

Nonpharmaceutical Measures for Pandemic Flu and COVID-19

[Announcer] This program is presented by the Centers for Disease Control and Prevention.

[Sarah Gregory] Hi, I'm Sarah Gregory, and today I'm talking with Dr. Ben Cowling in Hong Kong. Dr. Cowling is editor-in-chief of *Influenza and Other Respiratory Viruses* and an associate editor for the *Emerging Infectious Diseases* journal. We'll be discussing nonpharmaceutical ways to prevent the spread of pandemic flu.

Welcome, Dr. Cowling.

[Ben Cowling] Yeah, thanks. Nice to talk to you.

[Sarah Gregory] So, I understand you are an associate editor for the EID journal. Tell us what that involves?

[Ben Cowling] That's right. So, there's quite a number of associate editors and then when a paper's submitted to the journal, the editor-in-chief, that's Peter Drotman, decides which of the associate editors he might pick to share the paper with. And then it's the job of the associate editor to take it from there: to search for reviewers for the article, to wait for the reviews to come back, and then once the peer review's been done, to then make a judgment and a recommendation to the editor-in-chief about whether the article should be accepted or maybe revised or maybe passed over and then suggest to the authors that they send it to a different journal. So, I handle probably a few papers every month, and I enjoy...I learn from reading those papers and from the experience of participating in the peer review process.

[Sarah Gregory] So, this is sort of a complementary position for you. Are you doing it because you, like you said, enjoy learning things from the articles or...?

[Ben Cowling] Yeah. It's part of my, you know, academic service to the academic community. So, I...I'm an editor-in-chief for another journal and I'm also associate editor for EID and, in the past, I've been associate editor for some other journals. And it just takes me, you know, a couple of hours a week maybe, unless it's a busy time, like it is now with the emerging infectious disease in China. But, you know, in the past, it's just been papers now and then to hand over because there's plenty of other editors that also share the workload together. So, it's something I just do in the evenings.

[Sarah Gregory] Okay, interesting. You recently published, in EID journal, 3 policy reviews about nonpharmaceutical measures to use during a pandemic flu in nonhealthcare settings. They include personal protective devices and environmental measures, social distancing, and international travel measures. So, we're going to talk about all three of these today, together, and also we're going to talk about the new coronavirus. Is that okay with you?

[Ben Cowling] Yeah, yeah, sure.

[Sarah Gregory] Okay, so would you explain what a policy review is? How is it different from a study or a research article?

[Ben Cowling] Yeah, sure. So, in this case, the articles are reviews of evidence base for some particular public health policies relating to influenza pandemics and also more severe influenza epidemics, seasonal epidemics, like the one you had in the US a few years ago. My team were

commissioned by the World Health Organization to do a review of the evidence base for all of these different nonpharmaceutical interventions. And then we decided we wanted to also report the findings in EID so that, you know...to have a broad readership for this evidence base, which we think is really important. And it turns out to be really important and good timing, because some of these measures we'll talk about later could be relevant for coronavirus, as well.

[Sarah Gregory] Well, going along on that same note, why are these particular policy reviews important?

[Ben Cowling] Going back to before the 2009 pandemic, there were a few reviews of what kind of nonpharmaceutical measures might be more or less useful, perhaps in the next pandemic. And there was also some reviews about what had been done in previous pandemics, particularly 1918. And then, in the 19...that is, in the 2009 pandemic and after, shortly after the 2009 pandemic, there was quite a bit of analysis done to look at responses to that pandemic and how effective some of those had been. But there hasn't really been a comprehensive review of the evidence base until last year, when the CDC did a very nice review and then we also did ours with the World Health Organization. So it's basically, you know, a 10-year update of what had happened in the 2009 pandemic and some of the work that had been done before 2009 pandemic just to bring us up to date.

[Sarah Gregory] Tell us about pandemic flus generally. How many have there been? How many outbreaks have there been in the last century? And...

[Ben Cowling] Yeah. So, there were three pandemics in the twentieth century and then there's been one so far in the twenty-first century. In general, we think pandemics occur maybe every 20, 30, 40 years and there were some even before the twentieth century. In this review we're focusing on the evidence for responses to pandemic flu, but actually, the responses also have value for seasonal flu, which comes every year. Some years we have a mild season, and then some other years we have quite a heavy season, and some of these measures might be particularly useful if it's a heavy season.

[Sarah Gregory] H1N1 was considered to be a pandemic, right?

[Ben Cowling] Right.

[Sarah Gregory] In 2009.

[Ben Cowling] In 2009.

[Sarah Gregory] Yeah, and now it's just part of the regular flu vaccine for every year, isn't that right? The strain?

[Ben Cowling] Yeah, that's right, that's right. So, that quite often happened in the past as well, that there's a new strain appears and it causes a panic and it goes around the world and infects quite a lot of people, maybe causes a bit more severe disease because it's the first time it's appeared. And then in the subsequent years there's more epidemics, a second waves, a third waves, and then, eventually just circulates, so maybe changes a little bit from year to year, but eventually just circulates as a seasonal strain.

And actually, that's an interesting question now for coronavirus, about whether we might see some similar patterns. So we might have a, you know, maybe a lot of circulation of the coronavirus this year. Or maybe it won't go away, it'll become endemic, and then it'll come back

in future years with smaller epidemics and eventually it will just be like another common cold infection or like a seasonal flu infection.

[Sarah Gregory] So, that's even another, greater, reason to get a vaccine for it, right?

[Ben Cowling] Right, definitely.

[Sarah Gregory] These policy reviews are specifically about pandemic flu, even though they can relate to this new coronavirus. Which strains cause pandemic-type flus and why are they more dangerous?

[Ben Cowling] So, we have two types of influenza—influenza A, type A, and influenza type B—and we've only seen pandemics of influenza type A. There's two particular strains circulating in humans at the moment, one called H1N1 and one called H3N2, but there's actually a lot of other strains of influenza type A that circulate in animals, particularly in birds but also in pigs.

And so, pandemics can occur when some of those animal strains make the jump over to humans and are able to transmit successfully between humans. In the past 15 or 20 years, we've seen some of those animal influenza strains jump to humans, but not really transmit very effectively, and the best known is H5N1 that we've been worried about. So, it can infect humans, but it doesn't seem to transmit in humans, so hasn't caused a pandemic. But we're keeping a close eye on those kind of bird influenza, bird flu strains because, you know, most likely, the next flu pandemic will be caused when one of those bird flus jumps into humans, and then successfully is able to spread from one person to another, and then, you know, cause an epidemic, and then a pandemic.

[Sarah Gregory] There's a dog flu now that seems to be relatively new. Is it possible that the...that could spread to humans too?

[Ben Cowling] Well, I think, I think there's a lot of different animals can be infected with influenza viruses, but whether those particular strains can also infect humans, usually not. Usually not very successful because of the physiology or the cell receptors or whatever are different. But, for sure, we need to keep an eye on any kind of animal flu strains to see if they pose a risk to humans and to spread in humans.

[Sarah Gregory] So, how is flu spread?

[Ben Cowling] That's a very good question. It's one of my other research areas in the past 10 years. And I'm sad to say that we still don't fully understand how flu spreads from person to person. We know that it can spread through respiratory droplets, so that comes out when you cough, maybe when you sneeze, or sometimes when you're breathing. But the size of the droplets is really the key question for transmission. We think, it's possible, that sometimes flu might spread through relatively smaller droplets that can, you know, maybe go a little bit farther, maybe stay in the air for a little bit of time. Those are called aerosols.

And then we also know that flu can contaminate surfaces, like door handles or hand rails in public transport. And so, in theory, one person could be infected when they touch a contaminated object and then touch their nose or their mouth and infect themselves that way. So, we're not sure which of these ways of transmission are the most important, but we can get some insights from which kind of interventions are more or less effective. And probably we're going to come to that in a moment when we talk about handwashing. So, I'll come back to that maybe in a little bit.

[Sarah Gregory] Okay, alright. So, is there treatment for flu? I know there are antivirals. Do they work and what are the drawbacks?

[Ben Cowling] Yeah, that's right. So, for people who go and see their doctor with flu, maybe for people who go to hospital because they've got more severe disease, there are antivirals. The best-known is called Tamiflu, and there's a few other antivirals, as well. They are effective. They're usually safe for people with relatively more serious illness, but they can be used in outpatients, as well.

One of the concerns, if they're used really widely, is that resistance might develop. So, in a pandemic, we're prepared with stockpiles of antivirals to use them to treat people with the new pandemic strain. But one of the fears is that, if antivirals are used in large amounts, you know, for lots and lots and lots of people who are sick, then maybe resistant strains of the virus will appear, and then spread. And then we'll have less antivirals to use for the patients who really need it, who are very sick in hospital. So, there are antivirals, they do work, but we can't rely on antivirals alone, maybe, in the next pandemic.

[Sarah Gregory] Okay, and they need to be used fairly soon after you get sick, right?

[Ben Cowling] Yeah, they're most effective if they're used like one or maybe, at most, two days after illness onset. They're relatively less effective if they're used later in the course of illness because by that point, the virus has already done, you know, some damage and, then, at that point, the antiviral can't work as well as it could do if it was given earlier.

[Sarah Gregory] Okay, and how do vaccines fit into this picture?

[Ben Cowling] We have vaccines for seasonal flu every year, which are some years effective, very effective, and then other years moderately effective, some years not so effective. In the next flu pandemic, we expect it's going to take about six months to get a vaccine specific to the pandemic strain available and used in the community. And that's what happened in 2009. So in 2009, the strain, the pandemic strain, was identified at the end of April, and then we did have a vaccine about six months later, in the US and in some other parts of the world. In the interim period, in the six-month window when the pandemic is spreading, maybe around the world, causing epidemics, causing lots of infections, we would not have a vaccine, most likely, that works. We might be able to use a seasonal flu vaccine, we might have some other vaccine, you know, in the stockpile somewhere, that might have some effectiveness, but we don't expect, in general, that we'll have a vaccine that's useful for a pandemic. And then for the nonpharmaceutical interventions that my policy reviews are about, they could also play a role if there's a seasonal flu epidemic when a vaccine doesn't work as well, which does happen from time to time.

[Sarah Gregory] Okay. And I just want to reiterate here, or want you to reiterate, which I...we so want people to understand, vaccines do not cause flu, right?

[Ben Cowling] No, vaccines do not cause flu, that's right. So, there's sometimes some mild transient side effects from getting a vaccine, which last for a couple of days after the jab-up, but vaccines do not cause flu, they protect against flu. The protection is not 100%, so we do find that in some years, people who got vaccinated will still get flu when it's the flu season. The flu vaccine's not 100% protective, but it does offer protection and it's a good idea to get vaccinated every year.

[Sarah Gregory] Besides vaccines, handwashing has been the gold standard for flu prevention, but according to your review, handwashing may not be that effective against the spread after all?

[Ben Cowling] Yeah, it surprised us a little bit because handwashing is one of the most commonly recommended measures against influenza. But what we found in our review is that there's only a very limited effect of handwashing in preventing flu transmission in the community, and there's maybe two reasons for that. So, one reason is that the handwashing interventions that were used weren't necessarily changing people from not washing their hands at all to washing their hands really, really perfectly, because many people already have reasonable hand hygiene. And then interventions in the studies that we reviewed improved that, but it was a marginal improvement, so you only expect a marginal, incremental benefit. And, in fact, the most effective inter... handwashing intervention that was identified was in children in a developing country where they really hadn't been washing their hands at all. And then hand hygiene was introduced, with running water and soap, and they were really taught how to do it and did it very well, and there was really a very big effect on influenza. So, handwashing does work, but if we have a handwashing intervention which marginally improves people's handwashing behavior, we only see a marginal benefit of handwashing in preventing flu.

The other aspect that I want to talk about, again, coming back to your earlier question, is that influenza probably spreads through respiratory droplets and a little bit in the air. It may also spread through contaminated objects in the environment, which would then bring hand hygiene into play, but that may only be one of the routes of transmission. So, even if we do have absolutely perfect hand hygiene, we may still face the risk of getting infected from virus that's transmitted from somebody coughing towards us or breathing towards us or, you know, we're standing next to someone on the bus who's sick with flu, then we can still get infected that way, even if we're absolutely having perfect hand hygiene.

So, that's the two aspects. So, one is hand hygiene interventions have probably given marginal improvements in hand hygiene practices, and so a marginal increase in protection against flu. And that's sometimes difficult to pick up in these studies. And the second one is that, hand hygiene...or transmission may only partly occur through hands touching objects which are contaminated.

[Sarah Gregory] Okay, so along those same lines, what did you discover about respiratory etiquette? And first of all, tell us what that means.

[Ben Cowling] So, respiratory etiquette means covering your mouth when you cough with your hand, some people do it with their elbow or maybe with a tissue. And then, if you've done it with a tissue, then throwing the tissue away and washing your hands if you've coughed into you hand, then really washing your hands at the next opportunity or sanitizing your hands. But we didn't find many studies about respiratory etiquette, so it's, of course, a good idea, we should do it, but we didn't find scientific evidence that it really prevents onwards transmission. So, actually, for quite a number of the nonpharmaceutical interventions that we reviewed in these three policy reviews, there's relatively limited evidence that they work, but there's a lot of mechanistic support, there's a lot of plausibility about these interventions. You know, it should...it should reduce transmission if everybody covers their mouth when they cough. And that's, you know, it's kind of common sense, it's polite, though in terms of the evidence base, it's limited.

[Sarah Gregory] What about masks, do any of them work, and, if so, which ones?

[Ben Cowling] So, we've reviewed the evidence, particularly for surgical masks, and that's three-layer surgical masks, which are specifically made so the outside is waterproof, the middle layer is a filter, and the inner layer is cotton to absorb moisture. That's a particular type of mask with a specific design for maybe preventing respiratory infections in hospitals or in the community, in theory. Actually, in terms of the evidence base, there's not a massive amount of evidence that they work, but again, there's mechanistic support. We do have a number of studies that show that if people wear masks when they're sick, they can prevent virus from spreading into the environment because the mask catches the virus. But they have to wear it properly and they have to dispose of it properly and wash their hands. Otherwise, there's a risk that they catch the virus in the mask, then they contaminate their hands, and then they contaminate the environment and then contamination can continue that way.

There's relatively less evidence that if people, in general, wear masks—so if healthy people, not infected, wear masks—there's relatively less evidence that that can protect against infection, but there's mechanistic support that it could work. So, in the policy review, we considered, you know, for typical flu seasons, it's probably not necessary, but in a pandemic, you know, particularly if it was going to be a more severe pandemic, then we might consider asking lots of people to wear masks just to try and reduce transmission, even if it only reduces it a small amount. You know, it may help, because the goal in the pandemic is not necessarily to stop all transmission from occurring, because that may be too difficult, but at least to slow it down, to buy some time, to spread out infections over longer periods, so that hospitals don't get overwhelmed with...with people coming to the emergency room and so on.

But then, now in Hong Kong, when you go out on the street here, almost everybody is wearing masks. We did a survey and 98 percent of people wear masks when they go out. And we've got a problem now of mask supply, which we really hadn't thought about until now. So, because everybody's wearing masks all the time and we're recommending people change their masks quite frequently, that means we need a lot of masks. Someone did a calculation that the supply to Hong Kong is maybe 200,000 per day, but we have seven million people. So that means that if seven million people are wearing multiple masks every day, that's a lot of masks that we need, and we don't have the supply, we don't make masks here. They make masks in China, but they're also wearing masks in China. So, that's something that we've just realized that, you know, because of the coronavirus outbreak here, that we need to think more carefully about mask stockpiles or maybe thinking about how we can get larger numbers of masks if we were going to recommend masks to be used in the next pandemic in the way they're being used in Hong Kong now.

[Sarah Gregory] Where do you get surgical masks?

[Ben Cowling] So, we just buy them in pharmacies. So, in Hong Kong, people have worn masks when they're sick, all the way going back to SARS 20 years ago. People wear masks out of politeness and then some people also wear masks to protect themselves—maybe they really don't want to get flu for some reason. So they wear masks all the time anyway. So, it...in the past, it's been possible to just go into pharmacies and buy boxes of surgical masks, but now they're all sold out.

[Sarah Gregory] What about airplanes? Do you think people should be wearing them on airplanes? I mean, non-sick people, I know you said they were not shown to be...

[Ben Cowling] Yeah, so I flew back from Australia a couple of weeks ago, from a scientific meeting, and everybody on the plane was wearing masks, coming back from Australia to Hong Kong. I think airplanes, the ventilation is actually very good, is actually very good. So, you know, I don't know the extent to which masks would reduce any risk of infection, and I don't think there's a lot of infected people travelling on planes anyway. But, you know, in general, in Hong Kong at the minute, everybody's wearing masks, you know, all the time they go out, when they travel to work, when they go in the office, when they go home from work, when they go shopping, when they go out to dinner—they wear the mask into the restaurant, just take it off to eat, and then put it back on again. It's really ubiquitous.

[Sarah Gregory] Did you wear a mask on the plane back?

[Ben Cowling] I wore a mask when I boarded the plane and then I took it off when I was sitting on the plane, because I was in a row by myself, there wasn't anyone else around, so I felt like it was okay to take it off because it is not that comfortable to wear a mask for a long time—it's about an eight-hour flight. And then I put it back on when we landed because I was going to go back through the Hong Kong airport where everybody is wearing masks.

[Sarah Gregory] Ahh...yeah, they're hard to breathe in. Okay, so tell us about travel-related nonpharmaceutical interventions. What do these include?

[Ben Cowling] So, we looked at a few specific travel-related interventions. The first one was entry and exit screening, and that's probably the most talked about, you know, the thermal scanners that are used at some airports, particularly in Asia, to pick up people who've got a fever. They have an imaging software and a camera, and then people with a fever show up as red. And they can pull them aside and maybe see what's their travel history or if they've got any other...any other thing to worry about. And right now, you know, maybe test them for coronavirus or some other stuff before letting them continue with their travel, particularly entry screening.

Apart from that, we also looked at travel advisories and restrictions, outright travel bans, and then complete border closures, which are really not the kind of thing that we can do anymore, in today's world. But in 1918, there were some scientific articles describing how some Pacific islands completely closed themselves off to the outside world, in 1918, to prevent pandemic influenza from coming in to those islands. And they did it successfully, but then they were blocked off from the rest of the world for those months.

[Sarah Gregory] What did you find when you looked at the studies about these interventions? Are they effective?

[Ben Cowling] So, there's not much literature on most of those interventions, but entry screening does have a reasonable amount of literature now. The thermal scanners at airports, we know that they'll pick up some people with fever, but they won't be able to catch every infection. And that's relevant now, when we think about coronavirus. We know that some people may travel with coronavirus infection. When they arrive at the airport, let's say it's Seattle or Los Angeles, if there was a thermal scanner there, it could pick them up if they had a fever, but it wouldn't pick them up if they were in their incubation period. In other words, if they were infected, say yesterday, today they don't have any symptoms, tomorrow they don't have any symptoms; it's only in a few days' time that they're going to develop a fever. And so, when they go through the airport, you'd miss them. So there's, you know, there's some potential for entry screening, like

thermal scanners, to pick up infected people if they do have a fever, but then it wouldn't be able to pick up everyone, and it costs a lot of money, and time, and effort to use those kind of scanners. But then...you know, so, in the review, we talked about how they probably wouldn't be that useful for pandemic flu.

Having said that, for coronavirus, entry screening has been able to pick up a number of cases at ports of entry to a number of countries. And so, you know, maybe it does help if you pick up some cases. You can delay the start of a local epidemic to some extent. I mean, it also depends how hard you want to try to catch cases coming in. You know you can't catch everyone, but you want to try hard to catch some or more. Even if a few slip through, it may still be a good idea to catch as many as you can.

[Sarah Gregory] We're seeing quarantining now with the coronavirus outbreak. And, as you sort of mentioned, quarantining has been around for a long time. It was even used to help stop the spread of plague in the Middle Ages. So tell us a little bit more about that and how it may or may not work.

[Ben Cowling] So, the original idea of quarantine was to keep people who were coming to a city, initially in Croatia and then also to Venice, to keep them outside the city for 30 days or 40 days until you could be sure that they weren't having the plague, in those days, and then they could come into the city. Nowadays, we will sometimes use isolation of cases; we'll do contact tracing of their close contacts, and we'll quarantine the close contacts. We saw with the cruise ship in Japan that everybody in the ship was quarantined, and even now, when they're repatriated to their home countries, they still need to go through quarantine again, to see whether they've been infected or not. And we've set the period for the quarantine, as kind of about the longest incubation period that we could think of. Maybe not the longest that was ever possible, but the longest that we could reasonably think of. And for coronavirus, that's about 14 days. It does help and we have seen for coronavirus that some of the people who were put into quarantine do turn out to have the infection. And by having them in quarantine, we've prevented them from being able to spread it onwards.

But it also takes a massive amount of resources to do quarantine. You know, we need a lot of facilities. I think in China at the moment, there's tens of thousands of people in quarantine in hotels and different places around the country. So, in the early stages of an influenza pandemic or something like coronavirus, we can think about case-based approaches to maybe containment or maybe to slowing the spread, where we'll identify people who are sick with the illness, whether it's pandemic flu or coronavirus, we isolate them in a hospital ward or in a special facility for isolation, we trace their close contacts in the past number of days, maybe their family members, the people they work with, and so on. And then we put those close contacts into quarantine, either in a special quarantine facility, like a hotel somewhere or at home. So, WHO, they typically recommend home quarantine is sufficient. You don't necessarily need special facilities because if you put people in special facilities, it costs a lot of extra money, a lot of extra work, a lot of extra resources.

[Sarah Gregory] So, when people are put in quarantine at home, how do you make sure they stay there?

[Ben Cowling] Well, that's...that's one of the things that public health authorities need to solve. In Hong Kong, we have some people in quarantine at holiday camps and we have some people in home quarantine, and the way that it's monitored is that the quarantine officers will phone up

people using FaceTime or using Skype e-video, or whatever, and ask them to share around where they are. Are they still at home? We do have some of those prison-type bracelets that you could, in theory, put on someone and monitor where they're going, if you thought they were particularly high risk for going out into the city and then, you know, not following the rules for the quarantine. But there's also, to some extent, there's a...there's a honor system that, if you're asked to quarantine yourself at home, you do stay at home as much as possible. You don't have to stay at home 24 hours a day for 14 days, but the concept is that you stay at home as much as possible, because if you were to develop illness, you'd then want to alert the health authorities, so they could then get you into isolation.

[Sarah Gregory] Along these same lines, what about social distancing, what does it mean and how does it work?

[Ben Cowling] Social distancing is another approach to the slowing down concentration in the community. So, one way that we just talked about is identifying people who are sick and then trying to get them to stay at home or isolating them in facilities and then to stop their contacts from spreading it if they also turn out to be infected. But, as numbers increase, and we saw this in 2009, as the numbers of infections increase, it becomes more and more difficult to trace their contacts and to quarantine them. So, at the beginning, when there's five cases, it's fine. And the next week, when there's 10 or 20, it's fine. And the next week, there's 40, and it's more difficult, or 80. And then, the next week there's a hundred, then 200, then 500. And you can see, at some point it becomes too difficult to do case-based approaches to slowing down transmission.

So, social distancing is a different concept where we just want to get people not to mix with each other as much as they did. And there's a number of different strategies for doing that. One that's probably best known, is school closures. So, we ask children to stay at home instead of going to school, because for pandemic flu, children are probably the group that would spread the most out of any age group.

But other social distancing measures that we can also think about is canceling mass gatherings. So, stop people from going to the churches, going to other religious ceremonies, stop them from going to movies, stop them from having political meetings, stop them from having...I don't know, from going to sports events, all those kind of places where crowds gather together and are closely packed together and could easily spread infection—stop those.

And then for people who go to work, we can think about what measures might be possible to reduce contact between people at work. So we can think about staggered shifts. Instead of everybody coming in from 9 'til 5, we could ask some people to come in from 7 'til 1, others to come in from 11 'til 7 or 8 in the evening, so there's only a little bit of an overlap, and then some people could work from home, as well. And that means we'd also have less people in the rush hour, on the buses and on the trains.

So, all of these kind of measures to just keep people apart from each other as much as possible, get people to stay at home more, can really help to slow down transmission. One of the biggest concerns in a flu pandemic, is that there'll be a surge for hospitals, for hospital beds, and there'll be too many patients that hospitals need to handle at the same time, and that's really bad news for all the patients that need to get into hospital, because if there's not enough beds, not enough doctors, not enough nurses, then they can't receive the best kind of care. So, by social distancing measures, another kind of measure to slow down transmission, we can spread out infections over longer time period. We can't necessarily prevent infections from occurring, infections may still

occur, but we can spread them out over longer time period so that hospitals can cope better with the surge in cases. Doctors can cope better with the surge in people waiting in their...to see them in their surgeries, and so on.

[Sarah Gregory] Tell us a little bit more about school closures and what have you discovered about these practices?

[Ben Cowling] Well, school closures are particularly disruptive. So, they've been used in some previous pandemics, in the US and in Europe and in other parts of the world. In Hong Kong we actually close schools quite often. They're quite disruptive socially because when children don't go to school, it means parents have to arrange ways for looking after the children if both parents are at work—that can be difficult. Also, there's the lost learning opportunities for children. So, now in Hong Kong we've got schools closed for quite a number of weeks, going into at least April and maybe longer, so schools are now doing online lessons instead, for the first time. And then for some children, particularly low-income families, they'll have meals, free school meals, and if they don't go to school, they can't get those free school meals. So there's a lot of issues about closing schools that we need to think about. It...you know, when we think about flu, we think children are spreading it, so closing schools would be a great idea, but there's actually a lot of other issues that need to be considered for...before a school closure policy can be introduced. And in the US, it's a particularly a difficult issue, I think. So, you know, our review highlighted some of those issues.

[Sarah Gregory] Is there anything else about these policy reviews you'd like to add or how it relates to the coronavirus that we haven't covered?

[Ben Cowling] Yeah, so we don't know exactly how coronavirus is spreading between people, but we presume it's similar ways to influenza. That means it's respiratory droplets in close contact, maybe face to face, talking and coughing, breathing. We think that coronavirus can survive on surfaces and that brings hand into play. It could survive on hand rails, on door handles, and in the buses and in the environment, so then, if we can encourage hand hygiene, we may be able to reduce some coronavirus transmission. But, ultimately, it looks like there's going to be global transmission, global outbreaks, global epidemics of the new coronavirus.

And then, given it looks to be a little bit more severe than flu typically is, we do need to think about what interventions might be justified. When we thought about flu pandemics, we thought, you know, maybe there's some pandemics which are relatively milder, like 2009, when we might not need to do too many interventions; we'll think of it like a normal flu season, and generally won't do too much, just get hospitals prepared for a little bit of a surge in admissions. But then we also think sometimes about more severe flu pandemics, like what happened in 1957, 1968, or even 1918. And we think that in those types of pandemics, more aggressive measures might be justified. I think now, in the United States and in other countries, you've got to be thinking about what more aggressive measures might be justified if there is local transmission of coronavirus. And quite a number of these nonpharmaceutical interventions would definitely come into consideration. I think school closures could be considered, workplace measures or even workplace closures, cancelation of mass gatherings, and then, of course, all the individual-based measures about improving hand hygiene, improving cough etiquette, maybe wearing masks, if you're sick. I'm not sure about universal, universal masking. But, you know, all the stuff that we've covered in these policy reviews would come into play basically.

[Sarah Gregory] Okay, so what's the bottom line here? What do clinicians need to know about pandemic flu and coronavirus and what do people need to know about protecting themselves?

[Ben Cowling] So, for pandemic flu and also for coronavirus, the first and most important thing is that most people who are infected will just have mild illness. It's not a really, really scary infection for most people. The worry that we have about pandemic flu and also about coronavirus is that, because, you know, potentially a lot of people could be infected. With pandemic flu, we worry about 10 to 20 percent of the population or more being infected within a short space of time. With coronavirus, maybe even more than that. When you have such large numbers of people infected, and the minority are severe, that can put a lot of pressure on the hospital system. And it's particularly a concern for people who are older, maybe with some underlying medical conditions. We've seen those are particularly affected by flu and also particularly affected by coronavirus.

In terms of what people can do to protect themselves, you know, the first thing is to stay at home more, if you can, and to avoid crowded areas, if you can. And then, of course, practice good hand hygiene. And if you think that you are, you know, been infected, you think you've got a respiratory infection, then go see your doctor or seek advice from the...you know, from the relevant healthcare provider.

[Sarah Gregory] So, which...which are the measures in this policy review that would be most applicable to the new coronavirus?

[Ben Cowling] In the past probably month or so, we've seen a lot of focus on case-based measures, particularly in the US. We've seen people are identified as cases and they're isolated, maybe their contacts are traced and quarantined. The returning travellers from China have been quarantined if they don't have signs of infection or isolated if they do have signs of infection. That's fine for now and it's going to work for a little while longer, when more cases are identified.

But at some point it's not going to be feasible any longer. Most likely there's going to be an increase in the number of infections like what we've seen in Italy. And so, at some point, we need to switch over to other measures. What's been done in Italy is an attempt to follow what was done in China, where entire cities were locked down and a cordon sanitaire was drawn around those cities. So, that's two interventions: The first intervention is everybody's got to stay in their home as much as possible. And that really, you know, tries to stop transmission within, within the towns where there have been outbreaks. And then the second intervention is the cordon sanitaire around the town to try to stop infected people from leaving and going elsewhere.

I think those...both of those interventions and both of those purposes are very difficult to achieve. In China, it looks like it has been possible, but that's with really extreme use of technology and also monitoring by local officials. In Italy, I doubt it would work as effectively and I don't think the same kind of interventions that have...that have seemed to work in China would be very feasible, maybe, in the US or other European countries. So, fairly soon it's going to be necessary to think about some of these social distancing measures that we covered in our pandemic preparedness review. Which of those might be more feasible? When could they be introduced? How could they be introduced? That's really some of the critical questions now, thinking about coronavirus.

[Sarah Gregory] Okay, so continuing to talk about coronavirus, while there have been a whole lot of cases worldwide and increasing daily, at one point it still seemed like more people were dying of seasonal flu. Is that switching now? Do we need to be more worried about coronavirus than this bad flu season or...what's going on with that?

[Ben Cowling] I think in a typical year, there's maybe 200-, 300-, 400,000 deaths globally from seasonal flu. I forgot the number in the United States, but it's...I guess the order tens of thousands, that the CDC have their estimates of the influenza-associated mortality every year. I think that the deaths from coronavirus in the year 2020 will far surpass those kind of numbers.

We've only seen the beginning of what is likely to be a coronavirus pandemic. Places like the US have relatively better resources, relatively better hospitals, you know, and a government which can, you know, ask people to do things to protect themselves, to stay home more, and be trusted and listened to. But in some other parts of the world, those kind of things are all going to be quite different. And, you know, I'd really be quite concerned about some parts of the world with relatively weaker health infrastructure and relatively less public compliance with instructions and advice from governments about what to do, because the coronavirus could really do quite substantially more damage to public health than seasonal flu would do in a typical year, as it currently...as it currently looks, as the picture currently stands.

[Sarah Gregory] Okay, well, that's quite frightening. You, as you've said, live in Hong Kong. What do you do there? I mean, tell us about your jobs, but also just what do you do for fun there?

[Ben Cowling] Well, yes, so I'm a professor at the University of Hong Kong. I've been here for 15 years. I work mainly on influenza epidemiology, but also a little bit on emerging infectious diseases. In the past few years I've focused on how flu spreads, looking at how flu spreads in the community, and how can we best prevent it, particularly with vaccines. And I've been doing a number of vaccine trials, but right now, almost all of my time is focused on working on coronavirus research. How is coronavirus spreading? What might be going to happen next and what are the best ways that we can control it? So, in the past few weeks I've had very little spare time. But before that, when my life was relatively calmer, if I've got some free time, might play some golf or, you know, enjoy the countryside in Hong Kong—it's really a lovely place.

[Sarah Gregory] Okay, this is just showing my ignorance. I think of Hong Kong as a very urbanized country, but there's still golf courses and countryside, yeah?

[Ben Cowling] Yeah, that's right, there's actually a lot of countryside. So, Hong Kong is a very, very densely populated city, but around the edges of the urban areas, there's mountains and a lot of really nice countryside. I think 80 to 90% of the land mass is not actually occupied by development; it's countryside. But then, when there is development, it's really, really the most densely populated place on earth. It's remarkable to see.

[Sarah Gregory] Yes, I guess that's what I'm envisioning. Okay, well thank you so much for taking the time out of, I'm sure, your incredibly busy days now, to talk with me, Dr. Cowling.

So, listeners can read the three policy review articles Nonpharmaceutical Measures for Pandemic Influenza in Nonhealthcare Settings—Personal Protective and Environmental, Social Distancing, and International Travel-Related online at [cdc.gov/eid](https://www.cdc.gov/eid).

I'm Sarah Gregory for *Emerging Infectious Diseases*.

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