HAP-COVID Research Workshop

WORKSHOP KEY TAKEAWAYS

HAP-COVID Research—*a workshop on connections between chronic HAP exposure and COVID-19*

Date: August 18-19, 2020

Host: Clean Cooking Alliance (Alliance)

Day 1: August 18; 9:00am – 11:30am EDT

09:00 – 9:10 Opening remarks (Donee Alexander, Clean Cooking Alliance)

- Thank you to the steering committee, our moderators, and our speakers for making this event possible.
- Our goals are to (1) identify key researchable questions on chronic household air pollution (HAP) exposure and COVID-19 and (2) assess the feasibility of study designs that might answer those questions.

09:10 – 10:30 Session One: Current state of knowledge on COVID-19 and the linkages between air pollution and COVID-19

- COVID-19 transmission dynamics – direct and indirect impacts – and incidence forecasts (Cecile Viboud, NIH)
    - It is unclear which interventions have worked at different times and places to prevent the spread of COVID-19. Certain packages of interventions have shown significant effects on transmission, but identifying which intervention is the most effective is particularly challenging.
    - There is a gradient of susceptibility by age, with children being less susceptible. Gender differences have also been noted, with males having more severe cases than females. The period just before symptom onset is the most infectious period. How many contacts you have, the length of contact, and where contact occurs can influence transmission. The highest risk of transmission is seen in households, especially under lockdown measures. The transmission dynamics of COVID-19 can change quite rapidly, depending on interventions.
    - Many uncertainties remain for immune dynamics (e.g., immunity threshold, waning). Models are being developed for short- and long-term forecasts of COVID-19. Complex

dynamics among intervention, susceptibility, and climatic drivers need to be considered to develop long-term forecasts.

Air pollution and the course of SARS-CoV-2 infection (Jon Samet, Colorado School of Public Health)

- We may look to the literature on smoking and COVID-19 transmission/severity as a meaningful parallel to the HAP-COVID dynamic. The linkages between smoking and COVID-19 are inconclusive. Multiple studies have suggested an increased risk of severity but little effect on transmission.
- Acute respiratory distress syndrome (ARDS) is one of the causes of mortality from COVID-19. Previous studies—mainly in the United States—have shown that exposure to air pollution is linked to the occurrence and severity of ARDS. These studies suggest that underlying inflammation from air pollution could contribute to more severe outcomes.
-

- The methodological challenges of studying HAP and COVID-19 (Sara Adar, University of Michigan)

  - One of our greatest challenges in studying HAP and COVID-19 is understanding who has or had COVID-19. Incomplete testing and the variable quality of tests makes administrative data less reliable. A focus on hospitalization and mortality data may be a promising solution. However, this approach would only be effective in more developed contexts where hospital capacity exists. Also, time is our friend as subsequent reviews of COVID-19 attribution data in hospitals will improve this data over time.

  - Differential testing of individuals can produce biased results. Differences in test seeking behavior by exposure might introduce significant selection bias. There is a need for case identification that is complete, accurate, and consistent across exposure groups. When using administrative records, we must consider their accuracy. Mortality may be our most reliable measure. However, the cause of death can be incorrectly classified in these data.

  - Factors such as access to care, overcrowding, access to preventative measures, local policies, and cultural/social norms for prevention can bias our results. Studies need to control for these factors either through adjustment or via matching of exposed and unexposed populations.

  Group discussion

  - We should pay attention to differences among rural and urban populations. Population density is likely to be a confounding variable.
  - There is higher incidence of COVID-19 in urban areas. However, urban areas also have higher levels of ambient air pollution. It will be difficult to separate the effects of household and ambient air pollution.
  - Migration has taken place as a result of the pandemic. COVID-19 may have increased HAP exposure in households if there are more mouths to feed.
  - There also may be changes in fuel use patterns due to households not being able to obtain clean fuels (due to movement restrictions) or purchase clean fuels (due to decreased income).

- Serology may be one promising tool to obtain useful data about COVID incidence (but not severity).

10:30 – 11:20 Session Two: Determining key researchable questions under the current circumstances

- Group discussion
  - Participants discussed the following and other key researchable questions:
    - Does HAP exposure affect the course/phenotype of COVID-19 disease and, if so, by what mechanisms?
    - Does HAP exposure impact the long-term sequelae of COVID-19 (after recovery from acute disease)?
    - Is there evidence to suggest that HAP plays a role in: 1) infection risks or 2) disease outcomes? Relatedly, which of these questions is more relevant to public health concerns and/or feasible to answer given likely constraints?
    - What mechanisms might be involved in an interaction between HAP and infection rates?
    - Do HAP exposures affect COVID-19 dynamics differently than ambient air pollution (or smoking)?

11:20 – 11:30 Wrap up (Elisa Derby, Alliance)

Day 2: August 19; 9:00am – 11:30am EDT

09:00 – 09:10 Opening (Helen Petach, USAID)

09:10 – 09:45 Session Three: Immunological responses to COVID

- COVID-19: Immunological mechanisms leading to host defense and disease (Kymberly Gowdy, Ohio State University)
    - COVID-19 produces delayed interferon responses when compared to other respiratory viruses. The virus has a mechanism by which it delays production of antiviral cytokine responses in the lungs. It produces a different and more severe inflammatory profile compared to other pneumonias.
- Phenotypes, co-morbidities, and risk factors related to COVID-19 (Jared Radbel, Rutgers University)
    - Certain co-morbidities and risk factors are linked to more severe cases of COVID-19. Hypoxemia (the need for oxygen) is often the determining factor in whether an infected individual is hospitalized or told to go home and quarantine. Older individuals; males; certain ethnic groups; and individuals with hypertension, diabetes, COPD, or chronic kidney disease are more vulnerable to the virus.

09:45 – 10:30 Session Four: How to conduct research safely during COVID

- Logistical challenges with conducting in-field research during a pandemic (Will Checkley, John Hopkins University)
    - In Puno, Peru, a large increase in cases occurred in a short amount of time while testing remained scarce. Accessing accurate data has been a hurdle in Peru due to poor data management resulting from a fragmented healthcare system. The team has utilized technology to communicate and conduct work remotely, although challenges remain. Maintaining a long-term relationship with the community has been key to the continuation of our efforts.
    - The field staff needed to adjust to a new work modality. There was also significant price inflation and limited access to important resources, such as personal protective equipment (PPE). Strict regulations and restrictions on movement presented additional challenges (e.g., difficulty in obtaining official paperwork). Many factors remain outside the control of researchers (e.g., behavior outside the workplace, self-accountability, staff leaving their positions abruptly).
- Risk management and PPE protocols in HAPIN (Suzanne Simkovich, Medstar Health Research Institute/Georgetown University)
    - We created a scale that measures the risk associated with various research activities. We took steps to clarify what PPE is appropriate and necessary for a wide range of HAP community research-related activities. Critical variables include exposure time; intimacy; and whether or not the research activity might produce coughing, crying, or

other events that will aerosolize the virus. The results will be made available for researchers in the coming weeks. It is important to determine the burn rate and ongoing costs of PPE. Researchers must never take away PPE in communities if it is needed for clinical care.

10:30 – 11:15 Session Five: Assessing the feasibility of conducting a study during a pandemic in LMICs and optimal study design to answer key researchable questions

- Group discussion
    - Participants discussed the challenges of studying the HAP-COVID relationship. These include identifying cases where testing is limited, defining severity of cases, accessing accurate data, and isolating the effects of HAP exposure from other factors.
    - Despite these challenges, participants agreed this is an important issue to explore. Also, they noted that achieving buy-in from governments and partner organizations seems likely.
    - Feasible study designs discussed included randomized control trial (RCT), case-control, cohort, and retrospective. Participants agreed that a HAP-COVID study could leverage existing infrastructure, networks, and capacity through ongoing RCT and cohort studies since building from the ground up may not be feasible under the current circumstances.
    - Participants shared a list of many recent or ongoing studies that could provide this foundation. Participants also discussed the possibility of conducting case-control and retrospective studies.

11:15 – 11:30 Wrap up and discussion of outstanding/unresolved discussion topics and issues (Donee Alexander, Alliance)

Key Researchable Questions

Effect of chronic HAP exposure on COVID-19:

- How does chronic HAP exposure impact COVID-19, in terms of transmissivity, severity, mortality, and recovery?
- Does HAP exposure affect the course/phenotype of COVID-19 disease, and if so, by what mechanisms?
- Does HAP exposure impact the long-term sequelae of COVID-19 (after recovery from acute disease)?
- Is there evidence to suggest that HAP plays a role in 1) infection risks and/or 2) disease outcomes for COVID-19? Relatedly, which of these questions is more relevant to public health concerns and/or feasible to answer given likely constraints?
- Do HAP exposures affect COVID-19 dynamics differently than ambient air pollution (or smoking)?
- Does HAP lead to a higher degree of hypoxemia in an individual or a higher proportion of hypoxemia in the population?
- Considering air pollution increases clotting factors and many COVID-19 patients have large clots in their lungs, how does COVID-19 severity in the lungs interact with HAP exposure?
- What are the effects of HAP on lymphocytes, and is that a mechanism that affects COVID-19 severity?
- How does the fact that HAP increases systemic inflammation relate to the severity of COVID-19?
- Would chronic HAP exposure (potential decreased ability to mechanically clear a virus/increased state of inflammation that might be more hospitable conditions for a virus) be a realistic risk factor for SARS-CoV2 infection?
- Does having access to clean fuels at home improve resilience to outbreaks by minimizing the extent to which populations are exposed to air pollution by venturing out to collect fuel?
- Does chronic HAP exposure increase child susceptibility to COVID-19?

Impact of COVID-19 on HAP exposure:

- How has COVID-19 influenced migration (e.g., urban to rural areas) and daily activity patterns (e.g., increased time spent indoors)? What does this mean for exposure to polluting cooking methods and the associated human health burden?
- How have interventions intended to control the spread of COVID-19 impacted individual and household behaviors and choices with respect to household energy use (e.g., forced to return to polluting cooking methods, increased stove stacking), and what have been the subsequent results on HAP exposure due to these changes?
- How has COVID-19 impacted access to and the use of clean cooking, and what has been the subsequent impact on HAP exposure and related human health outcomes?