Covid-19: Preparing for the next pandemic wave

WHO - WIPO - WTO Joint Technical Symposium on
The COVID-19 Pandemic: Response, preparedness, resilience - 16 December 2022

Salim S. Abdool Karim, FRS
Director: CAPRISA
Professor of Global Health, Columbia University
Adjunct Professor of Immunology and Infectious Diseases, Harvard University
Adjunct Professor of Medicine: Cornell University
Pro Vice-Chancellor (Research): University of KwaZulu-Natal
Director: CAPRISA Global Virus Network Center of Excellence
Outline

• The virus, the disease and the pandemic

• Covid-19:
  …more than an acute respiratory infection

• 5 benefits of vaccines

• Beyond the Covid-19 pandemic emergency:
  …living smartly with the virus

• A key Covid-19 lesson
History of deadly plagues, epidemics and global pandemics

Source: Trinitonian.com
The global COVID-19 pandemic at a glance

Total reported cases: ~650 million
Daily reported cases now: ~600,000

Reported deaths: 6.6m
Estimated 20 million (14m – 24m) excess deaths worldwide during the pandemic

Still high in some countries eg. USA Covid-19 deaths: ~ 400 per day

Data Source: Our World in Data, Data up to 12 December 2022
The virus & the disease: SARS-CoV-2 & Covid-19

Spike protein

How does SARS-CoV-2 cause COVID-19?

SARS-CoV-2 infects ACE2-expressing nasal epithelial cells in the upper respiratory tract. Virus infects ACE2-expressing type II alveolar epithelial cells and patients exhibit pneumonitis. Severe disease involves disruption of the epithelial-endothelial barrier, complement deposition, and hyperinflammation.

The initial problem → Pandemic Emergency
Rapid spread of Covid-19 → pressure on hospitals

Many with severe disease
↑↑ % acute respiratory illness

Cumulative confirmed COVID-19 cases
Due to limited testing, the number of confirmed cases is lower than the true number of infections.

Data Source: Our World in Data
Pandemic emergencies in countries in 1\textsuperscript{st} waves

Covid-19 surges due to the initial (D614G) variant in India, Brazil & SA

Source: Our World in Data
Variants of concern changed the endgame

Repeat surges due to variants of concern in India, Brazil & SA

Due mainly to vaccines / natural / hybrid immunity → waves of acute clinical respiratory infection are now smaller
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People with Covid-19 might experience no symptoms, or just one or a few of these, or several in severe cases.

**Eyes**
- Inflamed outer eyeball membrane (pink eye)

**Brain**
- Swelling, headaches, confusion, stroke

**Nose**
- Loss of smell and taste (anosmia), sneezing, runny nose

**Throat**
- Sore throat

**Hands**
- Tingling or numbness, swelling and pain

**Lungs**
- Cough, shortness of breath, chest pain, inflamed air sacs, blood clots

**Kidneys**
- Damaged filters severe enough to require dialysis

**Feet**
- Tingling or numbness, swelling and pain

**Blood**
- Deterioration of blood vessel walls, clots

**Body Overall**
- Fever, chills, muscle pain, fatigue, skin rashes on the chest, back, arms or legs

**Heart**
- Weakened muscle, arrhythmias, heart attacks

**Gut**
- Loss of appetite, abdominal pain, nausea, vomiting, diarrhea

**Liver**
- Damage (not known if permanent)

**Toe**
- Red or purple rash or lesions, dubbed Covid toe

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**Sources:** Stanford University; Johns Hopkins University; Baylor College of Medicine Medical Center; Cleveland Clinic; Harvard University; Science Magazine; CDC; Mahdi Darsow, MD; Yale University; Robert Sabeta, MD; Case Western Reserve University

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**nature**

Every Covid-19 Symptom We Know About Right Now, From Head to Toe

The most perplexing things about a disease that has proved vexing, deadly, and ‘unprecedented in many ways’
Long COVID-19 “brain fog” – The next wave

- Study of a cohort of 3762 people in 56 countries
- Time to recovery in >90% exceeded 8 months
- Most frequent symptoms after 6 months:
  - Fatigue
  - post-exertional malaise
  - cognitive dysfunction & memory problems

Source: Lancet eClinicalMedicine, 38, 101019, 2021
Long-term impact of Covid-19 on heart disease

- >50% ↑ risk of heart disease - from stroke to heart attacks & myocarditis 1 year later
- ↑ risk in asymptomatic, mild & severe Covid-19
- ↑ risk regardless of cardiac risk factors… (age, weight, etc)

153,760 Covid-19+ compared to 5 million current & historical controls
High new diabetes risk months after Covid-19

- 181,280 Covid+ participants
- Post-acute Covid-19: ↑ risk of new diabetes diagnoses & anti-hyperglycaemics
- Increased diabetes risk worst in those with severe acute Covid-19
Covid-19 increases risk of mental health disorders

Risks of mental health outcomes in people with covid-19: cohort study
Yan Xie, Evan Xu, Ziyad Al-Aly

Increased risk of:
- anxiety disorders (35% higher)
- depressive disorders (39% higher)
- neurocognitive decline (↑80%)
- sleep disorders (41% higher)

Mental health diagnoses increased by 60%
Even Mild COVID-19 May Change the Brain

Jennifer Abbasi

SARS-CoV-2 is associated with changes in brain structure in UK Biobank

Gwenaelle Douaud, Soojin Lee, Fidel Alfaro-Almagro, Christoph Arthofer, Chaoyue Wang, Paul McCarthy, Frederik Lange, Jesper L. Andersen, Ludovica Griffanti, Eugene Duff, Saad Ihsall, Barnd

• 401+ and 384- UK brain scans from Biobank – 2 images in 5 mths

• Effects of SARS-CoV-2 infection:
  • Smaller brain size
  • ↓ in grey matter thickness – up to 2% loss
  • Less able to complete complex tasks
Since 2019, many people dropped out of Britain’s job market (mental health problems & long-term sickness)

- Problem getting worse over time

2019 → 2020 (~363,000) → 2022 (~2.5 million)
Covid-19’s looming future wave

A Tsunami of chronic diseases

…while 600,000 reported clinical Covid-19 infections and unreported millions of asymptomatic infections are continuing to occur each day…

…and the possibility of yet more waves remains
Each additional infection makes Long Covid worse: SARS-CoV-2 re-infection is not harmless!

Figure: Cumulative risk & burden of sequelae in people with 1, 2 and 3 or more SARS-CoV-2 infections compared to non-infected controls.
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The 5 benefits of Covid-19 vaccines

• **Individual benefits:**
  1. ↓ asymptomatic infections
  2. ↓ clinically apparent infections
  3. ↓ severity / hospitalisations / deaths
  4. ↓ progression to long Covid

• **Community benefits:**
  5. ↓ secondary attack rate to close contacts
     • ↓ infectious if infected when vaccinated
     • ↓ period of infectiousness when vaccinated

<table>
<thead>
<tr>
<th>Level of benefit varies by:</th>
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<tbody>
<tr>
<td><strong>Type of vaccine</strong></td>
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<td><strong>Time since vaccine:</strong></td>
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<td><em>waning immunity</em></td>
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<td><strong>Variant:</strong></td>
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<td><em>immune escape</em></td>
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<td><strong>Old age &amp; Immunosuppression</strong></td>
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Vaccination reduces SARS-CoV-2 transmission

**Direct Protection Effect**
Protection of parents from having been vaccinated

- 94%

**Indirect Protection of Household members**
Reduction in Risk of transmission from infected parent to unvaccinated child

- 72%

- Two-parent homes with at least one vaccine-ineligible child
- Children with vaccinated parents - 72% lower risk of getting infected
Vaccination reduced SARS-CoV-2 transmission to household & workplace contacts (in two variants)

- 146,243 contacts of 108,498 index patients tested (37% were PCR+)
- Pfizer (X2) reduced infection by 68% in contacts compared to infections in contacts of unvaccinated
- Vaccine → ↓ viral load - ↓ infectiousness
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We are still living in the midst of the pandemic…

Data Source: Our World in Data
But, the pandemic emergency is receding as death and severe disease decline

Data Source: Our World in Data
The virus will likely be with us for a very long time as it infects many animals as well.

SARS-CoV-2 evolving to spread faster & more immune escape

New variants are more transmissible than original strain

Alpha = 1.7 times faster
Beta = 1.6 times faster
Delta = 2.5 times faster
Omicron = 5.8 times faster
BA.2 = 8.9 times faster
Scientists Find a New Coronavirus in Bats That Is Resistant to Current Vaccines

- Khosta-2 found in bats in Russia in 2020
  - Can infect human cells and evades immunity from current Covid-19 vaccines
  - Attaches to ACE2 receptor
  - Thought not to cause serious disease
- Potential to recombine \( \rightarrow \) ↑ resistance to immunity and virulence
5 elements of “Living smartly with the virus”

1. Be fully vaccinated

2. Know level of community transmission – e.g. are cases rising?
   - adjust your risk appetite accordingly

3. Know the potential risky situations you may be entering
   - know what you can do to mitigate that risk

4. In essence, avoid poorly ventilated indoor spaces and if you have to go indoors, use a medical mask

5. Do what you can to protect others (not just yourself)!
The 3 Eras of the Covid-19 response: Adding “Test & Treat to [Vaccines + Public health measures]”

- **Era 1 - 2020**: Public health measures
- **Era 2 - 2021**: Vaccines & Variants
- **Era 3 - 2022**: Test & Treat
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A key Covid-19 lesson: Failure to act with common purpose

1. **Global threat → Global pandemic response**
   Cannot control a pandemic if countries pulling in different directions – there is no scenario where successful pandemic control is achieved by only some countries being able to control spread of the virus.

2. **Health threat → Health, Social & Political threat**
   Covid-19 exacerbated disparities, sowed divisions and undermined truth and science → undermined the response & social cohesion.

3. **Inequitable access to life-saving technology → ↑disability & deaths**
   Failed to make the tools to combat the pandemic equitably available – diagnostics, vaccines & treatments – where IP protections enabled corporates to determine who does & does not get vaccines ---- and now treatment too!
But, there are several positives & glimmers of hope from the global Covid-19 response, for example…

- **Covax**: a far-sighted initiative for vaccine equity  
  *It has delivered over 1.8 billion Covid-19 vaccine doses*

- **WHO mRNA Technology Transfer Hub**: for poor countries to make vaccines  
  *It has produced its first mRNA vaccine candidate*

- **African Union’s 2020 Partnership Accelerate Covid-19 Testing (PACT)**  
  *Pooled procurement of diagnostic kits when African countries could not get kits*  
  *Secured donations of millions of kits from Jack Ma Foundation, Mastercard & Germany*

- **NGOs & good Samaritans**: Thousands came forward to help those in need  
  *Provided food and support to those impacted financially by the lockdown in countries across the globe*
A key lesson from HIV for Covid-19: Importance of mutual interdependence & shared responsibility

“The AIDS movement demonstrates that with a shared vision, shared responsibility and through global solidarity… …we can change the course of history.” – UNAIDS 2015

- **Shared responsibility:** An IP solution was found to share the benefits of ARVs - Markets were segmented and voluntary licences offered to generic manufacturers
  - *Truvada ~$33 /pill in USA but ~33 cents in South Africa*

- **Global solidarity:** The wealthy provided the poor access to life-saving medication eg. Global Fund & PEPFAR

- **No-one is safe until everyone is safe!**