# Exit Strategy from COVID-19: Vaccination and an Alternative Solution

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**COVID-19, Spain**
**21st July 2021**

# Motivation

**More than 4,101,000 people died till 18th July 2021**

- Economy and mental health suffered tremendously.
- No proven cure for the disease is found yet.
- Mass vaccination started on 8th Dec' 20, but there are many limitations.
- Considering that **Emergency Situation** in mind some **Urgent**, **Simple** **Solutions** were proposed as early as 17th March 2020 (Roy, 2020a) purely based on **Science**.
- These solutions are practically without side effects, no funding required, can be practiced in own home and **no Vested Interest.**

# Outline

- Analyses: Initial Period - Global Spread
- Temperature Sensitivity of virus: Statistical Analyses and Clinical Trials
- Solutions
- Analyses: Post-vaccination Period
- Insight from Flu, Mutation of virus
- Optimism or Pragmatism?
- Summary

# Analyses: Initial Period - Global Spread

## Temporal Pattern

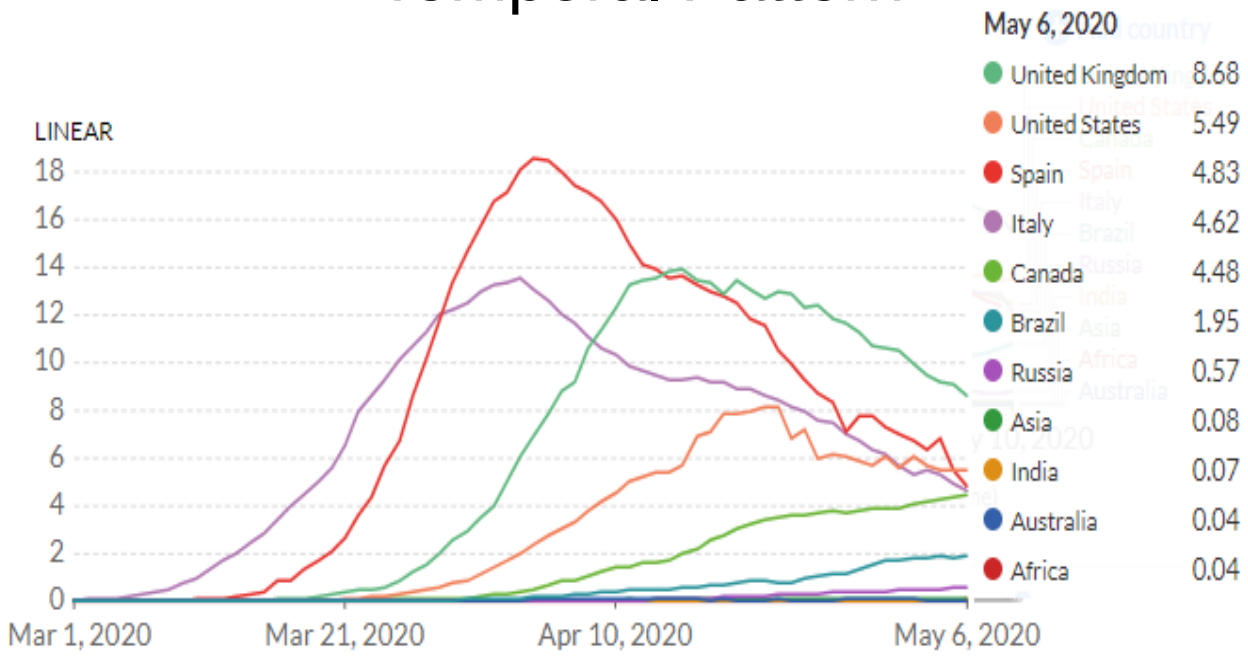



**Fig.** Rolling 7-day average of daily confirmed COVID-19 deaths per million upto 6th May 2020.

[Plot : https://ourworldindata.org]

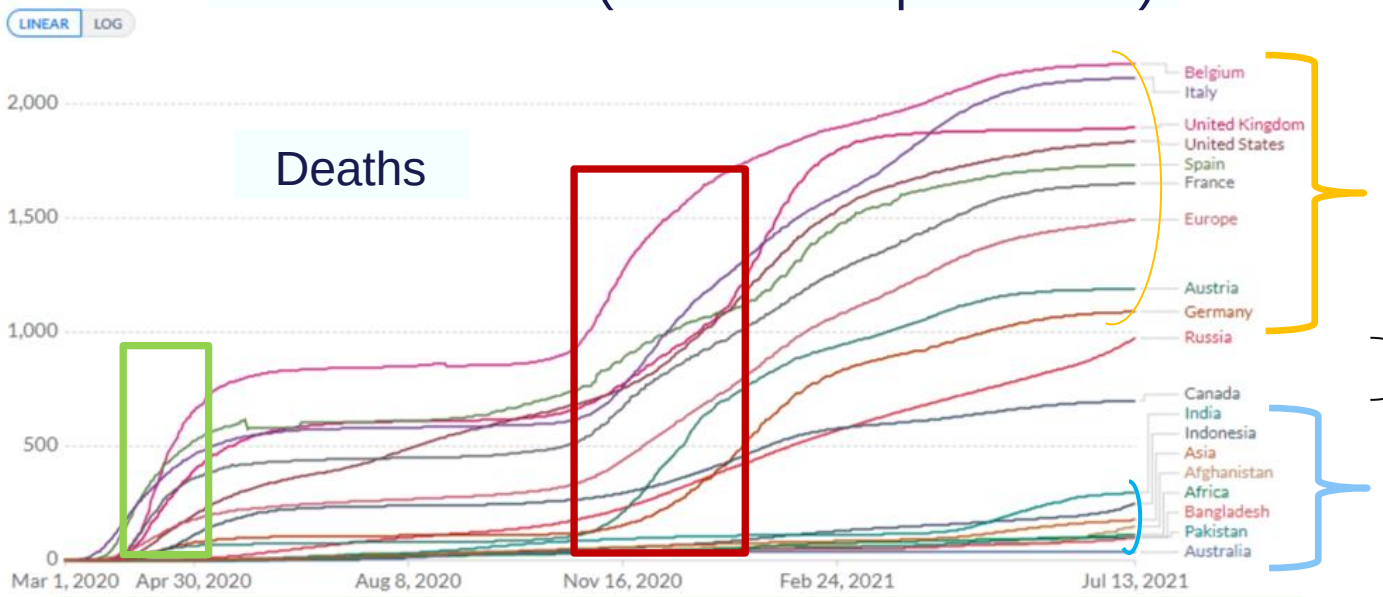
- **India, Asia, Africa and Australia all show very low count** and practically merges with X-axis (hence not visible).
- **Bottom three curves are for Russia, Brazil and Canada** respectively. All three indicate a rising trend till May.
- **Top four high peak curves are for UK, USA, Spain and Italy.** All four are showing a declining state in May, 2020.

Is the pattern still maintained?

- If more countries are included and
- If covered till July 2021

In spite of various peaks in different countries, with varied amplitude and timing, that ranking of countries are still valid.

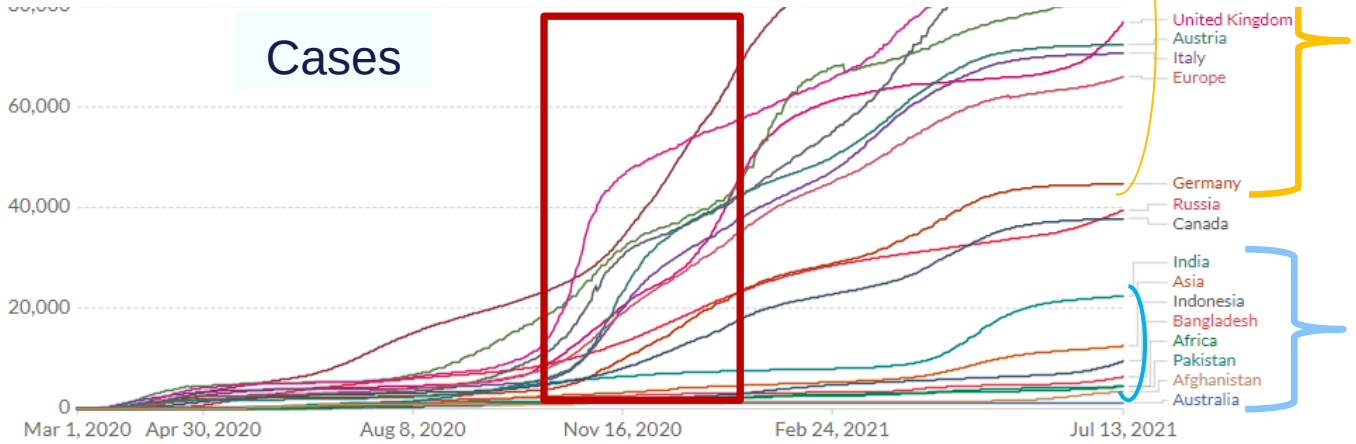
# Deaths/ Cases (Cumulative per Million)




Russia, Canda

- **Seasonal Temperature Important** and can not be ignored.

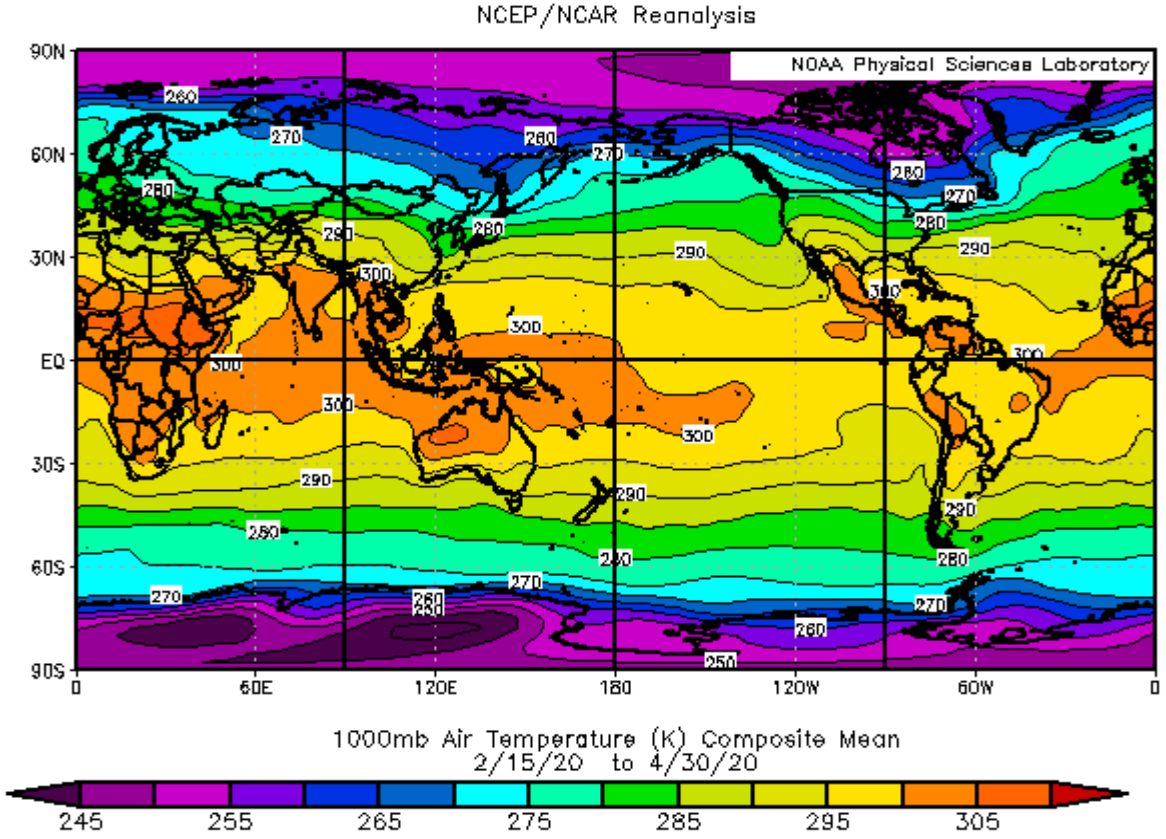
- **Europe and US:** Steep rise in cases and deaths in winter. Trend was practically nominal in summer, 2020 in all countries.




Russia, Canda

- Top group Moderate cold, middle very cold and bottom warm (winter).

# Global Air Temperature:
## Mid-February to April 2020




Average air temperature (K) from mid-February to April 2020.

(Plot: https://psl.noaa.gov/data/composites/day/ )

[Source: Roy, (2020)]

Same analyses was done with global 2m air temperature. Used different data sources but temperature dependency similar.

# Temperature sensitivity of the virus SARS-CoV-2 and Global transmission

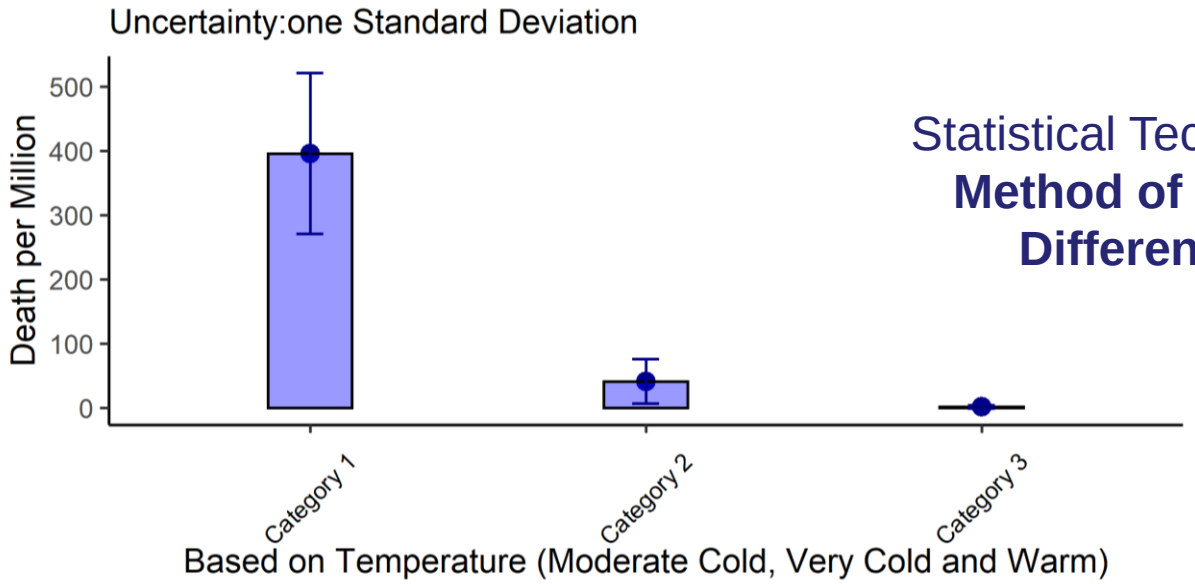
**Global Temperature analyses: till 1st May**
**Vulnerability measured in: Deaths per Million**

- **Moderately cool** [275 K(2°C) to 290 K(17°C)] environment was the most favourable state for susceptibility of virus. Countries like USA, UK, Spain, Italy etc.
- Countries with **very cold temperature** [< 275 K(2°C)] were moderately affected in March-April (e.g. Canada, Russia, Scandinavian countries).
- **Warm countries** and places [ >300 K(27°C)] were likely to be **less vulnerable**. e.g., SAARC, South East Asian countries, African continents and Australia.
- **Risks from the virus were reduced** significantly in very **high temperature** environment [ >305 K(32°C)]. Parts of African continents and Australia.

# Statistical Analyses: Globally

Vulnerability measured in: Deaths per Million

**(till 1st May)**



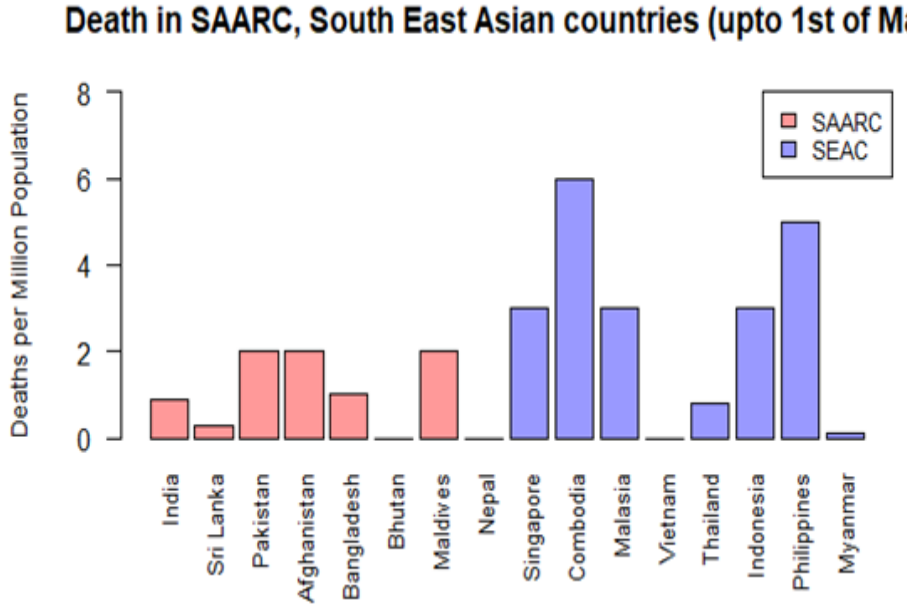

Statistical Technique:
**Method of Mean Difference**

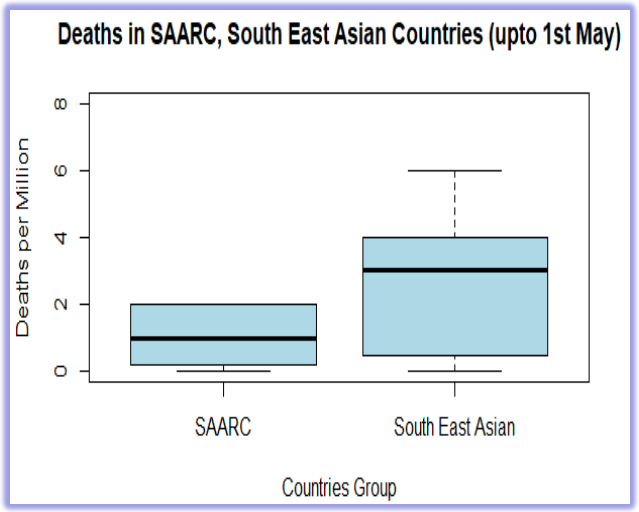
[Source: Roy, (2020)]

Difference among Category 1 (Moderate Cold), Category 2 (Very Cold) and Category 3 (warm) were Statistically Significant.

**Moderately Cold:** **USA, UK, Italy, Spain, France**
**Very Cold:** **Canada, Russia, Finland, Iceland**
**Warm:** **SAARC, South East Asian Countries, African Continents, Australia.**

# Statistical Analyses
## Temperature Sensitivity – Proof for all countries
from SAARC and SEAC



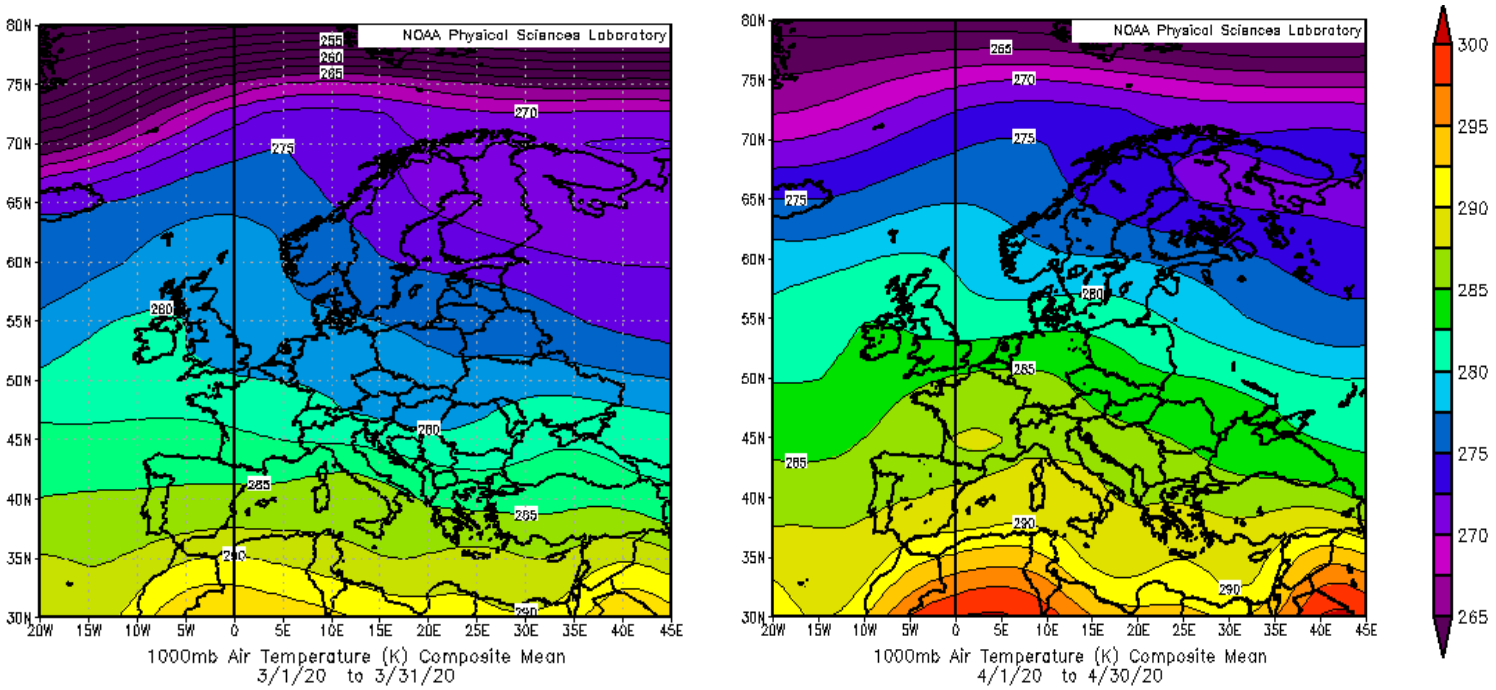

[Roy, (2020)]

- **Varied characteristics:** popular tourist spots, international business hubs with more foreign travellers, level of testing, infrastructural facility, population density, different degree of lockdown restrictions.
- **In spite of all dissimilarities still one common factor:** Death per Million for all those countries from SAARC and SEAC were much less and the pattern is still maintained. It was lesser than **8** till 1st of May, while in Spain it was 531, Italy 467and UK 405.

Because of **large populations**, India was one of the **highest** ranked during August '20, in **overall counts of total Deaths, as well as total Cases**.

**Transition:** Countries can switch from one vulnerability state to another, **based on Variability of Temperature**

South American countries, like Brazil turned warm to cooler in June, while Canada and Russia from very cold to moderate cold.
**Death rate increased in those countries.**

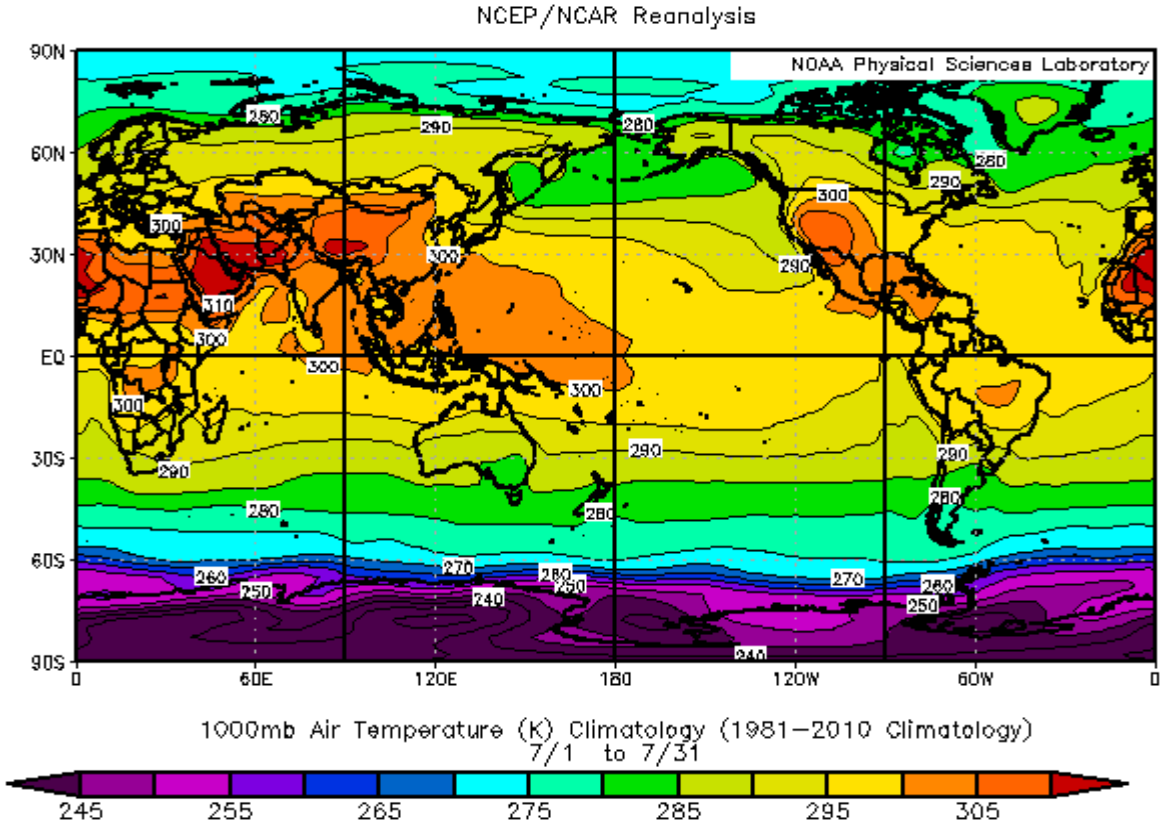



Mean Air temperature in March (left) and April (right) for Europe in NCEP/NCAR Reanalyses. [Source: Roy, (2020)]

(Plot generated: https://psl.noaa.gov/data/composites/day/ )

**Europe tuned warmer from moderately cold and death rate decreased from March to April 2020. The same pattern is observed till August.**

# Future Predictive Maps




Climatology (30 yr average) Global Temperature, **July**

- Indicate which countries are in advantageous/disadvantageous state in coming months based only on temperature variation. Useful for country-wise future preparedness.
- South America, Australia, S. Africa etc. will turn colder and need additional risk-based preparedness. Victoria from Australia usually mostly affected in July. We can also verify July, 2021

# Temperature Sensitivity of the Virus: Statistical Analyses

**This family of viruses is very sensitive to Temperature.**

- True for this virus SARS-CoV-2 responsible for COVID-19: Scafetta N., (2020); Paulo M et al., (2020); Roy I., (2020).

- Paulo M. et al. (2020) in a review work presented sixteen recent papers on COVID-19 and all found strong connections of temperature.

- True for similar generic category Coronavirus SARS and MARS (Van Doremalen N., 2013; Chan et al., 2011).

- True for other similar Seasonal air-borne Flu viruses (Lowen et al., 2007).

# Temperature Sensitivity: Clinical Trials

- **Seasonally dependent endemic virus (Lowen et al., 2007):** Temperature of 5 ºC and Relative Humidity (RH) 35% to 50%, infection rate was very high (75-100%). Whereas, when RH was still kept at 35%, but ***only temperature was increased to 30°C, infection rate surprisingly reduced to zero***.

- **True for similar Coronavirus genus SARS and MARS:** Virus remain active for a long time in low temperature (Van Doremalen N., 2013). Low temperature significantly contributes to the survival and transmission of the virus (Casanova et al., 2010; Chan et al., 2011; Seung et al., 2007).

- **Typical Air-Conditioning Temperature:** SARS could be active for at least five days in typical airconditioned environments which has relative humidity 40-50 % and room temperature 22 -25°C (Chan et al., 2011).

- **Similar generic Coronavirus (viz. SARS-CoV) using a variable Temperature (Casanova et al., 2010):** Inactivation of virus was faster at all humidity level if temperature was simply raised to 20°C from 4°C, more rapid if the temperature was further **increased to 40°C from 20°C**.

# Clinical Trials: Airborne and Contact Transmission

COVID-19 is extremely contagious and invaded most of the globe in less than two months.

**Attention:** Understand nature of its transmission under variable temperature condition.

- **Lab experiment with Guinea Pigs (Lowen et al., 2007):**

Using similar seasonal air-borne virus, it studied effect of temperature on ***Airborne Transmission as well as Contact Transmission.*** Increasing temperature prevented airborne transmission but not contact transmission. When guinea pigs were kept in separate cages at temperature of 30°C for 1 week, no recipient guinea pigs were infected. But if those were kept in same cage to simulate contact transmission, between 75% to 100% became infected. No role of humidity is found in these experiments.

**Hence Contact Transmission plays role in all Temperature.**

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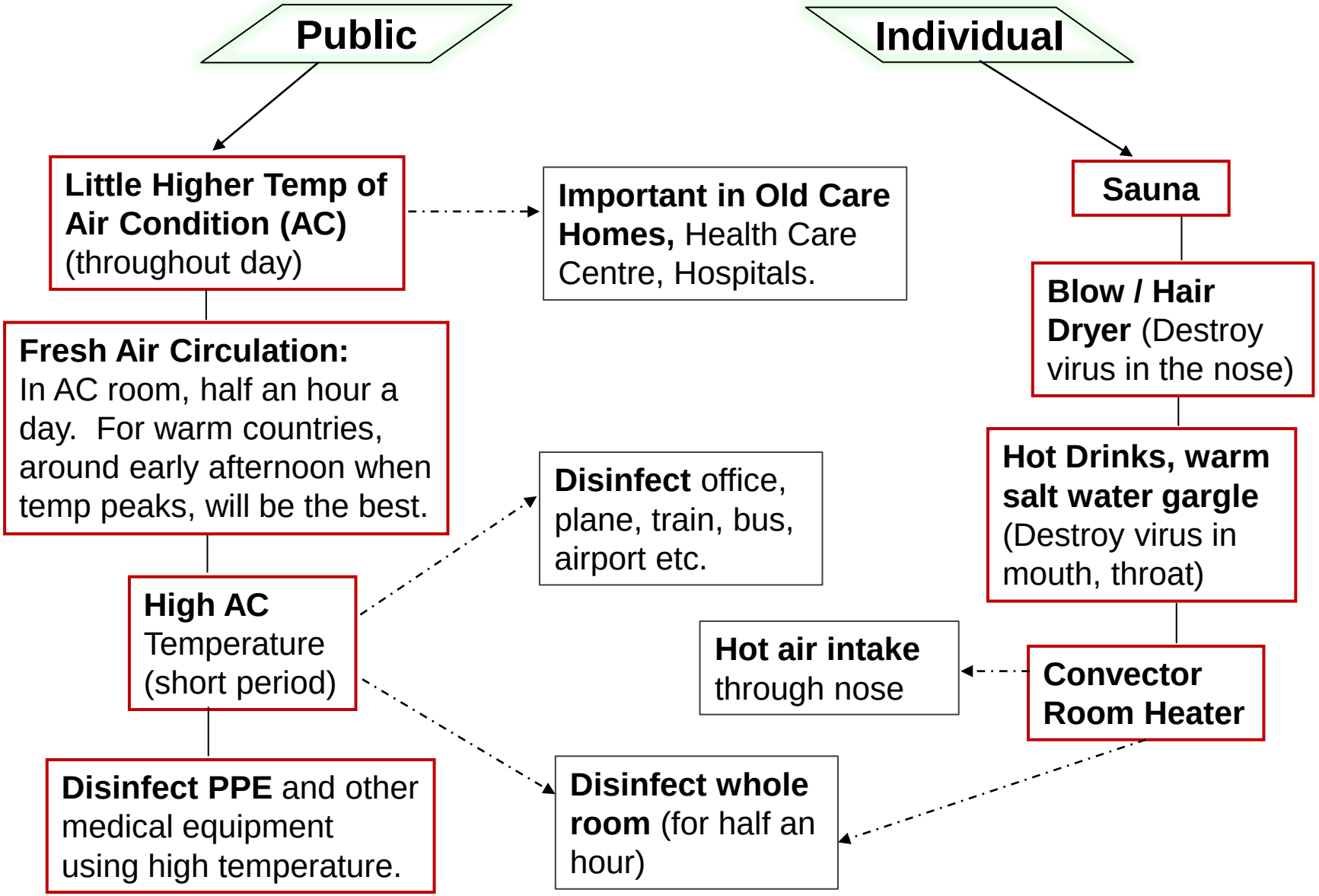
# **Solutions :** General Measures

- **Using Sauna facilities:** Usually hotels, gyms, leisure centres contain existing Sauna facilities. After Sauna, if surfaces of outside public places are touched, hand washing should be mandatory.
- **Portable Convector Room Heater:** Stay close to a convector room heater and inhale hot air at least two times a day for around half an hour each time (keeping comfort level). It would be very useful at the initial stages of the disease.
- **Disinfect any place using High Temperature:** Before start of office, school or business, temperature of premises may be kept very high, (say, 60ºC) for half an hour. For airports, train and bus, the same method of disinfecting could be thought of. *Optimum temperature and duration can be tested easily.* For any external object or material, disinfecting using high temperature could be a useful solution.
- **Using Blow Dryer/ Hair Dryer:** For minor symptoms, inhaling hot air intermittently through the nose (keeping comfort level) even for five minutes, say two/three times a day, will also be useful to kill virus in the nasal cavity.
- **Hot Drinks:** For very mild symptoms, take hot drinks (could be tea, coffee, warm milk, hot water with lemon etc.) few times a day to destroy virus in the mouth and throat. Gargle with warm salt water at least three/four times a day will be very beneficial. Hot soup will also be useful.

**Why:** The virus is very sensitive to Temperature. It mainly enters through the Nose (WHO). Testing is done with swabs from the nasal cavity and the back of the Mouth.

**Important: Only even Convector Room Heater and Warm Salt Water gargle, Hot Drinks can serve the main purpose.**

# Solutions: The virus is very sensitive to Temperature



# Caution and Additional Points

**Caution**: If people already developed major symptoms, then all these methods discussed will not be effective and proper medical advice need to be solicited.

**Additional Points:**

- **Water Shortage**: Whether frequent Hand Washing can be replaced by sensor-based hand dryer (normally found in washroom), temp controlled.
- **Plastic Disposal**: Personal Protective Equipment (PPE) are single use. World is already under stress due to problems of disposing Plastic. If PPE can be disinfected using heat-based solutions and reused. It can be tested in laboratory and could prove very beneficial.
- **Contact Transmission:** For warm, highly populated countries, contact transmission can play important role and appropriate measures are required. Hand washing is useful; Air Conditioned (AC) premises, where mass gathering happens need disinfecting on a regular basis.
- **Very Warm Countries:** Some countries reached temperature more than 40ºC in July-August. In that uncomfortable temperature, people use more AC. That low temperature in confined space can increase transmission.

# Studies further strengthened Temperature-based Solutions

- A peer-reviewed paper on **clinical trial experiments** following **heat-based solutions** is also published (Marca et al. 2021). The **ethical committee** did not find any issue and approved it.

- Another paper did a thorough literature review in support of **Heat-based solutions** to fight COVID-19 (Cohen 2020). Being a medical doctor, that author discussed **various mechanisms** involved in the biological process.

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# Questions raised via Rapid Response BMJ

(https://www.bmj.com/content/371/bmj.m4037/rr-20 dt 21.03.21)

- After initiation of vaccine programme, almost all countries experienced a sudden surge and most countries had to impose strict lockdown measures.

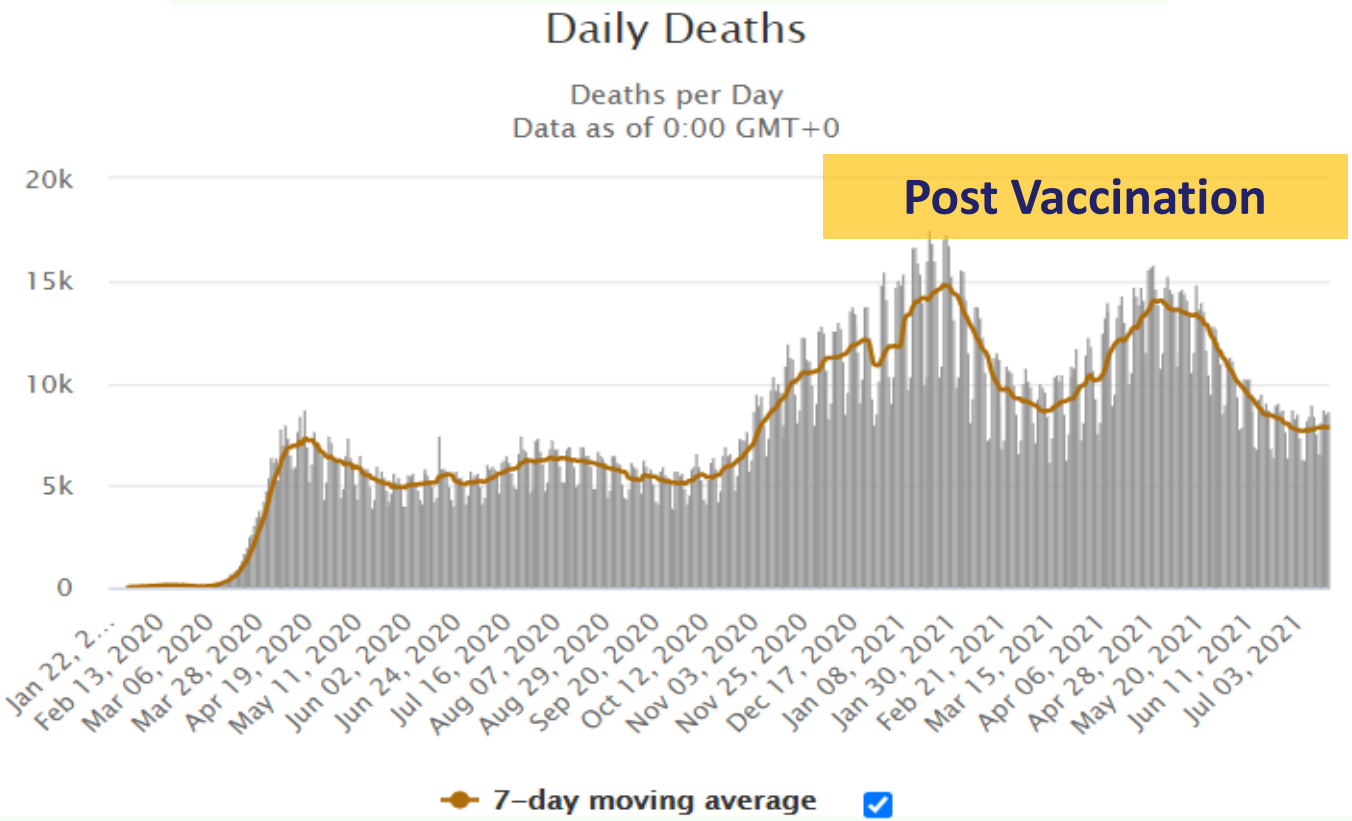
- Even for UK/ Israel, where massive vaccination started first, total deaths in three months after vaccination reached overall deaths of past 10 months before vaccination.

- A highly populated country India was having a steady decrease for five months. India passed major festive seasons where social distancing was very difficult to be maintained, still cases and deaths continued to decline. Vaccination started on 16th January and from around 16th February, India started showing a rise in cases and thereafter deaths.

- For Brazil, vaccination started in mid-January and a sharp rise in cases is observed since mid-February. Such a steep rise in deaths in Brazil that happened after that never happened in the whole period of pandemic.

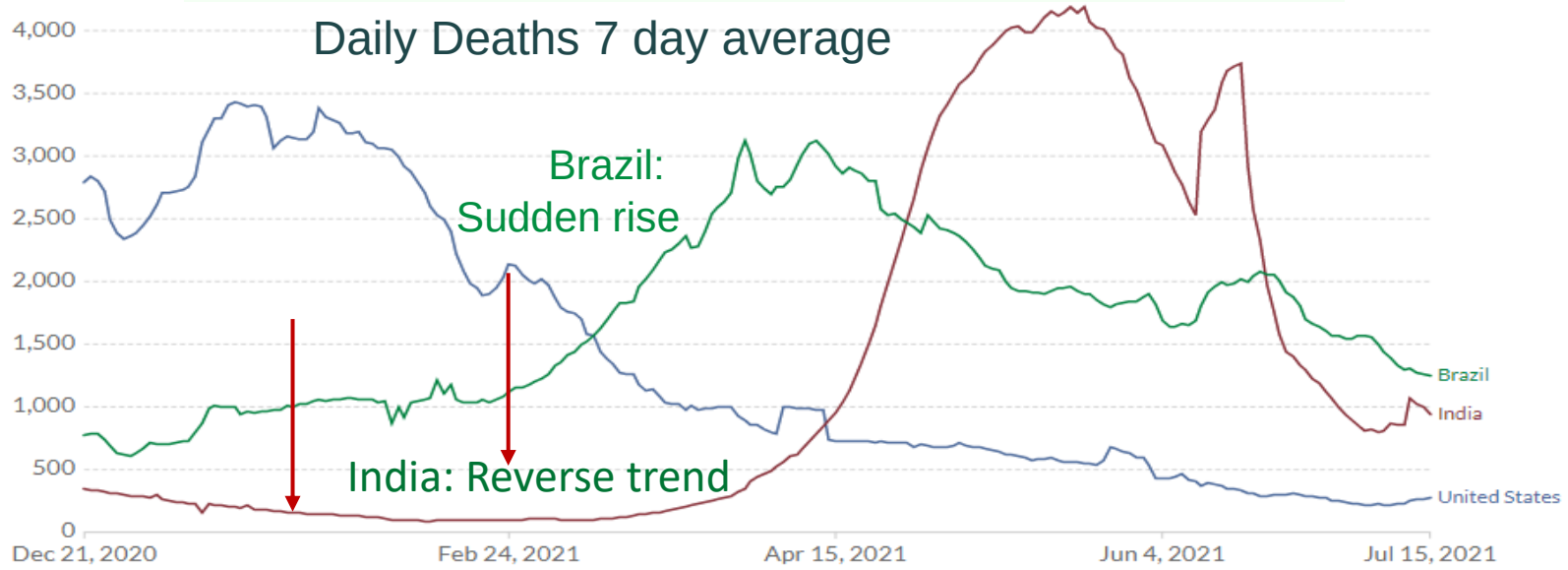
**Was indirect effect of mass vaccination explored by scientific Community yet?**

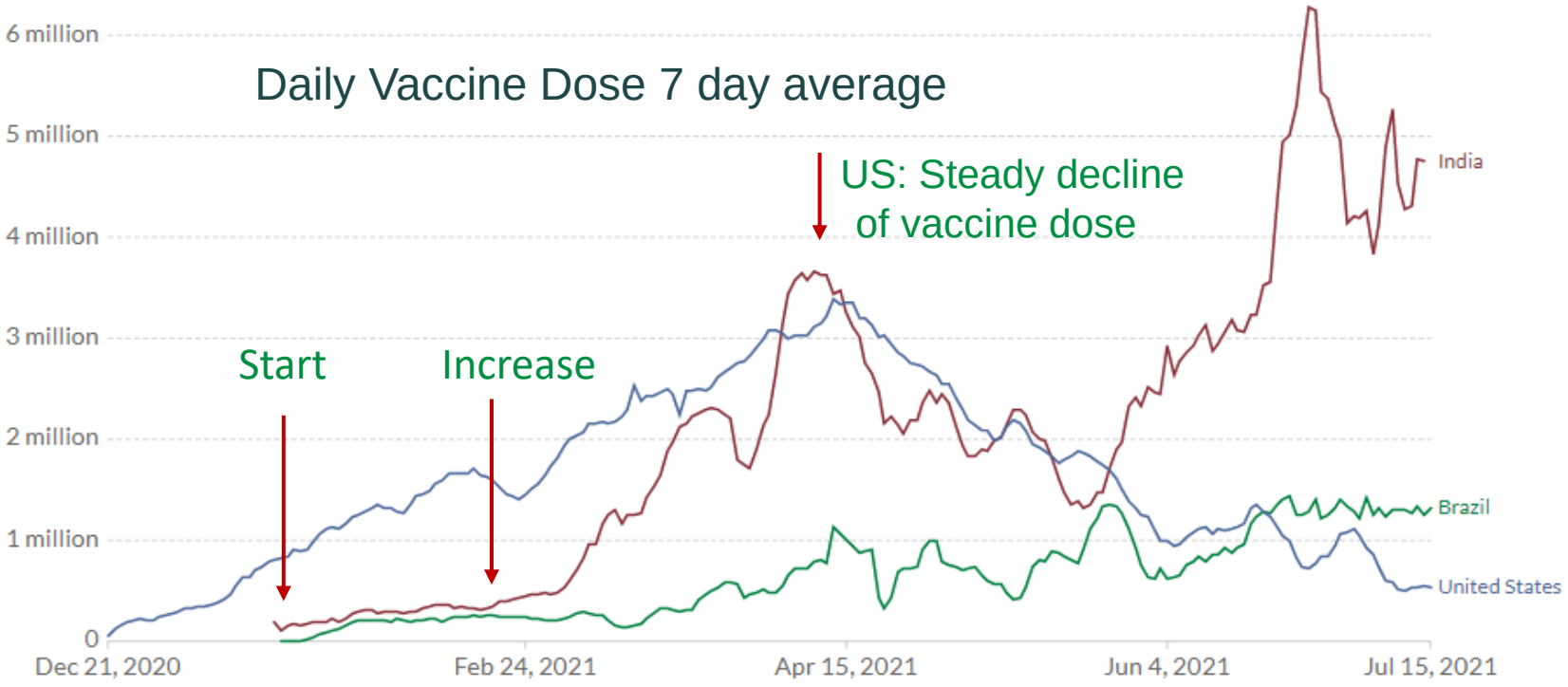
# Global: Daily Deaths/ Cases unusual rise



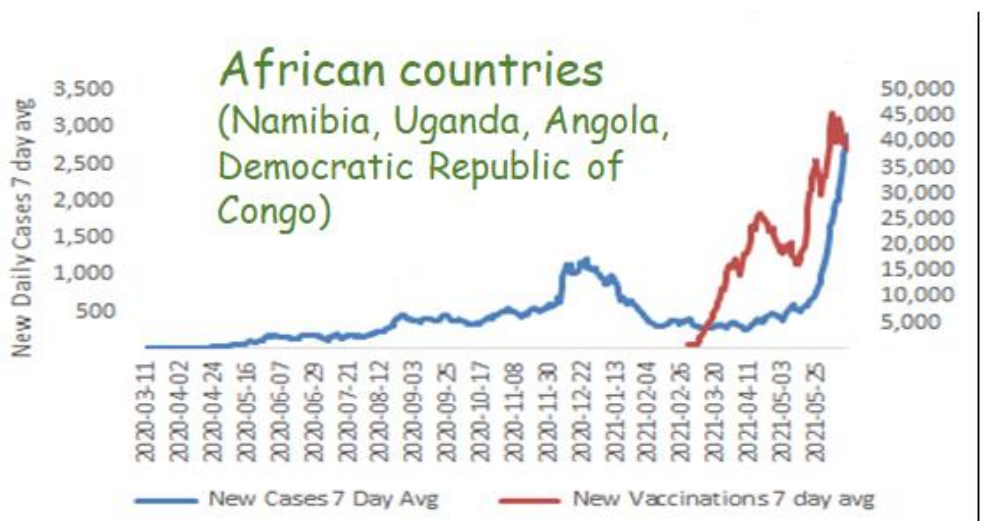

- Two highest peaks occurred **after the start of Mass Vaccination. P**eak in last winter just after the start of mass vaccination was the highest peak of all.
- It did not return to **pre-vaccination stage yet** even much vaccination doses were administered.
- Globally, cases started increasing after 5 weeks of a steady decline and coincidentally, the period of rise matches when mass vaccination was initiated.

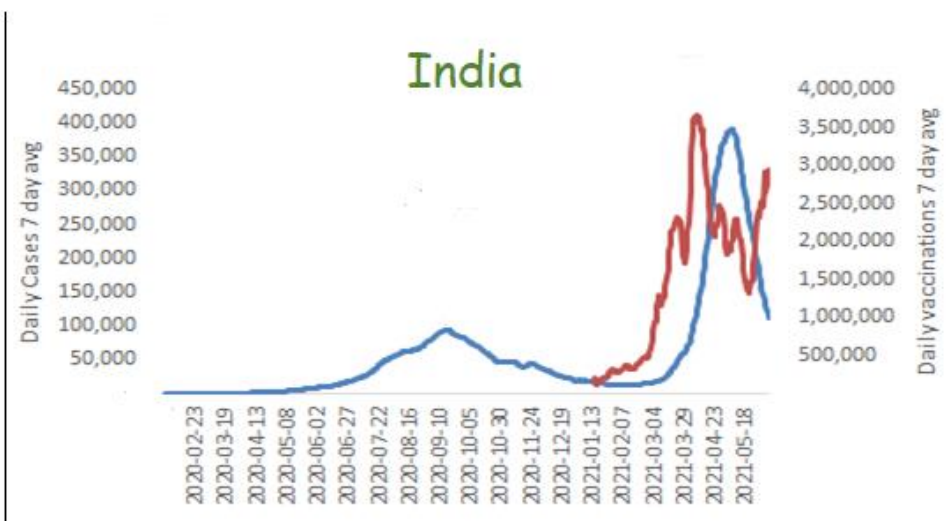
# Seasonality, Lockdown also has effect

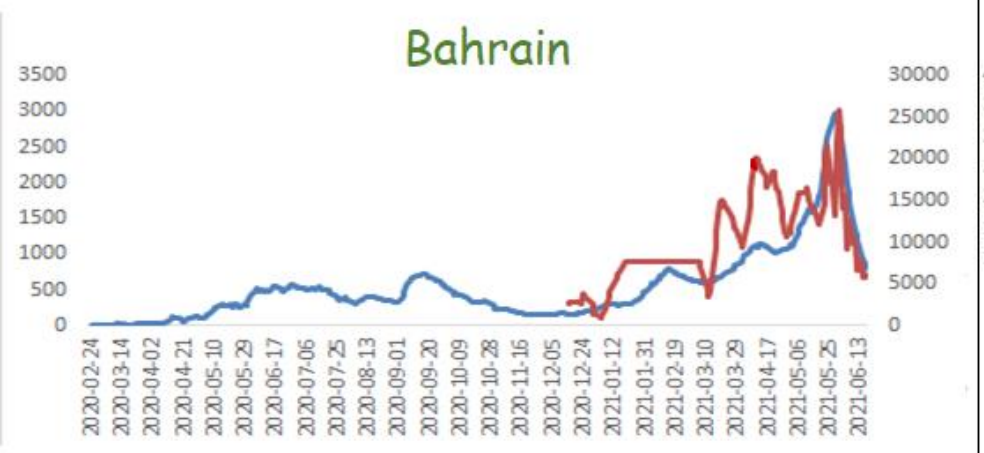


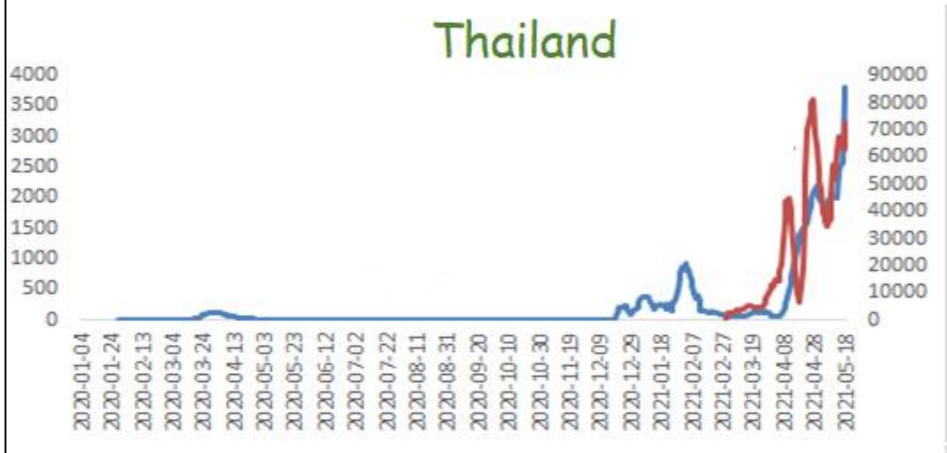



# Synchronization of cases with Vaccine doses

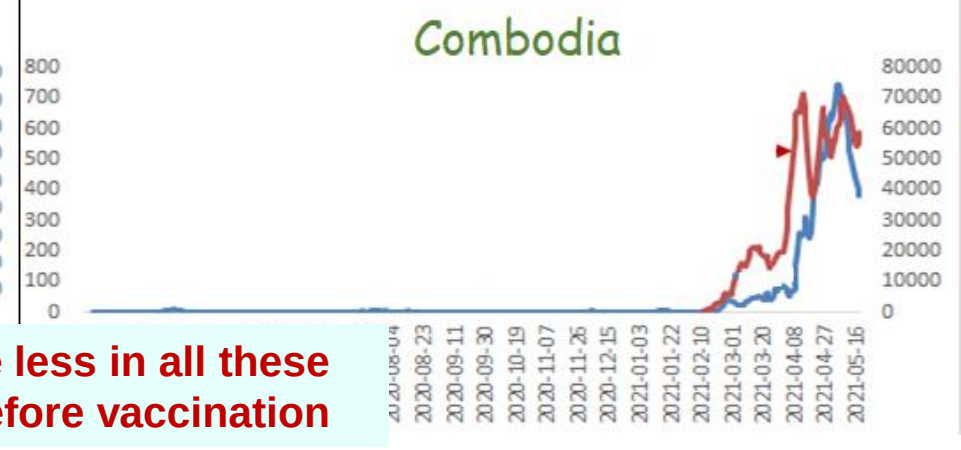


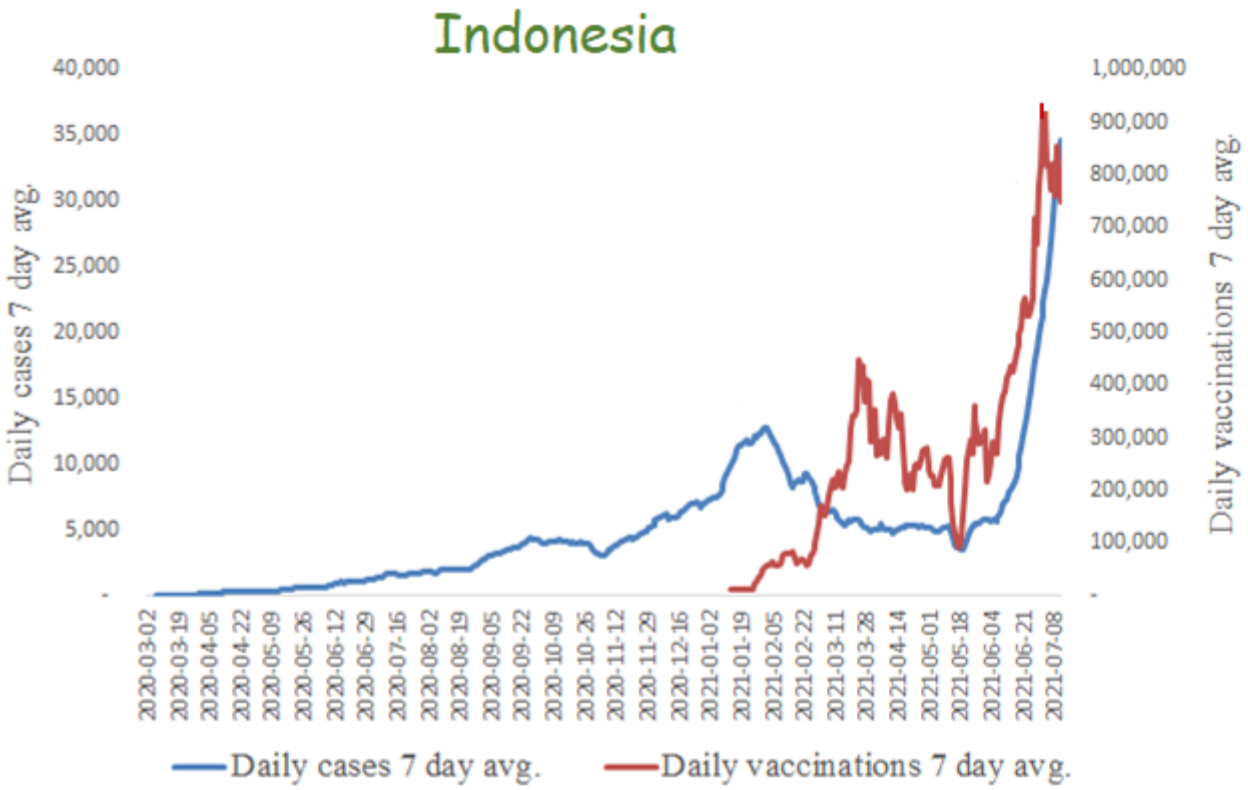





**Deaths were less in all these countries before vaccination**

# Vaccine Equity and Increase in Doses

What about the country that is showing highest daily Deaths in recent period?




[https://www.worldometers.info/coronavirus/]

Few consecutive days

**Highest daily deaths among world** in [1093(18/07/21), 1338 (19/07/21)]

2nd highest in Cases among world 44,721(18/07/21)

Resemblance with Flu and
Useful Timely Urgent
Insight

# Flu and COVID-19

## In spite of differences, striking similarities

'Flu season occurs in the fall and winter. In the U.S., that means October-March, and in the southern hemisphere, June-September. Although the reason for this seasonality is not entirely understood, influenza virus has been shown to survive longer at low temperatures and low humidity. Other suggested explanations include weakened host immunity due to decreased sunlight and vitamin D and increased exposure to the virus due to indoor cohabitation in the winter'

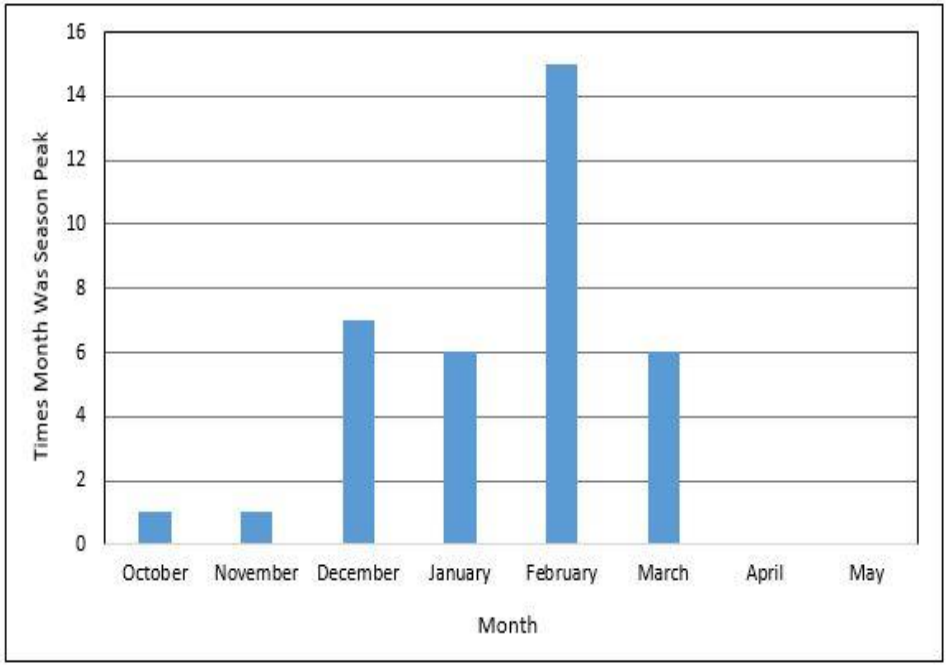
[Amer. Soc. for Microbiology]

- Beginning of winter old and vulnerable groups are vaccinated against Flu in Europe and N. USA; but still, it is not yet been possible to eradicate Flu. On the contrary, it became **more destructive in later years in spite of many new vaccine.**
- CDC estimated 61,000 deaths in US during 2017–'18 from Flu, which was higher than any season since 2009.
- Flu vaccine ineffectiveness in excess of 50,100 deaths (highest in 40 years) in UK and EU in 2017-18 . Reason: Virus is mutating.

**Hence question arises could it be similar for COVID-19?**

Following our past experience it can be speculated beforehand.

# **Flu season**, in US peaks in winter months (**February)**




[Source:https://www.cdc.gov/flu/about/season/flu-season.htm ]

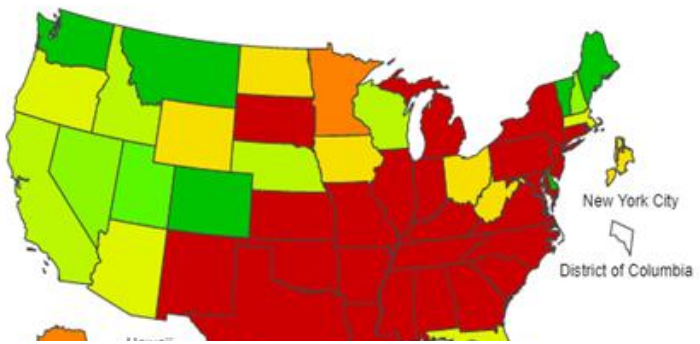
Peak flu activity during flu seasons in the US by month from 1982-1983 through 2017-2018. During this 36-year period, flu activity most often peaked in February

# **Flu**: Earlier vs. Later Period and Mutation of Virus

**Later Period**

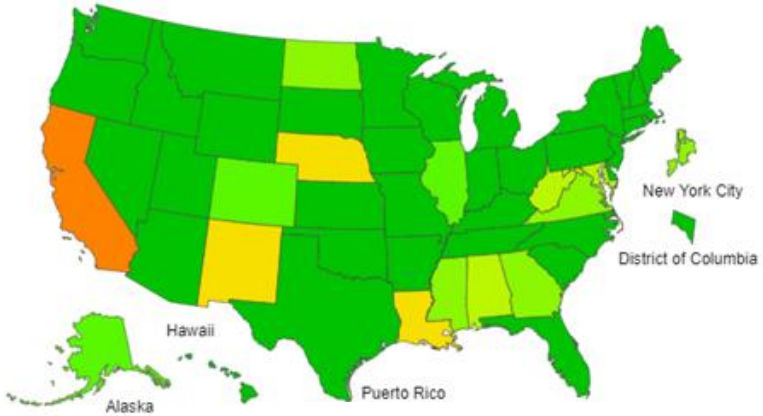
**a) 2017-18**


**b) 2016-17**

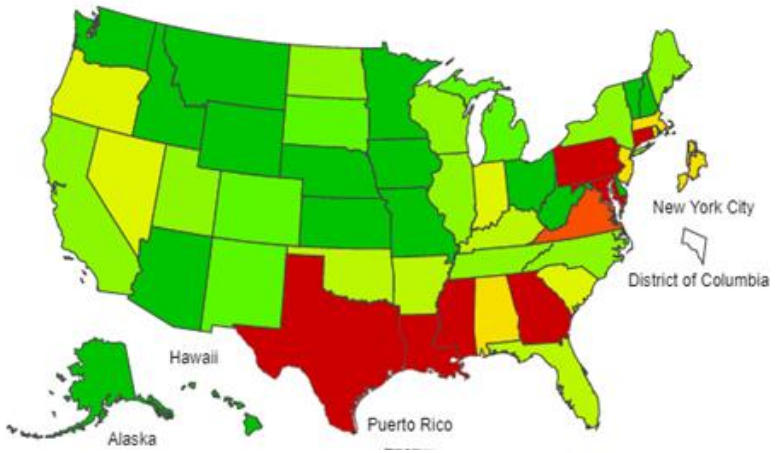



- Not yet been possible to **eradicate Flu**. On the contrary, it became more destructive in later years in spite of many new vaccines.
- Main reason: **virus is mutating over time and space.**

**c) 2009-10**




**d) 2008-2009**





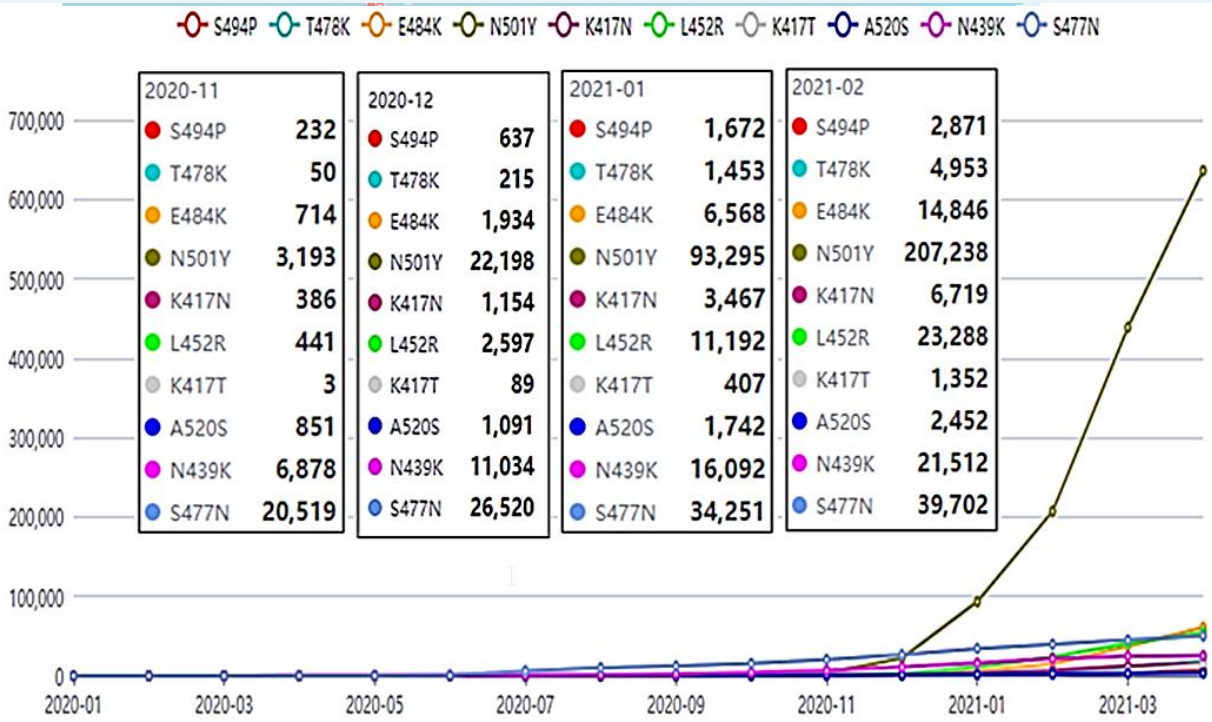


Source: https://www.cdc.gov/flu/weekly/usmap.htm

# **COVID-19**: Earlier vs. Later Period and Mutation

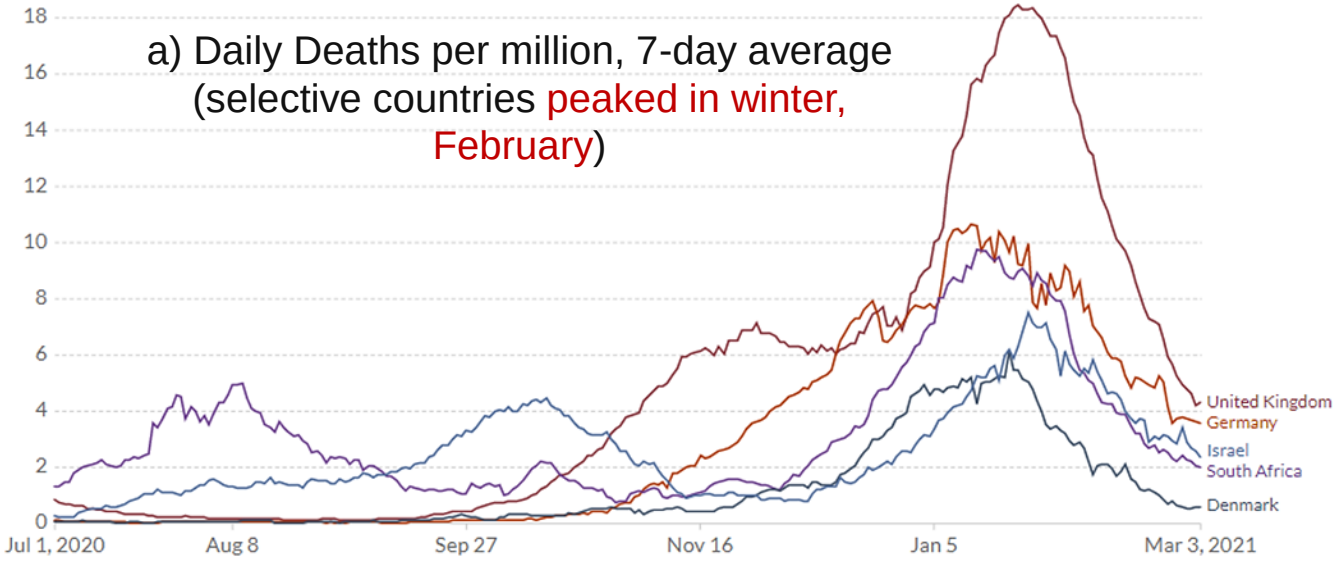
One hypothesis: time between initial vaccination and second shot to maximize immune response might serve as a sort of breeding ground for virus to acquire new mutations. [Prof Bieniasz]


Top 10 major virus mutations timeline are progressing at a very rapid rate since Dec 2020.



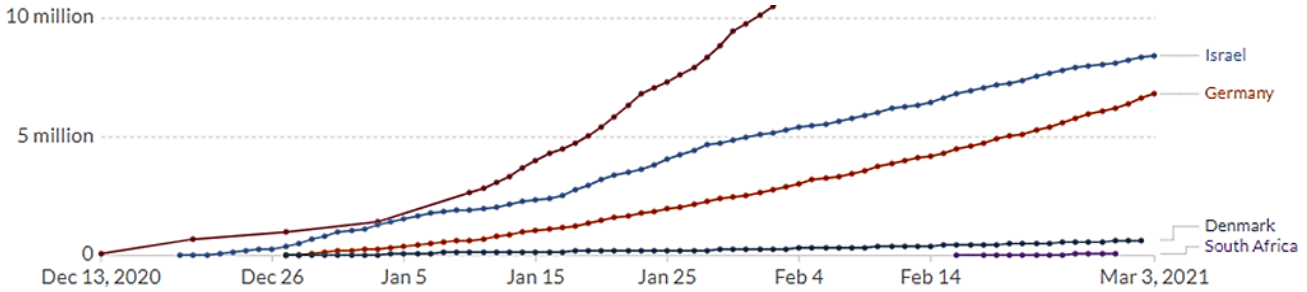

Source: https://www.cbrc.kaust.edu.sa/covmt/

# Early stages of Vaccine: Critical judgement
## Success story of UK and Israel

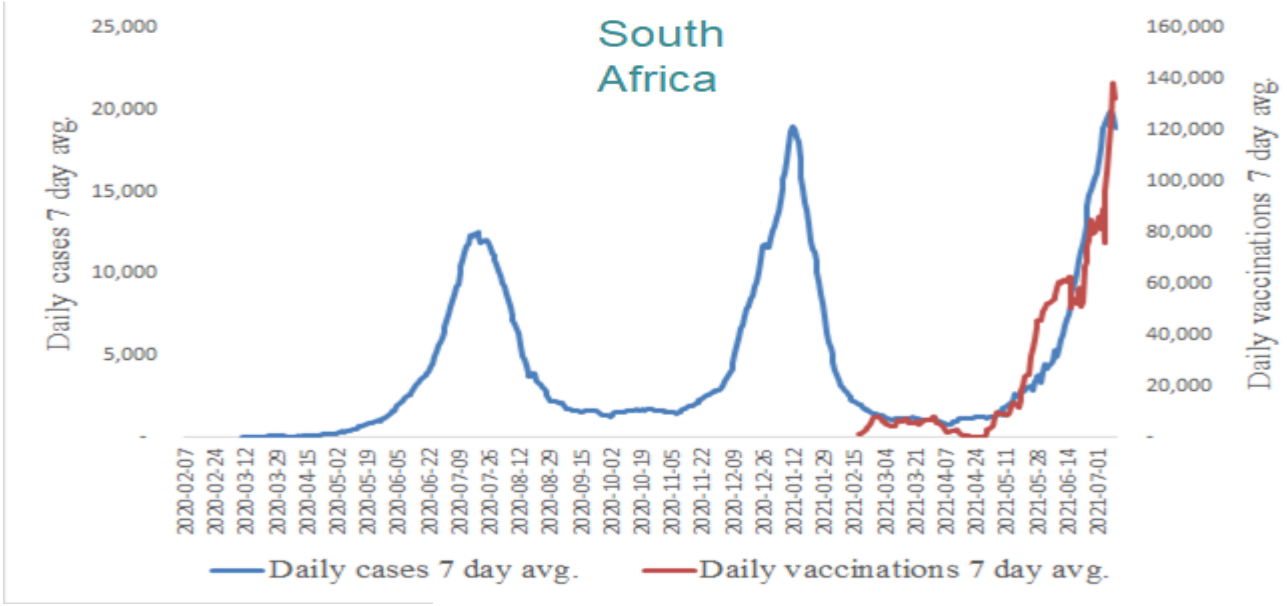



Israel, UK had highest vaccination though daily Deaths higher at beginning of March. South Africa had nominal vaccination, but daily Death though peaked higher than Israel but fell at much faster pace and even lower than Israel. Need to have critical judgement to understand vaccine success.

[ Source: https://ourworldindata.org/ ]

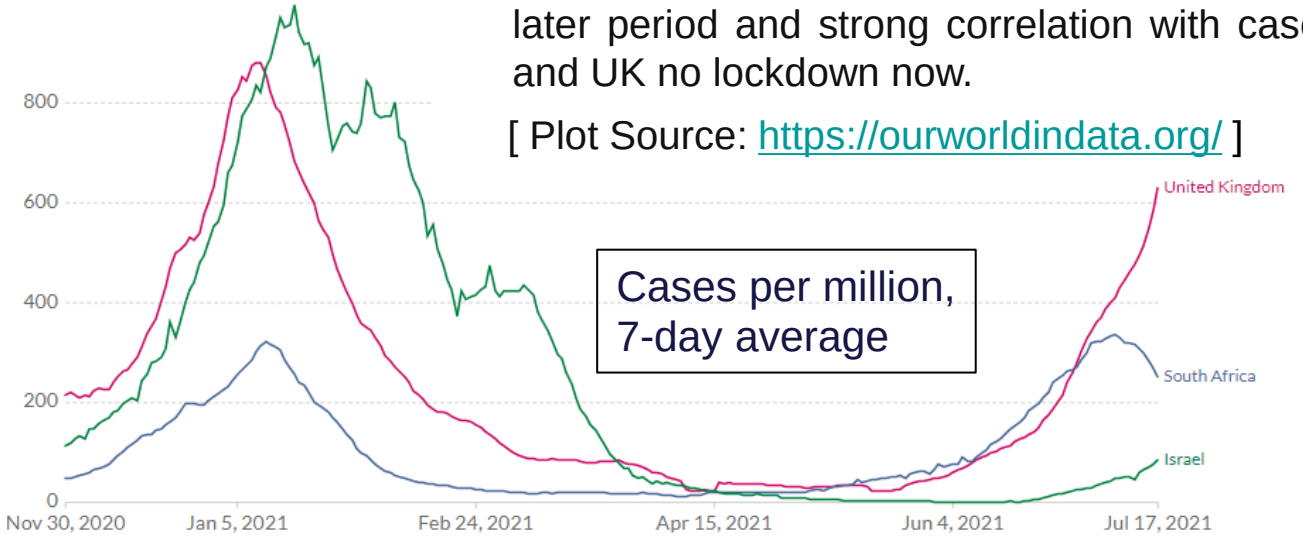



# Seasonality, Vaccine and Lockdown: Critical judgement



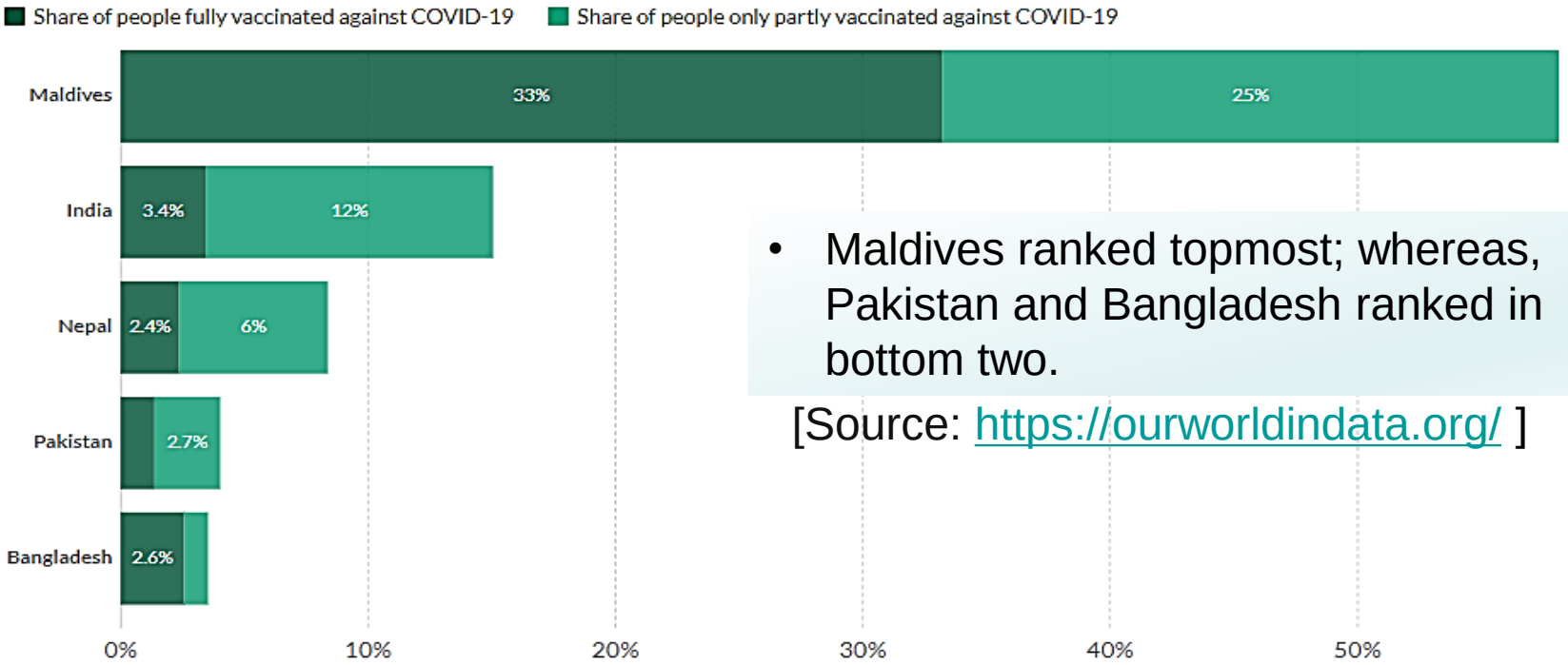

- Israel, UK, South Africa all shows a rise in July, 2021.
- South Africa vaccination dose suddenly increased in later period and strong correlation with cases. Israel and UK no lockdown now.

[ Plot Source: https://ourworldindata.org/ ]



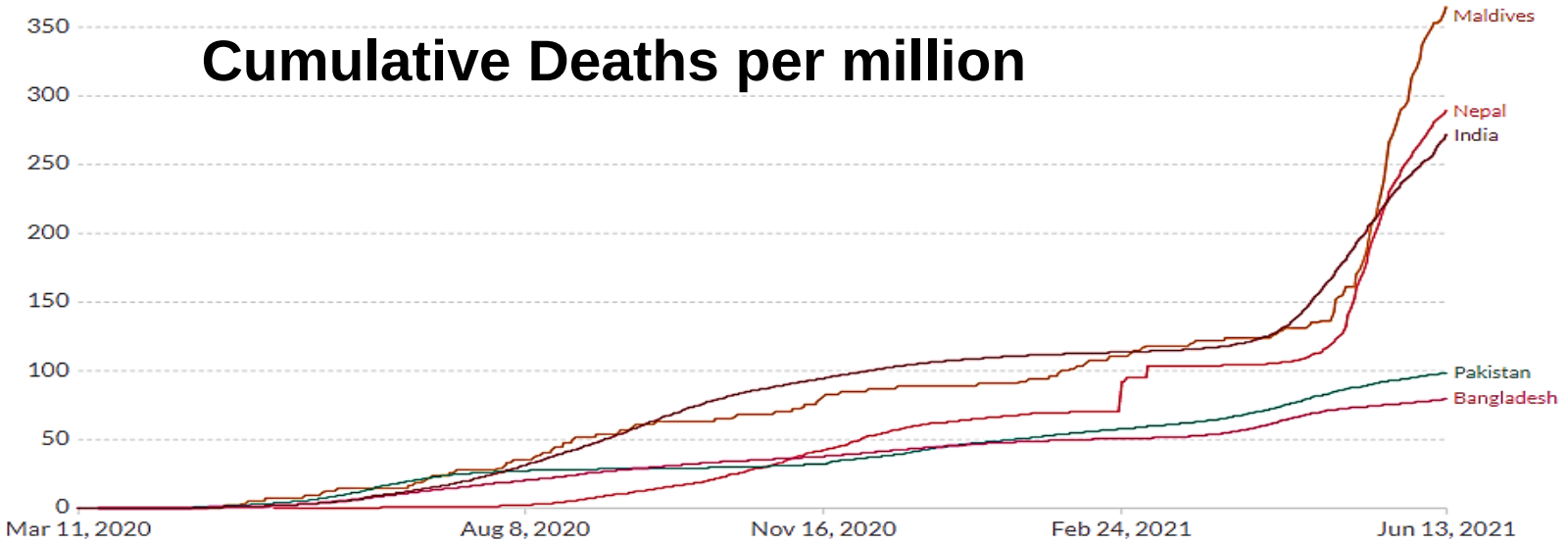
# Vaccine Dose Matters? (Analyses with Five Asian nieghbouring Countries)

# Share of People vaccinated against COVID-19

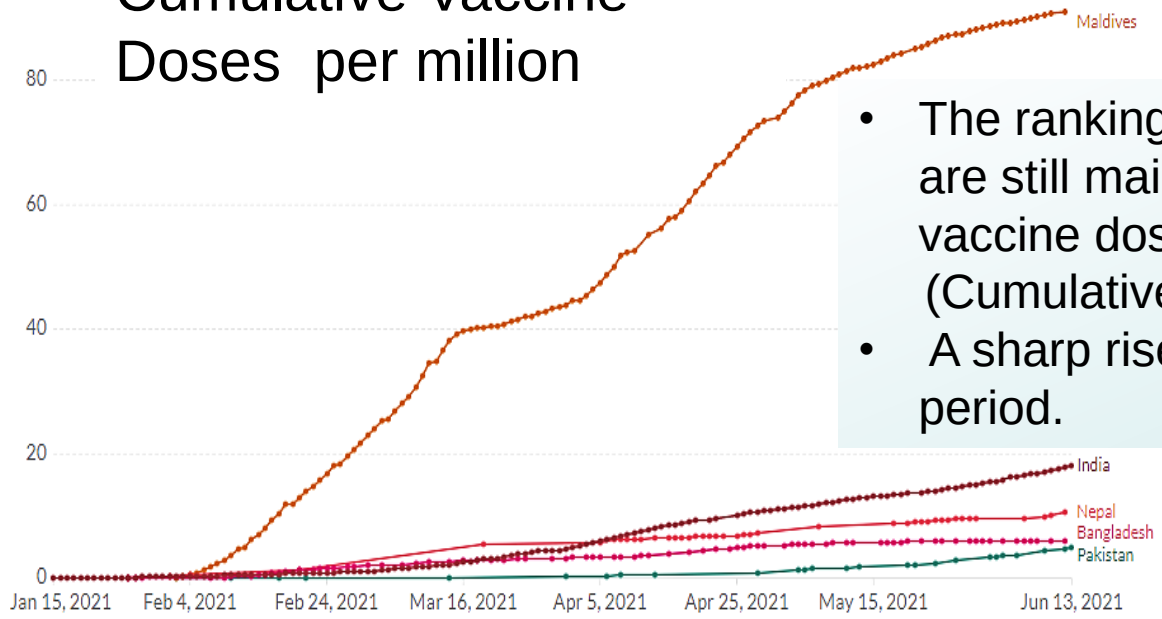



- Maldives ranked topmost; whereas, Pakistan and Bangladesh ranked in bottom two.

[Source: https://ourworldindata.org/ ]



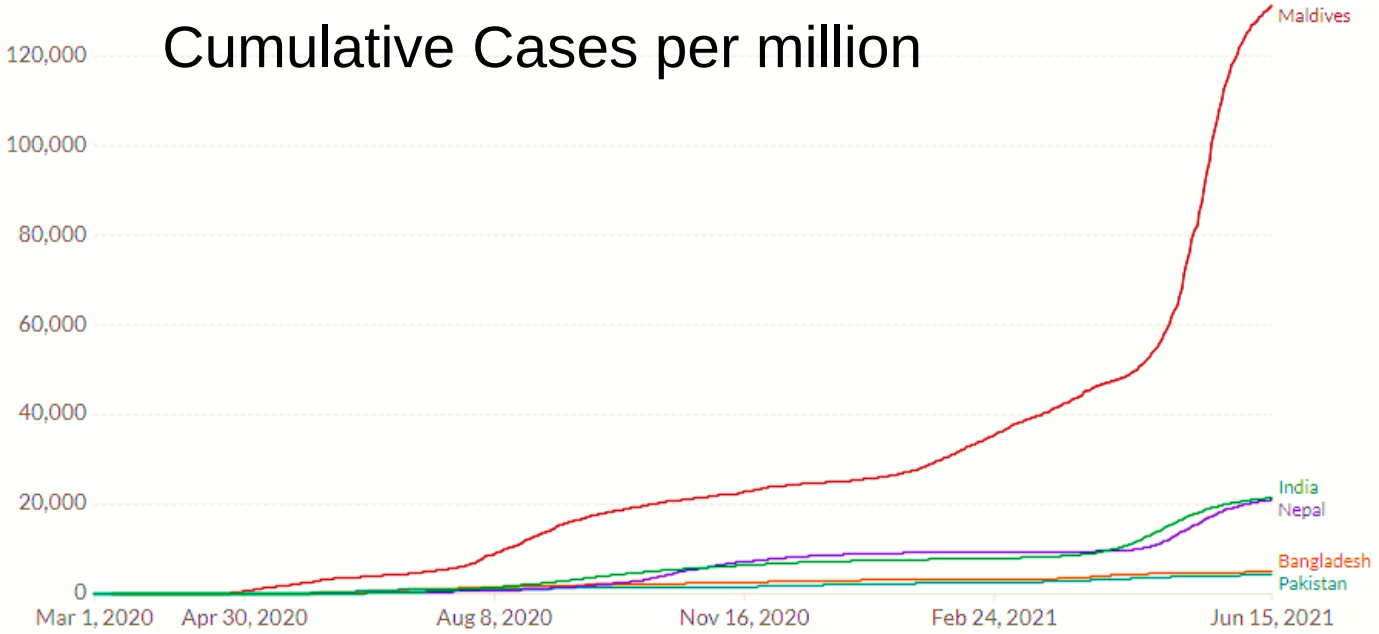
# Cumulative Vaccine Doses per million




- The ranking of those five countries are still maintained in terms of vaccine doses and Cases (Cumulative per million)
- A sharp rise for Maldives in later period.

[ Plot Source: https://ourworldindata.org/ ]

# Cumulative Cases per million



Need to ensure that vested interest groups are not overpowering the process of scientific integrity and transparency?

**Why?**


[Source: https://www.forbes.com/sites/giacomotognini/2021/04/06/meet-the-40-new-billionaires-who-got-rich-fighting-covid-19] dt 6 th April 2021

Interesting Read: **'Will covid-19 vaccines save lives? Current trials aren't designed to tell us.'**
doi: https://doi.org/10.1136/bmj.m4037. Published 21 October 2020 in BMJ - by Doshi, P

# Summary

- The most favourable state for spread of the virus was **moderately cold place and countries**; whereas **warm countries** are likely to be less affected.

- For analysing vulnerability **Deaths per Million was considered as a useful and effective metric.** Statistical analyses in the earlier period suggested the vulnerability to the disease was significantly different between moderately cold, severer cold and warm countries. Main findings are consistent throughout the period **before the start of Mass Vaccination**.

- Based on **variation of temperature** countries can move from one vulnerability state to another. Clear distinction for winter and summer in countries of Northern and Southern Hemisphere.

- Like other similar category viruses, this virus is also **very sensitive to temperature** shown by various **statistical analyses and Clinical trial experiments**. It gave valuable insights that regulating temperature can provide a useful strategy to stop and arrest the outbreak.

# (Cont.)

- **After the Mass Vaccination programme**, there are certain deviations. I addressed issues viz. seasonality, indirect consequences of mass vaccination and fast mutation of the virus after mass vaccination.

- Some countries even showed synchronized patterns between cases and vaccine doses. Those require urgent investigation about indirect effect of Mass Vaccination.

- To develop useful timely insights, some similarities between COVID-19 and Flu received attention.

- An alternative pragmatic pathway based on Heat-based solutions is mentioned which was proposed as early as 17$^{th}$ March, 2020 and is practically without side effects and no vested interest involved.

# Prediction?

Coming winter again lockdown in most countries?

Optimism with Vaccine or Pragmatism?

We have **Alternative Solutions**!!

Can we act together?

(Full Analyses:
DOI: 10.22541/au.162584191.11801390/v1)

# Interested in Details

- Roy, I. (2020a), Combating recent pandemic of COVID-19 - An urgent Solution. dt 17th March 2020, (doi: 10.13140/RG.2.2.22632.83208)

- Roy, I. (2020b), Atmospheric Variables and Additional Urgent Solutions for Combating COVID-19 dt 9th April. (doi: 10.20944/preprints202003.0366.v2)

- Roy, I. (2020c) Influence of Temperature on the Global Spread of COVID-19. *Preprints*, dt 22nd June. (doi: 10.22541/au.159301639.90704061/v2)

- Roy, I. (2020d) The role of Temperature on the global spread of COVID-19 and urgent solutions. Published version, Nov 2020. (https://tinyurl.com/2u55sc9d)

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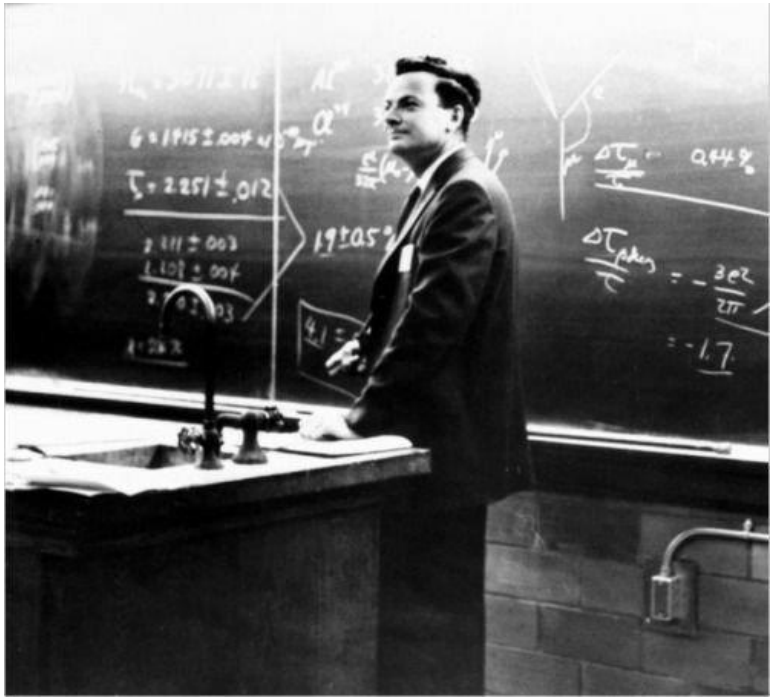
- **Casanova** L. et al., (2010). Effects of Air Temperature and Relative Humidity on Coronavirus Survival on Surfaces, Appl Environ Microbiol. 76(9): 2712.
- **Chan** KH et al., (2011). *Adv Virol***;** 2011**:**734690.
- **Cohen M. 2020.** Turning up the heat on COVID-19: heat as a therapeutic intervention, F1000Research, doi: 10.1016/j.lfs.2020.118801
- **Lowen** A. C. et al., (2007). Influenza virus transmission is dependent on relative humidity and temperature. Plos Pathogens, 3 (10), 1470–1476, 10.1371/journal.ppat.0030151
- **Marca et al.,** 2021, Thermal inactivation of SARS COVID-2 virus: Are steam inhalations a potential treatment? Life Sciences, doi: 10.1016/j.lfs.2020.118801.
- **Paulo** M. et al. (2020), Plos One, doi: 10.1371/journal.pone.0238339
- **Roy** I., (2020), Influence of Temperature on the Global Spread of COVID-19, doi: 10.22541/au.159301639.90704061/v2
- **Scafetta** N., (2020), Distribution of the SARS-CoV-2 pandemic and its monthly forecast based on seasonal climate patterns. Int. J. Environ. Res. Public Health, doi: 10.3390/ijerph17103493
- **Seung** W. K. et al., (2007). Aerobiologia. 23. 239-248.
- **Van Doremalen** N. et al., (2013). *Euro Surveill,*18(38)

# A Quote: Prof Feynman



Education isn't about the ability to remember and repeat, in which people study to pass exams, and teach others to pass exams, but nobody knows anything.

It is the ability to learn from experience, to think, solve problems, and use our knowledge to adapt to new situations.

*Thank You*