



## Distribution of COVID-19 vaccines

23 February 2021

Paul Crombach

# 7 billion vaccines are expected to be distributed by air

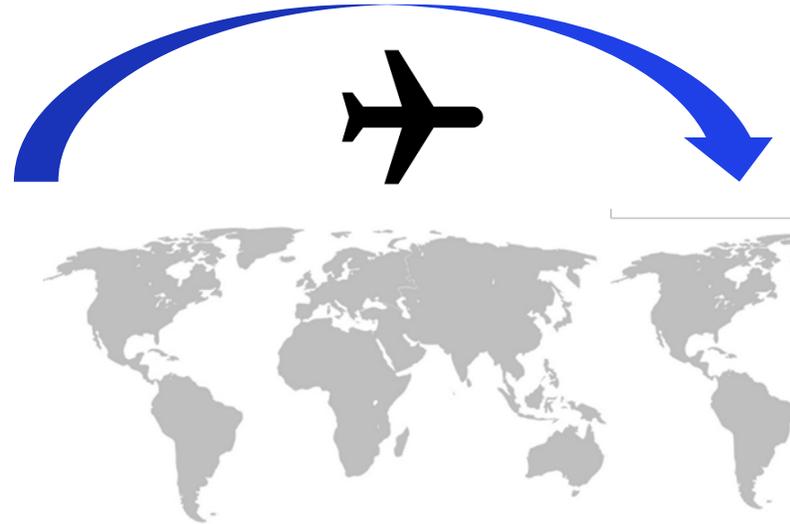
There will also be air cargo demand for ancillary goods (e.g. PPE, needles) and medicines (e.g. adjuvans)

**16Bn**  
vaccine doses needed worldwide



**7Bn**  
Air distribution

**60k**  
Tonnes of air freight



©DESIGNALIKE



**9Bn**  
Local/regional distribution

**60k tonnes equals:**

- 0.3% of 2018 air trade
- 12% of 2019 pharma air trade
- ≈ 5x 2019 vaccine air trade

# 68 vaccines are in clinical trials on humans

20 have reached the final stages of testing\*; Pfizer and Moderna most widely approved.



**PRECLINICAL TESTING** : Scientists test a new vaccine on cells and then give it to **animals** such as mice or monkeys to see if it produces an immune response.

**PHASE 1 SAFETY TRIALS** : Scientists give the vaccine to a **small number of people** to test safety and dosage, as well as to confirm that it stimulates the immune system.

**PHASE 2 EXPANDED TRIALS** : Scientists give the vaccine to **hundreds of people** split into groups, such as children and the elderly, to see if the vaccine acts differently in them. These trials further test the vaccine's safety.

**PHASE 3 EFFICACY TRIALS** : Scientists give the vaccine to **thousands of people** and wait to see how many become infected, compared with volunteers who received a placebo. These trials can determine if the vaccine protects against the coronavirus, measuring what's known as the efficacy rate. Phase 3 trials are also large enough to reveal evidence of relatively rare side effects.

**EARLY OR LIMITED APPROVAL** : Britain and other countries have begun giving emergency authorization to vaccines based on preliminary evidence that they are safe and effective. [China](#) and [Russia](#), on the other hand, have authorized vaccines without waiting for the results of Phase 3 trials, which experts say has serious risks.

**APPROVAL** : Regulators review the complete trial results and plans for a vaccine's manufacturing, and decide whether to give it full approval.

**COMBINED PHASES** : One way to accelerate vaccine development is to combine phases. Some vaccines are now in Phase 1/2 trials, for example, which this tracker would count as both Phase 1 and Phase 2.

**PAUSED** or **ABANDONED** : If investigators observe worrying symptoms in volunteers, they can pause the trial. After an investigation, the trial may resume or be abandoned.

## Leading vaccines

Developer	How It Works	Phase	Status
Pfizer-BioNTech	mRNA	<b>2</b> <b>3</b>	Approved in Saudi Arabia and other countries. Emergency use in U.S., E.U., other countries.
Moderna	mRNA	<b>3</b>	Emergency use in U.S., E.U., other countries.
Gamaleya	Ad26, Ad5	<b>3</b>	Early use in Russia. Emergency use in Belarus, other countries.
Oxford-AstraZeneca	ChAdOx1	<b>2</b> <b>3</b>	Emergency use in Britain, India, other countries.
CanSino	Ad5	<b>3</b>	Limited use in China.
Johnson & Johnson	Ad26	<b>3</b>	
Vector Institute	Protein	<b>3</b>	Early use in Russia.
Novavax	Protein	<b>3</b>	
Sinopharm	Inactivated	<b>3</b>	Approved in China, U.A.E., Bahrain. Emergency use in Egypt.
Sinovac	Inactivated	<b>3</b>	Limited use in China, Indonesia.
Sinopharm-Wuhan	Inactivated	<b>3</b>	Limited use in China, U.A.E.
Bharat Biotech	Inactivated	<b>3</b>	Emergency use in India.

Source: New York Times Corona Virus Tracker (14 January)

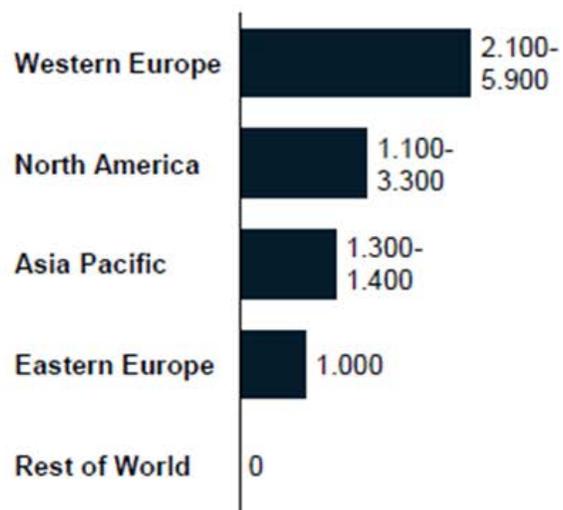
# Large part of the vaccines will be produced in Western Europe

India and China are the main manufacturing countries in Asia

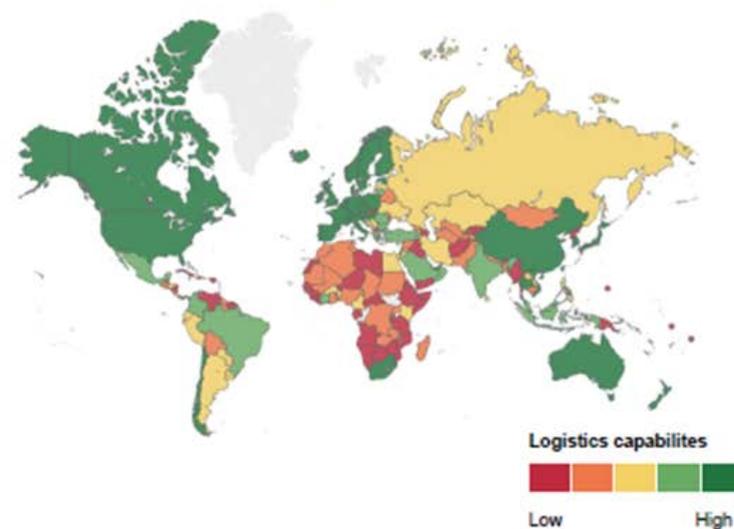
## Required storage temp. depends on maturity of vaccine

Vaccine maturity	Early stage	Mature stage
Temperature requirements	~-80°C until fill/finish ~-20°C for primary distribution	~-20°C during production 2~8°C for distribution

**Covid-19 vaccine production sites**  
In million doses



**Global capacity to manage refrigerated vaccine distribution (2 – ~8°C)**



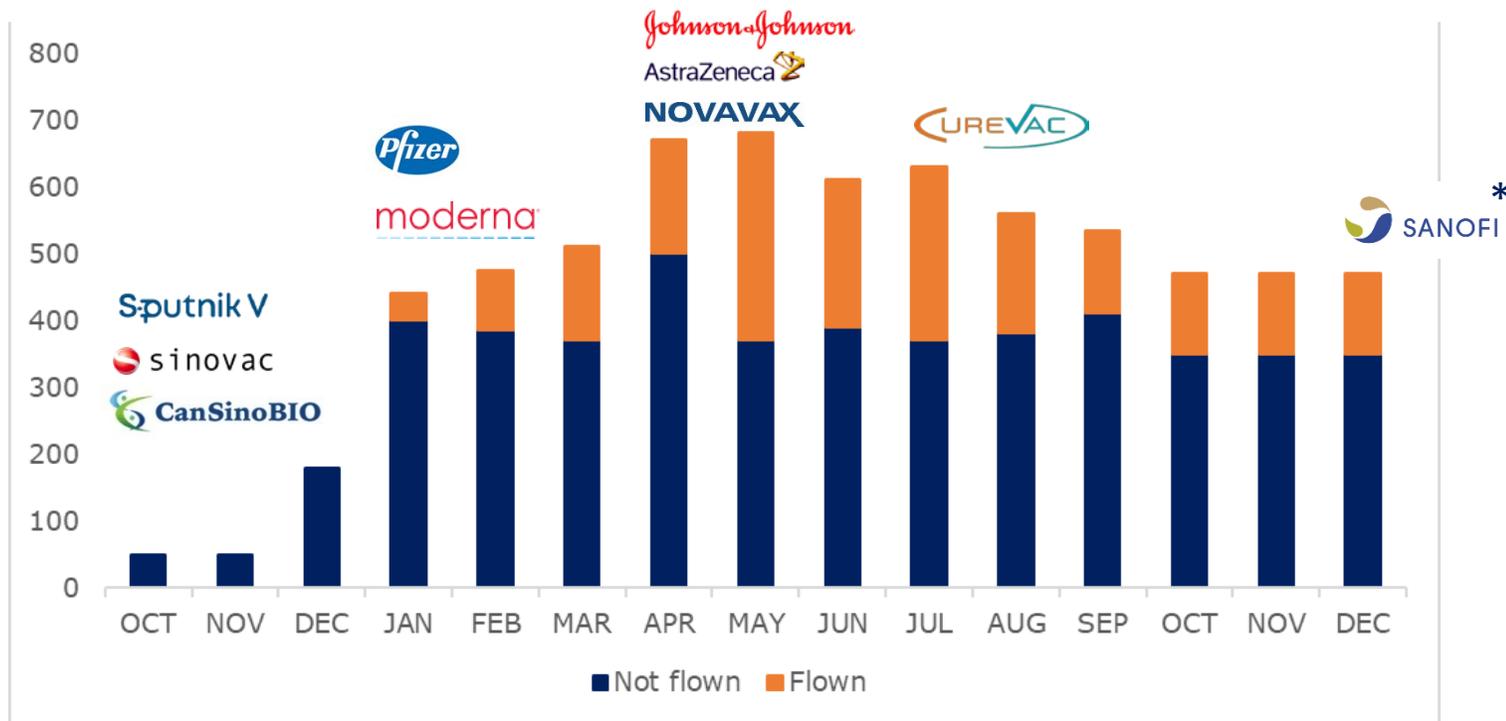
- Pfizer is the only vaccine that has to be transported at -80 °C.
- Moderna and Curevac vaccines are based on the same technology, but can be distributed at -20 °C.
- These vaccines will hardly be used for the developing countries.
- As more stability data on these vaccines becomes available they may be transported at regular temperatures (2-8 °C).

# Air cargo distribution will build up in the first half of the year

*It will take 2-3 years to vaccinate most of the worlds population*

## Monthly vaccine production outlook

Million doses, per transport requirement



- Vaccines will initially be consumed predominantly in the country of origin.
- As more vaccines are approved in more countries the volumes will increase.
- Q2/Q3 expected to be the peak for air cargo volumes but highly dependent on approval of vaccines.

\* Outlook of Seabury assumed introduction of Sanofi vaccine in July but it will be no earlier than end of 2021

# Difficulties in vaccine transport

*What makes COVID19 vaccines different than normal pharma or vaccines*

## Last minute information availability

- Volumes and timing very uncertain
- Daily changes in information
- No/limited link to pharmaceutical companies

## High quantity of Dry-Ice

- Considered dangerous good
- Maximum amounts allowed on aircraft
- Dry-ice stock
- Re-icing
- High volumes only on Cargo aircraft only



## High volumes in short times

- Everybody wants to have the vaccine fast
- Volume on top off regular flows
- Low availability of air cargo capacity
- Capacity to receive goods at destination



## Temperature compliance

- Very vulnerable to temperature deviations
- No stability data

## Security risks

- Vulnerable to theft and/or tampering
- High interest by foreign nations
- Cyber threats



# How did we prepare

*What we did to be as ready as we could be*

## Try to be as close to the source of information as possible

- A lot of interaction with all relevant parties in the supply chain.
- Studies by various parties used in our predictions

## Pro-actively push our 'Corona package'

- Years of experience in pharma transport
- Customers were not sure what they needed yet, by pro-actively promoting what we could do we are in control

## COVID19 taskforces with specialists and with mandate

- Started at the beginning of summer 2020
- Commercial and operational taskforces
- Mandate to change processes, do investments and use resources

## Some luck

- AFKL has had the cool chain program since 3 years in which we have been improving the way we handle temperature sensitive freight.
- Pharma recognized as focus growth product
- Investments to allow for product volume growth for coming years
- Opening of new cool and climate rooms
- New capacity can be used for Vaccine flows that are 'on top off'



# Positive exposure for KLM

A lot of news outlets have visited SPL handling  
High(er) risk of negative PR if things go wrong!

[RTL](#)

[Al Jazeera](#)

Reuters

Nieuwsuur

[Intern on a Mission](#)

[AD](#)

Etc



Zo gaat KLM de coronavaccins vervoeren

RTL Nieuws



Kaag wil onderzoek naar #MeToo-beschuldiging tegen D66-prominent  
Frans van Dommelen zou vrouwen binnen de partij hebben geïntimideerd en hebben lastiggevallen. Hij herkent zich niet in de beschuldigingen.



8793 nieuwe besmettingen, 2210 meer dan gisteren • ING leent miljard aan mkb  
Volg hier het coronanieuws uit binnen- en buitenland van donderdag 10 oktober 2020.



VVD-leden hebben meer invloed op verkiezingen door corona  
Zaterdag is er een VVD-congres. Gedreven leden hebben meer te zeggen omdat de voorbereidingen online gaan.



LAATSTE NIEUWS SPORT

