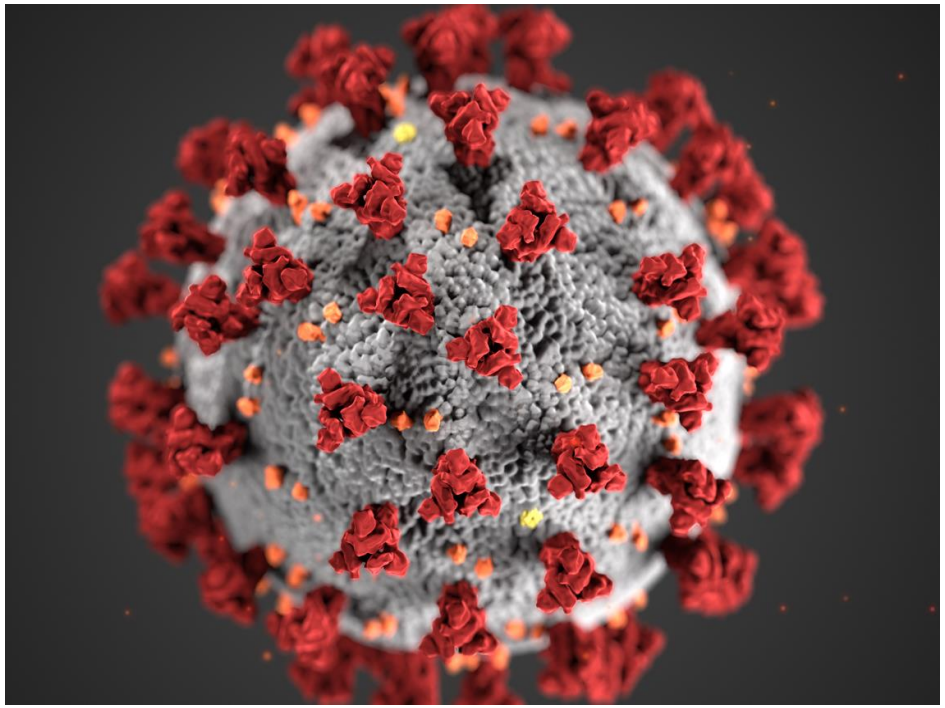
COVID-19 VACCINES AND CURRENT EVIDENCE RELATED TO THEIR SAFETY AND EFFECTIVENESS IN PEOPLE LIVING WITH HIV



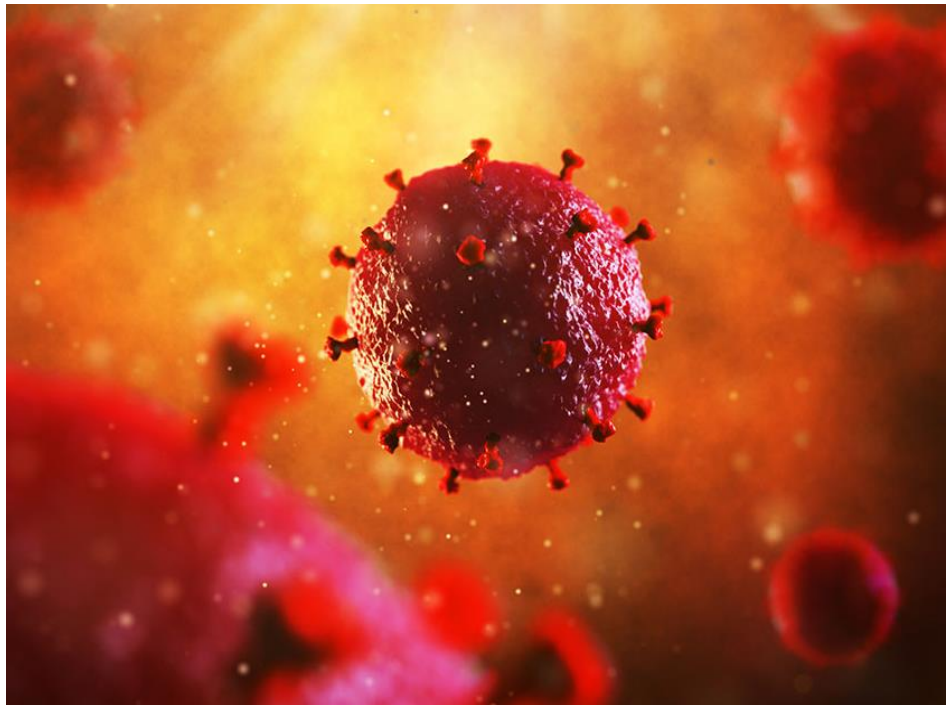


Image credits: CDC

David Gogolishvili, MPH
Senior Lead, Knowledge Synthesis and Rapid Response Service
April 28, 2021

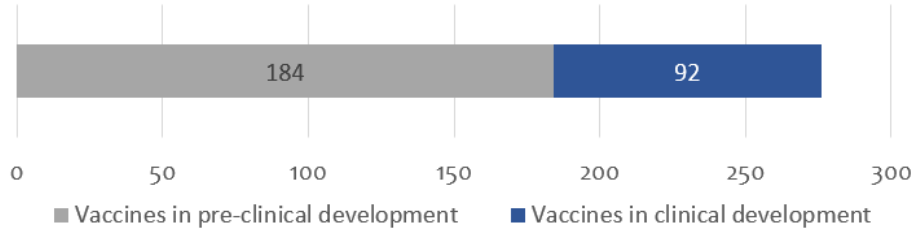
COVID-19 VACCINES

COVID-19 VACCINES - April 27, 2021:
NUMBERS, PLATFORMS, DOSAGE, ROUTES OF ADMINISTRATION

Source: [WHO Draft landscape and tracker of COVID-19 candidate vaccines]

Summary Information on Vaccine Products in Clinical Development

1. - Number of vaccines in clinical development	92
2. - Number of vaccines in pre-clinical development	184



Platform		Candidate vaccines (no. and %)	
PS	Protein subunit	29	32%
VVnr	Viral Vector (non-replicating)	14	15%
DNA	DNA	10	11%
IV	Inactivated Virus	12	13%
RNA	RNA	13	14%
VVr	Viral Vector (replicating)	4	4%
VLP	Virus Like Particle	5	5%
VVr + APC	VVr + Antigen Presenting Cell	2	2%
LAV	Live Attenuated Virus	2	2%
VVnr + APC	VVnr + Antigen Presenting Cell	1	1%
		92	

Number of doses & schedule	Candidate vaccines (no. and %)	
1 dose	**11**	**12%**
Day 0	11	
2 doses	**60**	**65%**
Day 0 + 14	6	
Day 0 + 21	23	
Day 0 + 28	31	
3 doses	**1**	**1%**
Day 0 + 28 + 56	1	
TBD / No Data (ND)	**20**	**22%**

Route of administration

Oral		**2**	**2%**
Injectable		**77**	**84%**
SC	Sub cutaneous	3	3%
ID	Intra dermal	3	3%
IM	Intra muscular	71	77%
IN	Intra nasal	7	8%
TBD / No Data (ND)		**13**	**14%**

13 ATHORIZED/APPROVED COVID-19 VACCINES - April 23, 2021

Source: RAPS - Regulatory Affairs Professionals Society's COVID-19 vaccine tracker

Name	Vaccine Type	Primary Developers	Origin	Authorization/Approval
Comirnaty (BNT162b2)	mRNA-based vaccine	Pfizer, BioNTech; Fosun Pharma	Multi-national	Albania, Andorra, Argentina, Aruba, Australia, Bahrain, Bosnia and Herzegovina, Brazil, Brunei, Canada, Caribbean, Chile, Colombia, Costa Rica, Ecuador, European Union, Faroe Islands, Greenland, Hong Kong, Iceland, India, Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Liechtenstein, Macao, Malaysia, Maldives, Mexico, Monaco, Mongolia, New Zealand, North Macedonia, Norway, Oman, Panama, Peru, Philippines, Qatar, Rwanda, Saint Vincent and the Grenadines, Saudi Arabia, Serbia, Singapore, South Africa, South Korea, Suriname, Switzerland, Tunisia, Turkey, Ukraine, UAE, UK, US, Vatican City, WHO
Moderna COVID-19 Vaccine (mRNA-1273)	mRNA-based vaccine	Moderna, BARDA, NIAID	US	Andorra, Canada, European Union, Faroe Islands, Greenland, Iceland, India, Israel, Liechtenstein, Mongolia, Norway, Qatar, Saint Vincent and the Grenadines, Singapore, Switzerland, UK, US, Vietnam
COVID-19 Vaccine AstraZeneca (AZD1222)	Adenovirus vaccine	Oxford University, AstraZeneca	UK	Afghanistan, Albania, Algeria, Andorra, Angola, Argentina, Australia, Bahamas, Bahrain, Bangladesh, Barbados, Bhutan, Botswana, Brazil, Brunei, Cabo Verde, Canada, Chile, Colombia, Congo, Costa Rica, Dominican Republic, Ecuador, Egypt, El Salvador, Eswatani, Ethiopia, European Union, Faroe Islands, Gambia, Georgia, Ghana, Greenland, Guatemala, Guyana, Hungary, Iceland, India, Indonesia, Iran, Iraq, Ivory Coast, Kenya, Kosovo, Kuwait, Lesotho, Lebanon, Liberia, Libya, Malawi, Malaysia, Maldives, Mali, Mauritius, Mexico, Moldova, Mongolia, Morocco, Myanmar, Namibia, Nepal, Nigeria, Norway, Pakistan, Papua New Guinea, Philippines, Rwanda, Saint Vincent and the Grenadines, Serbia, Seychelles, Sierra Leone, Somalia, South Korea, South Sudan, Sri Lanka, Sudan, Suriname, Taiwan, Tajikistan, Thailand, Timor Leste, Tonga, Togo, Uganda, Ukraine, UK, Vietnam, WHO
COVID-19 Vaccine Janssen (JNJ-78436735; Ad26.COV2.S)	Non-replicating viral vector	Janssen (Johnson & Johnson)	Belgium /US	Andorra, Bahrain, Brazil, Canada, Colombia, European Union, Faroe Islands, Greenland, Iceland, India, Liechtenstein, Norway, Philippines, Saint Vincent and the Grenadines, South Korea, Switzerland, Thailand, Tunisia, US, WHO
Sputnik V	Non-replicating viral vector	Gamaleya Research Institute	Russia	Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Azerbaijan, Bahrain, Belarus, Bolivia, Congo, Djibouti, Egypt, Gabon, Ghana, Guatemala, Guinea, Guyana, Honduras, Hungary, India, Iran, Iraq, Jordan, Kazakhstan, Kenya, Kyrgyzstan, Laos, Lebanon, Mali, Mexico, Moldova, Mongolia, Montenegro, Morocco, Myanmar, Namibia, Nicaragua, North Macedonia, Pakistan, Palestine, Panama, Paraguay, Republika Srpska, Russia, Saint Vincent and the Grenadines, San Marino, Serbia, Slovakia, Sri Lanka, Syria, Tunisia, Turkmenistan, United Arab Emirates, Uzbekistan, Venezuela, Zimbabwe
CoronaVac	Inactivated vaccine (formalin with alum adjuvant)	Sinovac	Russia	Albania, Azerbaijan, Bolivia, Bosnia and Herzegovina, Brazil, Cambodia, China, Chile, Colombia, Dominican Republic, Ecuador, Hong Kong, Indonesia, Laos, Malaysia, Mexico, Pakistan, Panama, Paraguay, Philippines, Thailand, Tunisia, Turkey, Ukraine, Uruguay, Zimbabwe

13 ATHORIZED/APPROVED COVID-19 VACCINES - April 23, 2021

Source: RAPS - Regulatory Affairs Professionals Society's COVID-19 vaccine tracker

Name	Vaccine Type	Primary Developers	Origin	Authorization/Approval
BBIBP-CorV	Inactivated vaccine	Beijing Institute of Biological Products; China National Pharmaceutical Group (Sinopharm)	China	Afghanistan, Algeria, Angola, Argentina, Bahrain, Belarus, Bolivia, Brunei, Cambodia, China, Egypt, Ethiopia, Equatorial Guinea, Gabon, Guyana, Hungary, Iraq, Jordan, Kyrgyzstan, Laos, Macau, Maldives, Mauritania, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nepal, Niger, Pakistan, Peru, Senegal, Serbia, Seychelles, Sierra Leone, Somalia, Sri Lanka, Sudan, UAE, Venezuela, Zimbabwe
EpiVacCorona	Peptide vaccine	Federal Budgetary Research Institution State Research Center of Virology and Biotechnology	Russia	Belarus, Russia, Turkmenistan
Convidicea (Ad5-nCoV)	Recombinant vaccine (adenovirus type 5 vector)	CanSino Biologics	China	Chile, China, Hungary, Mexico, Pakistan
Covaxin (BBV152)	Inactivated vaccine	Bharat Biotech, ICMR	India	Guyana, India, Iran, Mauritius, Mexico, Myanmar, Nepal, Paraguay, Philippines, Zimbabwe
WIBP-CorV	Inactivated vaccine	Wuhan Institute of Biological Products; China National Pharmaceutical Group (Sinopharm)	China	China
CoviVac	Inactivated vaccine	Chumakov Federal Scientific Center for Research and Development of Immune and Biological Products	Russia	Russia
ZF2001	Recombinant vaccine	Anhui Zhifei Longcom Biopharmaceutical, Institute of Microbiology of the Chinese Academy of Sciences	China	China, Uzbekistan

COVID-19 VACCINES IN DEVELOPMENT (PHASE 3 TRIALS) - April 23, 2021

Source: RAPS - Regulatory Affairs Professionals Society's COVID-19 vaccine tracker

Candidate	Mechanism	Sponsor	Trial Phase	Institution
NVX-CoV2373	Nanoparticle vaccine	Novavax (US)	Phase 3	Novavax
CVnCoV	mRNA-based vaccine	CureVac (Germany), GSK	Phase 2b/3	CureVac

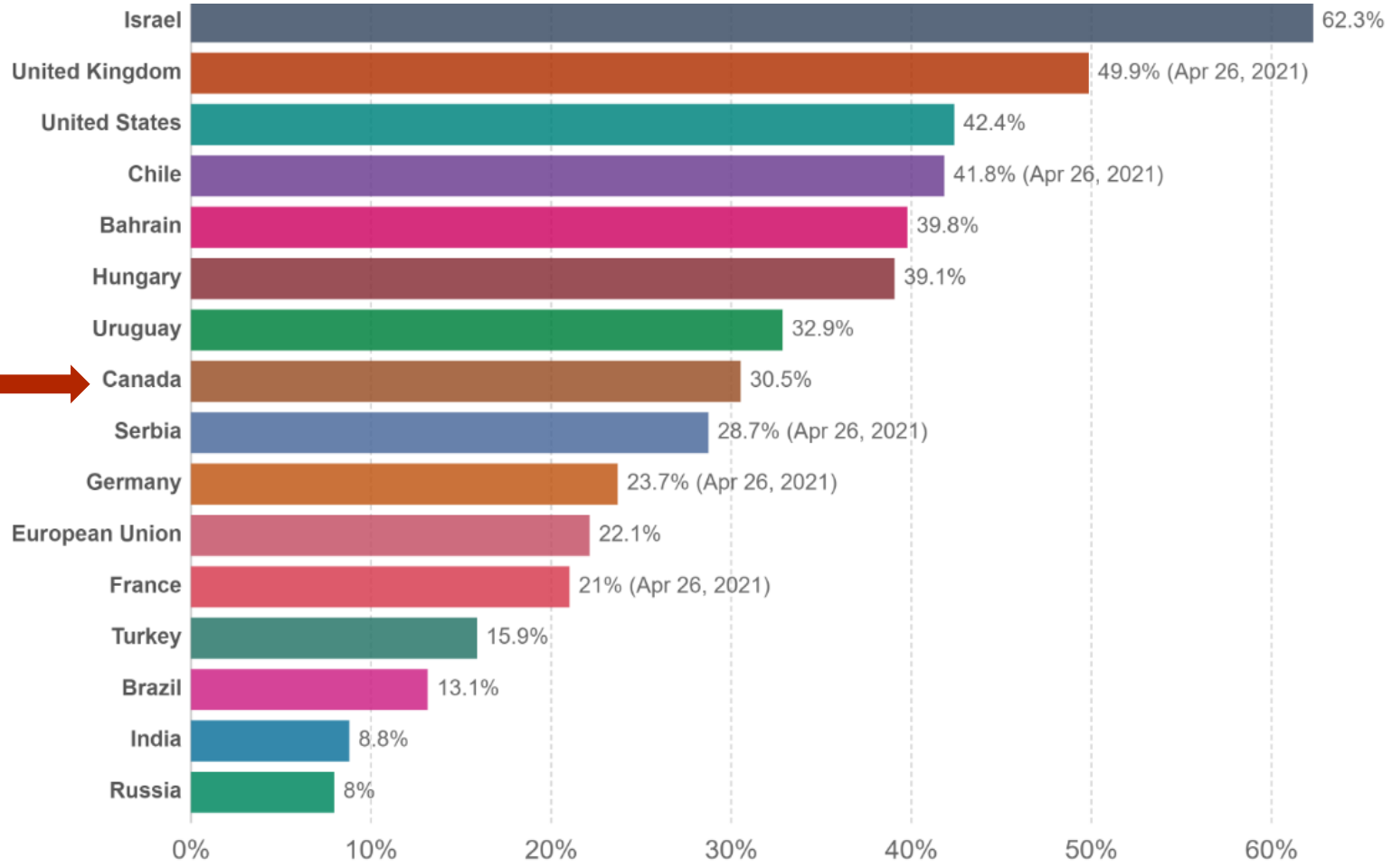
Novavax: Currently being evaluated in 2 pivotal Phase 3 trials:
Trial in the UK and the PREVENT-19 trial in the U.S. and Mexico
Also being tested in 2 ongoing Phase 2 studies: Phase 2b trial in South Africa, and Phase 1/2 continuation in the U.S. and Australia

- 89% efficacy in UK trials (January 29, 2021)
- Applications to the European Medicines Agency (EMA), US FDA, UK Medicines and Healthcare products Regulatory Agency (MHRA) and Health Canada

CureVac: Phase 2b/3 study (HERALD), initiated on December 14, 2020, has successfully completed recruitment, with currently about 40,000 participants in Latin America and in Europe.
In February 2021: a rolling submission started with the European Medicines Agency (EMA) and Swissmedic (Switzerland). Subject to the clinical trial results, expects the potential authorization for use in the EU in the 2nd quarter of 2021.

SHARE OF PEOPLE WHO RECEIVED AT LEAST ONE DOSE OF THE COVID-19 VACCINE, APRIL 27, 2021

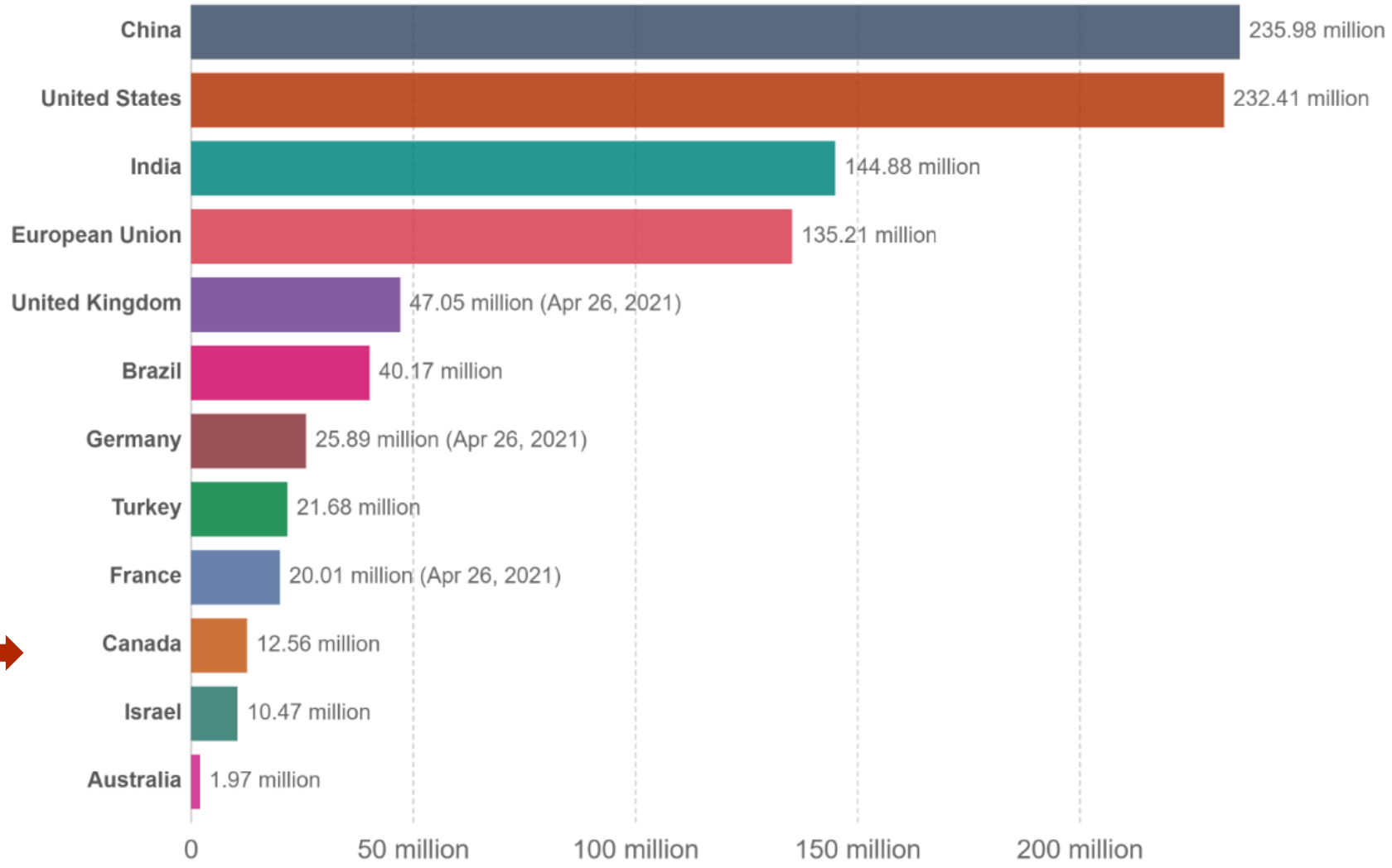
Source: Our World In Data



This may not equal the share that are fully vaccinated if the vaccine requires two doses.

COVID-19 VACCINE DOSES ADMINISTERED, APRIL 27, 2021

Source: [Our World In Data]

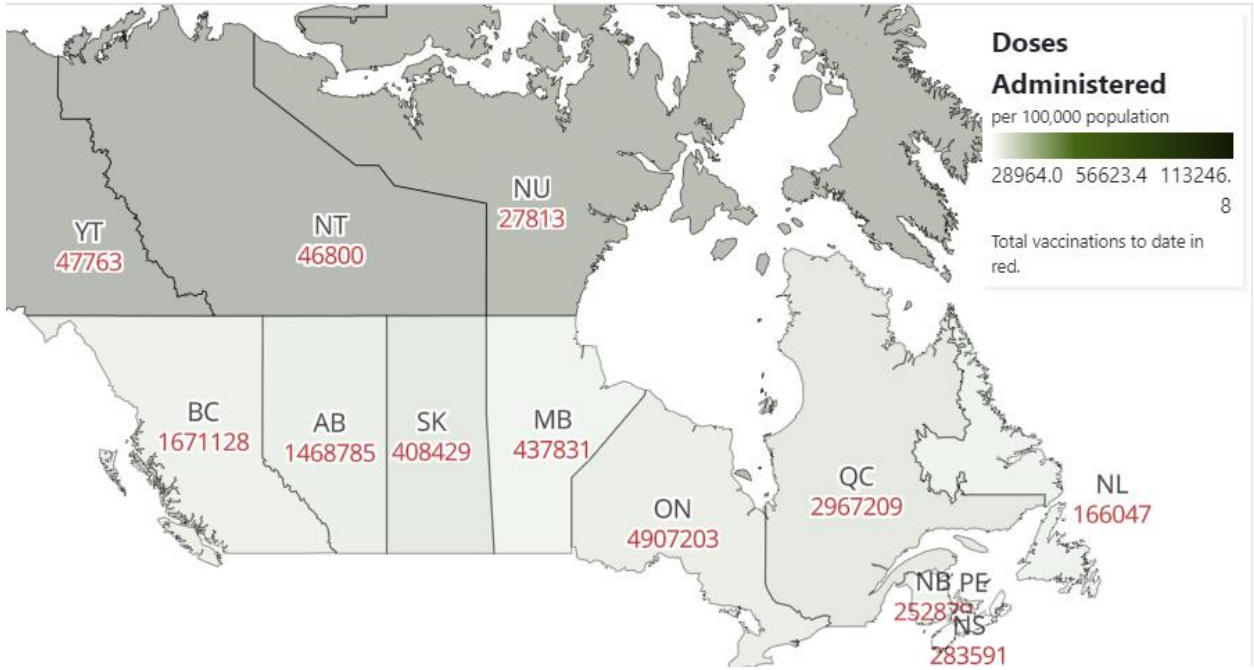


World total: 1.06 billion

This is counted as a single dose, and may not equal the total number of people vaccinated, depending on the specific dose regime (e.g. people receive multiple doses).

COVID-19 VACCINATION IN CANADA, APRIL 28, 2021, 9AM

Source: [COVID-19 Vaccination Tracker]



- **12,735,374 doses administered**
- **14,409,714 doses delivered** (88.4% of doses delivered have been administered)
- **1,056,707** Canadians fully vaccinated

Ontario:
4,907,203 doses administered
33,307 doses per 100,000

HOW SOME OF THE COVID-19 VACCINES COMPARE

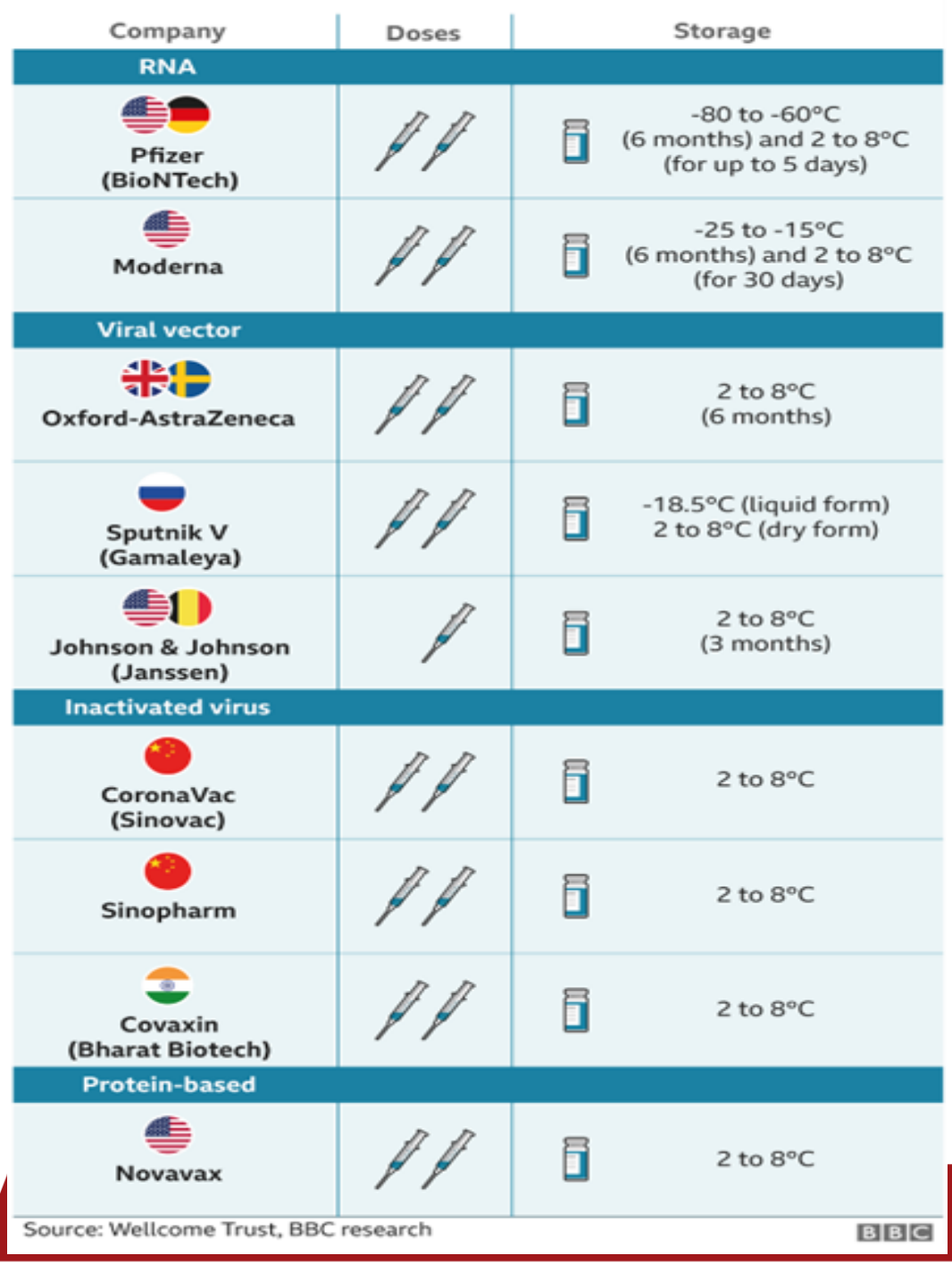
Source: Wellcome. January 7,2021.

Technology / company	Suitable for people with weak immune systems	Number of doses	Storage	Other vaccines using this technology
RNA Pfizer-BioNTech Moderna	✓	2	**Pfizer-BioNTech:** -70C and 2-8C for up to 5 days **Moderna:** -20C for 6 months and 2-8C for 30 days	**No other licensed vaccines**
Viral vector Oxford-AstraZeneca CanSino Biologics Gamaleya Research Institute Janssen	✓ (Depending on viral vector used)	1 to 2	2-8C	**Ebola**
'Whole' virus Sinovac (inactivated) Bharat Biotech (inactivated) Sinopharm (inactivated) Medicago Inc. (virus-like particle)	✓	2	2-8C	**Whooping cough (inactivated)** **Rabies (inactivated)** **Hepatitis A (inactivated)** **HPV/cervical cancer (virus-like particle)**
Protein subunit Novavax Chinese Academy of Sciences	✓	2	2-8C	**Hepatitis B**

As of 6 January 2021. Source: Company data/Gavi

HOW SOME OF THE COVID-19 VACCINES COMPARE

Source: BBC April 14, 2021.



Company	Doses	Storage
RNA		
Pfizer (BioNTech)	2	-80 to -60°C (6 months) and 2 to 8°C (for up to 5 days)
Moderna	2	-25 to -15°C (6 months) and 2 to 8°C (for 30 days)
Viral vector		
Oxford-AstraZeneca	2	2 to 8°C (6 months)
Sputnik V (Gamaleya)	2	-18.5°C (liquid form) 2 to 8°C (dry form)
Johnson & Johnson (Janssen)	1	2 to 8°C (3 months)
Inactivated virus		
CoronaVac (Sinovac)	2	2 to 8°C
Sinopharm	2	2 to 8°C
Covaxin (Bharat Biotech)	2	2 to 8°C
Protein-based		
Novavax	2	2 to 8°C

Source: Wellcome Trust, BBC research

BBC

HOW COVID-19 mRNA VACCINES WORK

Source: Health Canada

- RNA (ribonucleic acid) is a molecule that provides cells with instructions for making proteins. RNA vaccines contain the instructions for making the SARS-CoV-2 **spike protein** found on the surface of the virus.
- mRNA molecule is essentially a recipe, telling the cells of the body how to make the spike protein.
- COVID-19 mRNA vaccines are given by injection into the muscle of the upper arm.
- After the protein piece is made, the cell breaks down the instructions and gets rid of them. The mRNA never enters the central part (nucleus) of the cell, which is where our DNA is found.
- The cell then displays the protein piece on its surface. Our immune system recognizes that the protein does not belong there and begins building an immune response and making antibodies.

COVID-19 VARIANTS

Source: CDC

Variant of Interest

A variant with specific genetic markers that have been associated with changes to receptor binding, reduced neutralization by antibodies generated against previous infection or vaccination, reduced efficacy of treatments, potential diagnostic impact, or predicted increase in transmissibility or disease severity.

- B.1.526 New York
- B.1.526.1 New York
- B.1.525 UK/Nigeria
- P.2 Brazil

Variant of Concern

A variant for which there is evidence of an increase in transmissibility, more severe disease (e.g., increased hospitalizations or deaths), significant reduction in neutralization by antibodies generated during previous infection or vaccination, reduced effectiveness of treatments or vaccines, or diagnostic detection failures.

- B.1.1.7 UK
- P.1 Japan/Brazil
- B.1.351 South Africa
- B.1.427 California
- B.1.429 California

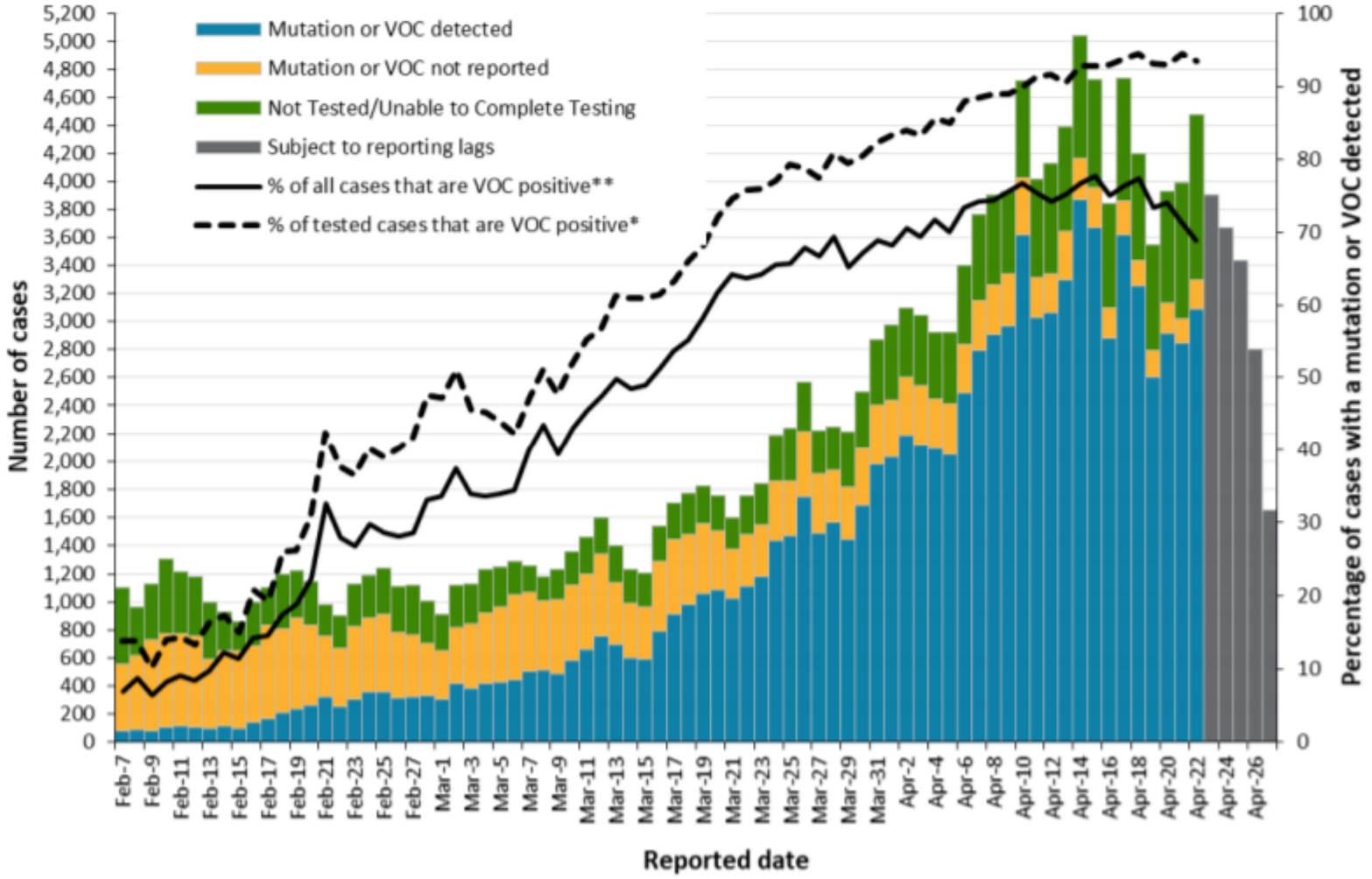
Variant of High Consequence

A variant of high consequence has clear evidence that prevention measures or medical countermeasures (MCMs) have significantly reduced effectiveness relative to previously circulating variants.

- Currently none.

NUMBER OF CONFIRMED COVID-19 CASES AND PERCENT POSITIVE FOR MUTATIONS OR VARIANTS OF CONCERN (VOCS): ONTARIO, FEBRUARY 7, 2021 TO APRIL 27, 2021

Source: [Public Health Ontario]



COVID-19
and
PEOPLE LIVING WITH HIV

IMPACT OF COVID-19 ON PEOPLE LIVING WITH HIV

- Although the totality of the data is somewhat contradictory, it is nonetheless clear that the COVID-19 pandemic has had a negative impact on people with HIV.
- The most consistent finding is that the severity of COVID-19 disease in people living with HIV is related strongly to the presence of comorbidities that increase the risk of severe disease in COVID-19 patients in the absence of HIV.
- There are multiple profiles of persons living with HIV and the impact of COVID-19 may differ for each.

  Eisinger, et al. 2021
- Although people living with HIV who are on treatment with a normal CD4 T-cell count and suppressed viral load may not be at an increased risk of serious illness, many people living with HIV may have other conditions that increase their risk: **Almost half** of people living with HIV in Canada are **older than 50 years,** and **chronic medical conditions, such as cardiovascular and chronic lung disease,** are more common in people living with HIV.

  https://hivclinic.ca/information-on-covid-19-for-people-living-with-hiv/

ACCEPTED MANUSCRIPT

HIV/AIDS in the Era of COVID-19: A Juxtaposition of Two Pandemics FREE

Robert W Eisinger, Andrea M Lerner, Anthony S Fauci

The Journal of Infectious Diseases, jiab114, https://doi.org/10.1093/infdis/jiab114

Published: 07 April 2021 **Article history**

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Abstract

The COVID-19 pandemic has significantly impacted persons with HIV interfering with critical health services for HIV prevention, treatment, and care. While there are multiple profiles of persons living with HIV and the impact of COVID-19 may differ for each, the severity of COVID-19 disease in persons with HIV is related strongly to the presence of comorbidities that increase the risk of severe disease in COVID-19 patients in the absence of HIV. An effective response to the juxtaposition of the HIV and COVID-19 pandemics requires a novel coordinated and collaborative global effort of scientists, industry, and community partners to accelerate basic and clinical research, as well as implementation science to operationalize evidence-based interventions expeditiously in real-world settings. The accelerated development and clinical evaluation of prevention and treatment countermeasures is urgently needed to mitigate the juxtaposition of the HIV and COVID-19 pandemics.

IMPACT OF COVID-19 ON PEOPLE LIVING WITH HIV

Although the data are somewhat contradictory, certain general patterns emerge:

TABLE 1. Profiles of Persons with HIV and Potential for Severe COVID-19 Disease.

Profile of Person with HIV	Potential for Severe COVID-19 Disease*
Uncontrolled viremia, immune suppressed with comorbidities	++++
Uncontrolled viremia, immune suppressed without comorbidities	+++
On ART, virologically suppressed, immune competent with comorbidities	++
On ART, virologically suppressed, immune competent without comorbidities	+

*Given the somewhat conflicting data regarding each of these situations, the assignment of a risk from + to ++++ is based on a broad interpretation of the weight of the data.

Eisinger, et al. 2021

COVID-19 VACCINES and PEOPLE LIVING WITH HIV

TESTING COVID-19 VACCINES IN PEOPLE LIVING WITH HIV

aidsmap April 2021

- People living with HIV were initially excluded from vaccine trials, but that changed with the help of advocacy groups.
- Relatively small numbers of people with HIV have been involved so far and the length of time they have been in the studies is relatively short. For this reason, specific data on people with HIV has not yet been released from most studies.
- **Pfizer**: recruited at least 196 people with HIV, but they were not included in the analysis published in the New England Journal of Medicine or in the data which has led to approval by regulators in the US, UK or Canada.
- **Moderna**: recruited 176 people with HIV. One person who received the placebo and none who received the vaccine developed COVID-19. No unusual safety concerns reported in people with HIV.
- **Oxford/AstraZeneca:** recruited 160 people with HIV (UK and South Africa). 2 studies have been published on the HIV-positive participants. Vaccine produced the same strength of immune response in people with HIV and people without HIV. There was no difference in the common vaccine side effects. People in both studies had high CD4 counts (above 500) and were on antiretroviral treatment.
  https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3829931
  https://www.researchsquare.com/article/rs-322470/v1
- **Janssen (Johnson & Johnson):** recruited 1,218 people with HIV (2.8% of all participants). US, South Africa and 6 South American countries. 2 cases of COVID-19 in people with HIV receiving vaccine and 4 in people with HIV receiving placebo. Due to the small numbers of cases, this difference is not statistically significant and any conclusions about efficacy specifically in people with HIV cannot be drawn.
- **Novavax:** recruited 148 people with HIV for one of the studies into its COVID-19 vaccine in South Africa (6% of all participants). Overall efficacy of the vaccine was 49.4% (95% CI 6.1-72.8), with an apparently higher efficacy when the HIV-positive participants were excluded (60%, 95% CI 19.9-80.1).

COVID-19 AND PEOPLE LIVING WITH HIV

Source: Infectious Diseases Society of America (IDSA) and HIV Medicine Association (HIVMA)

COVID-19: Considerations for People with HIV
Version: December 27, 2020

- The CDC recommend that because people with HIV may be at higher risk for serious illness, they **can receive** the Pfizer-BioNTech and Moderna vaccines if they have no contraindications.
- It is not yet known whether the level of protection for people with HIV is as strong as it is for those without HIV.
- People with HIV who fall into a group that is prioritized (e.g., a health care worker or certain age groups) should be eligible to receive the vaccine.
- Care and treatment for COVID-19 in people living with HIV should follow the same protocols advised for patients without HIV.
- Until more data are available, heightened awareness for severe disease should be considered for people living with HIV, particularly those who have other comorbidities associated with worse COVID-19 outcomes or CD4+ T cells <200/ml or viral load >1,000/ml.

NATIONAL ADVISORY COMMITTEE ON IMMUNIZATION (NACI), APRIL 23, 2021

Source: Government of Canada's Recommendations on the use of COVID-19 vaccines

- Currently, there are no data on COVID-19 vaccination in individuals who are immunosuppressed. Participants in the mRNA COVID-19 vaccine clinical trials only included individuals who were not immunosuppressed, such as those with stable infection with HIV, and those not receiving immunosuppressive therapy during the trial.
- No safety signals of concern have been noted to date in non-immunosuppressed participants with an immunocompromising condition (e.g., stable HIV infection) included in the clinical trials.
- The relative degree of immunodeficiency in individuals who are immunocompromised varies depending on the underlying condition, the progression of disease, and use of medications that suppress immune function. Therefore, the balance of benefits and risks must be made on a **case-by-case basis**.
- Immunocompromised persons, including individuals receiving immunosuppressant therapy, may have a diminished immune response to the vaccine.
- People living with HIV that are considered immunocompetent may be vaccinated.

COVID-19 VACCINES FOR PEOPLE LIVING WITH HIV IN ONTARIO

- People living with HIV are considered part of the Ontario Phase 2 priority group (Immune deficiencies and autoimmune disorders; Immunocompromising health conditions).
- People living with HIV may also be eligible based on other criteria, such as age or where they live.
- There is no evidence that antiretrovirals will enhance or impair the response to the vaccine.
- Current vaccination options in Ontario:
  - Pharmacy for those of age 40 or over
  - Vaccination centres for eligible groups
  - People ages 18 to 49 in hot spot communities
  - UHN Vaccine Registry currently open for pre-registration to all UHN patients who are part of the Phase 2 priority group. This includes all patients of the Immunodeficiency Clinic.
  - Vaccine Hunters – City of Toronto officially partnered with this volunteer group that helps people navigate COVID-19 vaccination rollout.

ADDITIONAL RESOURCES ON COVID-19 AND HIV

- HIV Medicine Association (HIVMA). COVID-19 Vaccines and People with HIV: Frequently Asked Questions. March 16, 2021
- National Institutes of Health (NIH). COVID-19 Treatment Guidelines. Special Considerations in People With HIV. April 21, 2021
- U.S. Centers for Disease Control and Prevention (CDC). What to Know About HIV and COVID-19. February 1, 2021
- U.S. Department of Health & Human Services. Interim Guidance for COVID-19 and Persons with HIV. February 26, 2021
- UHN Toronto General Hospital. Immunodeficiency Clinic. Information on COVID-19 for People Living with HIV. Common Questions/Answers on COVID Vaccines.

Thank you!

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