NASEM Environmental Health Matters Initiative
Indoor Air Management of Airborne Pathogens

Session 3: Organizational change, response, and management in the face of the pandemic or future crisis

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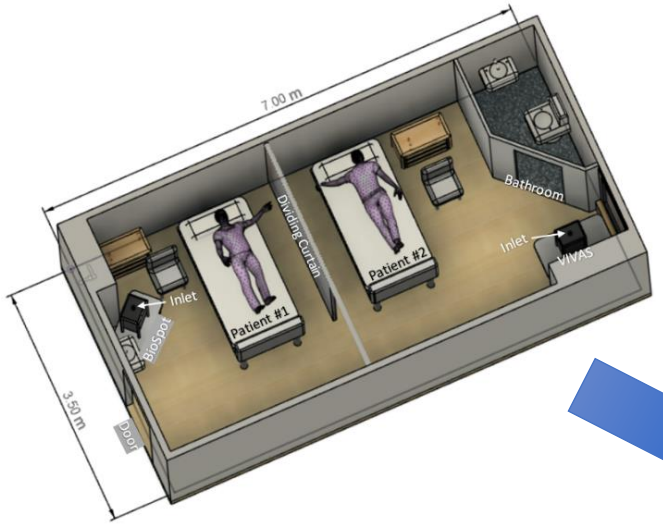
Engineering Innovation and Messaging to Support Decision Making for Minimizing the Exposure Risk to Infectious Virus Aerosol

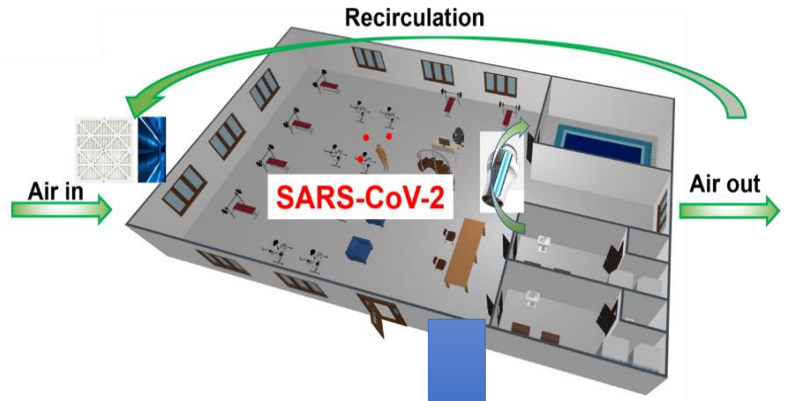
A simple, clear and accurate message is important to public health; it will take longer to correct bad messaging than it will to review the first message a few more times.

Which scenario has a higher SARS-CoV-2 aerosol concentration?

COVID-19 Patient Room



Fitness Center



Self-Isolation Room

Volunteer B
[With severe COVID-19 symptoms]

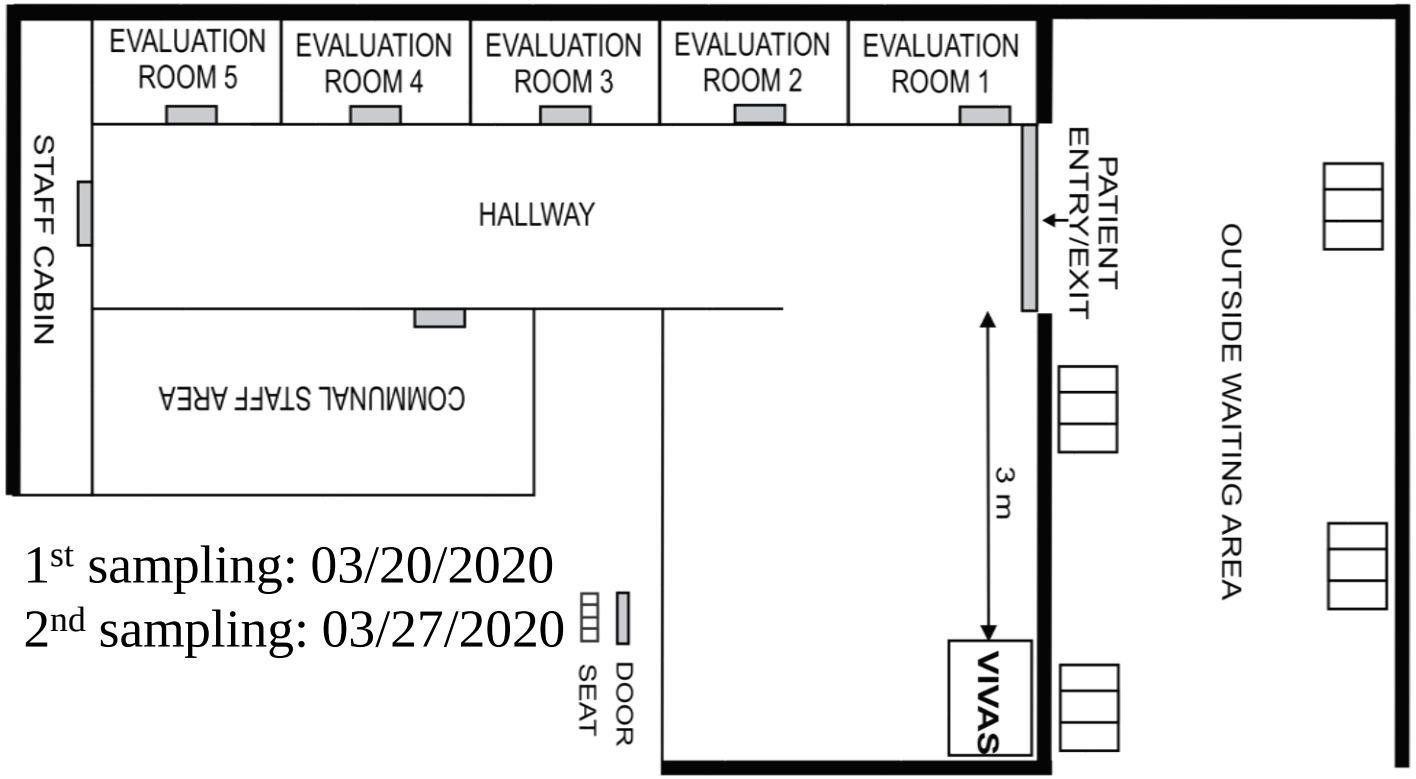
Concentration	94 GE/L [1]	0 [2]	5.9×10^{8} GE/L [3]
Air Change per Hour (ACH)	6	10	0.35?

Ventilation is important!!!

Most people make a wise decision when relevant information is provided:

Ex. 1 - Healthcare center quickly adopted new protocols once it saw evidence of aerosol transmission of SARS-CoV-2 [4]

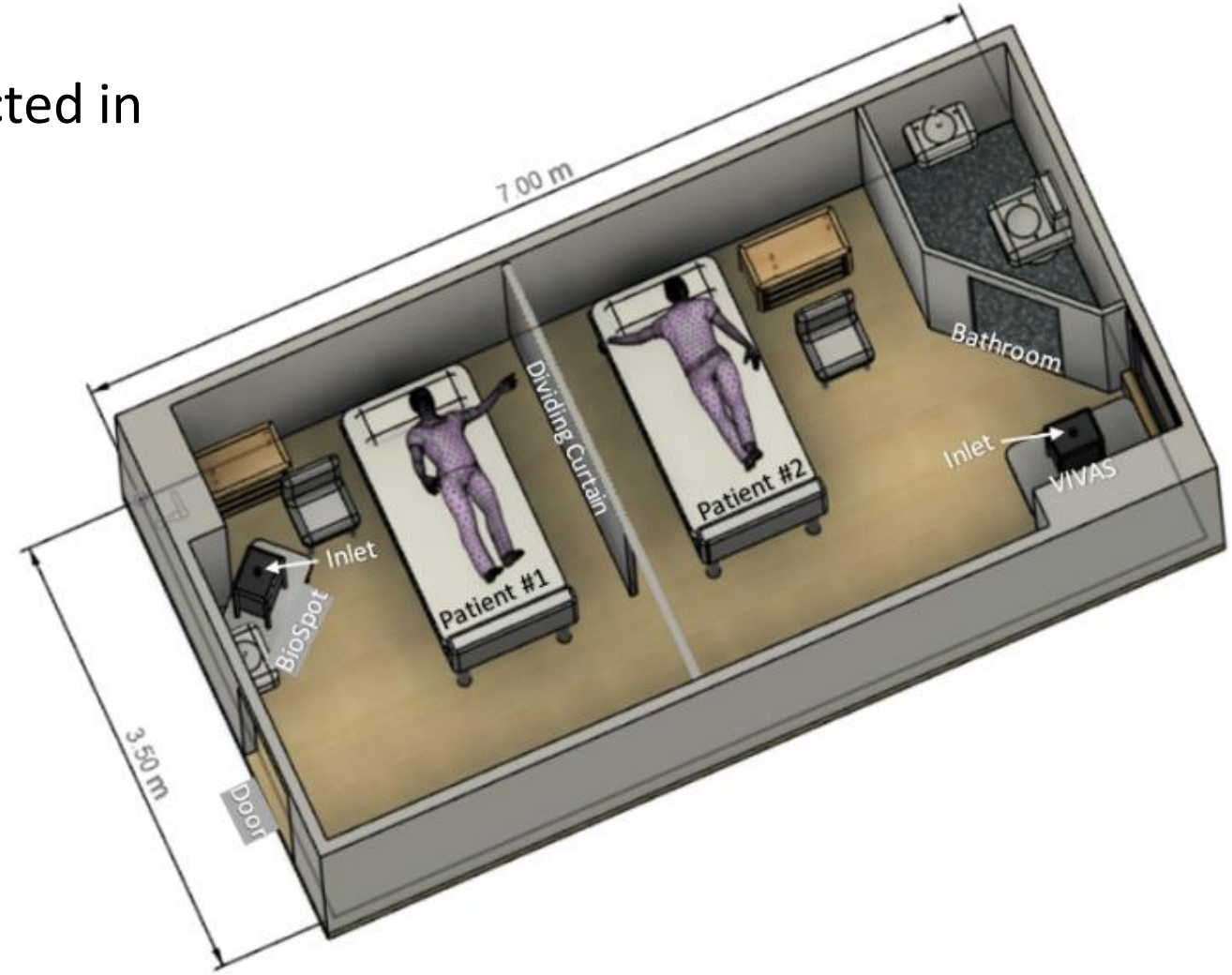
- **All staff switched from surgical masks to N95**
- **Respiratory ward operation moved to outdoor**
- **Enhanced disinfection**



1st sampling: 03/20/2020
2nd sampling: 03/27/2020

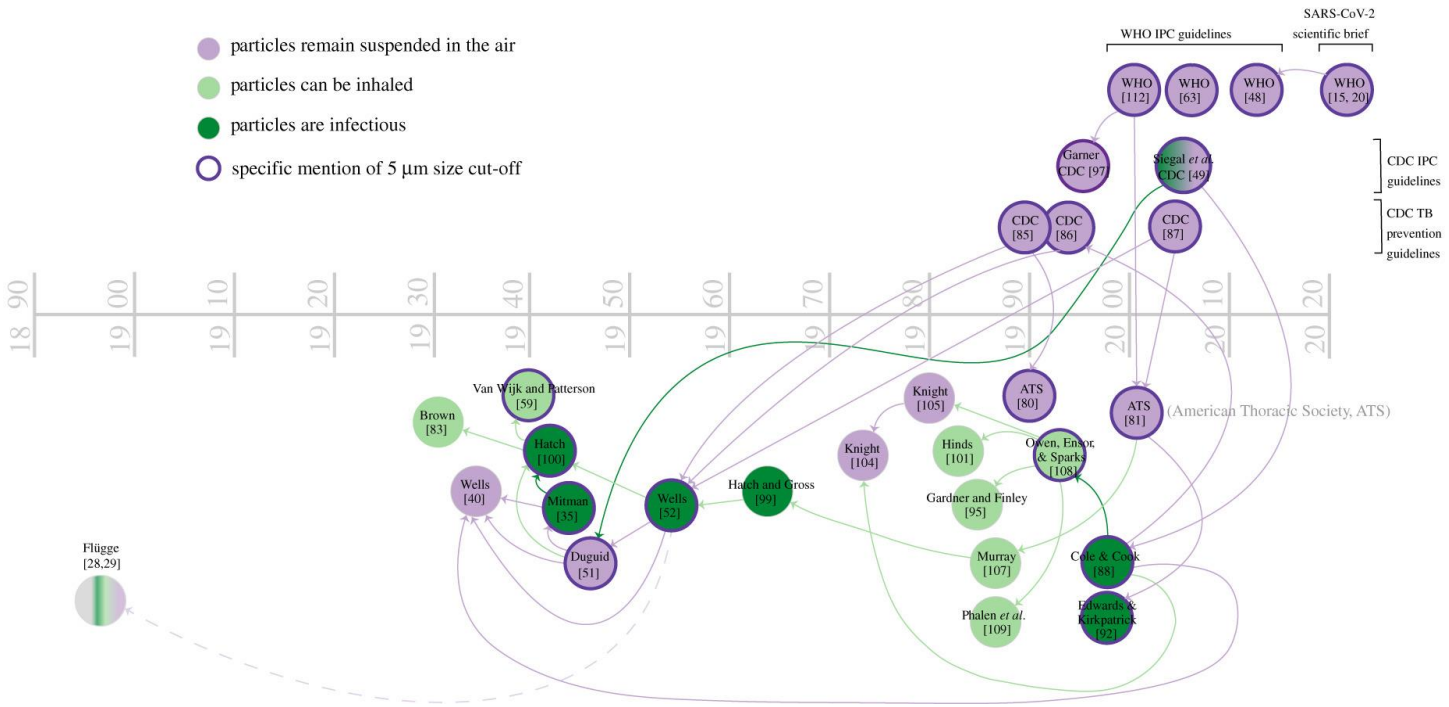
Most people make a wise decision when relevant information is provided:
Ex. 2 – WHO's medical experts were not convinced about aerosol transmission when only RNA data were presented, but they started to change their mind when viability data were shown [1]

Viable SARS-CoV-2 concentration collected in room air **> 2 m away** from patient = 74 $TCID_{50}$/L. Genome sequences of the air sample **exactly matched** with the corresponding sequences of the virus isolated from patient.



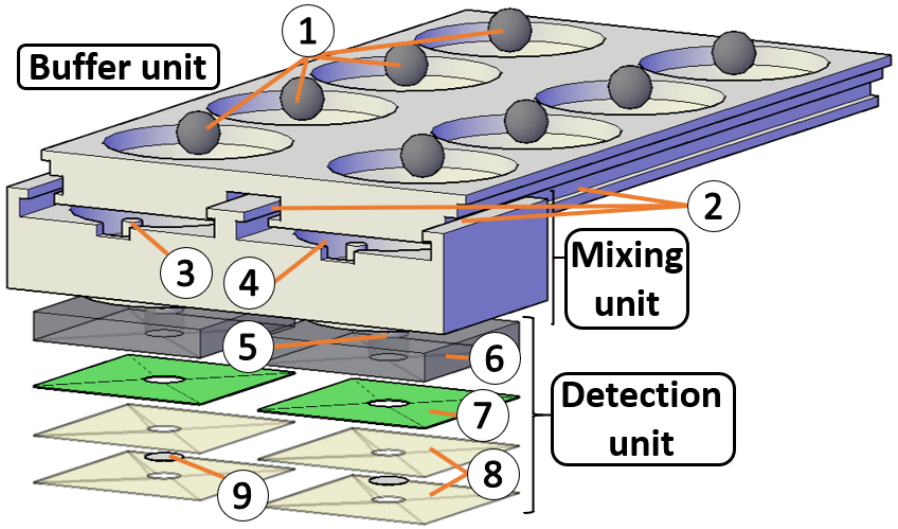
Do not assume everyone uses the same language and definition; it's important to define terms so that people of different sectors are talking about the same thing

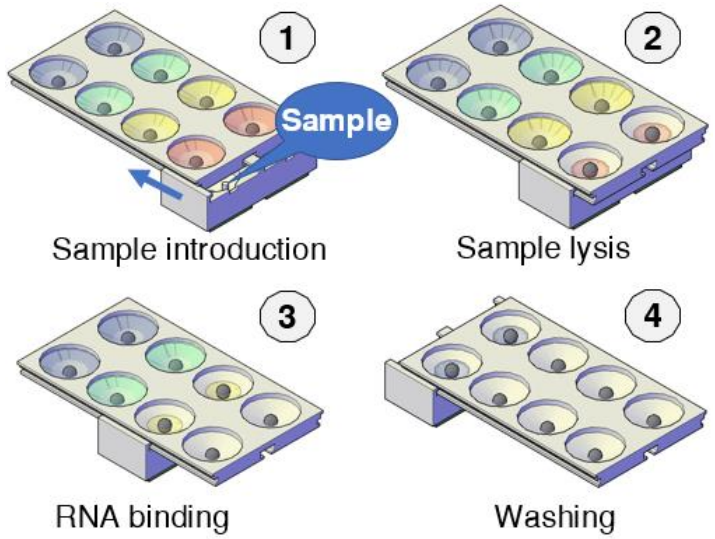
- **What is aerosol?** [5]
  - **Engineering and natural science**: A suspension of solid particles or liquid droplets in air or gas
  - **Medicine**: Particles less than 5 μm (droplets if > 5 μm)

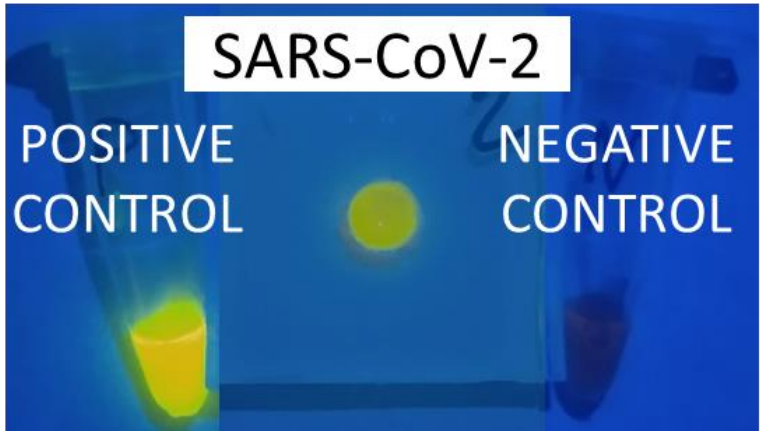


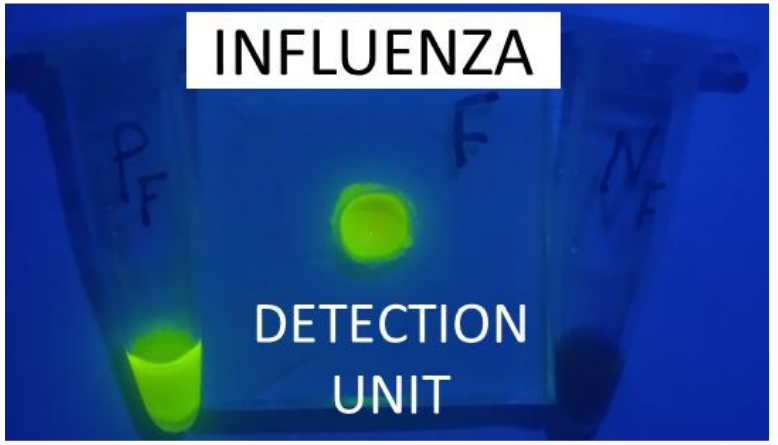
Regulations/policy and technology innovation are complimentary to each other

- Imagine how we can make a decision/plan, if we have an On-The-Spot detector of SARS-CoV-2 or influenza virus aerosol [7,8]



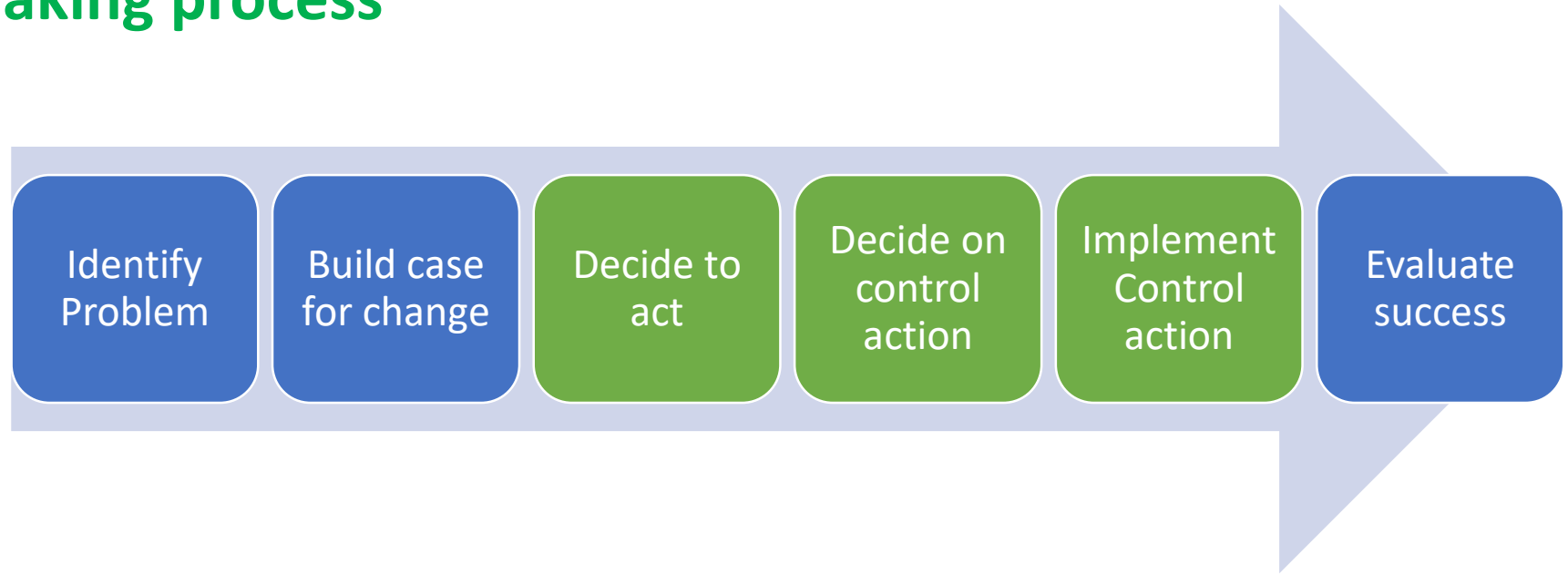






Regulations/policy and technology innovation are complimentary to each other

- Data are needed for air quality action, indoors and out
- Often decision makers (e.g., facilities managers) lack some of the information they need to make decisions, e.g., ACH in naturally ventilated buildings. Engineers can develop methods to get them past that roadblock and help support the decision-making process [6]



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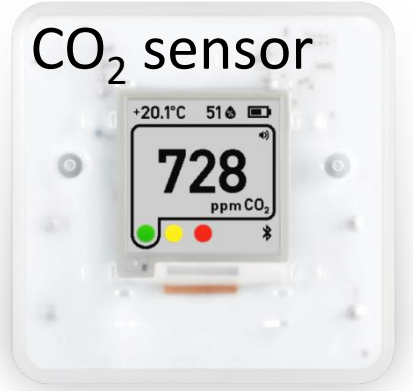
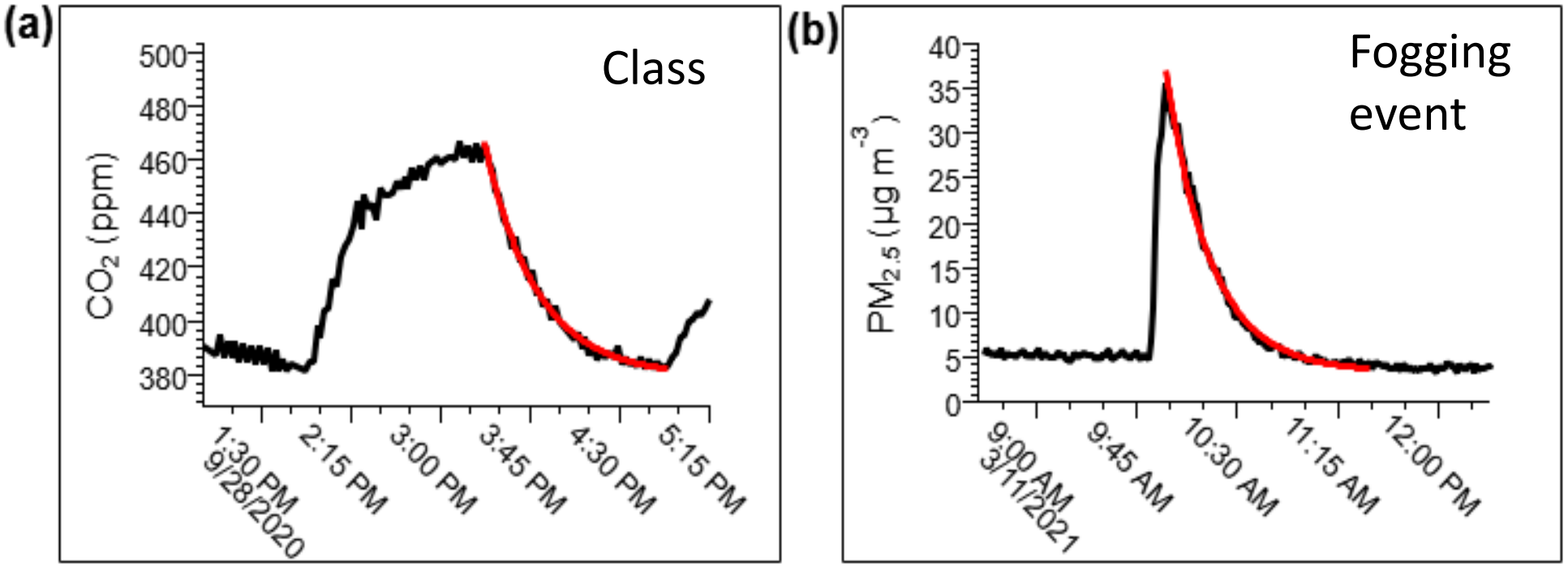
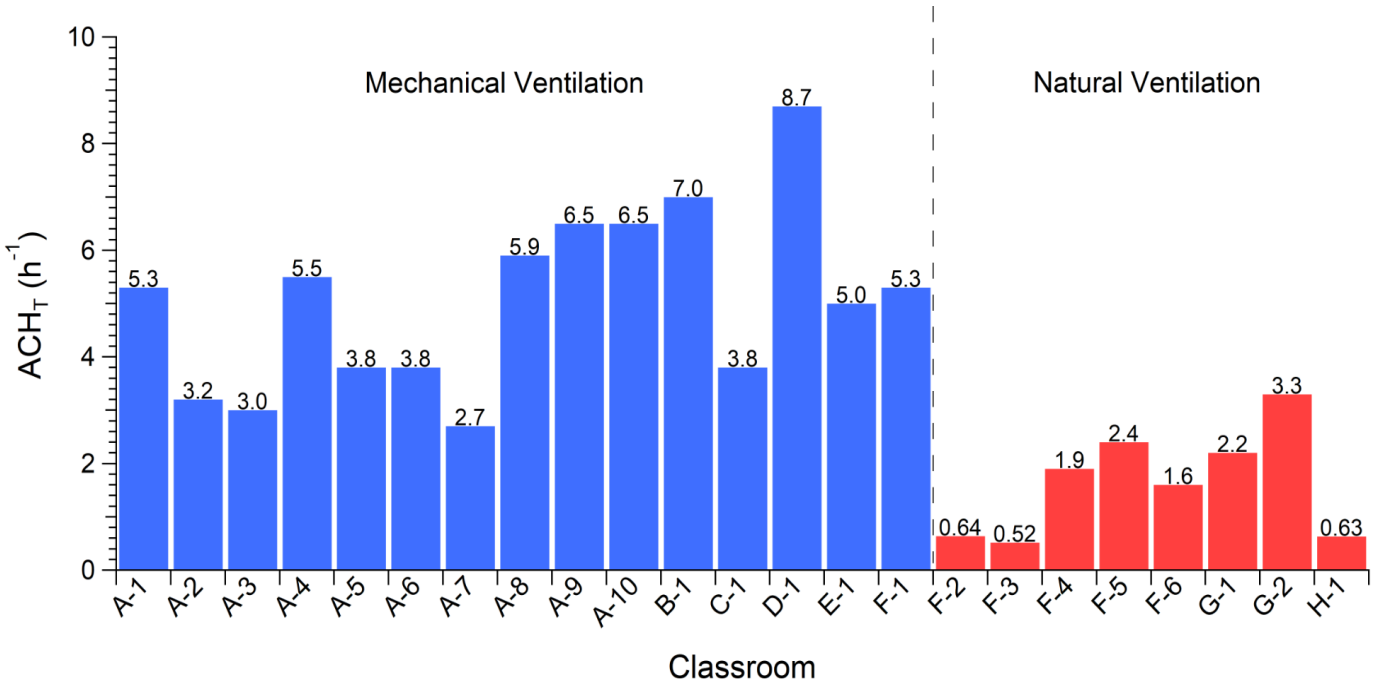


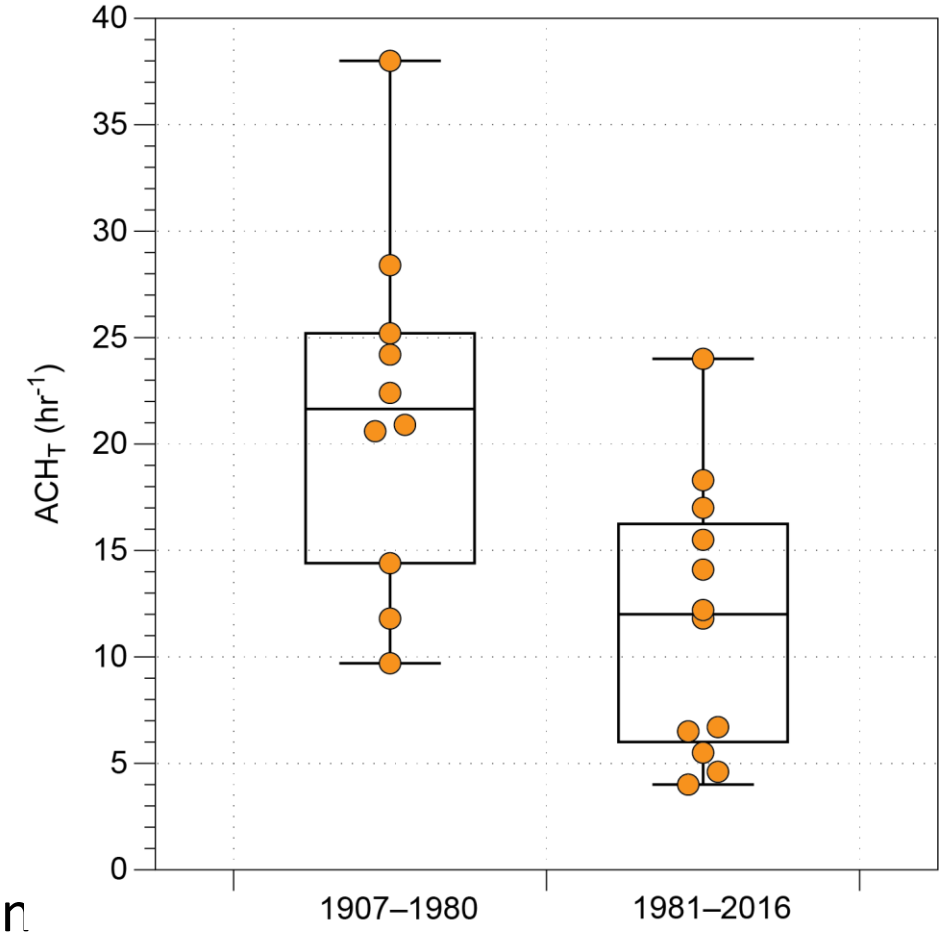
Use real-time data from low-cost sensors (CO_2, PM) to determine ACH



Regulations/policy and technology innovation are complimentary to each other



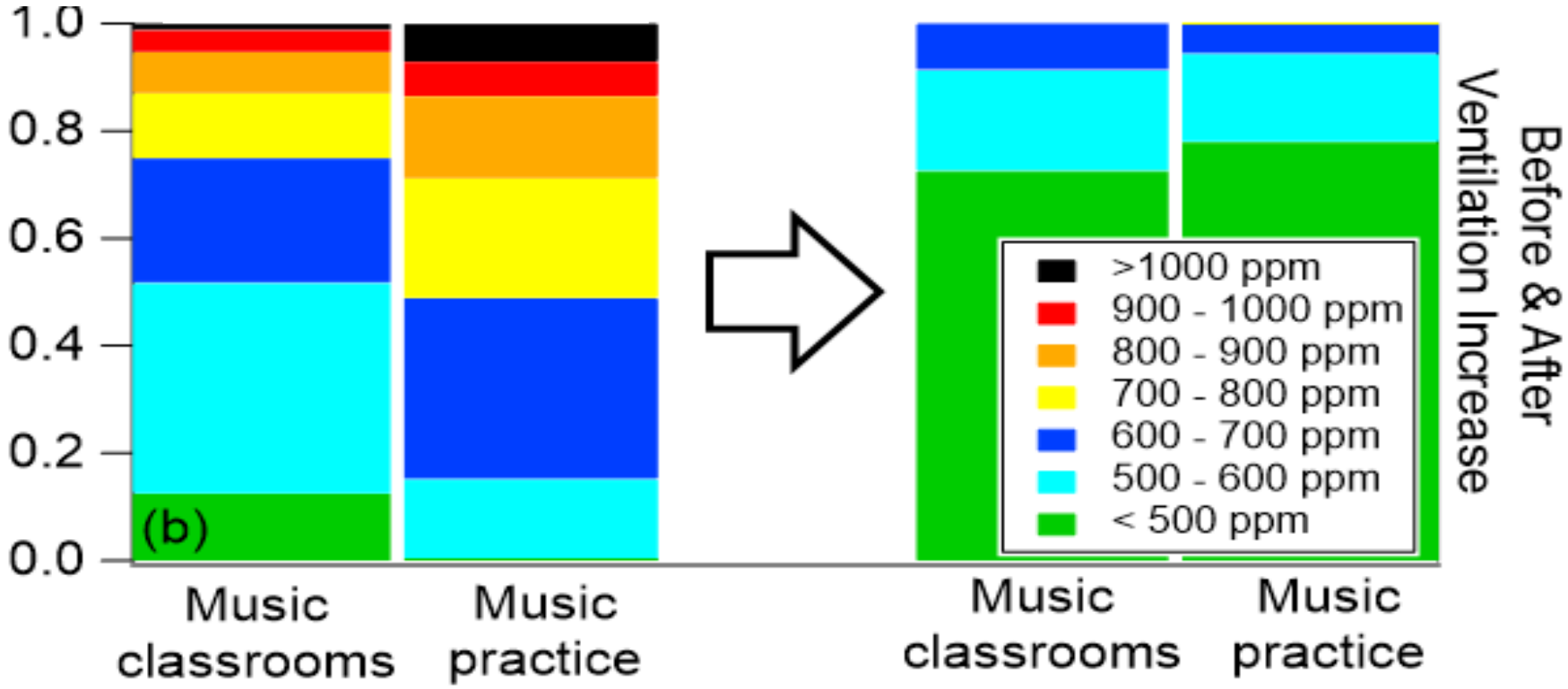
Older buildings in the Northeast USA: Natural ventilation needs to be supplemented with air filtration



Older buildings in Southern CA: excellent natural ventilation

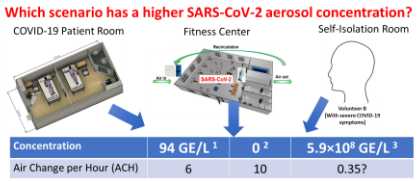
Regulations/policy and technology innovation are complimentary to each other

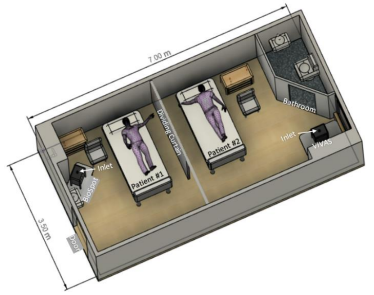
In situ CO_2 monitoring revealed need for change in HVAC schedule

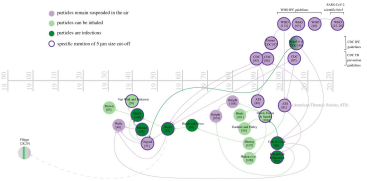


- Collecting and sharing ventilation data builds trust within the community and alleviates anxieties
- Participation in data collection, e.g., hosting a sensor, gives occupants of a space a sense of agency

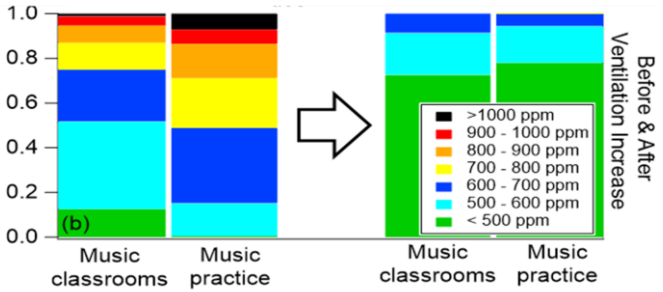
Summary

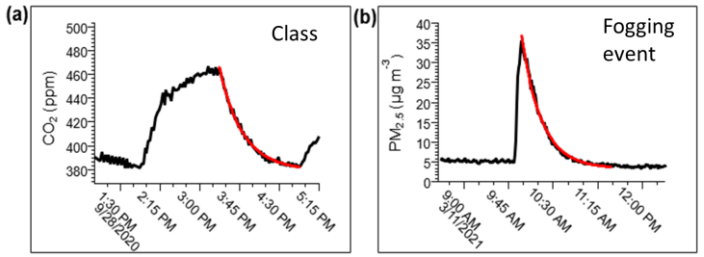


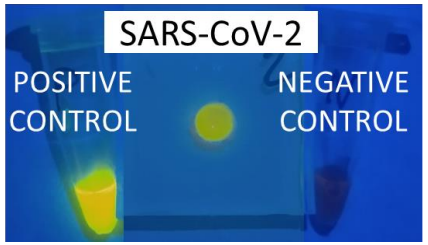




- A simple, clear and accurate message is important to public health
- Most people make a wise decision when relevant information is provided
- Do not assume everyone uses the same language and definition
- Regulations/policy and technology innovation are complimentary to each other
  - Decision makers lack some of the information they need to make decisions; engineering innovation helps provide solutions that support the decision-making process
  - Build trust within the community by engaging the community in collecting and sharing data







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