COVID-19 Epidemiology
*Past and current trends, drivers of transmission and severity, and epidemiological research gaps*

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Key epidemiological questions

• Global surveillance and detection of variants including epidemiological early signals of transmissibility and severity

• Predicting viral evolution (and consequences of combinations of mutations/deletions) and trends in infection/severe disease

• Assessing the levels of population immunity and waning (vaccine and infection derived) against infection and severe disease

• Understanding the distribution, determinants, prevention and treatment of Post COVID-19 condition (long covid)
COVID-19 global situation
Forces acting on pathogen transmission

**Viral Evolution**
Evolution of SARS-CoV-2 variants with higher transmissibility and greater immune evasion

**Immunity**
Susceptible populations due to lack of access to vaccines, vaccine hesitancy and/or waning immunity following infection or vaccination

**Seasonality**
Seasonal variation in mixing and indoor crowding affecting social mixing

**Mitigation**
Use of Public Health and Social Measures in the context of increased social mixing
Viral evolution drives transmissibility and immune evasion

Data source: GISAID
Proportions have not been adjusted for country sequencing capacity
Population immunity

- Population immunity is high in many regions due to combined effect of vaccination and infection, though unprotected populations remain.

- Strength and duration of protection is lower against infection than against severe disease.

Source: Bergeri et al., 2021.

Dotted line indicates approximate emergence of Omicron.
Forces acting on disease severity

**Viral Evolution**
Emergence and circulation of VOCs with increased or decreased virulence and immune escape

**Immunity**
Vaccination coverage particularly in vulnerable populations. Widespread previous infection

**Age**
Including distribution of immunisation (vaccine/prior infection)

**Medical interventions**
Treatment availability: steroids, antivirals

**Comorbidity**
NCD, Obesity and Immunosuppression

**Human genetics**
Human Genetic Susceptibility: Neanderthal haplotype increases susceptibility to severe disease
Variants and immunity affect COVID-19 severity

Variants can have **higher or lower intrinsic severity**

**Omicron** has resulted in proportionally lower severity as a result of lower intrinsic severity and more preserved immunity against severe disease than infection.
Research gaps and priorities

• Understanding the implications of viral evolution on key epidemiological parameters, vaccine induced and natural immunity on transmission and disease severity (strengthen surveillance and sequencing, VOC/VOI studies)

• Evaluating Post COVID-19 condition (long covid) in different populations and the value of current and future vaccines

• Identifying novel, cheaper treatment that will prevent progression to severe disease

• Assessing the most effective and efficient combinations of public health measures to prevent transmission of SARS-CoV-2, its variants and future respiratory pathogens
Thank you