. So I don't think I can zip through at the beginning here, I think it's pretty clear by now the severe consequences of having millions of kids out of school in this country for so long, consequences that were predictable and we're seeing them escalate and accumulate. And I think this is just the beginning of these kinds of reports in terms of virtual dropouts, food insecurity issues, decreases in physical activity, reports of abuse, neglect, exploitation. And of course we're seeing increasing reports of mental health issues in kids. Also want to recognize that a room full of 20 or 30 people is different when the majority of the people in that room are kids. We know some things are quite different less likely to get infected than adults, certainly

less likely to suffer severe consequences if they do get infected on the order of 10 to the minus six or one in a million for a likelihood of death for those under 14, about 10 to the minus five or one to 100,000 for those under 18, really under 24. Third bullet, they're less likely to transmit. I think there's lots of debate there and the science is mixed. It looks like the younger kids though in particular looks like they transmit less. I want to be very clear that the plans we've put forth in this report, my team first released in June and reissued in November of last year it was designed to protect both kids and adults in schools. This is not just a conversation of kids trying to protect everyone in the school building. I've done this for a long time prior to joining Harvard as a professor at the school of public health I led forensic and vet teams investigating sick buildings. So what sometimes these were severe issues. Multiple people dying in buildings, healthcare settings, schools, worked at them on military basis, you name it. I think I've seen everything that goes wrong in buildings. And so really understand how to assess a hazard and importantly put in controls to mitigate that risk. So I run the healthy buildings program at Harvard and I have been applying that background and practice into helping people reopen safely everything for biotech finance, the arts, police departments, I'm a special advisor to reopening jury trials in Massachusetts across the board and including schools and universities. And I'm on a commission on the Lancet COVID-19 commission where I chair the task force on safe work, safe schools and safe travel and interacting with my colleagues around the world on this topic. So the what to do has is clear. The playbook is known at this point, the way we framed it was across these five healthy areas. I'm not gonna talk about all of them in our report but I will draw your attention to the healthy buildings. 'Cause this is a key topic right now. In particular, our recommendations. And I'll reiterate these in a little bit on what to do in the building, specifically bringing in more outdoor air, better filtration, use of portable air cleaners and what you should avoid. We've seen a lot of schools spending millions of dollars on unproven technologies. This is very concerning to us. We have a new report taskforce for the lancet COVID-19 commissions working on report. We worked through the weekend writing it. We're trying to publish this soon. So fewer schools continue to make those mistakes. In terms of why we care about the building. That's because the evidence has been clear for over a year that airborne transmission is happening. Farfield airborne transmission, transmission beyond six feet in conditions of low to no ventilation where aerosols, respiratory aerosols can accumulate. I've been writing a lot about this but I think probably the most effective thing that's happened is this work we did with the New York Times. It's published as a digital tool a couple of weeks ago but yesterday was the front page in New York Times showing what happens in a classroom, real classroom, New York city classroom. And so I'll walk through the series of slides because I think the visuals make the case better than anything I have ever written or said on this topic. So first this first picture is a typical classroom airflow and those streamers or tracers are really just people's breath normally. So in a typical room under typical ventilation, we breathe in about 3% or let's say it better. 3% of the air you breathe in is air that just came out of the respiratory system of everybody in that room. So about 3%, called the rebreathe fraction. You want to keep that under 5%, preferably lower for a highly infectious virus like this. So we're constantly breathing in other people's air. In this situation, we have a low ventilation rate. Now what happens in this simulation? And this is a computational fluid dynamic modeling, here we have an infected student reintroduced and you see the plume rising up. So we have a natural thermal plume students wearing a mask. A lot of the escape happens through the top and the

side of the mask but you still have this thermal plume, a thermal mask. Very quickly the aerosols from the respiratory system will spread out and accumulate in the room. They're too small to deposit out within six feet. That's a total mistake that respiratory aerosols and the size fraction were interested in dropping six feet. That's a mistake they will accumulate around and act very much like a gas until they're diluted out of the air through ventilation or cleaned out of the air through filtration. And as this simulation shows it accumulates pretty evenly throughout the room very quickly. As we know, we've studied this for decades. This is really nothing new to be honest. Here is another shot of that same classroom. But I added this one, the story goes on to page six. If you want to follow it or you can look at the digital version but on the right there's the overhead view. And you can see the accumulation of the aerosol concentrations, right? Highest concentrations depicted by the darker color, the infected students in the bottom right and the overhead view there. And you see generally a pretty uniform concentration certainly higher as you'd expect around the infector. Problem is of course we don't know who's infected in a normal school. We don't know where they're sitting, 'cause we have asymptomatic transmission or emissions. Now look what happens when you start to add ventilation rates. So in this case, we introduced one window open. So the concentration overall is lower depicted by the lighter colors. You still have a higher concentration around the student but if you're looking at the top, right the overall steady state concentration, the level at which the emission rate hits a constable, the emission rate stays the same, but the concentration in the room hits its max level in balance with ventilation or air cleaning and the emission rate. And here it's constant emissions. Now we add in an air cleaner in the back. We're now achieving six air changes per hour which our targets have been four to six air changes per hour. And the overall concentration in the room is diluted. Again, you can see by the lighter color. So for most of the people in the room and I'll explain something very interesting that we intentionally kept in this in a minute, the concentration is much lower. This is important because all of the outbreaks of three or more people have been attributable to time spent indoors and nearly every single high profile outbreak you've heard about or read about restaurants to ice hockey to spin class, to gyms, have been conditions with time indoors low to no ventilation with attack rates that can approach 90% meaning one person can infect 90% of the people in the room. It's because of this long range aerosol trend mission. In this example, we have a fan in the window blowing across what happens when blowing across the face of an infected student not knowing who is where and it's blowing it onto somebody else. And so it's critical that we do not have airflow that's blowing cross anyone's face. So I prefer the fan blowing out and the air cleaner closer to the room. The next in the simulation, which is not in the print shows this example, the air blowing out air cleaner a bit more centered in the room. All right. I think that's probably the most effective way to show that Farfield airborne transmission matters and so do ventilation and filtration. So the next question becomes, what do I do about it? And what are the targets? Here is where I think a lot of the major organizations have failed us in the past year. That includes ASHRAE the standard setting body for ventilation rates, WHO and CDC. CDC failed to acknowledge this for over a year. They're all now talking about the importance of ventilation, which is excellent. Doctor Valensky a terrific new head of the CDC has expected turning us around there very quickly but still CDC, WHO, ASHRAE no one has said what the target should be. They'll say, bring in more outdoor air. That's great. And I've worked with schools and many businesses as soon as you say that, they say, well, what number should I target? So as far as I

know we're the only group to put out a number which is really quite shocking a year into this. But here's what we recommend at minimum four to six air changes per hour through any combination of higher ventilation rates better filtration, through merv 13 filters or the use of portable air cleaners with HEPA filters. You'll notice something on here. And if you've read anything I've written or I've been presenting on this for a year, it's intentional that you don't see other technologies listed here. I've been very careful to put forward solutions that are practical, cost-effective and proven meaning we have years of peer reviewed science on their efficacy. So it's the basics, is what we really need to do right now. In terms of the how, to we've been releasing a lot of tools. And I should say, all of this information is available on my Harvard healthy buildings program website at forhealth.org F-O-R health. We have a page dedicated to schools, schools.forhealth.org. All of these tools are there. Last August we went out to schools and started measuring ventilation rates because we heard a lot of feedbacks as well. How do we assess this? And so we do it how we've done it in my field for a long time and then use that field work to write up a guide. So not just here's what you need to do and here's what the target is, but how do you do it? And we put in many examples, I won't go through all of them. It's a five step guide. Some of it is if you have a mechanical ventilation system, a unit ventilator, like in this class that blue device is just an airflow capture hood. And we call it balometer. It's measuring the air flow coming in through that an air intake that's covered for a unit ventilator on the other side of this classroom. We also walked through examples of how do you assess ventilation rate for naturally ventilated places like places that have window opening. In this case, we used a technique. We use dry ice to elevate the CO2 levels and watch the natural decay curve. We have other tools on the website where I think there's some people out there measuring steady state CO2. So I'm measuring CO2 in my office right now. It's just under 1,000 parts per million. I can use this to understand the ventilation rate in my office. I could do this in schools. And we have a tool on our website where you can enter in number of students in the classroom, number of adults, your target air change, level of activity you're doing, you're doing light reading or you're doing moderate activity. And they'll tell you a do not exceed CO2 level in case other people are using these kinds of tools. And this is what some the examples we have look like, oh, sorry from the top there. But here we look at the decay of CO2. So what happens CO2 where the main source of CO2 indoors, it builds up in the classroom when people leave or you remove the source. In this case, the dry ice you can see how the CO2 dissipates or leaves and based on the slope of that curve you can actually estimate the air exchange rate with windows open with door opens and we find minimum two air changes per hour with windows open, even a couple of inches up to 14 air changes per hour, depending on what's happening with the weather and the cross flows and the buildings. So really simple strategy to start getting air changes for those buildings that can do this. Right, I wanna cover two other things before I end and then happy to answer some questions or talk with Doctor Bourdeaux. I want to talk about this key questions of distancing in the context of airborne transmission. So we've been very vocal since November that the six foot distancing is inappropriate for student to student interactions. It's the key limiting factor and keeping many kids out of school. Three foot distancing is okay from an exposure and risk standpoint. These are our rationale back in November, that's now been supported by additional studies showing several additional studies, showing that risks can be kept low. Even with student to student interaction at three-foot provided robust infection control measures are in place. Remember a lot of times we think

about these controls in isolation. So we think about distancing only, distancing came in last February and March before universal masking. So universal masking, if you can do any of this modeling of indoor air quality and risk, even close contact or Farfield masking is a single most important measure when you have that distancing becomes less important. And what you're trying to do with ventilation and filtration is prevent the accumulation of the aerosol around the room where you could get attack rates in the 70, 80, or 90% range, not just one-on-one. So the evidence there is really quite robust. I'll make the case quickly. And I can share these slides that we're not the only one saying this. This is a group of experts from around Harvard and the hospitals in Boston also drew a similar conclusion in November more recently, about 60 physicians top infectious disease physicians from all of our top medical centers from around the State of Massachusetts have signed on to this as the approach. There are many more people supporting this. Unfortunately, the new CDC guidance that came out last month my view has two really critical mistakes in it. I wrote an article with a colleague at Harvard School of Public Health. One is the reliance on six foot. I think that's going to ensure that kids don't get back full time. If there's a strict read of that guidance, kids won't be back full time. Maybe not even in the fall. The second one is the use of community spread metrics to determine the level of reopening. We know that community spread well. First community spread is important, full-stop, two, we know that the risk within schools or any building can be decoupled from community spread risk when robust infection control measures are in place. And that playbook is well known. Good masking, good hand hygiene and also ventilation and filtration. The last point I'll make is on that hand hygiene we've been spending too many resources and both time and real money on a risk that's diminimous, it's low. We actually don't have a verified peer reviewed documented case of fomite transmission. So transmission through contaminated services. Yet, if you look at what's still being recommended it's one of the first things people are saying to do, enhanced cleaning. There's some schools unbelievably to me that are staying closed for an entire day for deep cleaning. Don't really even know what the definition of that is deep cleaning, but certainly it's not tied to any real risk reduction at the same time you're introducing high levels of VOCs, volatile organic chemicals which can be respiratory irritants into these indoor spaces. And most importantly, can fomite transmission happen? Sure. Is it going to lead to super spreading? No. And most importantly, it's very effectively controlled through good hand hygiene, hand washing and the use of hand sanitizer. I'm gonna stop there. I will let you know that all these resources again are at schools.forhealth.org. We have that five step guide, the full 60 page risk reduction report and if have calculator you can use if you're trying to figure out what size portable air cleaner to buy for the size classrooms and that CO2 tool. I just mentioned if you want to use CO2 as a way to gauge risk in any room. So thanks for inviting me and happy looking forward to the conversation Doctor Bourdeaux.

Margaret Bourdeaux - Thanks so much Doctor Allen. I think one of the questions and I think it's piggybacking on some of the things in the Q and A, the first response I get when I've talked to local leaders about making investments in ventilation and air filtration in their schools is, oh my gosh that sounds like a pretty big capital project and investment is gonna be needed. And we can't even talk about that until next year and making those kinds of changes aren't we taught. So A, aren't we talking about something that needs to occur it's gonna take a big effort a year out. And then I get the reverse which is isn't the epidemic gonna be over? Why make these

investments now, because vaccines are gonna save the day. So I don't know what your answer to those two sentiments are.

Joseph G. Allen - Yeah, it's a great comment and great set of questions. So first I'd say we have to think about the right now, what needs to be done to get kids back in school and keeping kids and adults safe. Here I think it's the simple measures opening up the window, bringing a little more outdoor air, better filters. That's a couple of dollars. You supportable air cleaners. Those can be a couple $100 per classroom, relatively affordable against the cost of having schools closed. These are stop gap measures. I don't think permanently, we have portable air cleaners in every classroom going forward. So now is the time we use those, the stimulus dollars to say let's get a handle on the real problem. The first thing I think everyone should do is bringing a commissioning agent, an engineering firm to understand what your systems are. I think most buildings are designed and then often forgotten about or the budget's not there to maintain them. And commissioning is just equivalent to getting a tune-up for your car. What are my systems doing? And what, how can I improve them? You'll find that some systems can, you can enhance things and others, you have to actually pay for a capital upgrade. It'll also save you money, commissioning can save about 15 to 20% on energy and improves indoor air quality. So that's the first step. And then you can start to think about, well then talk to your mechanical engineer contractor. What should I be doing in this space? In terms of, yeah, the pandemic hopefully we'll be getting through this next phase. Why invest? So plexiglass goes away but these other things should have been there all the time anyway, we've written about how the school building influences student health, student thinking and student performance, same for adults in that building and things like higher ventilation rates and better control of temperature in the classroom, for example, are associated with better scores on reading comprehension tests, better scores on math tests. And by the way, this is from kindergarten up through high school and even university students. We did a study in university students showing better performance on cognitive function tests, better sleep quality, reductions in asthma exacerbation, lower student and teacher absenteeism. So across the board these are things that should have been done. The current ventilation standards are bare minimums. And we're saying push above that for infectious disease the bare minimum are not set for controlled infectious disease. And they also provide all these other, health co-benefits beyond the current crisis. So lots of reasons to keep investing in the school infrastructure.

Margaret Bourdeaux - So I think that's a great point that it's both about short-term investments that are relatively inexpensive and certainly should be able to be covered by the federal funding that has just been released to schools. And then also an assessment of what you can do to make those changes and improvements in ventilation and air quality in general over the long-term will pay dividends in terms of student and staff health. I think the other issue that came up I was talking about this with a teacher and I was comparing the experience of being a physician in a hospital, I said, us doctors we work and we know that buildings can be made safe because we are working, kind of close together in a hospital setting but we have not had a lot of outbreaks in hospitals, which is very unusual. Most epidemics, usually the center of the epidemic is the hospital. And she really looked at me and she said, yeah but you have an army of infectious disease and infection control specialists that work in the hospital and you trust

that they will do their jobs. And I think she was making a very fair point that there's not always the trust of a school staff member in the whatever, government or a school board or whatever, is making decisions about the quality and the safety of the building they're entering. So I wanted to sort of frame the question of what could an individual teacher do to really assess the quality of the air they're breathing in their school. And I think that that will piggyback a little bit onto some of the questions in the question and answer about what are useful brands of CO2 monitors or how would that be assessed?

Joseph G. Allen - Yeah, that's a really great comment. And I understand the anxiety. I'm a parent of three kids. So I fully get this. And I understand where teachers are coming from in that regard is clearly quite different from what's happening in a hospital. That said, there's some of these things that are really let's say quite verifiable, right? So I've toured some of these schools, right? You can open your windows, make sure you see an airflow coming in, you can feel it. You can look at the, if you have a portable air cleaner you can look up the spec and use our simple little tool. It'll tell you how many air changes you're getting. So we put out that target four to six you can actually very simply size of your room, look at the spec on the device and know, okay I'm getting four air changes per hour. So regardless of anybody saying if you have that in your classroom, that looks pretty good. I know some have started to say, well I'm gonna monitor CO2. And then there the question is well, how do I know what's a safe level? And so we built that other tool, generally rule of thumb under 1,000 parts per million. We'd like it under 800 parts per million. You have to be very careful though. Filters do not capture CO2. So you can have high CO2 in your classroom but because you have great filtration, the risk is low. And so you have be careful with the CO2 measures a little bit more nuance there that I've seen it simplified out in social media. It's useful. You have to be careful there. And the last thing I'd say really importantly is before you get vaccinated any adult in the school and with new variants that are more transmissible, it's time to up our mask game. We're all wearing a mask anyway why not wear a good mask, surgical masks, 70% effective. You can double mask, get you to 90%. That's a surgical mask with a cloth mask to improve fit. I like a KF94, the one out of Korea fits great. 94% efficient. Not everyone can get an N95 and even healthcare has had a hard time getting that unbelievably for the past year. So we can upgrade our mask game too for an extra layer of protection until adults are vaccinated in schools.

Margaret Bourdeaux - Fantastic and fantastic point about CO2 only measuring the ventilation not the other part of the equation, the filtration. I think Katie asks a good question. Can you give a good answer for why four to six air changes per hour? Shouldn't you try to get to six? Isn't that a lot better than four? Or does it, what is the trade off there?

Joseph G. Allen - Yeah, I'd say get as high as you can here. Here's where the numbers come from and I'll put it in context. So if you're meeting minimum ventilation standards in a school, it's about three air changes per hour. Most schools actually get one and a half because they haven't been kept up to the minimum. A typical home gets half an air change per hour. Why the four to six, this is actually right in line with what hospitals do. And the mechanics of it, the physics of it are really quite simple. You think about air exchange rates and how quickly if I'm infectious and admitting respiratory aerosols just while I breathe, talking more, talking loudly

even more they'll accumulate in this room. But if you're increasing the amount of turnover the air that how long they'll stay in the air is greatly diminished. And importantly that steady state concentration is much lower. So if you think about that New York Times report if you go back and look at it, compare the low air exchange rate versus the six air changes per hour. And you'll see across the whole room the steady state concentration is much lower. It's really a competition between emission rate and how much air is diluting that and how quickly. So it's really derived from a health-based benchmark that we know works in hospitals and you'll see other people putting out numbers based on infectious disease modeling. If you're doing that, I'd say we built these models too. They're great, but they're largely built off infectious disease, super spreading events with adults. So I've seen the misapplication of these other models applied to risk in schools and then using that to set one of these targets that's a mistake you're overestimating risk by a lot. So anyway, we feel really confident. And when we put these controls in place, this is part of the suite that we've seen has been effective.

Margaret Bourdeaux - Fantastic. Just thank you so much for your time. I mean, it sounds so, I don't know, it's sort of intuitive, right? It's like we up our mask game, we get on that ventilation and air filtration to get the air exchange rates as high as we can between four and six and we have hand-washing and I feel like that's a really great recipe for safety and I really appreciate you sharing that strategy with us. I know there are a few other questions on the question to answer. I may just ping them over to you Doctor Allen, to follow up with one-on-one in a second but we just really appreciate you joining us today.

Joseph G. Allen - Thanks for having me.

Margaret Bourdeaux - Great. So now I'd love to pivot to president Monaco to talk about the other strategy. So here we're talking about, making the indoor as low risk for transmission of the virus as possible. And then we name this other issue, which is how do we detect infected people that are coming in and out of the school, be they students or staff quickly so that we can catch and prevent outbreaks at least while the vaccine is still rolling out. And of course we believe that children will be sort of at the end of the vaccine distribution process as we collect more data about safety of vaccines. So here to talk to us a little bit about how you do it, how do you stand up a screening program to catch outbreaks or prevent outbreaks from occurring is the president of Tufts University, Anthony Monaco. Well, you can join us.

Anthony P. Monaco - Thank you, Margaret. And it's a pleasure to be here with everyone. I'm gonna share my screen now for a PowerPoint presentation, if everyone can see that. So we know that currently over 3.2 million children have tested positive in the U.S. In Massachusetts, the zero to 19 year olds make up the largest group of those testing positive. Currently 23% of the total. And while serious morbidity and mortality is low in this age group, we don't know the long term effects. Most schools in the U.S have closed or reduced in-person learning to minimize spread. And we know one of the concomitant things to that has been an increase in suicides amongst adolescents, substance misuse, and increased medical and ER visits for behavioral and mental health disorders. And this has also highlighted known health disparities in the way we provide services or access to services for these issues. We do know that the

spread of COVID-19 in schools remains low. However, virtual schooling keeping students out of schools in person has had a negative impact on academic achievement. In-person learning is very important for enhancing the social and emotional skills of these age group. It provides exercise and food security and access to mental health and other support services through the schools. As I mentioned, the pandemic we know has disproportionately impacted marginalized communities and the infection rates, the health inequities and access to both testing and vaccines. And we know that 20% of teens, lack a computer or internet connection at home. At tops we've responded to the COVID-19, very early on working with our local cities of Somerville and Medford to open up our campus to provide during the summer places for first responders and even COVID positive patients to be housed. We learned a lot from that. And we set up a number of committees including my own office, the office of the vice provost for research Caroline Genco, who's with us today, our technology services office, health services and government relations to think about the number of areas where we needed to get ready to open up our campus in the fall. And that included in particular surveillance testing. We worked with the colleges across Massachusetts and the Broad Institute of Harvard and MIT just set up surveillance testing usually twice a week or once a week testing individual testing for all students especially residential students and faculty and staff that were working on our campuses. This slide shows the test positivity throughout the fall semester. And up to current times for the state of Massachusetts this is the number of positives out of the number of tests that have been administered across the state. The dark blue line shows that our current rate is 1.7%. And you can see here the post Halloween or post Thanksgiving or Christmas, and then the peak around January 1st and the steady decline since then, plateauing at around 1.7% currently, what you can also see here is the massive amount of testing that has gone on in higher education using the program I outlined. You can see the weekly cadence of testing with fewer tests being done on the weekends, and then in dark blue here at the bottom, you can see the number of cases. If you subtract out from the 1.7%, that is the total test positivity for Massachusetts. If you subtract out of that, the higher education you get a higher rate, which is significantly higher because higher education has been able to keep the test positivity 10 fold lower than the state by surveillance testing quite frequently At Tufts, we've been able to do about 18,800 tests per week and we've run over 420,000 tests since August. This provides a lot of data about viral spread on our campuses and our off-campus residences as well. All faculty staff and students attending any Tufts University campus is required to participate in this surveillance testing as well as wear masks and provide other healthcare protocols as you've heard. Over the last seven days we've had 15 positives through this out of 15,506 tests for test positivity of 0.1%. It was very important for us in the fall to think about how working with our local municipalities of Somerville and Medford, how could we share the resources and expertise that we had created and generated to keep our community safe? How can we share that with our municipalities to help them address the logistical and regulatory requirements to open up K to 12 schools. We did this by providing test sites within the K to 12 schools for COVID-19 testing. We used a dry swab method. The method that's been used by the Broad Institute and we conducted training on by a school nurses on nursing students and EMTs to provide this type of screening and surveillance testing I the K to 12 schools starting late in the fall semester. And currently now in the spring semester we've been engaging with our local communities and this slide shows how we've been supporting that reopening. And you see there's eight schools in

Medford, 11 schools in Somerville, and it shows some of the demographics of those school districts which are very similar to the state. I would note that Somerville has a much higher percentage of Hispanic students and families compared to the state and then a concomitant decrease in the number of white students. And I think an increase in economically disadvantaged students and families in that district. We've switched from individual testing at $25 a test to pool testing, which is similarly priced $25 for a pool test because limited resources in schools needed made us require a more cost-effective method than individual testing. We knew that this would be a barrier. So Caroline Genco who's with us worked on volunteers in Tufts to figure out a pool testing method that would work with the Broad. We're currently using 10 to one pooling. So here shows the cost per person in your surveillance cohort, compared to the positivity rate in that cohort here in this blue rectangle is the current rates that we are experiencing on our campus and in the school somewhere around 0.1 to 0.3% since the comeback in the spring semester. And you can see that individual testing is quite expensive at $25 a test, but if you can do 10 samples in a pool, it's quite effective at $5 really about the cost per test. We decided to use the PCR test 'cause it's the kind of gold standard. And also because of its sensitivity allowed pooling of 10 individuals to a tube so that you could get equally sensitive, efficient and reliable results. So if there's 10 individuals in a tube, when we get the results back from the Broad, most of the pools will be negative. And if we have a positive pool, then in the second round which we call reflex testing one requests individual samples, and then you can figure out who the positive student is, begin isolation protocols, contact tracing. And very importantly, since we know that 90% of cases in Massachusetts are from households, it allows us to help stop the spread within households. Both in Medford and Somerville. And I think this is true across many school districts in Massachusetts split their cohorts when they came back into half the students being attending Monday and Tuesday and the other half of students attending Thursday and Friday with Wednesday being a day being virtual learning. So we could collect pool samples on Monday for cohort A, get the results back early on Tuesday if possible, and then set up the individual reflex tests. And similarly for cohort B on Thursday. In K to one we're doing administered swabbing either from school nurses or train nurses in training or self swabbing from grades two to 12. We've set up a technology platform led by Christodora at Tufts to support the scheduling, the order submission, the labeling and the results monitoring of large scale testing operations. Through this, we've been able to reduce the cycling time. So the arrival of a student to sample collection to departure is approximately two minutes. So this is not a bottleneck for schools and the testing platform integrates well with both the school institutional systems, as well as the testing platforms, such as the Broad Institute. We can obtain detailed demographic information on testing participants to support the tracing of individuals in a positive pool but preserving subject confidentiality. At the beginning, we did baseline testing of both Medford and public schools in Somerville, Medford opened up earlier so we got more tests done. We did over 7,800 tests individually and in Somerville over 1,000. And then we switched to pool testing where in Medford we've been doing over 1,200 pools so far in Somerville less so 'cause they were slightly later in getting started. Interestingly, we found very similar positivity rates to what we find on our surveillance testing of individuals on the Tufts campus showing that this is an effective method for identifying positives and following up. So we currently are continuing this engagement with our host communities. We're doing a lot of data analysis and we'll have a lot more data to analyze

as we move forward on consent on how that features with the demographics of individuals in our surveillance testing program we can define the incidents of transmission and how that relates to the broader community and particularly household spread. And we'll be genetically sequencing positive samples to see how that relates to certain variants. We feel that answering these questions will be essential to ensure the equitable impact of surveillance testing in the community and help prepare us for the fall semester coming up. I'd like to thank my colleagues at Tufts here and also the Somerville and Medford public schools as well as the mayor Curtatone and mayor Maris Ellen Caggiano who have been our partners as well as those at the Broad Institute. So I'll stop there Margaret and allow them the panel to take questions. Thank you.

Margaret Bourdeaux - Thanks so much for laying that out for us but it can't have been an easy time to be leading a university in the middle of this. Well, this most unprecedented event. And I think the partnership between, the Tufts University and surrounding communities is so interesting in terms of providing resources to do some of this screening testing. So thank you so much for laying that out. I do wanna turn to Doctor KJ Seung of partners in health and helping with the contact tracing program in Massachusetts to lead a bit of a discussion here for folks who are interested in drawing from the experience of the K through 12 testing in Medford and Somerville and to think a little bit with panelists about how they stood that up, how you guys stood that up or the challenges, the day-to-day challenges, how it was received, and how folks can go forward replicating it. KJ over to you.

KJ Seung - Thank you, Margaret. Well I'm yeah, I'll just briefly say that as somebody who has been working on the contact tracing program in the state, I am, just personally really excited to see the sort of screening program being scaled up in school districts. And I know there are a lot of boards of health. The DPH has been really looking at what was being piloted in Somerville with a lot of interest and so very happy to see, to pick the brains of both mayor Curtatone and vice provost Genco here today. Maybe we could start with Mayor Joe. You could tell us just maybe introduce yourself a little bit and maybe just speak a little bit about this program how it started and how it's been going.

Joseph A. Curtatone - Great. Thank you. And to you KJ and Doctor Bourdeaux, all the panelists. Shirley, my good friend and I just want to give a shout out to Anthony Monaco, the president of Tufts. He has been an unheralded leader from the academic side. No offense to my good friend, Larry Bacow at Harvard. Anthony Monaco from the very beginning. Now they've been outspoken. He's reached out, he's partnering he's been innovative and creative. And I think in the community does as well as the vice provost, Caroline Genco, you know what motivated us, it was to understand how we could execute our responsibilities to interrupt the transmission of virus from person to person is a public health crisis and we're oriented by one goal. And it's still are today keep our community healthy, safe, and alive. Today we have 77 people who have died as a result of COVID, in Somerville, we know Massachusetts as a four highest COVID death rate in the nation. And in the context of schools we want to make sure is how do we do it and request to the Commonwealth and [Inaudible] the department early secondary education and getting guidance and consultation weren't received or were not responded to. So we turn to

our allies and folks like Anthony Monica and others to understand how do we understand how the pandemic is evolving not just in our community but within each individual classroom. How do we build upon what other universities were already doing? There had 110 colleges and universities by late summer had contracted with the Broad Institute. How do we leverage that expertise to get our schools not only open in a safe way for everyone, our educators, our staff, our students and the families in our most vulnerable neighborhoods and allow them to be open and remain open a sustainable way. We did not want to have to go through a whack-a-mole approach. There's a case in the classroom. The whole school closes down and we're out there cleaning the school. We know that's not effective. So that led us to really seek out and prioritizing opening school safely sustainably, helping us to identify how we can isolate asymptomatic students and teachers that was critical. We knew that at the time, Somerville at that time was the first city in the Commonwealth to actually test asymptomatic members of our community. The general public would I'll try [inaudible]. And what can we check the lines? We know testing has been, will continue to be an important tool to fighting the pandemic. So this was an opportunity we had to forced to on our own. Without guidance from anywhere else but plans to figure it out. And that's why we undertook the plan to seek the expertise and the plan to allow us to give us the tools. And I hope I get to answer a question in the Q and A as well as the filtration piece to tools to [inaudible] for the pandemic no matter what was going on in our neighborhoods and community in terms of transmission although that's relevant, but we would know real time within a classroom, within a cohort, what was happening and being able to contain and interrupt that transmission.

KJ Seung - Thank you, mayor and Doctor Genco, I know you've been really been working so hard on this pilot project for many, many months. Maybe you could tell us a little bit about what that experience has been like.

Caroline Attardo Genco - Thank you, KJ and thank you for the invitation to serve on the panel. So I have to say that one of the fantastic aspects of this project is really the partnership the partnership between our host communities where our campuses set and that's Somerville and Medford. I'd also like to acknowledge the partnership with the Broad Institute. And so as president Monaco indicated we spent a lot of time putting together protocols to bring our students back to campus in the fall of 2020. And we had the infrastructure to be able to do that. And we had the partnership with the Broad Institute but we realized that we could certainly help our host communities by applying the technologies that we had and kind of the brain power that we had a Tufts to help our host communities. And so really this idea came from president Monaco in August of 2020, how can we help our host communities? Can we start to look at pool testing? And at the time in the summer of 2020 no one had really tested the ability of pool testing to work using the dry swab method that the Broad had developed. So we put together a quick IRB protocol to test this in our student population. And we got great consent. We consented over 2,000 students to participate in this pool testing pilot. And we showed very quickly within three weeks that it actually worked. And so then we started to operationalize it with our host communities. And I have to tell you extremely rewarding to be able to work together with our host communities to make a difference in the communities. Now, early on in the fall of 2020 we were doing individual testing using again the Broad PCR based testing

modality, and part of our rationale for that was to establish baseline because these students were just starting to come back. Many of them in a hybrid model. And we wanted to establish a baseline of what positivity rates were in those students. And so for about a month, we did baseline individual testing of both students and staff. And I should say, we started first with the staff. We were doing individual testing with the staff for a couple of weeks to get them comfortable with it. We went onsite as president Monaco indicated and trained those school nurses. We were also able to get some nursing students from Northeastern participate as well as EMTs. And so we felt very comfortable and I think the teachers and the staff felt comfortable that this would work. And then we transitioned over into pool testing in the new year in 2021. And I can tell you that really, what was fundamentally important is the IT infrastructure to do that testing. And that was developed again at Tufts. I'd say in Medford we have had fantastic consent, 85% of the parents consent to have their kids come to be part of this surveillance testing. I know in Somerville, it's a bit different because in Somerville students have to be tested to be able to come back to campus. So I don't have the consent rates there but I'd say in general, the consent has been great. One of the problems that we've had is some of our kids don't have email addresses. Their parents don't have email addresses, obviously they don't have internet access or computer access. So one of the requirements to be part of our surveillance program is to have an email address so that the parent can be notified. Now, in the case that if the pool is positive, all the individual parents in that pool would be contacted. The kids come back in for reflex testing. And the reflex testing is either the PCR based testing or the rapid antigen testing. And all the contact tracing is done by the school districts. So in general, I can say that from an operational standpoint it's worked really, really well. One of the things that we're working on right now is most of the kids are tested throughout the day. We're trying now to test the kids as soon as they come in. And the reason we wanna do that is that the test, the results will come back much quicker. So if kids are not tested until the middle of the day, those samples aren't sent to the Broad, we don't get the results back till maybe the next day. So we're trying to operationalize it now so that most of the kids are tested as soon as they come to school. And it varies by school district and some school districts kids are tested in the cafeteria and gym and their classroom. And again, it varies by school district. And then in some schools, we pool classes together. And in other school districts, it's more random. In general we've been mixing teachers and staff with students because we don't want to put all of our staff or all of our teachers in one pool because if we have a positive pool, more of those teachers and more of those students will be out. So I'd say that a lot of what we're doing now is optimizing for each school what works best for those schools.

KJ Seung - Thank you, Doctor Genco. I'm glad that we're really touching on some of these operational issues. So I like to ask the mayor too, because that's really I think that's the major question that school districts have, who haven't started this yet. It really does seem an intimidating. Really what were the major operational problems that schools were encountering and how did they address those problems?

Joseph A. Curtatone - So that's a good question. And carrying over from when the vice provost just mentioned it gives good context, and you answered this when we were thinking about how to set up the program or what program would help us achieve our goals. For example, what

would be the testing modality? And I think that's all embodied in this question and the answer is in the fall of 2020, the city we had already set up an incident command structure system the only one city in the Commonwealth to do so back at the beginning of 2020 in advance of understanding how the pandemic would possibly hit us and what modeling was telling us. But that structure allowed us to be ahead of things, to understand what the best informed experts in science is telling us what we should be looking at in the context of schools to not only open schools but having them be sustainably open. So in the fall of 2020 our staff conducted an exhaustive research of the test available at the time. In fact, we evaluated 20 different, 23 different approaches from saliva to anterior nasal and we evaluated flexibility, sustainability, accessibility, reliability, ability to test minors, rapid results, all things that when you think about operationalize and execute, you have to consider. But at the end, again we landed on the opportunity provided by Tufts and the Broad. You use a flu testing protocol which was by far the most favorable, and it is labor intensive. Somerville public schools is currently recruiting right now 36 individuals to run the testing program. Per school would replace the current staff. It's an all hands on deck approach though. So currently we supplemented supported our efforts with staff who are part of that incident command system. Cause it's been all hands on deck beyond that traditional roles and duties. And the municipalities in the schools to fight the pandemic, and we're recruiting other individuals to support that effort. And there's cost involved, but we get relief on that coming right now from the federal government. So getting everyone registered and ensuring that they move through the process as it's been alluded to is a physically distant way. It's probably the most staff intensive thing but as part of our efforts, we're also gonna be hiring and recruiting, hiring COVID ops manager just to make sure we have enough oversight in execution of plans at the nine sites, especially as we move towards five days a week in-person learning.

KJ Seung - Thank you. That's a really good point. Sometimes we focus in the public health, “Well, what's the cost of this program is just the cost of the testing.” But I think you're making a good point, there's other costs here that school districts have to think about including additional staff and I think we're coming towards the end here but I'd like to ask both of you what overall has been the response of the teachers and the parents. This is gotta be a very new experience for both of those really important groups of people. Maybe mayor, you could go first and then Doctor Genco you can go next.

Joseph A. Curtatone - Well we've actually conducted surveys of our staff. I will say overall response has been very positive from the public, from the people working in the schools because everyone wants to be safe. We're not fighting each other here. We're not fighting those who, I mean validly have rightfully upset, but kids can't go to school. I have two kids in the Somerville public schools. I'm more than anyone, want my kids in the schools and you're those who have kids with higher needs. And I can't understand what even the groans we will have. We have a lot to do as a society to not only help them get back to where they were, but to advance. And it is immeasurable impacts. As we know, we're not children, but we all want to be safe. We're fighting the pandemic here and people want to feel safe. So we actually survey staff participating in the program. And that shows that assurances testing, that assurance testing increases their sense of safety in returning to school. So more than 45% say that weekly

assurance testing program is very reassuring to them. And the safety of being in-person learning almost about 34% say they're moderately reassured. So almost 80% of staff. And you have to have confidence in the people all our stakeholders and allies no matter what one expert or a mayor, or an academic institutional academic president will say, they have to have confidence that we're up for the best interests guided by the health and safety and wellbeing of everyone in the community and keeping people alive. No one wants to be the person that gets someone else infected. And we surely don't wanna be a case, we know in-school transmission has happened. In fact most schools were closed and they weren't, the Commonwealth was not testing asymptomatic kids. And what we don't want to have in Somerville community is to have a case transmitted to an intergenerational household of a home. And one of our most vulnerable neighbors in that community where people are dying at higher rates than most of us on this call. And that's why it builds confidence and helps us get not just for the pandemic, but for the long run as well. I hope you can ask me that other question in the Q and A, after the vice-provost talks.

Caroline Attardo Genco - KJ, I just wanted to add that. I think in general, I would agree with the mayor that the it's been a very, very positive reaction to doing the pool testing. And what I can tell you as we started to do the testing and realized that the rates are very, very, very low. I think it assures all the parents and the teachers that in fact this is true that the transmission is quite quite low in the classroom. So I think just starting to get more information and data there's more confidence in folks coming back to the classroom. But the one thing that I'd like to just kind of close on is while this has all been really positive we're still missing a group of parents and kids who aren't consenting to doing surveillance testing. And we're really interested in trying to understand what are the barriers to having parents consent, to have their kids be part of these pooled surveillance programs. Because I think that will also teach us a lot about vaccine hesitancy. And again, it seems to be that hesitancy is higher and more at risk communities. And so we think that by trying to understand what is it and to do that, I think we need to have more engagement with parents in our communities and try to understand what are the barriers and how can we help to facilitate getting those kids tested? Because that's the one thing that I worry about the most who are we actually really missing? We have the pool testing up, we know how to do the PCR. We know what we have the IT infrastructure in place. We have all the parts to make it happen, but we are still missing some kids. And I think it's important for us to try to understand who we're missing and how we can get them to be part of these programs.

KJ Seung - It's really been a fascinating discussion and I think we really benefiting from your early experience doing these sorts of programs. I think we're gonna get a lot more experienced in the state. Margaret, I think you can, we'll kick it back to you to close this out.

Margaret Bourdeaux - Oh, thank you so much. And I think that the two of you, Mayor Curtatone and Vice Provost Genco you have really highlighted some important points here. Partnerships, standing up a screening testing program really does require a pretty robust set of partnerships, from the lab, that's gonna do the test, what modality they're gonna use, the workers that are going to perform the testing, the IT involved, and then also the partnership with the community

and explaining what's gonna happen. And I think KJ, if you were on for a few more moments you've probably also echo that issue. That one of the biggest issues that we I know through the contact tracing program have really honed in on is the need to explain to people what's gonna happen. If they get a positive test and to reassure them that they're gonna receive the support that they need in order to stay away from others for a certain period of time until they're no longer infectious. And I think that that instilling confidence in people that they don't need to... That it's gonna be okay, that they can make their way through a period of either isolation. And they're gonna receive that support is also really critical ingredient here but there's also a lot we don't understand about how folks are responding to various COVID response measures that we need to study further. So I just we'll wrap up with a enormous thank you to everyone who has presented today. I mean, these are very, very, very tough moment here. And everyone who's come and leaned with what they have to offer is just to be absolutely applauded. So I really appreciate everyone participating and hopefully we'll see folks next time.