Yale SCHOOL OF PUBLIC HEALTH
Epidemiology of Microbial Diseases

Workshop: Innovation & Health Technology for Pandemics

ASEAN Military Medicine Conference Virtual Symposium

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Some examples of U.S. military participation and innovation during the COVID-19 pandemic

- Initial efforts were highly beneficial – USNS Comfort and USNS Mercy to NY and LA
- Field hospitals built and established in many cities early on
- National Guard used to provide emergency logistics and administrative support
- US. Air Force helped to deliver test kits and bring civilians back to the U.S.
- Rapid contracting capabilities leveraged
- Adaptation of field medical technologies for critical care/trauma
- Telemedicine has been a focus in the military long before COVID-19
- Operation Warp Speed – civilian-military partnership to develop and distribute vaccines

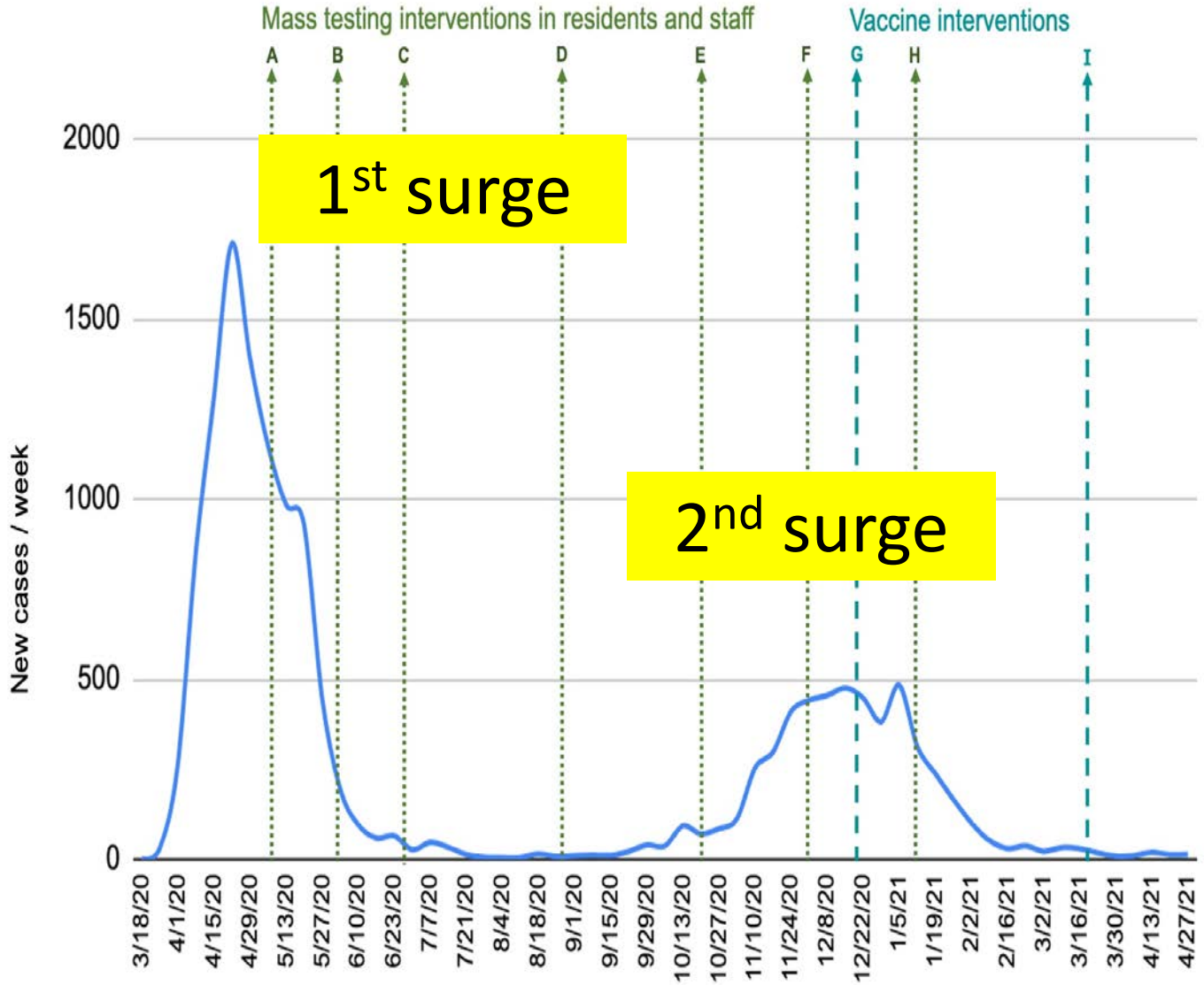
Overview of the workshop

- Didactics (20 min)
  - Overview of COVID-19 vaccines
    - Vaccine impacts in the U.S.
    - COVID-19 in the U.S. military
  - Vaccine platforms
  - Vaccine efficacy

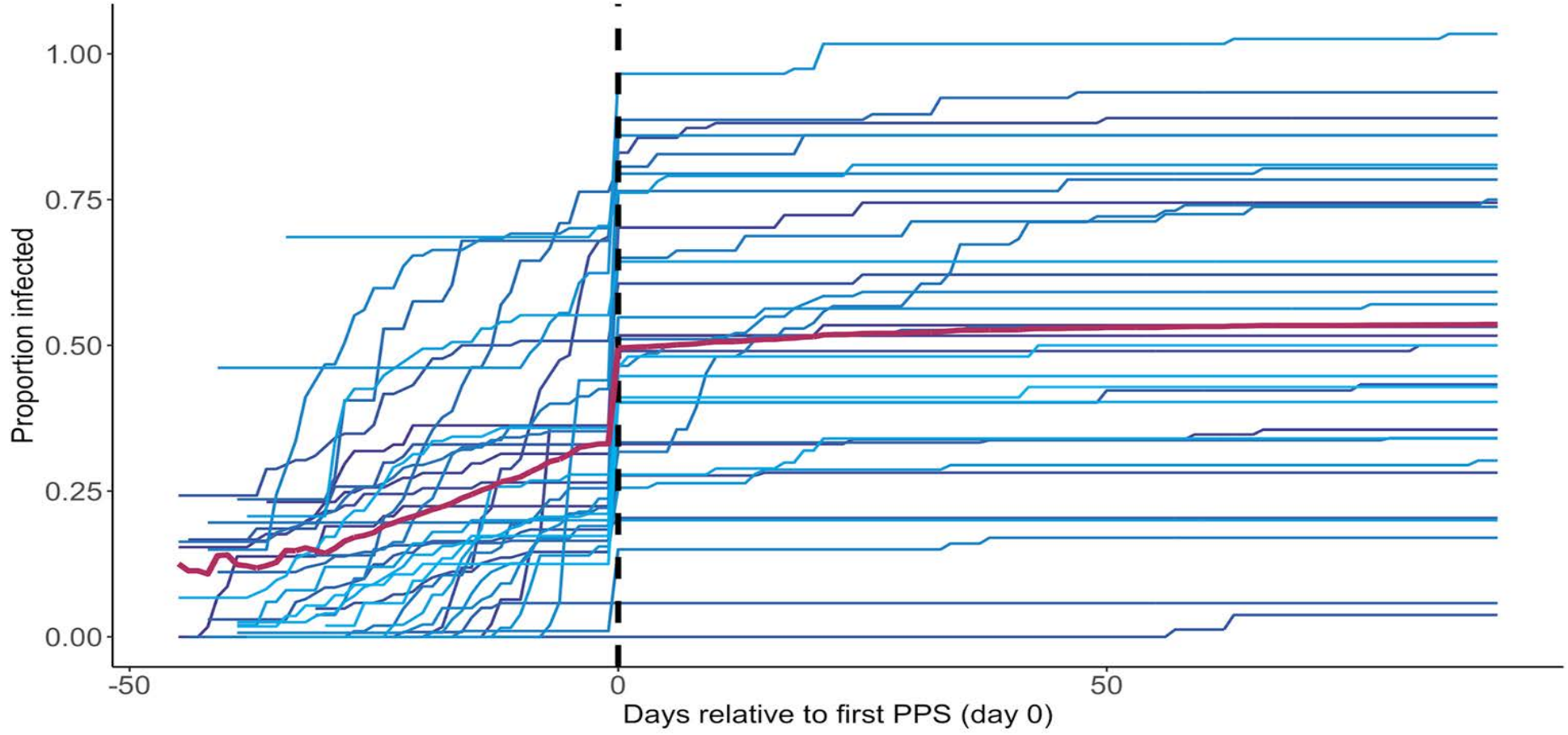
  - Global vaccine uptake
  - The U.S. military experience
  - Vaccine hesitancy and misinformation
- Small group discussions (20 min)
- Sharing session (20 min)

https://history.army.mil/covid19/historical-perspectives.html

Vaccination had a tremendous impact in nursing homes during the 2nd surge

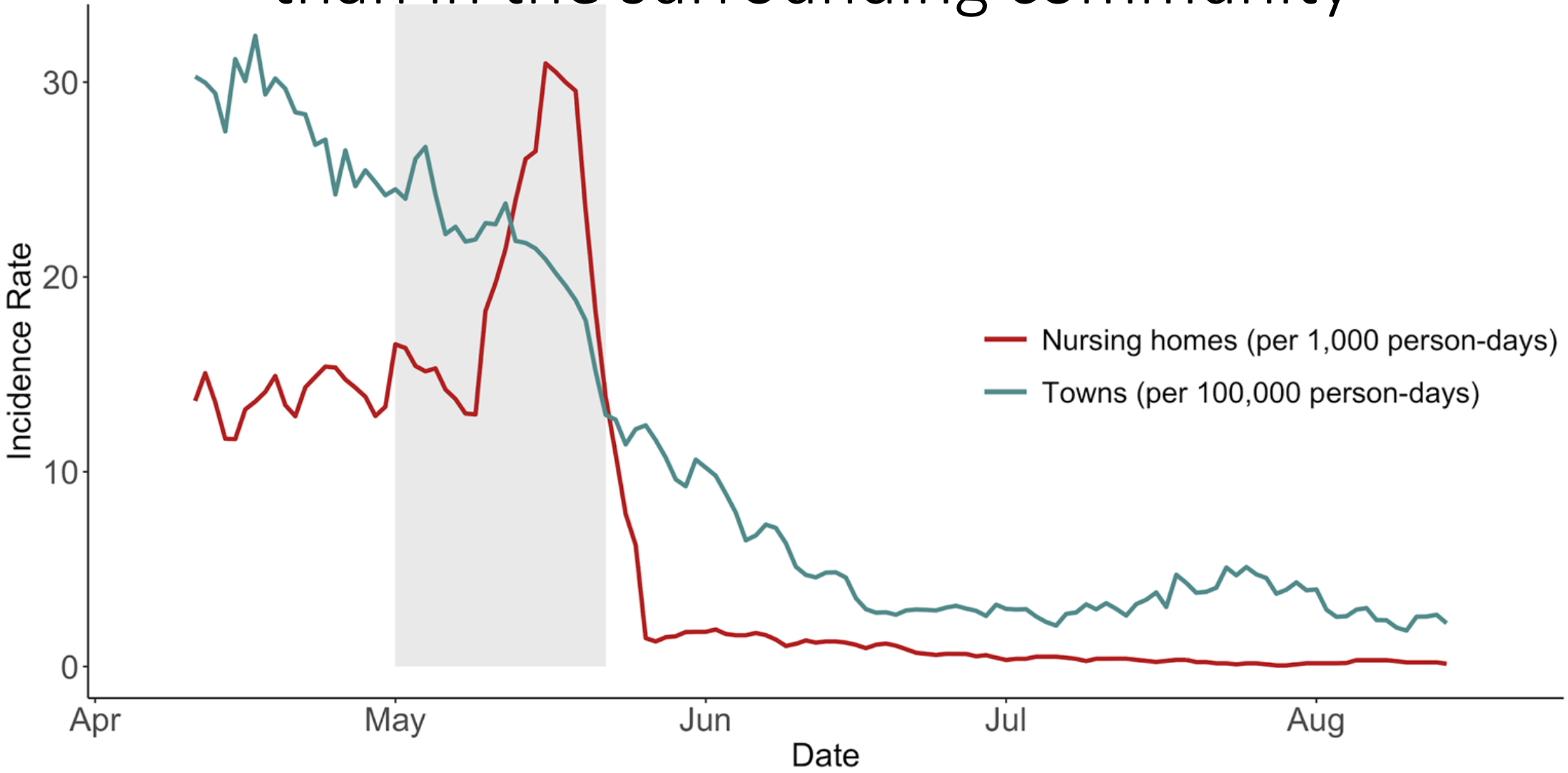


Repeat nursing home-wide prevalence testing is highly effective at containing outbreaks



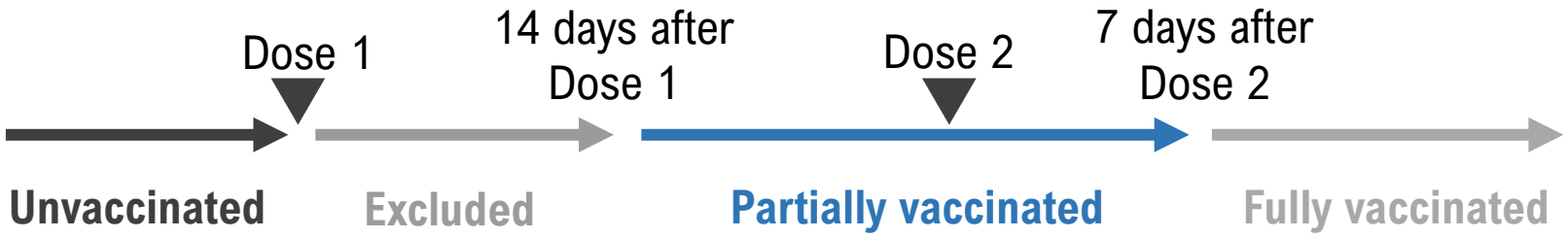
Ehrlich H, et al. *Emerging Infectious Diseases* 2021

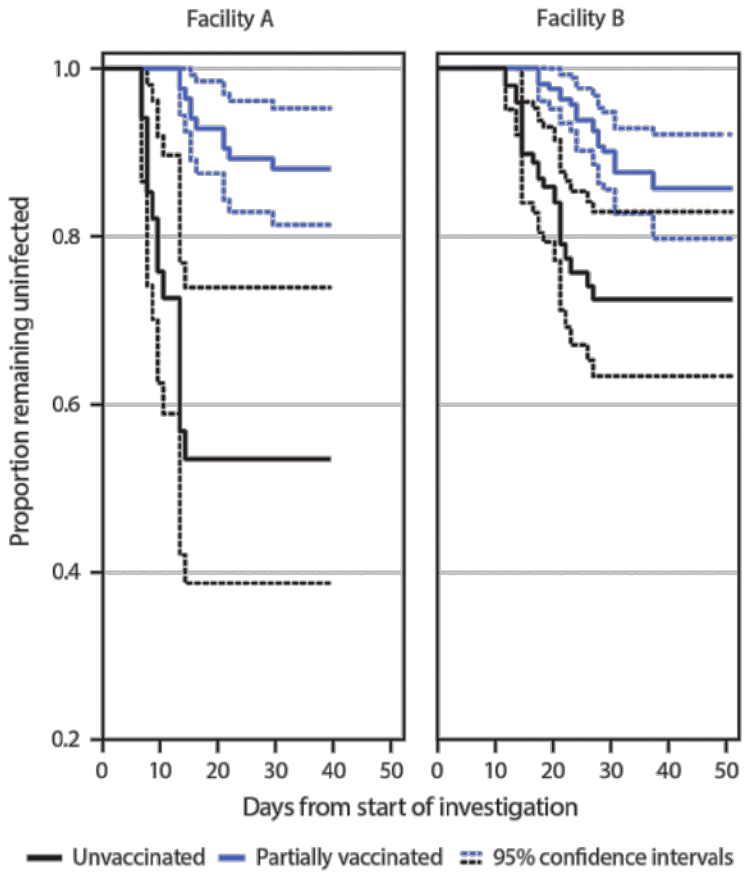
Testing may have helped rates to decline faster than in the surrounding community



Ehrlich H, et al. *Emerging Infectious Diseases* 2021

1st dose Pfizer vaccine effectiveness was estimated to be 63% in two Connecticut nursing homes experiencing outbreaks



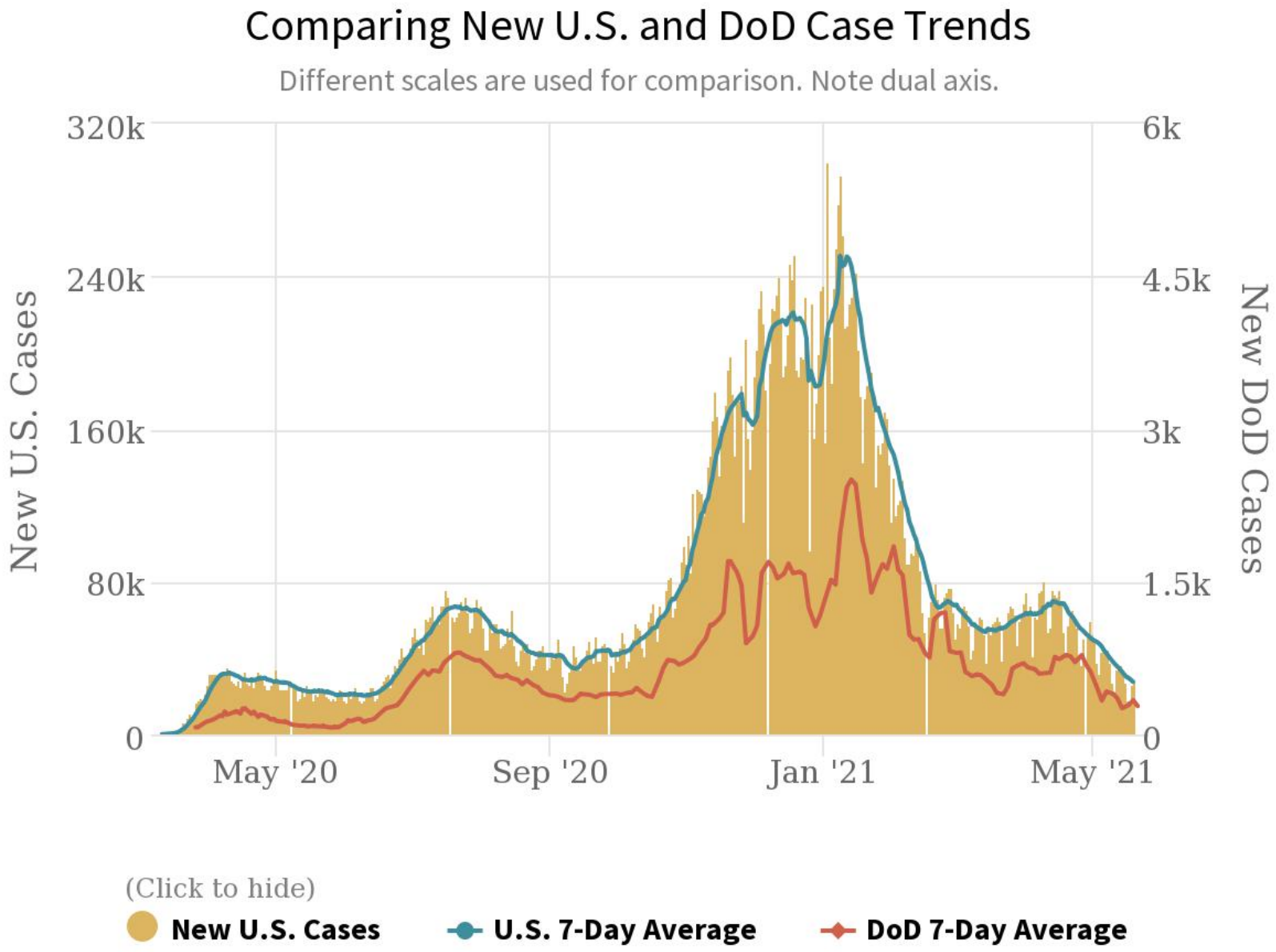


Full vaccination effectiveness could not be estimated because of declining cases and limited unvaccinated person-time.

Britton A, et al. *MMWR* 2021

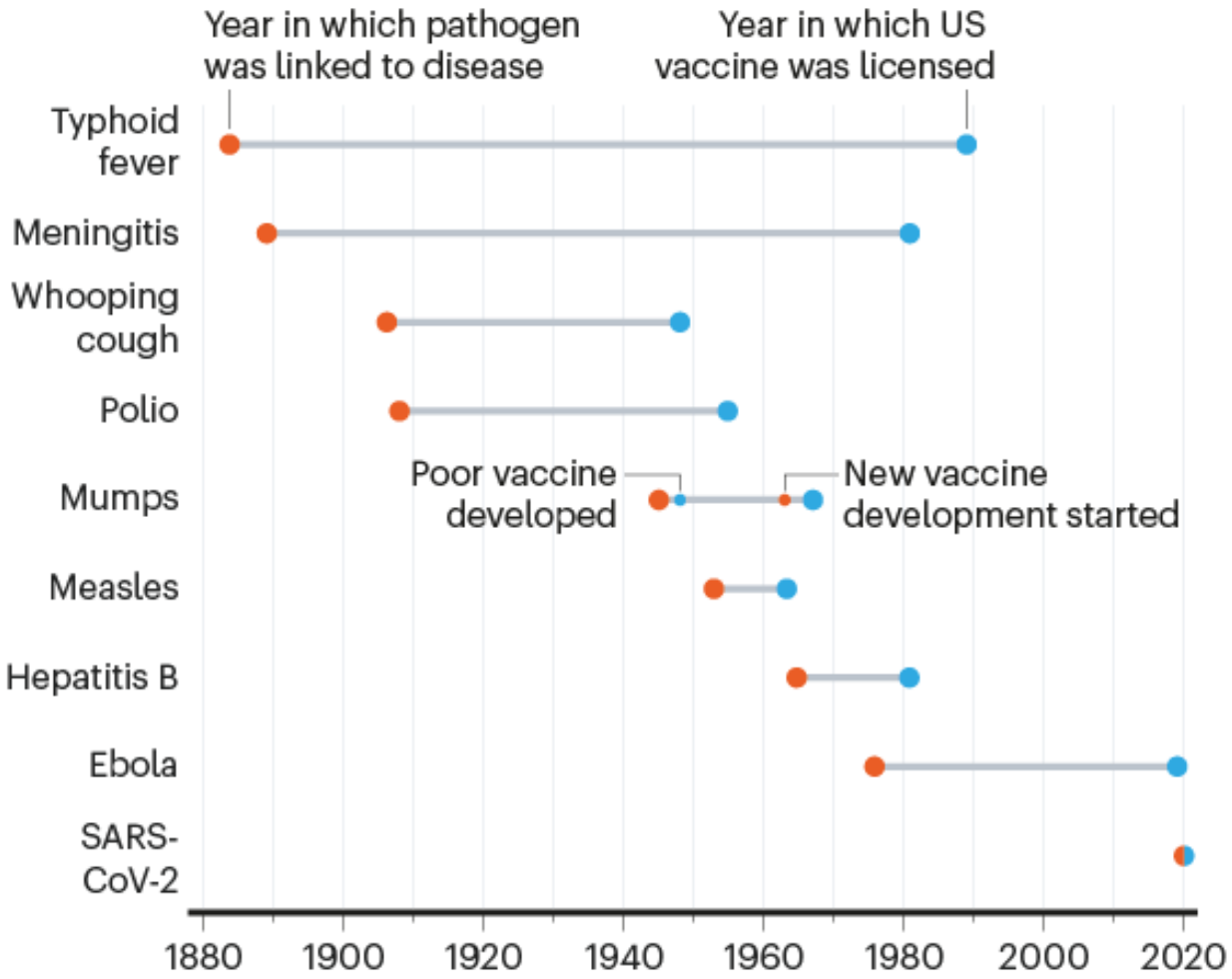
Military and COVID-19

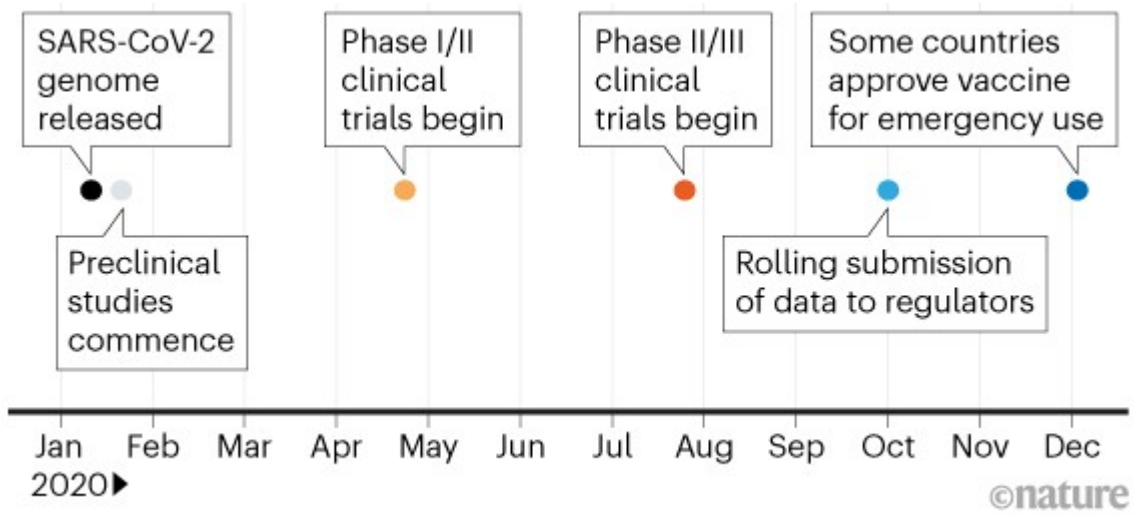
- Military are susceptible to COVID-19 and pandemics
- In the U.S., the DoD has experienced the same 3 waves as the general population
- USS Roosevelt – 1200 tested positive, 23 hospitalized
- Fatality rate much lower, as to be expected

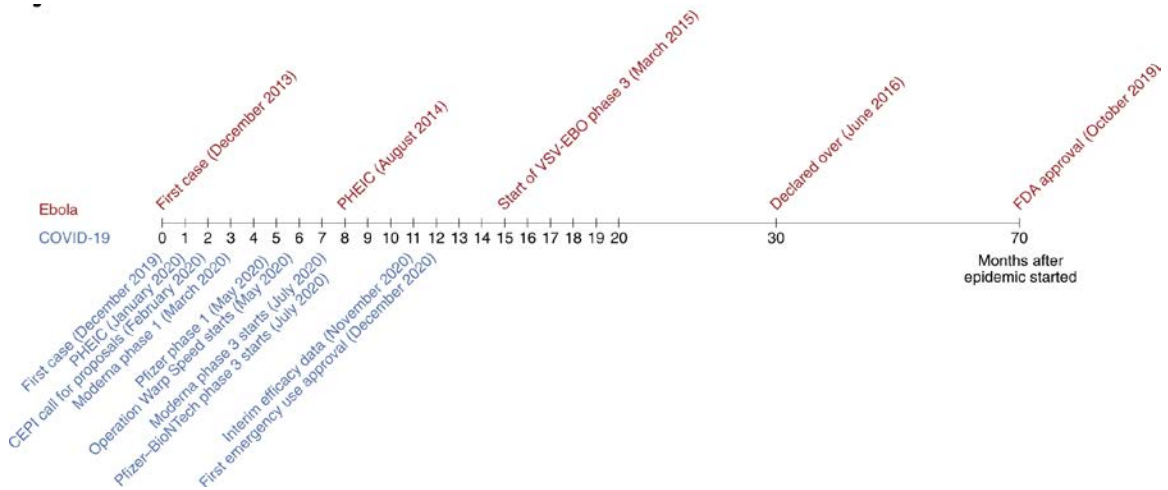


Center for Strategic and International Studies – Feb 12, 2021

What is so innovative about the COVID-19 vaccines?







https://www.nature.com/articles/d41586-020-03626-1; Excler JL, et al. *Nature Medicine* 2021

World Health Organization

R&DBlueprint
Powering research to prevent epidemics

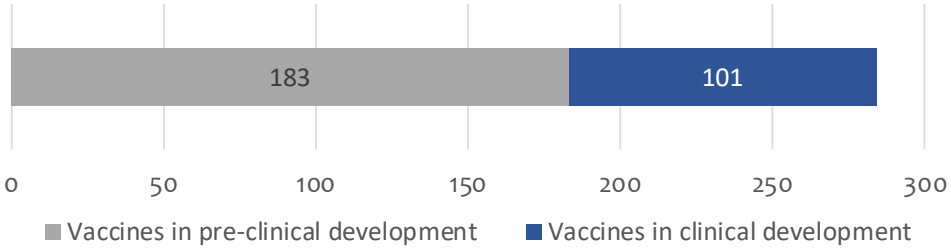
COVID-19 - Landscape of novel coronavirus candidate vaccine development worldwide

Friday, May 21, 2021

Summary Information on Vaccine Products in Clinical Development

1. - Number of vaccines in clinical development 101

2. - Number of vaccines in pre-clinical development 183

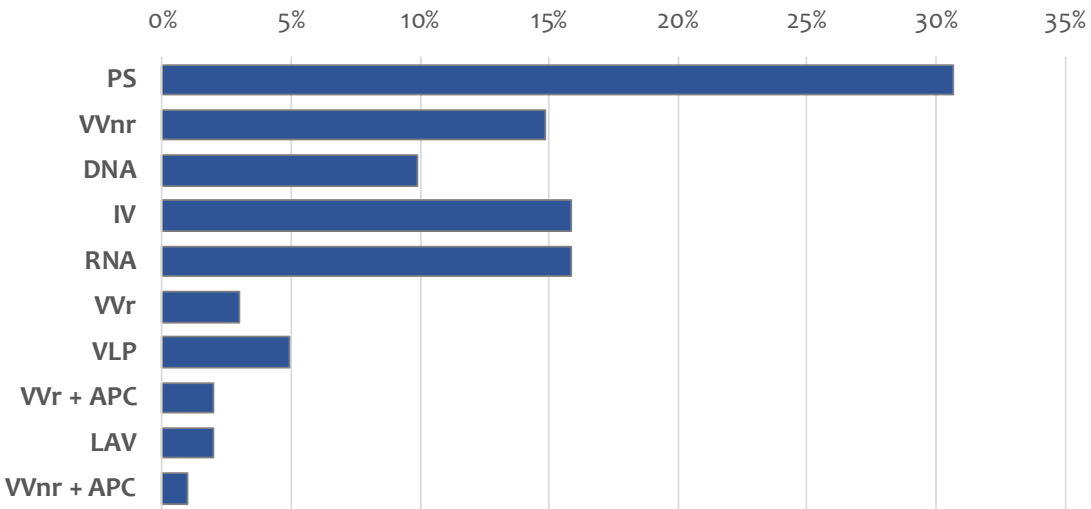


3. - Candidates in clinical phase

Filter	All

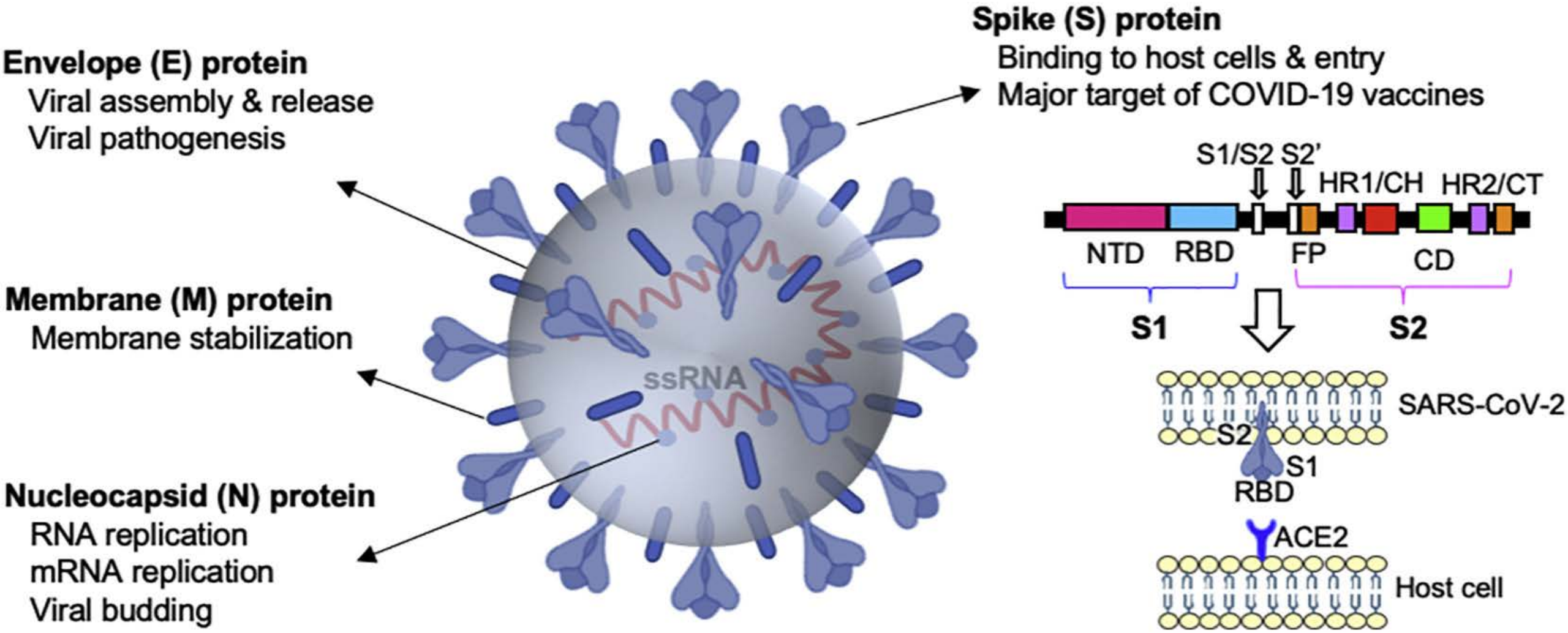
Select phase of development (default is all)

Platform		Candidate vaccines (no. and %)	
PS	Protein subunit	31	31%
VVnr	Viral Vector (non-replicating)	15	15%
DNA	DNA	10	10%
IV	Inactivated Virus	16	16%
RNA	RNA	16	16%
VVr	Viral Vector (replicating)	3	3%
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%



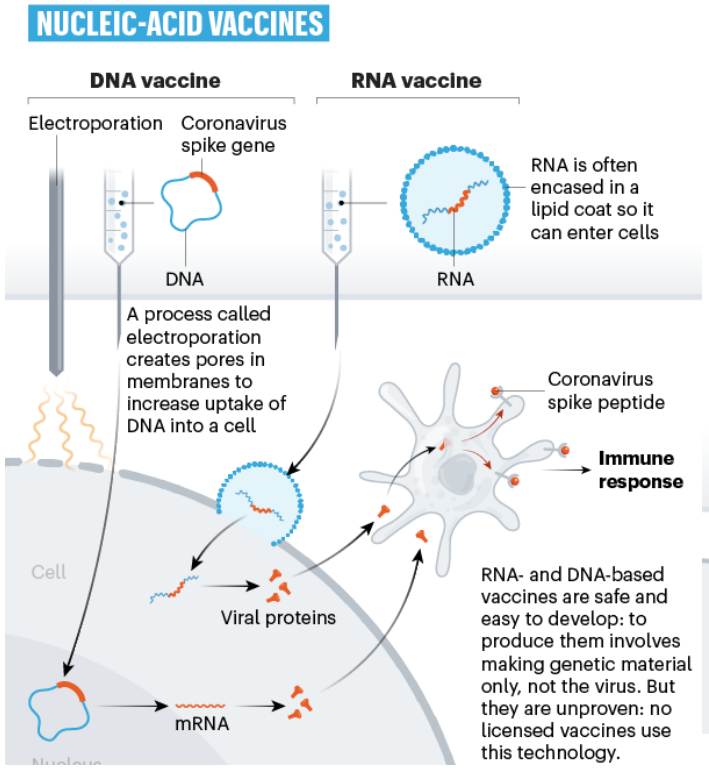
https://www.who.int/publications/m/item/draft-landscape-of-covid-19-candidate-vaccines

SARS-CoV-2 Virus structure

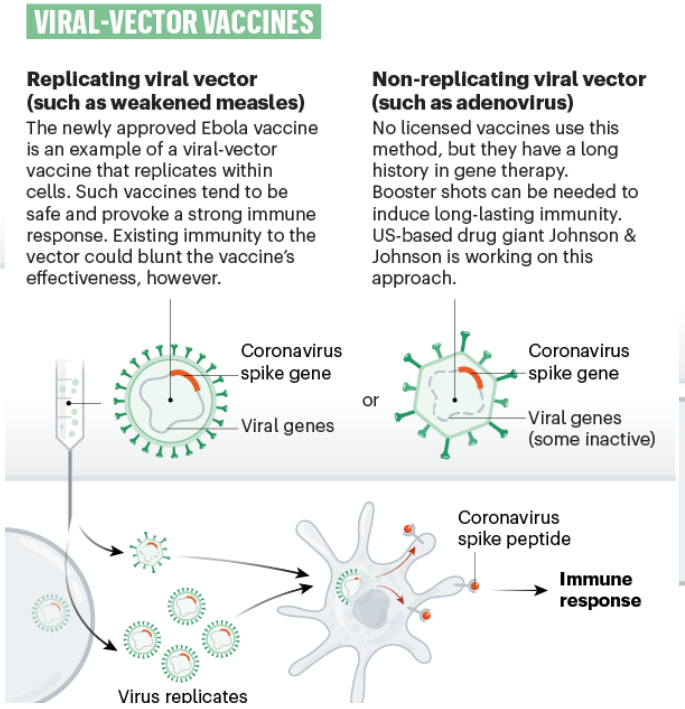


Chung JY, *Advanced Drug Delivery Reviews*, March 2021

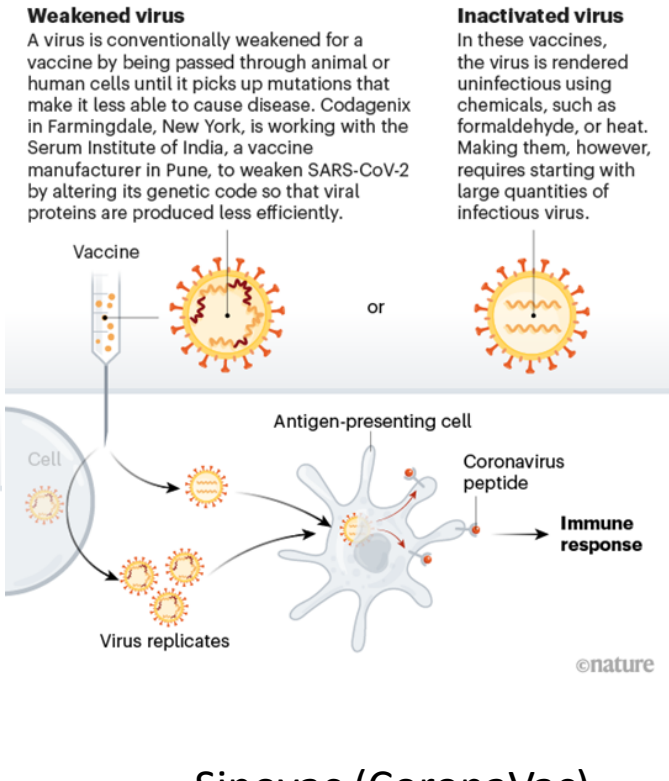
Main vaccine platforms



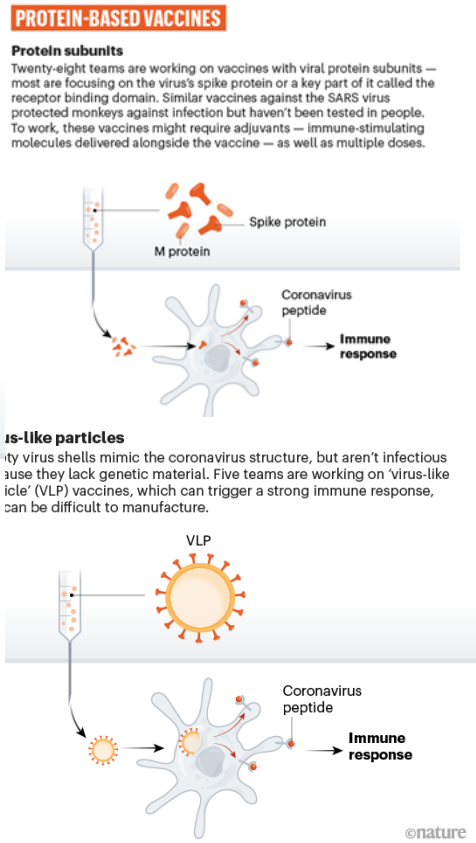
Pfizer-BioNTech (BNT162b2)
Moderna (mRNA-1273)



AstraZeneca (C19VAZ)
Janssen/Johnson & Johnson
Convidencia (Tianjin-CanSinoBIO)



Sinovac (CoronaVac)
Sinopharm (BBIBP-CorV)
Sputnik V (Gamaleya)
Covaxin (Bharat Biotech)



Novavax
Sanofi Pasteur/GSK
Serum Institute

Calloway E. https://www.nature.com/articles/d41586-020-01221-y

Nearly all vaccines have shown good efficacy, but there are some differences

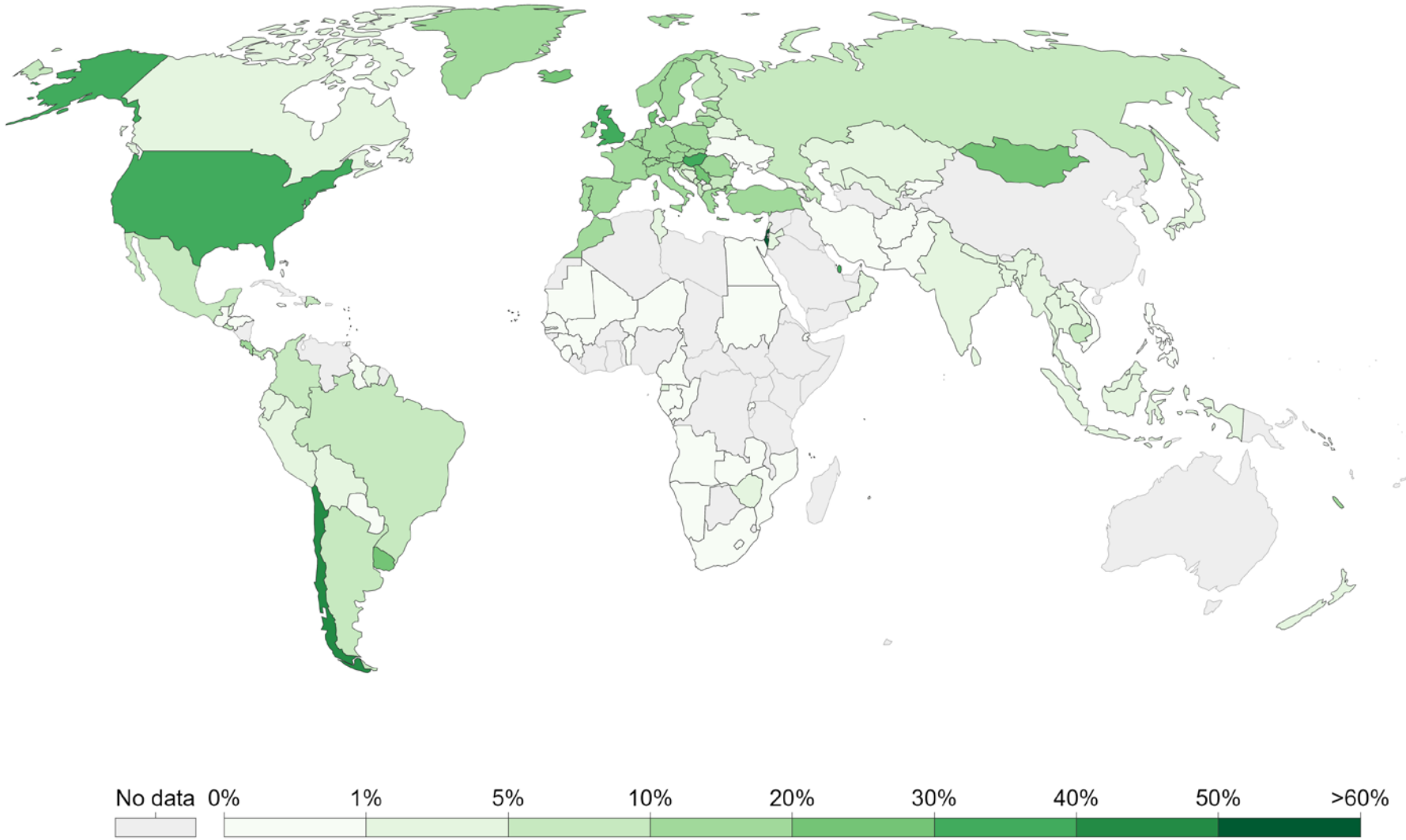
	Prevention of disease	Prevention of infection	Prevention of disease	Prevention of infection
	Ancestral/B.1.1.7		B.1.351	
Pfizer/BioNTech	91%	86%	76%	72%
Moderna	94%	89%	79%	75%
AstraZeneca	74%	52%	10%	9%
Johnson & Johnson (Janssen)	72%	72%	64%	56%
Sputnik-V	92%	81%	70%	61%
Novavax	89%	79%	49%	43%
CoronaVac	50%	44%	38%	33%
Sinopharm	73%	65%	55%	49%
Tianjin CanSino	66%	58%	50%	44%
Covaxin	78%	69%	59%	52%
Other mRNA vaccines	91%	86%	76%	72%
All other vaccines	75%	66%	57%	50%

* Shaded areas are modelled estimates; data as of May 19, 2021; IHME http://www.healthdata.org/covid/covid-19-vaccine-efficacy-summary

Share of the population fully vaccinated against COVID-19, May 23, 2021

Share of the total population that have received all doses prescribed by the vaccination protocol. This data is only available for countries which report the breakdown of doses administered by first and second doses.

Our World in Data

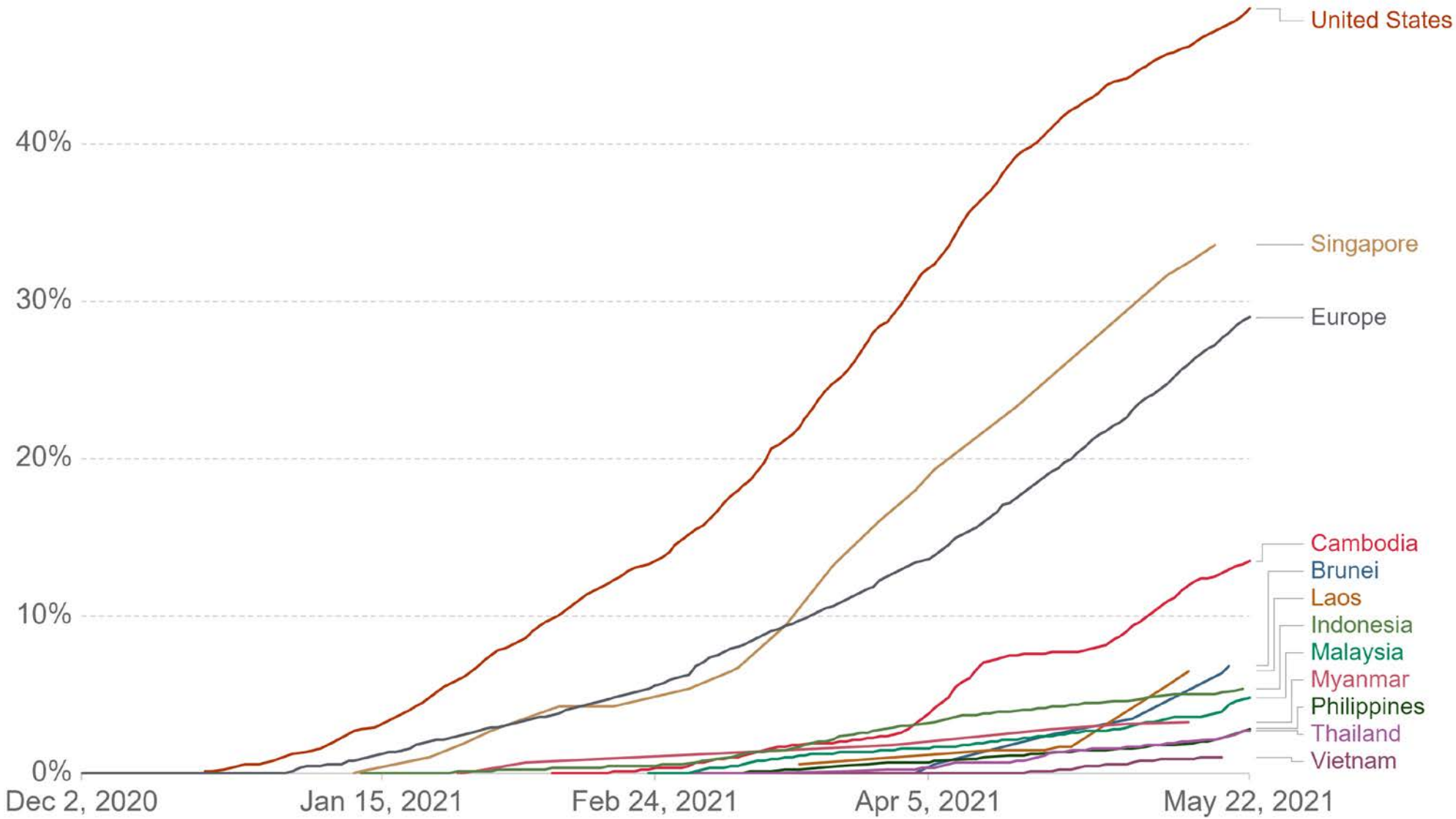


Source: Official data collated by Our World in Data – Last updated 24 May, 10:40 (London time)

Share of people who received at least one dose of COVID-19 vaccine

Share of the total population that received at least one vaccine dose. This may not equal the share that are fully vaccinated if the vaccine requires two doses.

Our World in Data

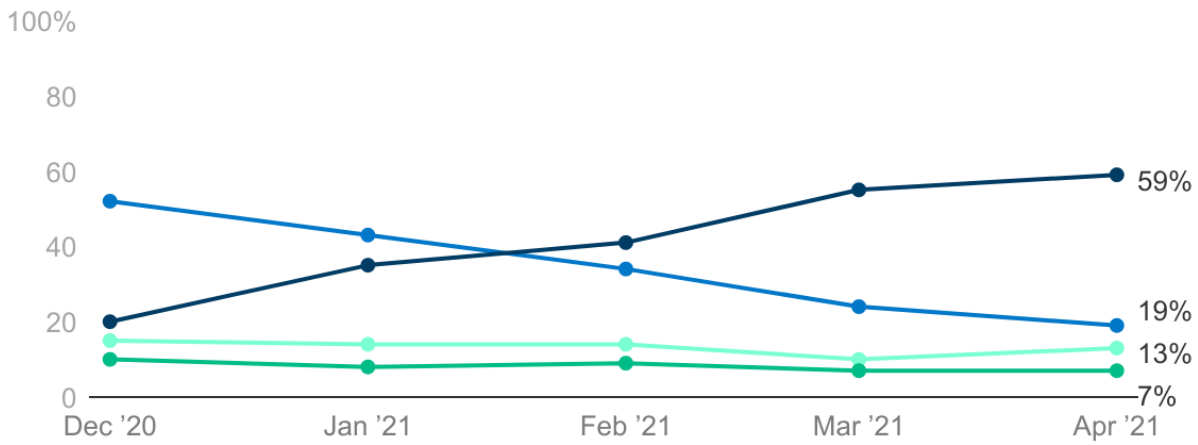


Source: Official data collated by Our World in Data

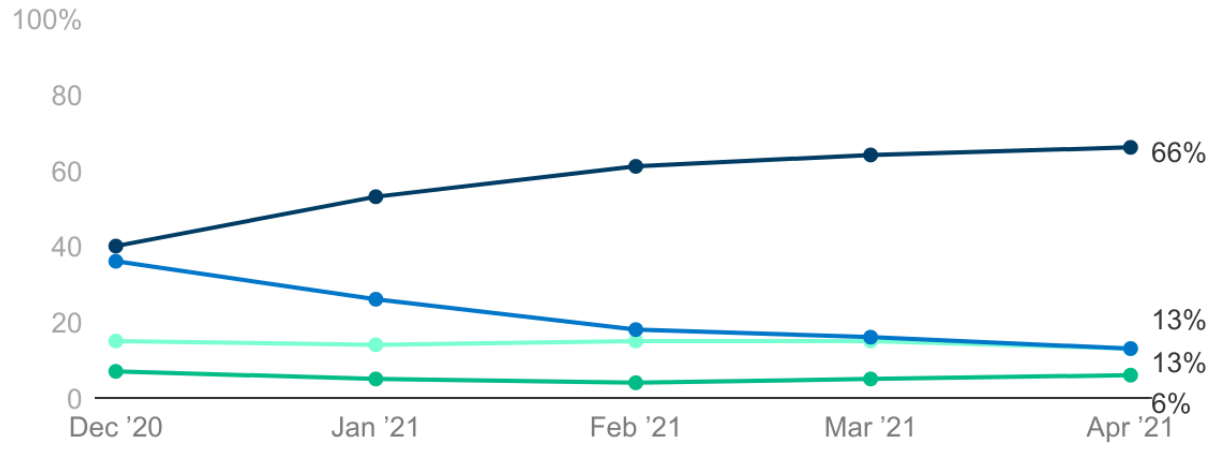
Ethnic/Racial differences exist, but can be addressed

Willingness/Acceptance for COVID-19 Vaccination in the U.S.

African-Americans



White Americans



Already gotten/As soon as possible
Wait and see
Only if required
Definitely not

https://www.kff.org/coronavirus-covid-19/poll-finding/kff-covid-19-vaccine-monitor-april-2021

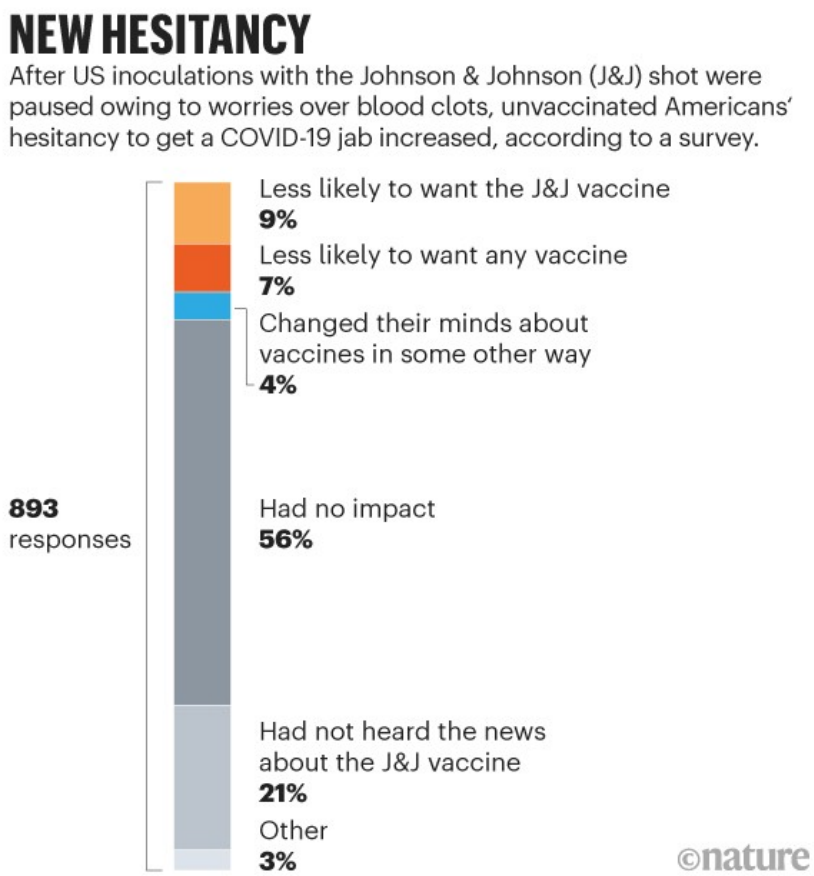
Vaccine uptake in the U.S. Military – *many issues mirror those in civilian population*

- Assess vaccine initiation/completion amongst military from December 11th to March 12th, 2021
- 361,538 (27%) initiated the mRNA vaccine
- Non-Hispanic Blacks were 28% less likely to initiate the vaccine than non-Hispanic Whites
- 93.8% who initiated, completed the series
- Females 10% less likely than males
- Major differences seen between the 4 branches
- 55% of active healthcare personnel initiated the vaccine
- As of May 21st, 2021 - ~3.4 million doses administered and ~740,000 fully vaccinated service members – key driver has also been opening it up to everyone

Lang MA, et al. *Medical Surveillance Monthly Report*, April 2021; https://www.defense.gov/Explore/Spotlight/Coronavirus/

Vaccine hesitancy and misinformation – *some based in fact, most in fiction*

Concerns/Misinformation (a sampling)
Vaccines were made too fast
The vaccine is unsafe and can kill you
The vaccine will make me test positive for COVID-19
The vaccine causes infertility
The vaccine will cause a miscarriage
Vaccinated people shed the virus
The vaccine will change your DNA



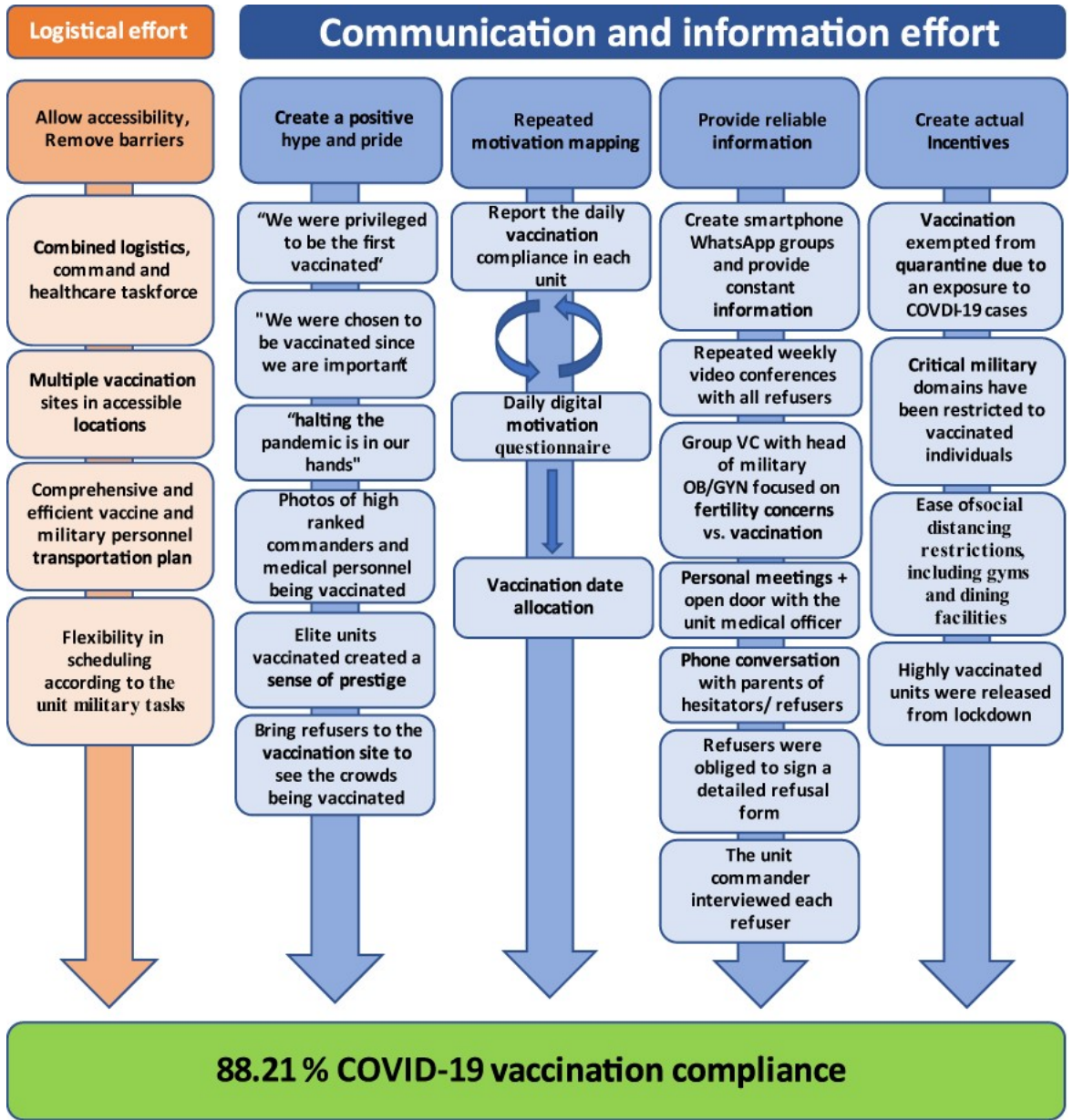
* As of March 25, 2021, the most popular news story on vaccines in 2021 was about a doctor who died after the vaccine. There is zero evidence of it being related, but it had received 5 million clicks.

How to tackle misinformation

1. Find and bookmark sites with good information
2. Remember, science can be messy and provisional
3. Set norms by modeling good behavior
4. Depoliticize the science
5. Consider before you “like” and forward social media posts
6. Set realistic goals
7. Make it about protecting your neighbors
8. Aim for immunity within your community

https://www.scientificamerican.com/article/how-to-debunk-misinformation-about-covid-vaccines-and-masks/

Actions taken to maximize COVID-19 vaccination rates among 70 military units (n = 18,719 individuals) in the Israeli defense force, and the vaccination rate achieved 54 days after the vaccination campaign was launched



Mil Med, usab183, https://doi.org/10.1093/milmed/usab183

Summary

- COVID-19 has touched every corner of the globe, and reinforced how interconnected we are
- Like previous pandemics, COVID-19 has spawned many innovations in technology and therapeutics, amongst which, vaccine development has been the most dramatic
- Many vaccines are already in usage, all with good efficacy and safety, though minor variations do exist
- Military personnel are at risk for COVID-19, and in some cases, may be placed in situations that are higher risk
- Vaccine uptake in the military is suboptimal, and faces many similar challenges to those seen in civilian populations
- Proactive measures should be taken to combat vaccine disinformation in the military