PREPARING FOR A SECOND WAVE; UNDERSTANDING TRANSMISSION AND HOW TO STOP COVID-19

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ErasmusMC, The Netherlands
(10)(2e)
Dalla Lana School of Public Health, Canada

Summary of key challenges and research needs

What we know (virus-host)

- SARS-CoV-2 replicates in the upper respiratory tract and spreads efficiently in animal models
- Shedding peaks at late incubation period
- Infection is asymptomatic or (apparently) mild in the majority of persons
- Infectious virus has been detected up to 3 weeks in nasal swabs, RNA (much) longer. Virus is shed in stool, culture rare
- SARS COV 2 is stable for prolonged periods of time in droplets, aerosols, and on surfaces

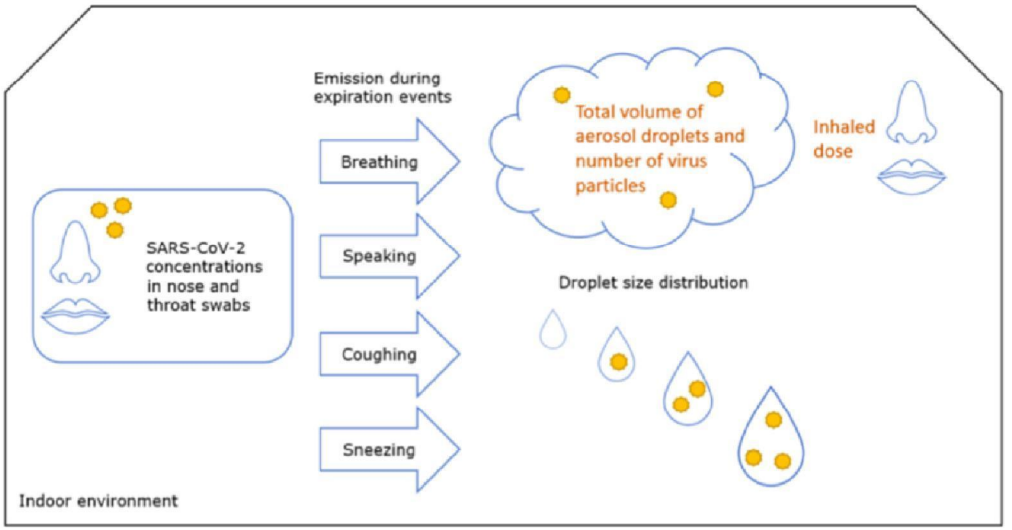
What we know (epidemiology, ecology)

- SARS COV 2 is spread through droplets
- Household transmission and superspreading events are important drivers of spread
- The role of children seems to differ from other respiratory infections (reasons not yet fully clear)
- Human to pet and farm animal transmission is possible (documented for cat, dog, mink)

Unresolved / partially resolved issues

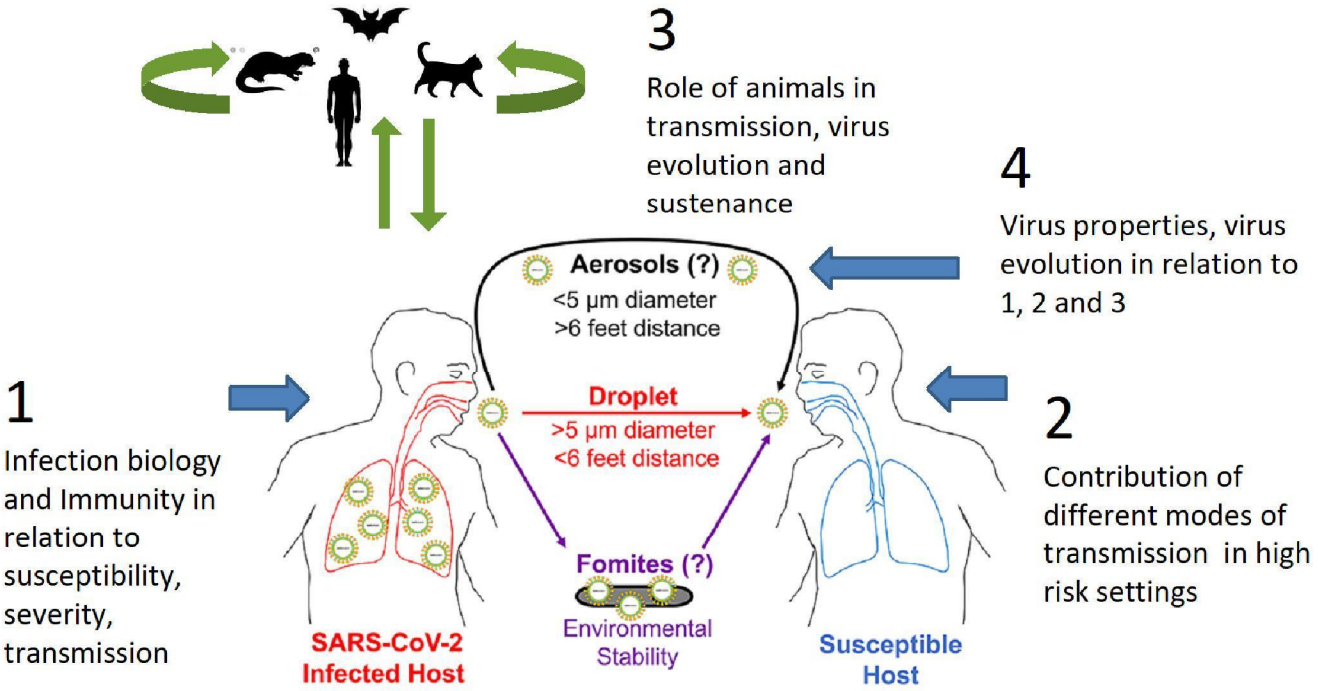
- What happened at the start of the pandemic?
- Is forward transmission of SARS COV 2 to animals a problem? Can SARS COV 2 be foodborne?
- What is the relative contribution of droplet, aerosol, contact transmission in different settings?
- What is the contribution of asymptomatic transmission?
- (how) can we recognize if viruses arise with important phenotypic changes? *(D614G spike, furin cleavage site mutations, RBV mutations)*

Exposure assessment for airborne transmission of SARS-CoV-2 via breathing, speaking, coughing and sneezing

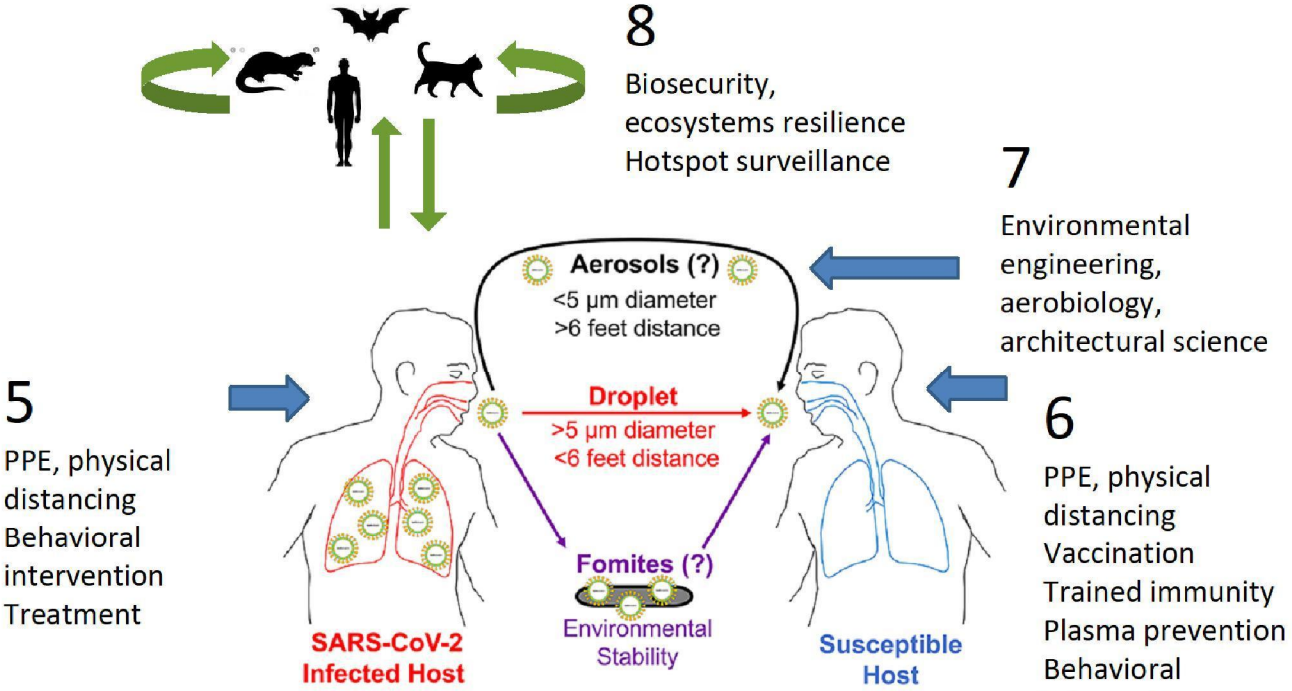


Schijven et al.
https://www.medrxiv.org/content/10.1101/2020.07.02.20144832v1.full.pdf

- Critical need: multidisciplinary outbreak research to address key knowledge gaps re transmission



- Critical need: multidisciplinary intervention studies



Review

A new twenty-first century science for effective epidemic response

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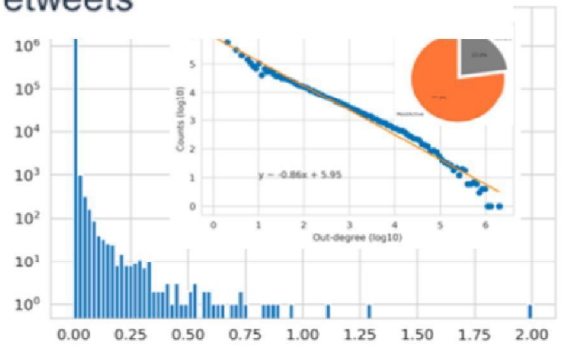
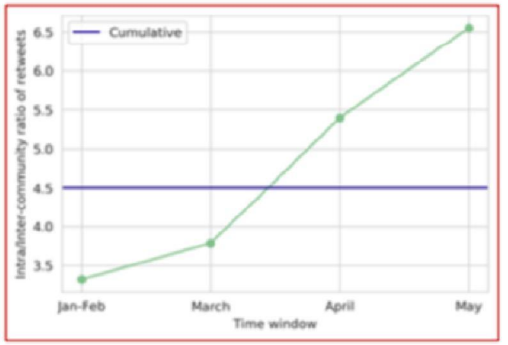
century epidemic responses

Area	Key areas and/or disciplines
Governance and infrastructure	Local, national and international organizations; integrate accountability and transparency across multiple stakeholders; improve data sharing, improve logistics and crisis management
Engagement and communication	Encourage a community-led response, community engagement and health diplomacy
Social sciences	Anthropology, political science, human geography, linguistics
Ethics	Consent, clinical trial designs
Emerging technologies	Pathogen genomics, metagenomics, systems serology and analytics, data science and artificial intelligence
Research and development	Diagnostics, therapeutics and vaccines
One Health	Ecology and environmental, veterinary and agricultural sciences

- Understanding public communication networks and communities, their evolution and impact

Tweets of COVID-related keywords (Jan-May 2020: 270M tweets)
Directed weighted network: user (node 22.5M) retweet (link 176M)
Hierarchy: 0.1% top users have >77% retweets





Remondini, Salathe et al, 2020

One size may not fit all!

Public health interventions attempting to slow transmission of COVID-19 will have to be “personalized” or “situationalized” to different countries and potentially even different areas within larger countries. The measures will require customization based on current pandemic developments as well as cultural differences.

Standing on eachothers shoulders: the critical need for data harmonization, governance and sharing

- Seemingly competing datasharing intiatives
- Need for data, terminology, technology standards across the board
- Particular need to arrange this for cross border studies

Standing on eachothers shoulders in the future: the critical need for continued investing in basic science

- Virology, biology, immunology
- Ecology, animal sciences
- Social science
- Health sciences, health system sciences
- Detection technology
- ……