

AJPH Podcast—January 2025  
Ventilation  
Hosted by Alfredo Morabia, MD, PhD

*[musical prelude]*

AM Hello and welcome to this new podcast of the American Journal of Public Health. Today, we will be talking about the very important issue that has some incredible [sorry] roots, the issue of indoor air pollution. And this can be home, this can be occupation, this can be a different environment, and uh you know, how long has public health been interested in those issues, and what, you know, we went through the Covid-19 pandemic—I mean, there were lots of issues related to indoor air quality and contaminations and what did we learn and are we better ready today after that pandemic than we were before. These are the questions that we are going to discuss with our guests. So, let's start with Jon Samet, hello Jon!

JS Hello Alfredo and hello everybody. I'm Jon Samet at the Colorado School of Public Health, and I've worked on issues related to indoor and outdoor air quality for a long time.

AM Thank you, Jon, and then we have David Michaels.

DM Hello Alfredo, it's great to be with all of you today. I'm a professor at the George Washington University School of Public Health in Washington, DC. During the Obama Administration, I ran the Occupational Safety and Health Administration.

AM Thank you, David. And then we have Paul Sampson, historian, here in our group, so Paul welcome.

PS Thank you, Alfredo. Thank you for having me on, it's wonderful to be here with you and with Jonathan and David, as well, and I'm a historian of science and medicine and I currently teach at the University of Scranton in Pennsylvania. I'm working on a long history of ventilation from the 18<sup>th</sup> century up until the mid-19<sup>th</sup> century.

AM Thank you, but that's interesting, and actually that brings us directly to our conversation, because you are thinking about 18<sup>th</sup> century and later, but when you think of it as soon as there is some [methical] thinking on the planet, immediately people have been associating pandemics or epidemics with air pollution. You know, this miasma theory, you find it in China, you find it in [meso] America, you find it in Europe, of course, everywhere. So, people in some way were obsessed with air pollution, so why does a history start in 18<sup>th</sup> century?

PS Well, that's, you're exactly right, Alfredo. I mean the obsession with air pollution, at least in the west, goes all the way back to Galen and the non-naturals and you know even further back into the ancient Greek medicine of Hippocrates; but, I began in the 18<sup>th</sup> century because I ran across a really strange device, a ventilator trunk, that was proposed by a British cleric and scientist, natural philosopher, in the early 18<sup>th</sup> century. And I found a kind of a spat of all these different strange devices being designed to mitigate air pollution, especially in closed spaces, and I wondered why in the 18<sup>th</sup> century did natural philosophers and physicians start to become really interested in these strange devices to mitigate air pollution when, you know, of course we've known [of] diseases associated with bad air for a thousand years at that point. So, that's where my history really began and my interest in the topic began.

AM Yeah, but you know, if we're associating disease with air—even when it was not in the air, you know, that, you know the miasma and cholera were wrong, and it was, you know, they found that air pollution caused cholera. So, it was really the main hypothesis in terms of this is causation.

PS Yeah, you're exactly right. So I mean what I argue is that air has always been a object of fascination, but as they started doing more and more mechanic studies of respiration, human respiration, they started to wonder if there was a way to improve air mechanically with these, with these machines and these new ways of, of ventilating in closed spaces. And what I argue is

that, even though it became clear later on, just as you say, that cholera and other diseases are caused by, you know, non-aerial factors, non-aerial vectors, these machines became part of the infrastructure of many modern buildings just because people felt safer and more comfortable with these machines. It became more about comfort and less about disease prevention; because clearly a ventilator is not going to prevent you from getting cholera or dysentery or any of these other kind of awful diseases.

JS Yeah, but I've come to a little bit more contemporary spin on it, and say that across the last century, the American Society of Heating and Ventilating Engineers and then American Society of Heating Ventilating Refrigerating and Air-Conditioning or Engineers, or ASHRAE, had a key role. And I think one thing that happens... the health community itself was quite separate from this group of mechanical engineers who were designing codes, standards, for ventilation for acceptable indoor air quality, and I think in my mind it wasn't really until somewhere around the 70s when public health community really began to take a strong interest in indoor air pollution and its consequences, and you see this connection and the realization that ventilation had something to do with health and, of course, accentuated, accentuated by Covid-19, the transmission of the SARS-CoV-2.

AM But (Jay), when you say 1970s, you mean OSHA?

JS Well, that's, it's interesting though that you raise OSHA, because it's another example of the stove-piping of our public health institutions. I mean, ASHRAE was working on one set of rules. Also, in really 1970s and really the second half of the 20<sup>th</sup> century, the industrial hygiene profession recognized that the best way to control indoor hazards in workplaces—and they were really thinking about industrial workplaces more than offices and things like that—was through the hierarchy of controls which requires first to eliminate the exposure if you can, and of course

with Covid that means encouraging people to stay home so that you don't bring the virus into the workplace, but in general moving to safer chemicals, whatever it is. But if you've got a hazard in the workplace air, engineering controls and particularly ventilation is going to address it. All of the ventilation issues at OSHA and the industrial hygiene being looked at tends to be hazard-specific rather than thinking about indoor air in general and how to make the air safe around all hazards for all people. OSHA did propose a standard for indoor air in 1994 that was, as you know, buried essentially by the tobacco industry and others.

DM Correct, I mean Jonathan's work on that issue was mightily important and OSHA proposed an indoor air quality standard of, but it was really for tobacco smoke, recognizing that indoor air exposure to tobacco smoke increased risk of several diseases. And the tobacco industry mobilized an incredible campaign including getting, I think, close to half a million letters and postcards, um, inundating OSHA saying don't do this. And OSHA backed way off because they couldn't stand the political pressure.

AM So, that was part of the conversation about exposure to passive smoke, environmental tobacco smoke, that was where the conversation [took place...] yeah. So, Paul, where does ETS stay, you know, environmental tobacco smoke, in your history?

PS Well, it's interesting because I think the perception of what constitutes clean air evolves quite a bit over time. So, in the early 19<sup>th</sup> century, for example, there was a lot of kind of increasing amounts of coal smoke in the air, especially in places like London. You know, they were industrializing really quickly. And that was actually perceived as cleansing in some ways or healthful. You know, it had this kind of acrid, acid quality to it, so they perceived that as a sign of progress and not necessarily dangerous; but as you mentioned earlier, things like miasma that

are kind of rotting organic smells were perceived as really dangerous. So, that evolves, of course, over time. By the end of the 19<sup>th</sup> and in early 20<sup>th</sup> centuries, as I'm sure you know Jonathan and David know much more than I do, it becomes very clear that, you know, a lot of particulates in the air is really dangerous for human health, and so it, you know, like I say it kind of begins to evolve and you have more and more kind of calls for clean air which I think culminates you know finally in the 1960s with the Clean Air Act. It's an ongoing story, I mean, I think it's continuing to evolve--

AM But it, it's the paradoxes here are very interesting, because John Snow actually was hired by the industry in litigation when the communities were complaining that all that is dust from the chimneys were polluting their neighborhoods and they were creating disease. He went, you know, to claim that, no, there was no way a disease could be transmitted by the air. It was all, and he was an expert in anesthesia and he knew about gases. So, but now we have the [revent] of the miasma with the ETS.

JS So, I just want to close out the second-hand smoke story, because I did chair a committee for ASHRAE that said that there could not be acceptable indoor air quality if there was smoking inside, and this position was endorsed by the ASHRAE and it's been reconfirmed. So I think that set that story of second-hand smoke and acceptable indoor air quality, I think that ended the story. You can't have smoking and acceptable indoor air quality, no matter how much you ventilate.

AM So, that's, you know, that's the historical, you know, turning point. And now we get to the issue of indoor air quality and infectious disease. I know that, David, you worked a lot on preparing some standards about this and they were ready, and what happened with that?

DM During the H1N1 pandemic, it became very clear to OSHA that the same thing was needed for airborne pathogens. CDC's suggestion that people wear surgical masks was not going to be effective. OSHA actually started that process; when I was there, we made some progress on the standard and we expected to issue a proposed standard in October 2017. That was on the federal regulatory agenda with that date. Unfortunately in January of 2017, a new administration came in and all work was stopped on that standard and it was essentially deep sixed. So, when the Covid pandemic hit in March of 2020, OSHA was unprepared. They hadn't made much progress; they'd really stopped working on that. The inspectors were unprepared to go out because they were unprotected, but the main thing is the Trump Administration essentially said we don't need the new standard; OSHA's general duty clause can, tells employers what to do which really is nonsense. And as a result of that, workplaces across the country were inundated with Covid cases. And really it was tragic. I mean the people with power in the United States—lawyers, CEOs, anybody who could work from home, people like us, could do that—but the workers in essential industries who have to make sure food was on the table and our sacred elderly were being taken care of, they had to go into work everyday and we had no requirements for their employer to make their workplaces safe. So OSHA began that process again with the new administration, with the Biden Administration, and then essentially it hit another traditional OSHA roadblock which is industry is very strong and they don't like to see OSHA standards. They viscerally oppose it, and OSHA was ready with a standard in April and May of 2020, and if we go back and look at that, that was a funny time in the Covid pandemic, because the vaccination program had really gone full speed. Many people were being vaccinated. We thought at the time that vaccinations would decrease transmission dramatically. We now know that what vaccinations do is they stop disease severity but people still get sick. And the White

House decided that, to deep-six that proposal; and so it was never released even as a proposal. OSHA did issue a temporary standard for healthcare workers and that did require some immediate controls—N95s, a few other things—but really didn't go as far as really necessary to tell employers, look, you've gotta prepare—you've gotta deal with this pandemic, prepare for the next one by building in air quality improvement. There are obvious ways to do that—you know, better ventilation, filtration if you don't have pure ventilation, and germicidal disinfection, whatever will work, but you have to do something. But right now, we have no requirements for most workplaces to do anything like that.

AM So, David, the the standard didn't go through and they're still not accepting? I mean, Jon, is there anyway from your experience with the tobacco smoke that you could give some advices on how to have this standard accepted so that there we do some real progress to... ?

JS I think David is the expert, you heard his frustration. I mean I think, and then of course there was the Supreme Court decision that figured in as well with the efforts of OSHA. So, you know, I mean common sense just doesn't seem to be prevailing here, does it? I think the real concern is there is a lesson learned here but nobody seems to want to learn it and do something. I will say David and I were on a committee of the National Academies that was asked to develop frameworks for providing respiratory protection for the many workers who are covered and the general population, and then as David and I have seen that report released a little bit over two years ago now. It's just had no traction, and I think Covid fatigue and whatever else are critical roadblocks. This is the time that we should be thinking perspective. I think that is happening around looking at ventilation in schools for example, and I think there is, you know I think there are some lessons learned that are, that are having impact but certainly not around respiratory protection.

AM But you know, Jon, if I recall well, the issue of the airline attendants having cancer was key when the decision about passive exposure to tobacco smoke, you know, was brought and the agreement was reached with the industry. So, there's no accountability for all the damage that occurs on the workplace because of contamination and, and infectious disease? Nobody's accountable for that?

JS [*inaudible*]... write to David...

DM No, I wish there were. You know, what's challenging is even in situations where large numbers of workers got infected clearly from workplace exposures because we've done genomic testing, workers have a great deal of difficulty getting workers' compensation payments for those illnesses. It very much depends on the state. Employers have no great incentive to put in those protections because the workers' compensation system protects them from being sued. You know, there isn't like a deep pocket like the tobacco industry which really was, you know, on the hook around cigarette smoking. Also, Covid has become so politicized that it's been very difficult to take this on, and I think it's a class issue also. I mean as, you know, if all of us who have power in the United States had to go to work every day during that pandemic and the offices not just of Tyson's Food but of Chase Manhattan Bank, people were worried about being exposed to Covid, we would see clamor for much better rules around ventilation. And unfortunately, I think we're seeing that now around heat, that a lot of workers have to be outside everyday in severe heat, but people with power in the United States can stay in air-conditioned rooms and do their work. And so there isn't this uproar, this clamor, saying we've gotta do something about this.



AM Paul, from your perspective, do you see this tension between the environmental exposure and infectious diseases when we talk about air quality? I mean, is there some trends or patterns historically that you could report?

PS Well, I just want to, I mean if you don't mind, I'd like to just kind of second some of what David said, that you know when these regulations work, and I think the blood-borne pathogens is a great example of this, when they work they kind of fade into the background and they become part of the natural kind of way of living that we all experience and we all say oh cool yes of course you wouldn't go to a dentist who wasn't wearing gloves, you know, that's completely unacceptable. And I think just from my experience and from my own research, I've seen that these public health decisions are always political decisions, and this a point that I've tried to make in the piece I wrote for AJPH with Elaine Lafay who's another excellent, you know, public health historian. We just tried to argue that that you know decisions of whether to focus on air quality are always decisions based on what is perceived as, you know, what can you sell basically to the business community, what can you sell to the public politically, and as, I mean you mentioned this earlier, you know, in the 19<sup>th</sup> century when sanitarian revolution was happening and sewer systems were being installed everywhere and here was an emphasis on clean public water, they made a deliberate decision. You know, a lot of the sanitarians made a deliberate decision to focus on water and to not trouble with air and air pollution because it, that's something that was seen as you know too difficult to address, leave it up to the free market. You know, maybe have some regulation about the number of windows that buildings have to have or things like that, but that does nothing about external environmental air pollution, as you mention. So, there's there's many different facets to these issues, and I think that some of what I guess I can just really echo David's frustration and Jonathan's frustration that the answer is going

to have to come through some strict regulations that are going to make sense that'll be functional and you can't just rely on basically voluntary contributions from the business community and things like that.

AM Got it. I would like to move to another aspect of indoor air quality. We've talked about, you know, corporations and industries, et cetera and how we address these problems at population level. But how can the individual, you know, understand how to protect themselves from any form of air pollution? There was a lot of confusion at the beginning of the Covid pandemic. Do we know today a little bit more how to communicate and what's the message to the individual when there are air pollution risks or air quality risks? What should they do?

JS So I'll comment, and of course for outdoor air we have EPA's AQI, Air Quality Index, and warning and it comes with the weather and that's basically about how the levels of air pollution outside relate to our national ambient air quality standards, and I think there's a lot more to be learned there about how to communicate, and then together with our ozone problems we're sort of in the unhealthy range much of the summer. But we don't have something comparable to for indoor air, per se. So carbon dioxide was used as a general indicator as sort of the level of ventilation, was there enough in relationship to occupancy; and that's one of the tools we have. There's a lot of work going on sensing and developing sensors for these infectious bio-aerosols; and I think the limit of it will come when we have that kind of information at hand is what does it mean and what does it mean for risk. And if we know that SARS-CoV-2 is present, maybe just telling us there's an epidemic going on or it's surging, and then relating that to risk is something we're going to have to learn how to do. And there are initiatives under way now to do just this, but I think it's fair to say and Paul is probably the right person to comment, essentially for about

a century—this is the work of Wells and Reilly—not much progress was made on dealing with infection through respiratory airborne pathogens. So, that would be my endeavor to Paul--

PS My impression is similar to yours, I mean I think that there's been—again this is an impression and you and David would be more qualified to comment but there's seems to have been a throwing up of hands when it comes to respiratory diseases or diseases passed through airborne pathogens that it's just chaotic, it's hard to control, you know, there's certain things you can do to try to mitigate it but really you know there's nothing really substantial you can do.

DM This is the classic public health hazard challenge in that individuals can't control their environment to the extent they'd like to, they don't know what's in the food, what's in the shampoo they buy, and certainly you can learn more about what's in your outdoor air but there's not much you can do about it. In terms about thinking about what individuals can do with indoor air, I think there are some steps. I mean obviously carbon dioxide monitors are useful and that a nice thing, but one thought is to have local ordinances or just individuals who reach out to their building operators and owners to post information about the ventilation and filtration capabilities and [attributes] of their building. And that sort of disclosure we know from behavioral sciences has an impact on, on behavior. You know, building owners who find out and have to post their ventilation isn't doing much, we'll do something to improve it. And so that's sort of beginning to build a movement around this, and I think that's the movement we have to see with people demanding clean air in their homes and their workplaces, in their public buildings and their schools, et cetera.

JS I was just going to say fine, but calling back to what David said that when the focus that probably receives the most attention is schools, and there we've learned that in fact many schools don't have adequate ventilation. We've also learned that we don't know much about ventilation

in schools. We don't really have that, and I think there's a couple hundred thousand public schools across the country, and you know many of them are quite old, and uh we just, we know we need to work on the ventilation in the schools and certainly weren't going on, but much more to be, much more to be done and a critical location.

AM Listen, I want to let you go, but I have this feeling that it's a little bit of a pessimistic podcast. I cannot let you go without at least some positive note, some silver lining. I mean what's coming that we can have, give us hope that this thing is going to get better? And I promise this is going to be your last word, and let's start with the historian.

PS I guess I will say there's never been more funding available to improve air quality in schools. I mean that was one thing that I, I learned in the course of my research for the AJPH piece is that, you know, the Biden Administration while they didn't provide clear regulation they did provide an enormous amount of funding infrastructure in schools. So, that's, I think that's a hugely positive step, and I think we can be thankful for that.

DM Well, you know, when we go back to tobacco, it was the research on the effects of second-hand smoke and environmental tobacco smoke on non-smokers who really drove a lot of these policy decisions. The increased risk of lung cancer among the spouses of smokers led to a lot of this, and I think we're seeing studies of indoor air quality impacting performance of schools, of students in schools, of the ability of people at work, and I think also some long-term chronic diseases. And I think as that research develops, there'll be more and more clamor for indoor air quality, and we should certainly encourage that and make sure the research is done well and disseminated widely.

AM Jon, you have the last word of this whole thing; it needs to be, you know, brightening our future.

JS Well, if there's a bright side of the pandemic or among them was, I think, a rapid advance in an understanding the transmission of respiratory pathogens, you know, and really leading to knowledge about what to do. I mean it's not that we don't have an understanding of what to do. We understand a lot. I think the challenge lies in implementation. The pandemic brought together the community of mechanic engineers, aerosol scientists, and health people in ways that were needed and that had not happened. If that collaboration continues and there's funding to support ongoing work, and I think there maybe, then maybe we'll get somewhere. I will comment, ARPA-H has this initiative out that a number of groups around the country responded to to develop enhanced sensors for pathogens to think about how to control building operations to reduce risk. So, I think there's awareness, there's attention. I will say that if we learned some good things to do and then talk about implementation, then the challenge comes because then we're talking about potentially millions of buildings where we might want to do some sort of upgrading, look at the ventilation system, install more sophisticated sensors. So, we could be on the verge of a revolution if we get the right tools to do things and people will do the implementation side. And that, you know, David was sort of drawing on a lot of the barriers that will inevitably come for that.

AM I like that, I like that. I mean what what we saw and now I'm talking to our listeners, I mean indoor air quality is an old history. I mean we've been thinking about it for a very long time, and we have historians that are working on it, et cetera. We had huge problems during the Covid-19 pandemic, but don't think whether we didn't learn anything. We didn't get what we wanted, of the standards and better protection of the citizens; but we've learned about and it's an old process but we are better off today to improve our standards and improve the indoor air quality than we

were before the pandemic. That would be my conclusion. Thank you very much, all of you, [I know you work everything], thank you for your time.

*[musical postlude]*