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SYNOPSIS

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Review of "Airborne Transmission of SARS-CoV-2: Proceedings of a Workshop in Brief"

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One-minute summary

- The report is a high-level summary of the presentations and discussions at a workshop[1] on airborne transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) held in August, 2020. This report summarizes views of individual experts and is not meant to represent consensus conclusions or recommendations.
- Speakers presented evidence on the significance of aerosols in the transmission of SARS-CoV-2.
- **Droplet and airborne transmission are not mutually exclusive.** Airborne transmission can be further classified as *obligate* (infection only occurs via aerosols), *preferential* (aerosols predominate), or *opportunistic* (non-airborne transmission is most common but aerosols may transmit under favourable conditions).
- There are a number of environmental and other variables (exposure time, protective measures, air characteristics, etc.) that can affect the relative importance of droplet versus airborne transmission.
- The workshop focused on four main questions:
    1. **What size aerosol particles and droplets are generated by people and how do they spread in air?**
       Aerosol scientists define particles <100 microns (μm) as aerosols, in contrast to the traditional definition of <5 μm used by infectious disease clinicians.
        - Aerosols <100 μm can be suspended in air over time and travel beyond 2 metres. These particles can build up in enclosed spaces and are inhalable at close and long range.
        - Particles >100 μm (droplets) settle quickly on surfaces and typically travel <2 metres. Exposure occurs via contact with eyes, nose, mouth at close range.
        - Most particles released by human breath are <10 μm.
    2. **Which size aerosol particles and droplets are infectious and for how long?**
       Infectious virus can be detected in aerosols (<100 μm) released by infected people.
        - The half-life of the virus is around 1.1 hours (based on laboratory-based experiments).
        - Ultraviolet (UV) light greatly decreases virus stability, and lower temperatures and humidity may increase stability.
        - Evidence for masks indicates a reduction in community transmission.

3. **What behavioral and environmental factors determine personal exposure to SARS-CoV-2?**
   Environmental and behavioural factors affect the relative importance of droplet versus airborne transmission, which are **not mutually exclusive.**
   - Indoor environments have been associated with outbreaks and superspreading events in settings with crowding or extended exposure indoors.
   - Ventilation, filtration, and germicidal UV-C light may be able to reduce indoor exposure risk.
   - The importance of layered interventions was discussed as was the racial and socioeconomic disparities in COVID-19, which may in part be connected to the built environment.
4. **What do we know about the relationship between infectious dose and disease for airborne SARS-CoV-2?**
   The infectious dose of SARS-CoV-2 is not known but human and animal studies from different coronaviruses have demonstrated a range of infectious doses that is dependent on external factors.
   - Aerosols released by animals infected with the virus can infect susceptible animals.
   - Animal studies suggest that higher inoculum doses lead to more severe infection.
   - Similar infectious doses can result in different disease severity based on host factors such as age, genetics, and obesity.
   - Further research is needed to define human infectious dose range and differences in infectivity by particle size.

- In the concluding remarks the speakers stressed the need for action to prevent transmission of the virus via the airborne route while pending further research to inform the infective dose range, relation between aerosol particle size and infectivity, and how environmental and host factors moderate disease severity. Panelists consistently pointed to a layered approach of prevention, including masking, hand hygiene, face shields where appropriate, physical distancing and maximizing ventilation.

Additional information

- The full workshop summary is available here[2] which contains references and links to additional information and presentations.

PHO reviewer's comments

- Clarifying differences in terminology is essential to contextualizing the discussion on aerosols and airborne transmission.
- Infection Prevention and Control (IPAC) within hospitals historically dichotomized droplet and airborne transmission routes as these were linked to effective control mechanisms. The use of the term airborne in this workshop does not reflect this dichotomy to institutional controls and there was no discussion at this forum related to IPAC within health care settings. Transmission of all viral respiratory infectious diseases likely exists on a spectrum. The relative importance of different transmission routes helps define which types of controls are necessary.
- SARS-CoV-2 is likely an *opportunistic* airborne pathogen (non-airborne transmission is most common but aerosols may transmit under favourable conditions). Epidemiological evidence supports close contact as the predominant transmission risk,[3] and current evidence does not

support long-range airborne transmission as the predominant mode by which SARS-CoV-2 spreads.

- The workshop repeatedly and appropriately emphasized the importance of layered interventions (i.e. masking, hand hygiene, physical distancing, and maximizing ventilation), acknowledging the heterogeneity in transmission routes which changes based on environmental and host factors.

References

1. National Academies of Sciences, Engineering, and Medicine. Airborne transmission of SARS-CoV-2: a virtual workshop [Internet]. Washington, DC: National Academies Press; 2020 [cited 2020 Oct 27]. Available from: https://www.nationalacademies.org/event/08-26-2020/airborne-transmission-of-sars-cov-2-a-virtual-workshop#sl-three-columns-c67bece1-4b4d-470f-8e0d-dbf76a481682

2. National Academies of Sciences, Engineering, and Medicine. Airborne transmission of SARS-CoV-2: proceedings of a workshop in brief [Internet]. Washington, DC: National Academies Press; 2020 [cited 2020 Oct 27]. Available from: https://doi.org/10.17226/25958

3. Ontario Agency for Health Protection and Promotion (Public Health Ontario). COVID-19 routes of transmission – what we know so far [Internet]. Toronto, ON: Queen's Printer for Ontario; 2020 [cited 2020 Oct 27]. Available from: https://www.publichealthontario.ca/-/media/documents/ncov/wwksf-routes-transmission-mar-06-2020.pdf?la=en

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