

10th Annual Dr. Ed Waits Respiratory Care Conference  
June 22, 2022

Absolute Risk  
and  
Absolute Risk Reduction  
in the  
COVID-19 Pandemic

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updated 6/25/22











## What will be covered:

3 numbers to consider when evaluating results of a clinical trial: perception

2 ways of thinking about the ongoing COVID-19 pandemic: perception

1 million ... how to conceptualize that large number: perception











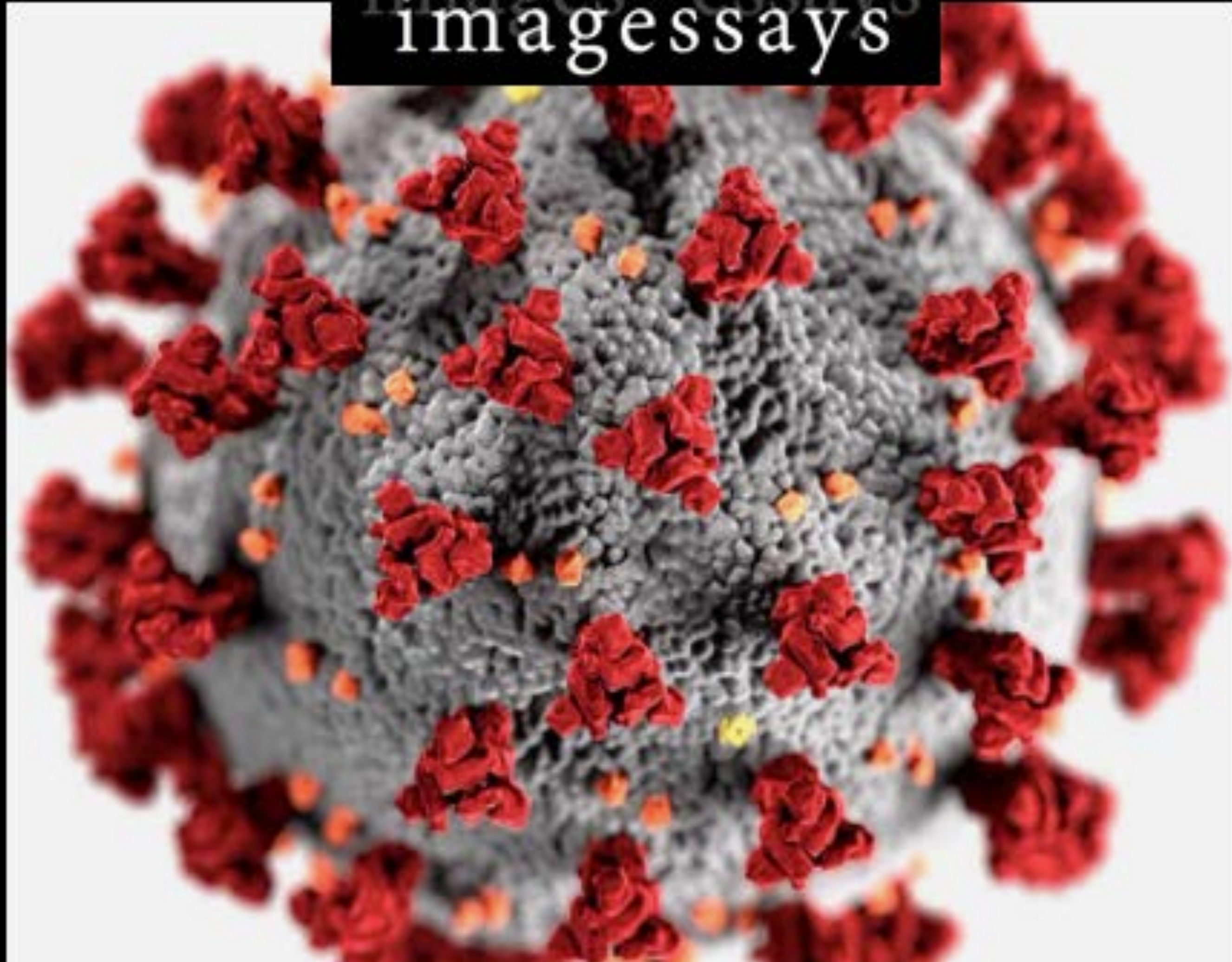








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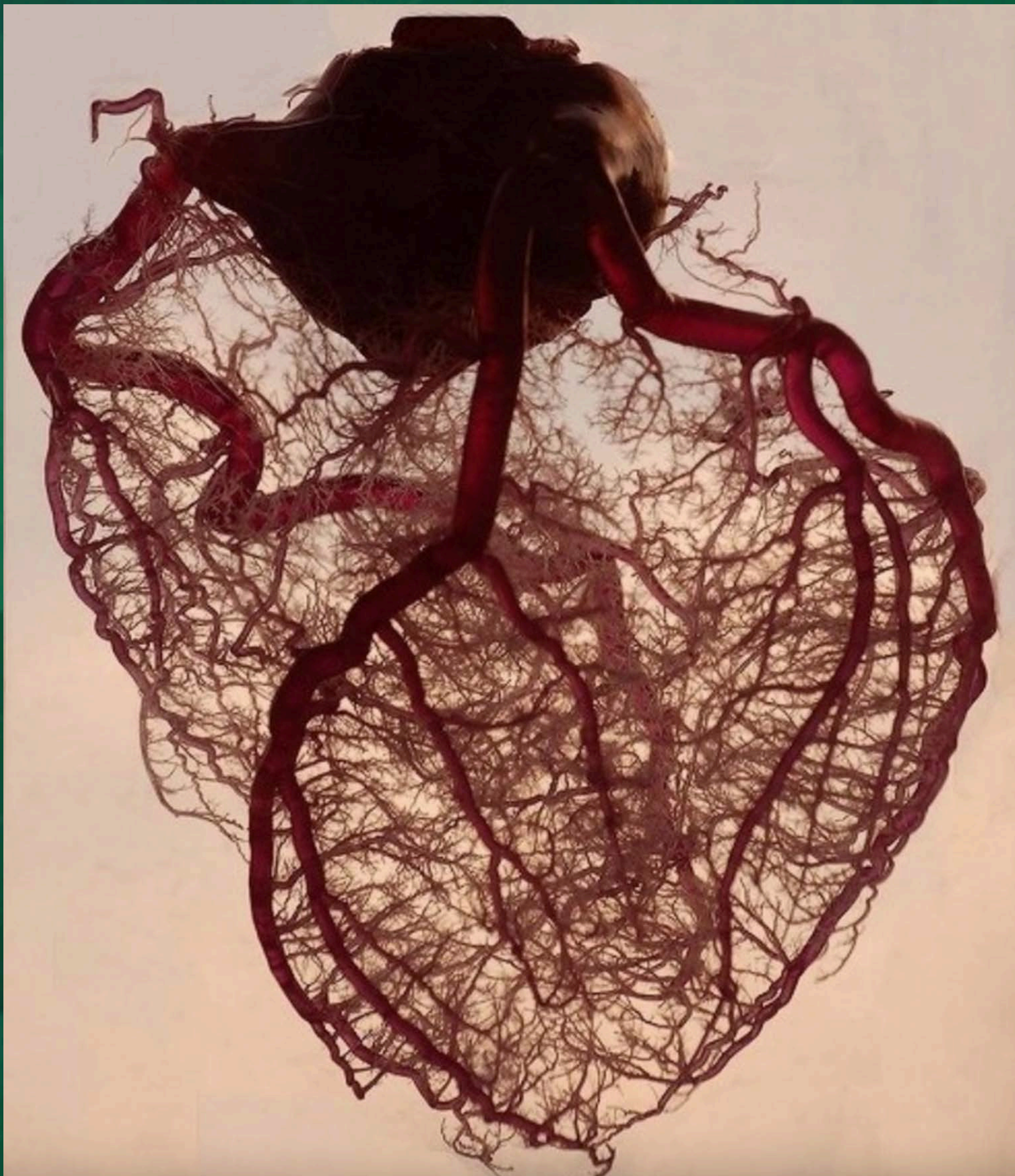
corona

See:

**\*corona\***

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[imageessays.com](http://imageessays.com)





In 1741, anatomists first named the arteries which supply heart muscle:

*“coronary arteries”*



The word  
“corona”  
is a Latin word  
meaning  
"crown", from  
the Greek  
κορώνη.













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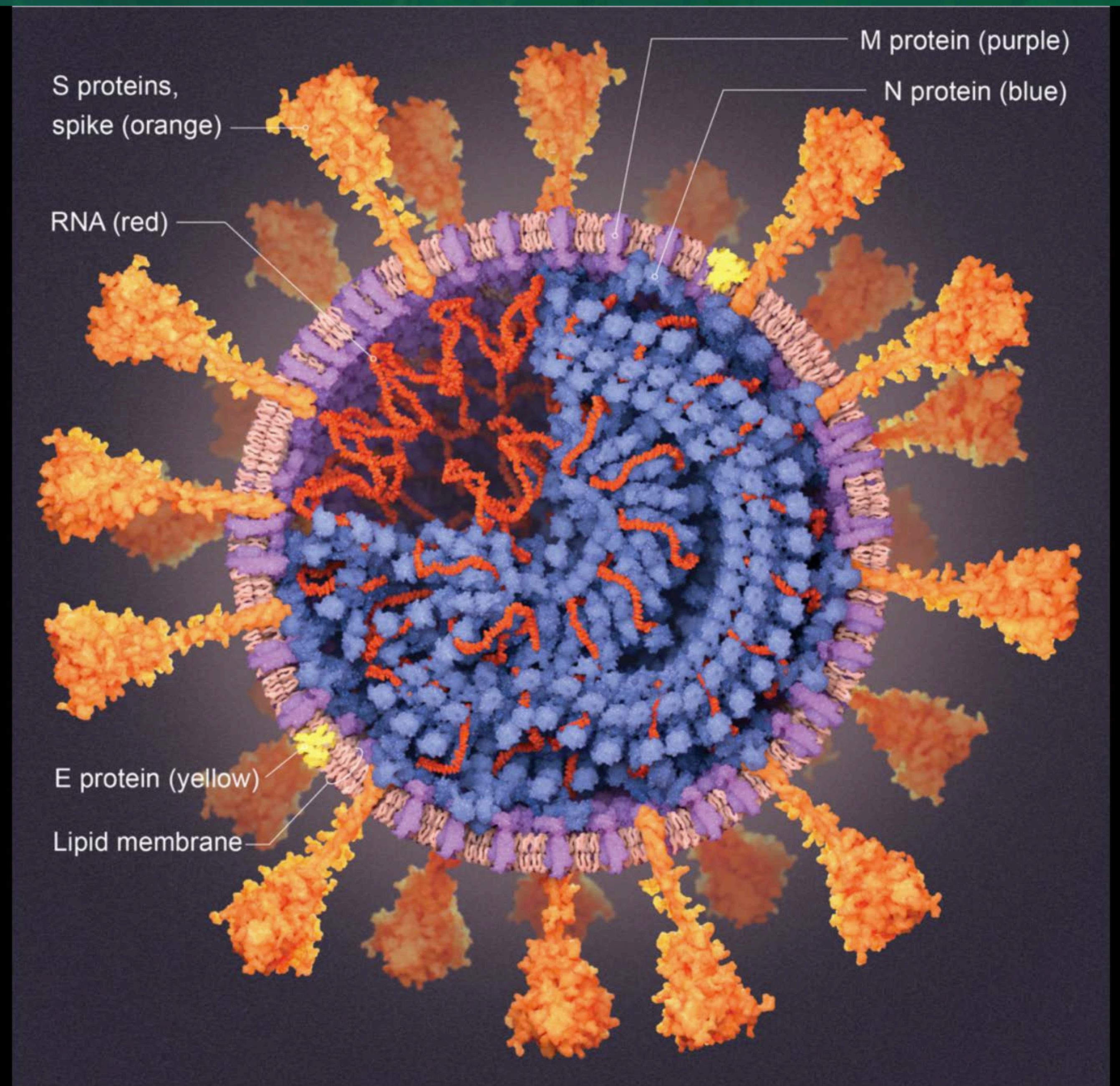






**“corona”  
during  
total eclipse of the sun**





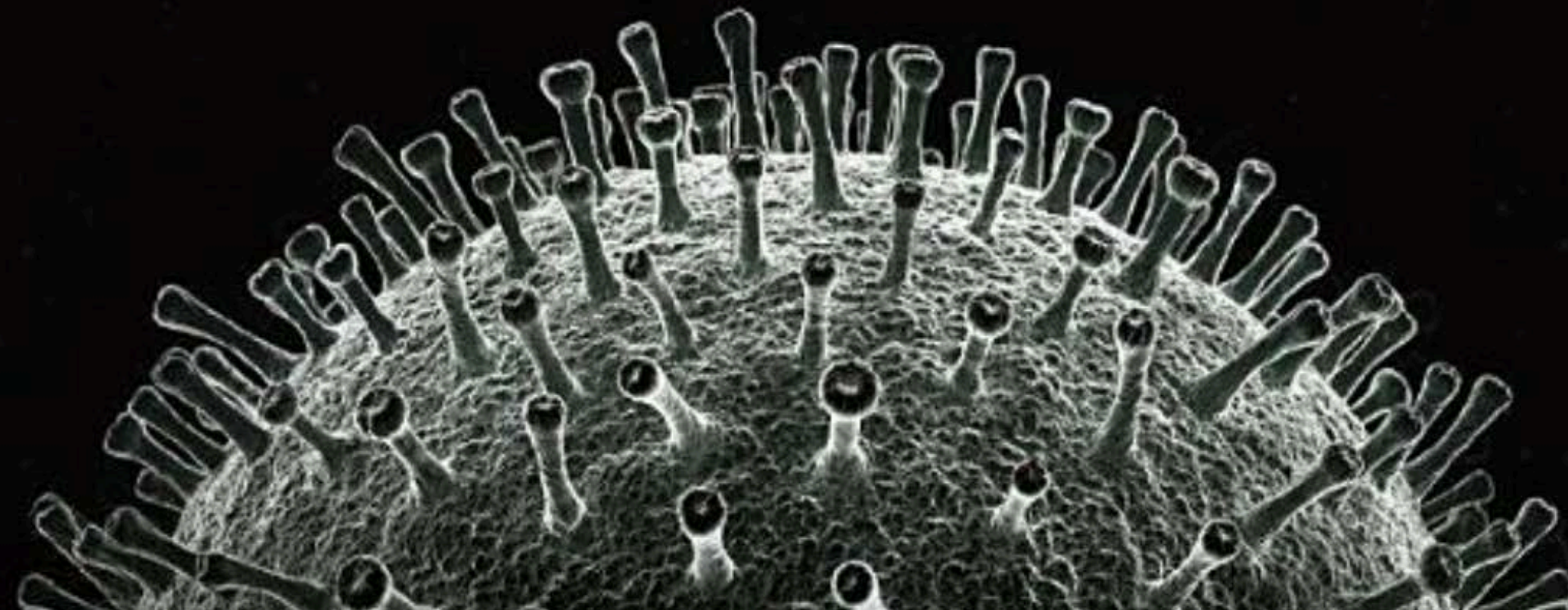
# coronavirus

A Visual Guide to the SARS-CoV-2 Coronavirus - Scientific American - July 2020



A  
CROWN  
OF  
THORNS

THE CORONAVIRUS  
AND US



The first confirmed death was on  
January 9, 2020

COVID-19 pandemic  
declared on  
March 11, 2020

As of June 22, 2022,  
more than 6,320,000 deaths  
had been attributed to COVID-19

c. 2020



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## Sudden Cardiac Arrest

Suddenly,  
a Person becomes a Patient  
... Now What?

Update on Treatment  
Guidelines for SCA

cardiocerebral

See:

**\*cardiocerebral\***

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on  
[imageessays.com](http://imageessays.com)



**“*patient*”**

from Latin verb: *patior, pati, passus sum*:

**to suffer**

**“*one who suffers*”**



## 3 numbers to consider when evaluating results of a clinical trial

- 1) adverse event rate in the untreated group: (CER)
- 2) adverse event rate in the treated group: (TER)
- 3) reduction in adverse event rate conferred by treatment (ARR)



## **Absolute Risk Reduction (%)**

**Absolute Risk Reduction (%): ARR**  
**[ reduction in adverse events (%) related to treatment ]**



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**Absolute Risk Reduction**

**(%)**

**absolute**

See:

**\*absolute\***

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**Control Group Event Rate (%): CER**  
**[ adverse event rate (%) in control group ]**

**Treatment Group Event Rate (%): TER**  
**[ adverse event rate (%) in treatment group ]**

**Absolute Risk Reduction = CER *minus* TER**



**Relative Risk Reduction (%): RRR**  
**is the *difference* between CER and TER divided by CER**

$$\text{RRR} = (\text{CER} - \text{TER}) \div \text{CER} = \text{ARR} \div \text{CER}$$

.

**This results in: RRR (%) >>> ARR (%)**



**Table 1.** 2 × 2 contingency table for SARS-CoV-2 infection in vaccine clinical trials.

	Infection	No Infection	
Vaccine	a	b	a + b
Placebo	c	d	c + d

$$\text{RR} = \frac{a / (a + b)}{c / (c + d)}$$

**(Risk Ratio)**

Absolute risk reduction (ARR):

$$\text{ARR (\%)} = \frac{c}{(c + d)} - \frac{a}{(a + b)}$$

Relative risk reduction (RRR) or vaccine efficacy (VE):

$$\text{RRR} = 1 - \text{RR} \quad \text{RRR, VE (\%)} = 1 - \text{RR}$$

Number needed to vaccinate (NNV):

$$\text{NNV} = \frac{1}{\text{ARR}}$$



## COMMUNICATING RISKS AND BENEFITS:

An Evidence-Based User's Guide

Baruch Fischhoff PhD,  
Noel T. Brewer PhD, & Julie S. Downs PhD, editors



Published by the Food and Drug Administration (FDA), US Department of Health and Human Services, [August 2011](#).

Contributors to this compilation are past or current members or consultants of the FDA's Risk Communication Advisory Committee. For more information on the committee, see <http://www.fda.gov/AdvisoryCommittees/CommitteesMeetingMaterials/RiskCommunicationAdvisoryCommittee/default.htm>

FDA Disclaimer: The findings and conclusions in this compilation are those of the individual authors and do not necessarily represent the views of the Food and Drug Administration.

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Communicating Risks and Benefits: An Evidence-Based User's Guide is available on FDA's Web site at <http://www.fda.gov/ScienceResearch/SpecialTopics/RiskCommunication/default.htm>

August 2011



US Department of Health and Human Services,  
Food and Drug Administration  
10903 New Hampshire Ave, Silver Spring, MD 20993

Cover photo: Nancy M. Ostrove, Rock formation, Valley of Fire State Park, 2009  
Cover design: Erica Munoz, 2011

**Provide numeric likelihoods of risks and benefits.** Describing risks solely with words, such as *You have a low chance of experiencing a side effect* is ineffective. It does not provide patients with the details needed to make an informed decision; it increases risk perceptions, and patients vary in their interpretations of what low and high risks are. Thus, it is imperative to provide patients with numerical estimates of the risks and benefits associated with treatment options.

**Provide absolute risks, not just relative risks.** Patients are unduly influenced when risk information is presented using a relative risk approach; this can result in suboptimal decisions. Thus, an absolute risk format should be used.

**Keep denominators constant for comparisons.** It is difficult for patients to compare across treatments when different denominators are used. A single denominator should be chosen for comparisons (e.g., 1 in 10,000, 337 in 10,000). It is easier for patients to understand whole numbers (e.g., 1 in 10,000) rather than fractions or decimals (.01 in 100); thus, if risks are very small, larger denominators will be necessary.

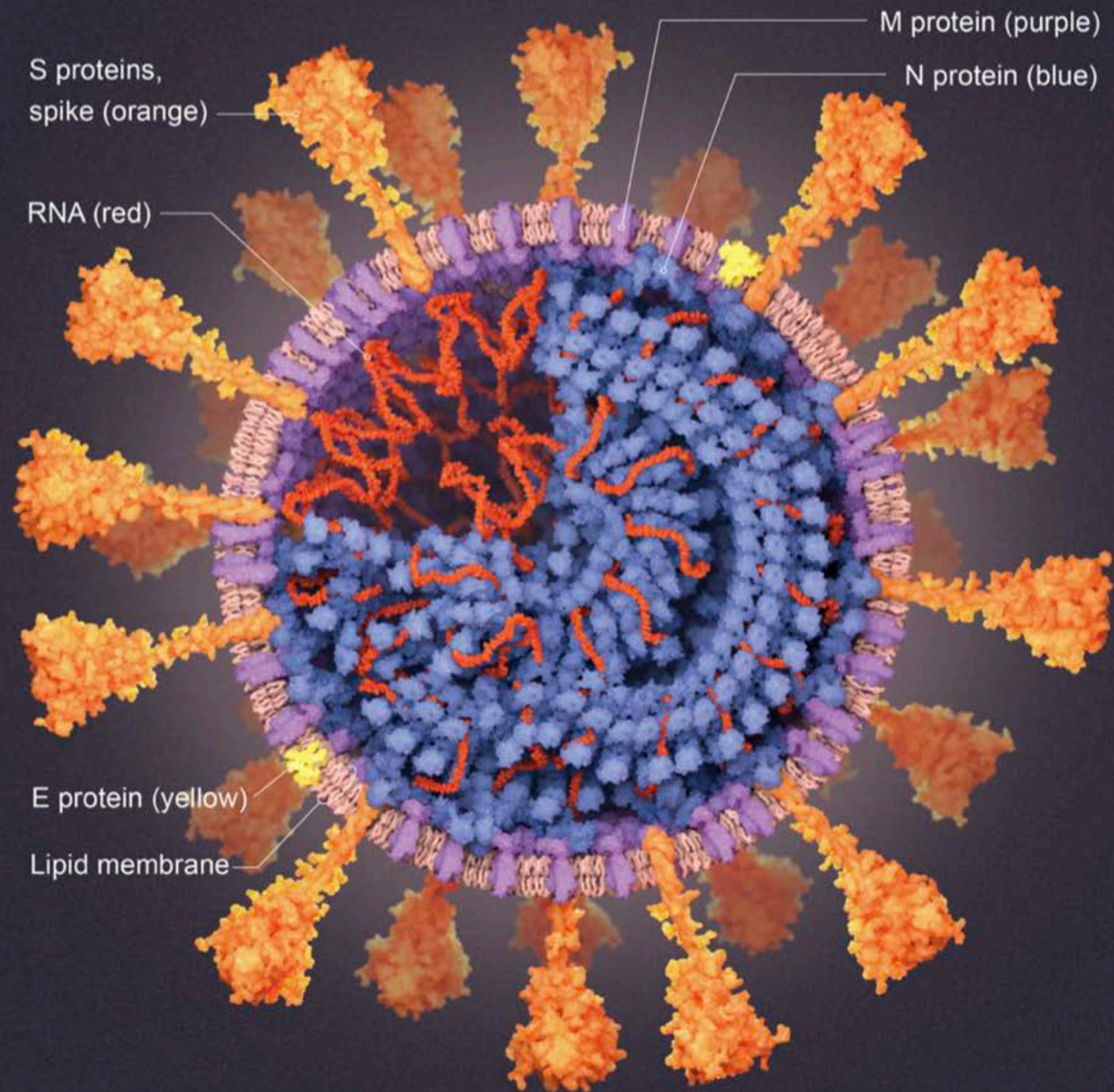


**1, 2, 3 - for clarity and transparency  
of clinical trials reporting:**

- 1) Control Group Event Rate (%)**
- 2) Treatment Group Event Rate (%)**
- 3) Absolute Risk Reduction (%)**



A SARS-CoV-2 virus particle wafting into a person's nose or mouth is about 100 nanometers in diameter—visible only with an electron microscope. It is a near sphere of protein (cross section shown) inside a fatty membrane that protects a twisting strand of RNA—a molecule that holds the virus's genetic code. Proteins called "S" form spikes that extend from the surface and grab onto a human cell, hundreds of times larger, so the particle, or virion, can slip inside; the crown, or corona, appearance gives the virus its name. Structural proteins—N, M and E—move inside the cell, where they help new virions form.





**Infectious Disease**

**Transmissible**



A thing of beauty is a joy forever:  
Its loveliness increases; it will never  
Pass into nothingness; but still will keep  
A bower quiet for us, and a sleep  
Full of sweet dreams, and health, and quiet breathing.

*Endymion*  
- Keats

John Keats, physician >>> poet,  
died at age 25 - in 1821 -  
of an infectious, transmissible disease (tuberculosis),  
as did his mother and two of his brothers.

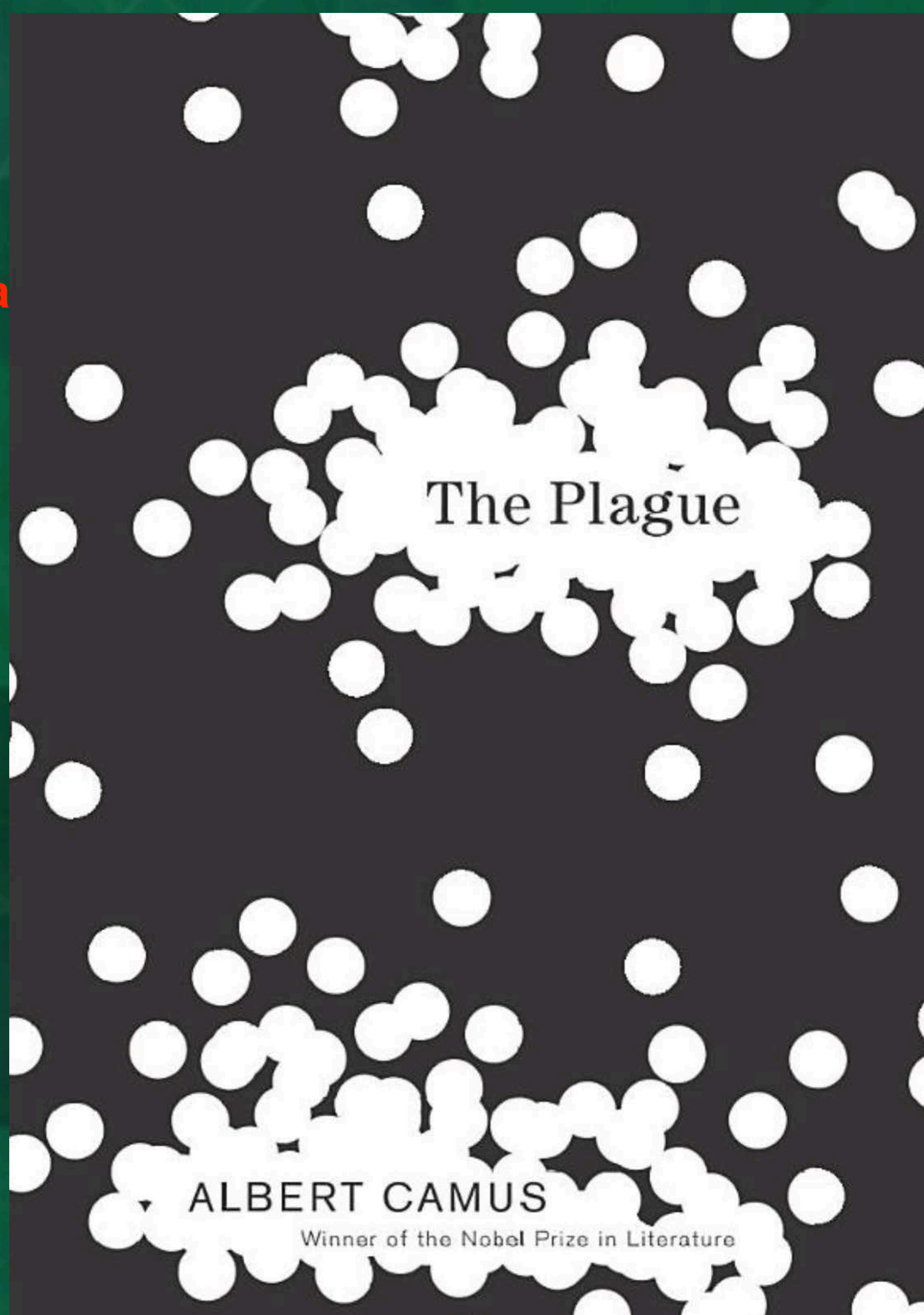
Infectious Disease

Transmissible



*The Plague* (French: *La Peste*) is a novel by Albert Camus.

Published in 1947, it tells the story from the point of view of a narrator of a plague sweeping the French Algerian city of Oran.



*“Everybody knows that pestilences have a way of recurring in the world; yet somehow we find it hard to believe in ones that crash down on our heads from a blue sky.”*

*There have been as many plagues as wars in history; yet always plagues and wars take people equally by surprise.”*

Infectious Disease

Transmissible





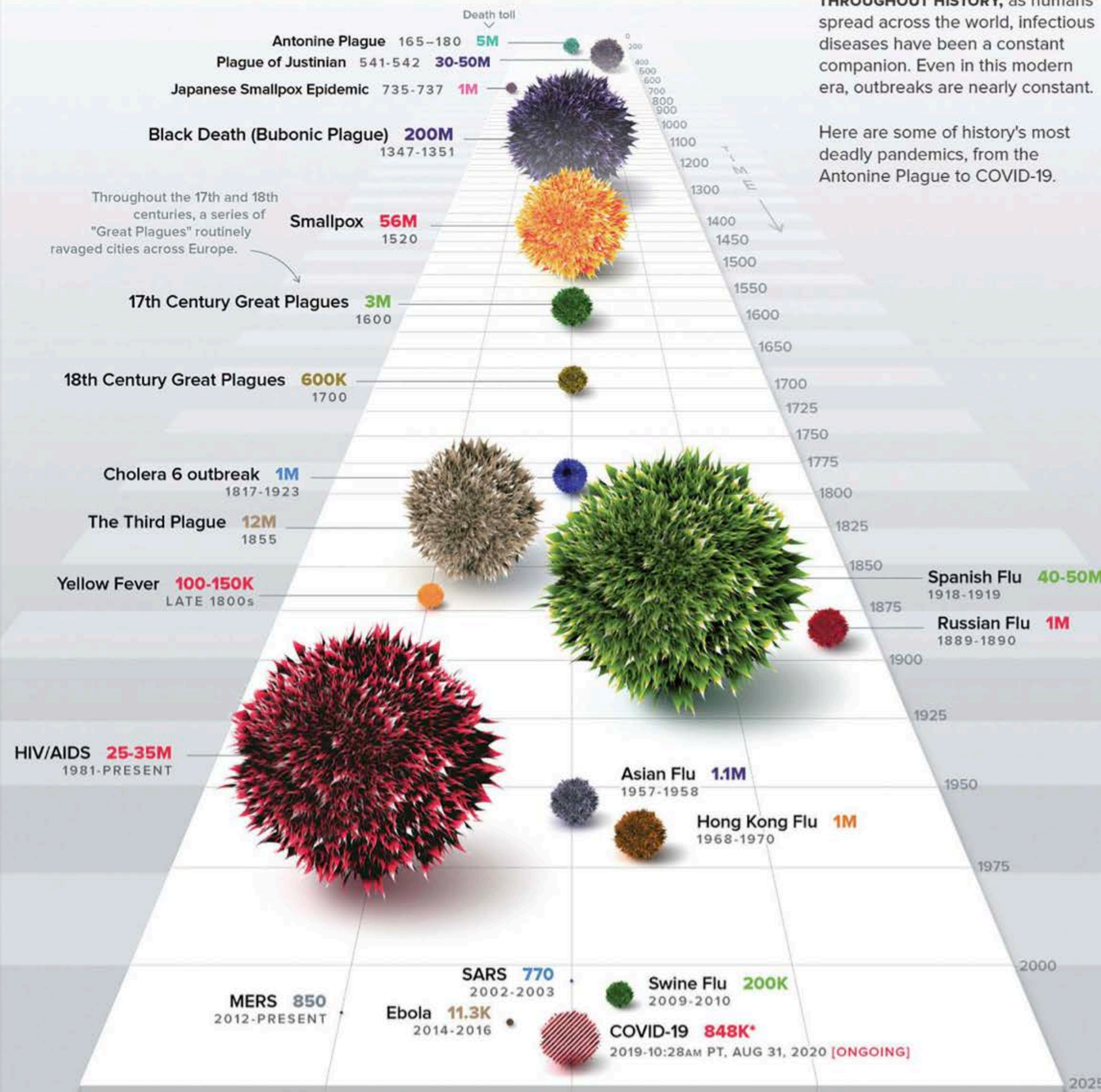
Faces of health care in COVID-19

# HISTORY OF PANDEMICS

PAN-DEM-IC (of a disease) prevalent over a whole country or the world.

THROUGHOUT HISTORY, as humans spread across the world, infectious diseases have been a constant companion. Even in this modern era, outbreaks are nearly constant.

Here are some of history's most deadly pandemics, from the Antonine Plague to COVID-19.



These numbers are current as of press time.  
 Courtesy of Visual Capitalist. <https://www.visualcapitalist.com/history-of-pandemics-deadliest/>

WHO officially declared COVID-19 a pandemic on Mar 11, 2020.  
 It is hard to calculate and forecast the impact of COVID-19 because the disease is new to medicine, and data is still coming in.  
 \*Johns Hopkins University estimates

AOA - The Pharos - Summer 2020

Infectious Disease  
 Transmissible



## Historian John Barry compares COVID-19 to the 1918 flu pandemic

October 6, 2020



People wait in line to get masks in San Francisco during the 1918 Spanish flu pandemic. John Barry '69 (MA), author of *The Great Influenza*, says that one of the greatest lessons from 1918 that can be applied to the COVID-19 pandemic is that "those in authority must retain the public's trust." (Photo by Wikimedia Commons)

#1 NEW YORK TIMES BESTSELLER

# THE GREAT INFLUENZA

The Story of the Deadliest Pandemic in History

publication date:  
2004

### John Barry '69 (MA) says that the virulence of the 1918 flu made it a very different disease than COVID-19, but the lessons of that pandemic still resonate.

When the novel coronavirus went from epidemic to pandemic early this year, John Barry '69 (MA) found himself in rather familiar territory. Barry is the author of *The Great Influenza: The Epic Story of the Deadliest Plague in History*. When the book was first published, in 2004, the National Academy of Sciences named it the outstanding book of the year on science and medicine. In 2020, Barry's book has returned to bestseller status.

In *The Great Influenza*, he considers what became known as the Spanish flu—so called because the press in Spain, which stayed neutral in World War I, had not clamped down on coverage in the name of morale—from a broad range of angles: scientists' quest to understand a new pathogen, officials' efforts (or lack thereof) to contain the spread of infection, and communities' and families' horrifying experiences of a disease so contagious and lethal that it infected about a quarter of the US population and killed between 50 and 100 million people around the world, the equivalent of 220 to 440 million today.

Anchoring *The Great Influenza* is Barry's consideration of leadership, science, and society. Trust, he argues, is crucial, because without trust in information people have no reliable knowledge of what is happening. In 1918, when leaders gave wartime morale priority over public health communication, terror overran society, so much so that some flu victims starved to death because others were too frightened to bring them food.

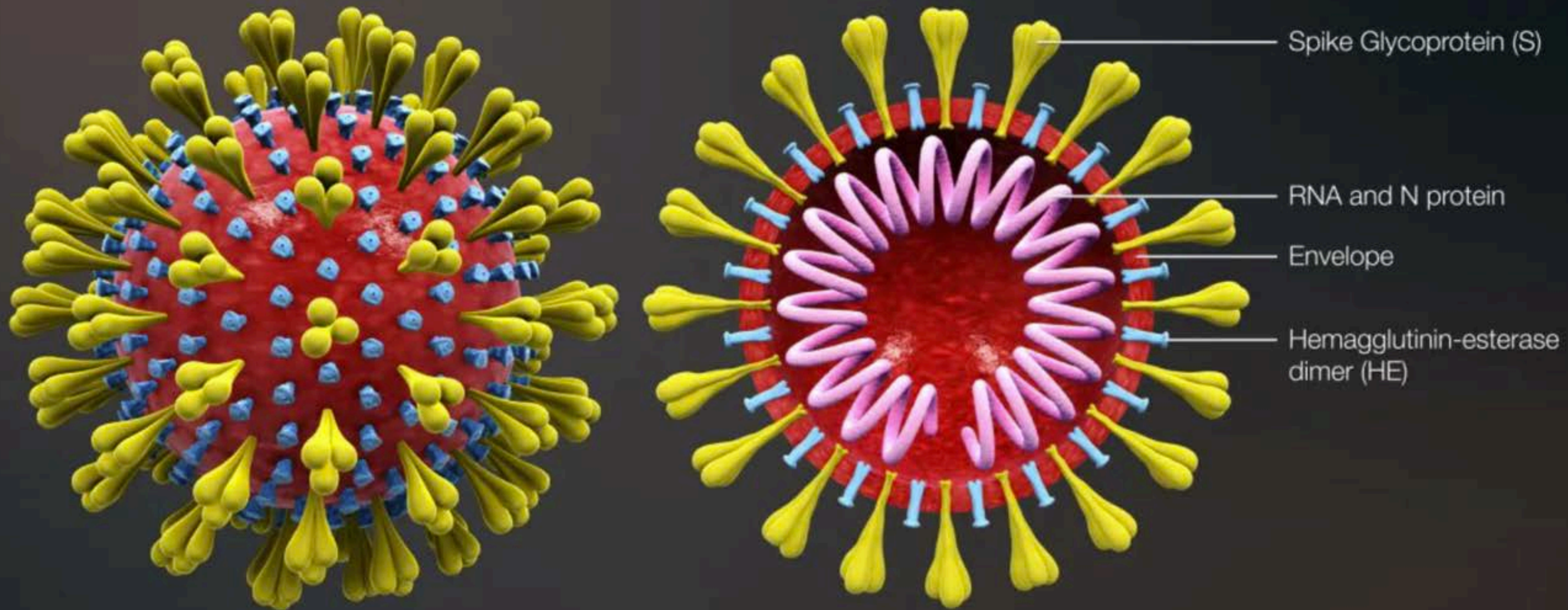
### About John Barry

John Barry studied in the graduate program in history at the University of Rochester. He went on to work as a football coach and then as a journalist in Washington, DC, covering economics and national politics. He's now adjunct faculty at Tulane University's School of Public Health and Tropical Medicine and the author of books including *The Great Influenza: The Epic Story of the Deadliest Plague in History*, *The Rising Tide: The Great Mississippi Flood of 1927 and How It Changed America*, and *Roger Williams and the Creation of the American Soul: Church, State, and the Birth of Liberty*.

Infectious Disease

Transmissible





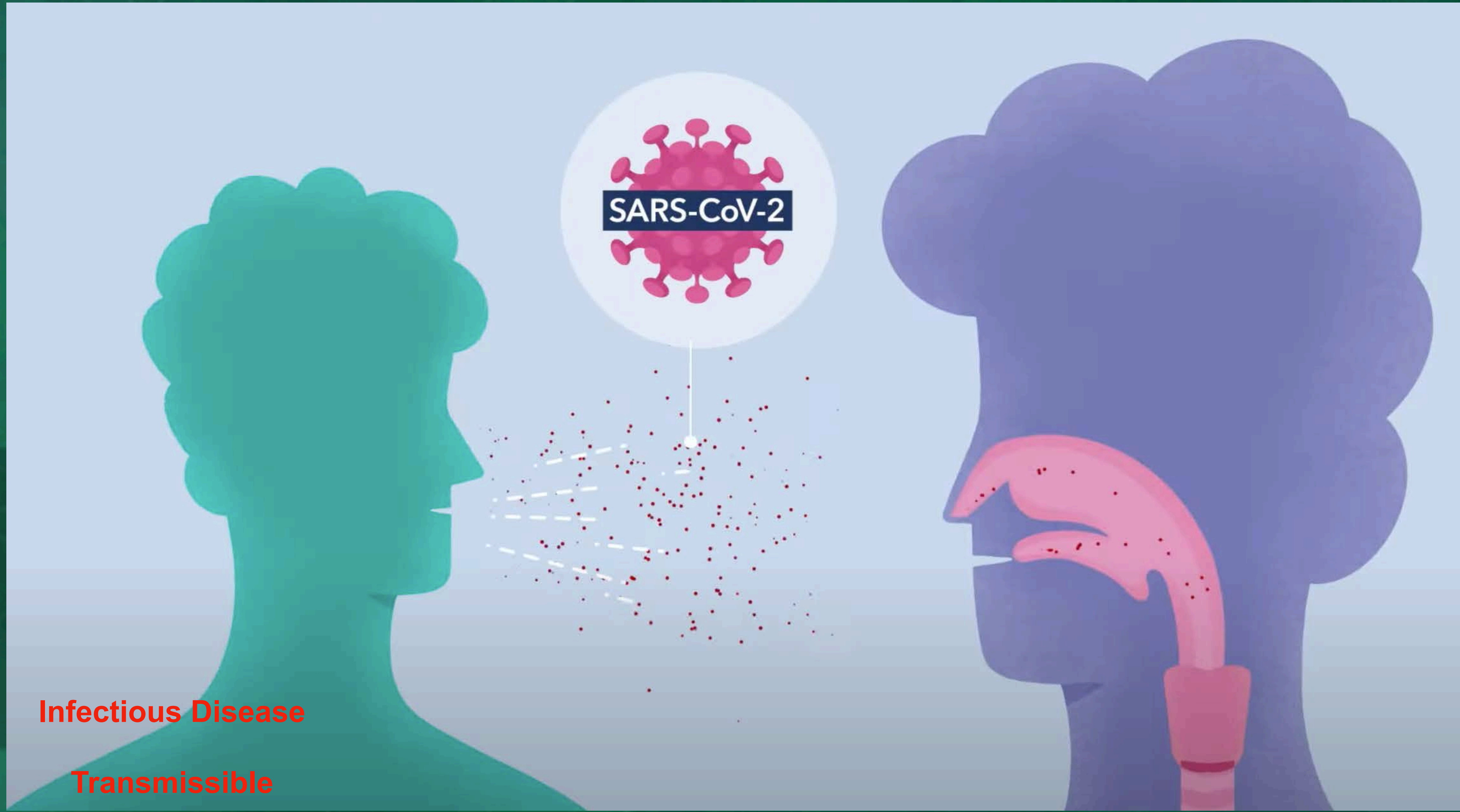
**Nature is not cruel, only pitilessly indifferent. This is one of the hardest lessons for humans to learn. We cannot admit that things might be neither good nor evil, neither cruel nor kind, but simply callous - indifferent to all suffering, lacking all purpose.**



SARS-CoV-2

Infectious Disease

Transmissible







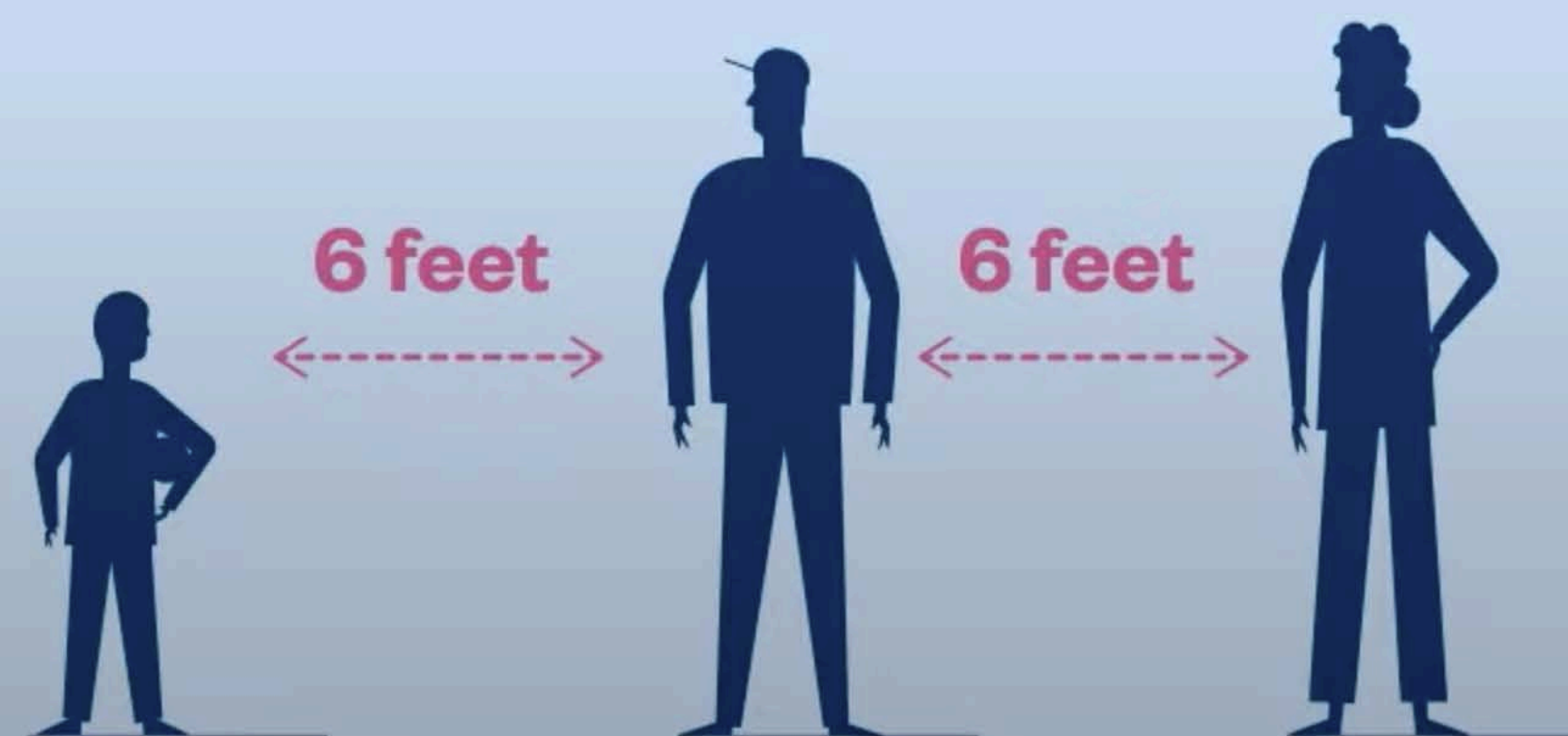
**Wash hands**



**Avoid crowded places**



**Wear a mask**



**Physical Distance**



***"All this has been said before—but since nobody listened, it must be said again."***

Infectious Disease

Transmissible



# images essays

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vaccines

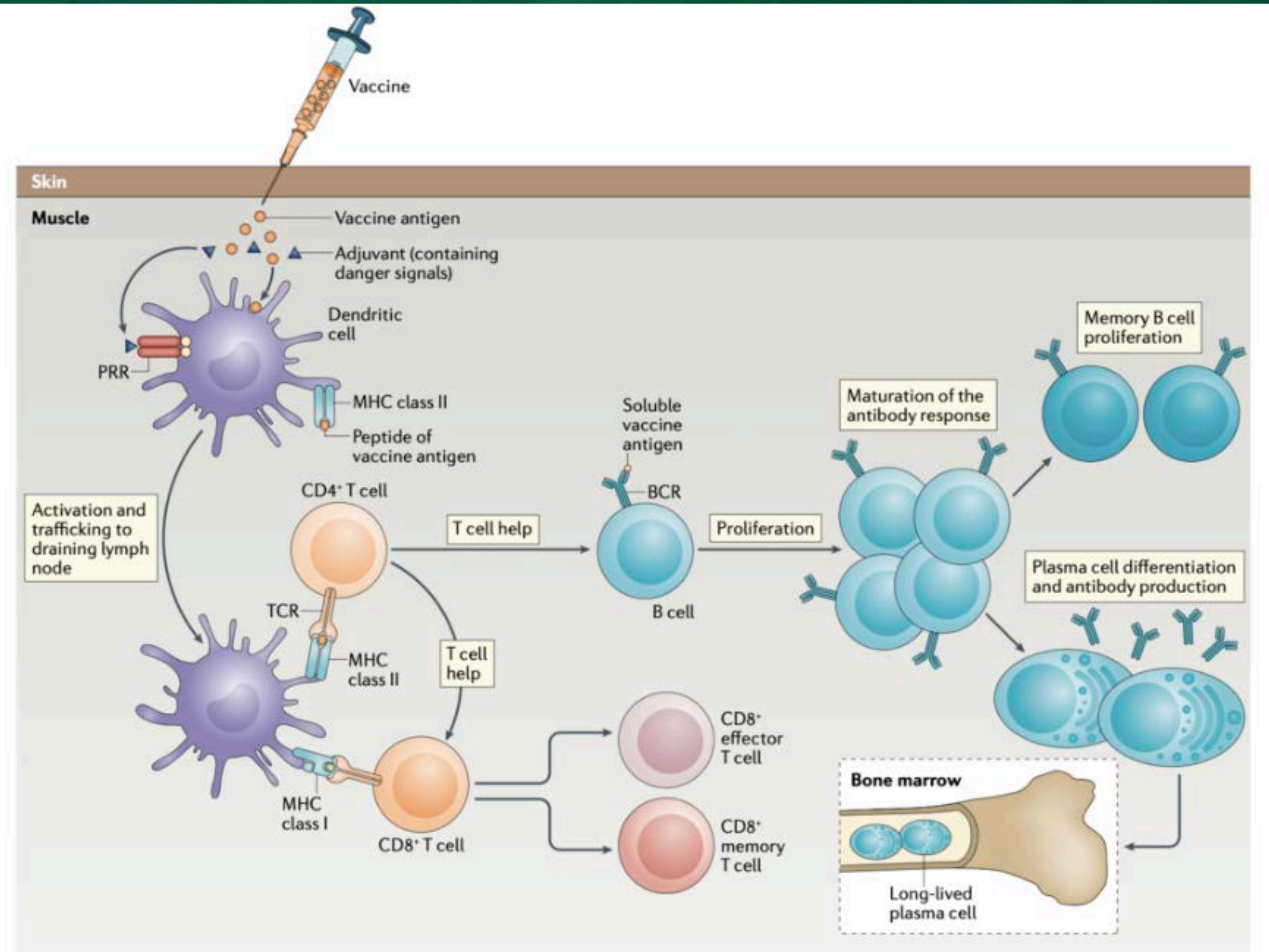
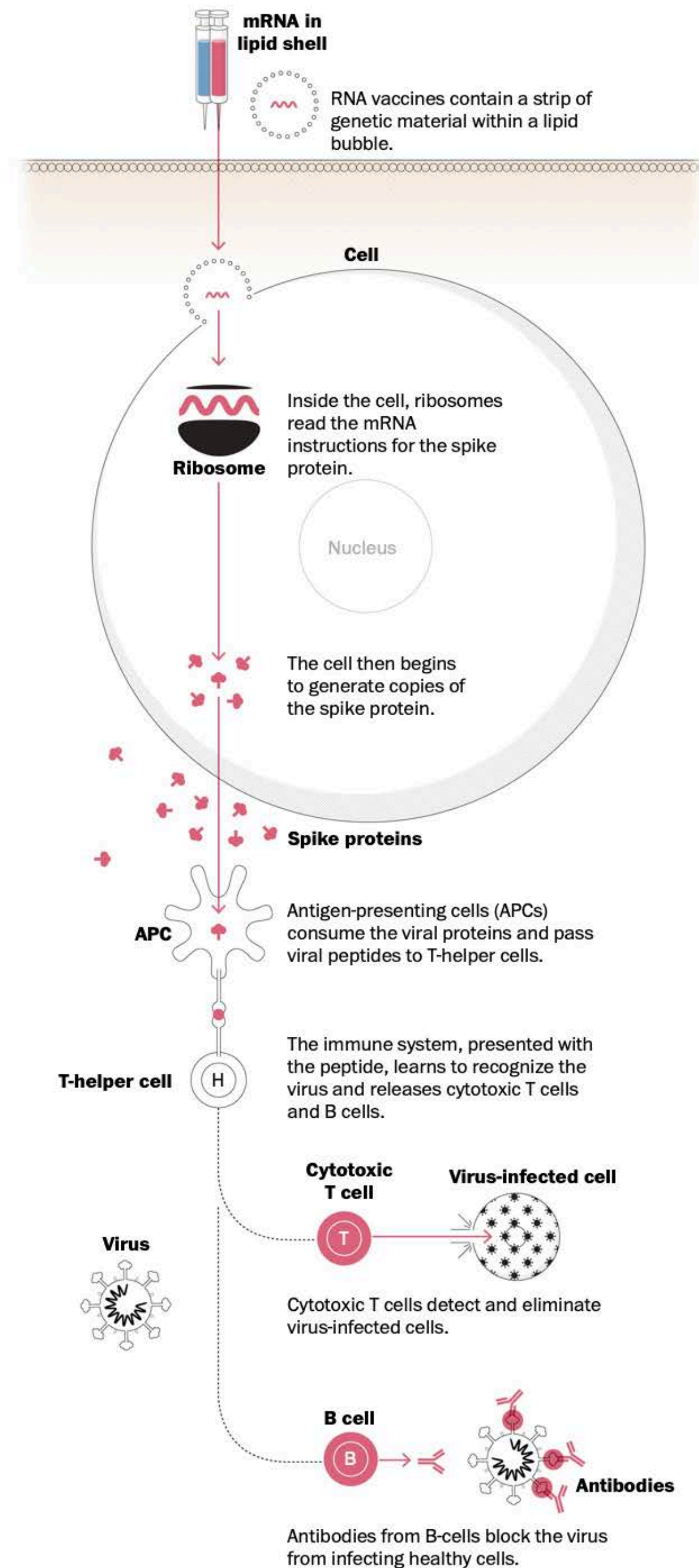
COVID-19 vaccine  
distribution  
began  
January 2021

See:

**\*vaccines\***

webpage  
on  
[imageessays.com](http://imageessays.com)





**Fig. 3 | The generation of an immune response to a vaccine.** The immune response following immunization with a conventional protein antigen. The vaccine is injected into muscle and the protein antigen is taken up by dendritic cells, which are activated through pattern recognition receptors (PRRs) by danger signals in the adjuvant, and then trafficked to the draining lymph node. Here, the presentation of peptides of the vaccine protein antigen by MHC molecules on the dendritic cell activates T cells through their T cell receptor (TCR). In combination with signalling (by soluble antigen)



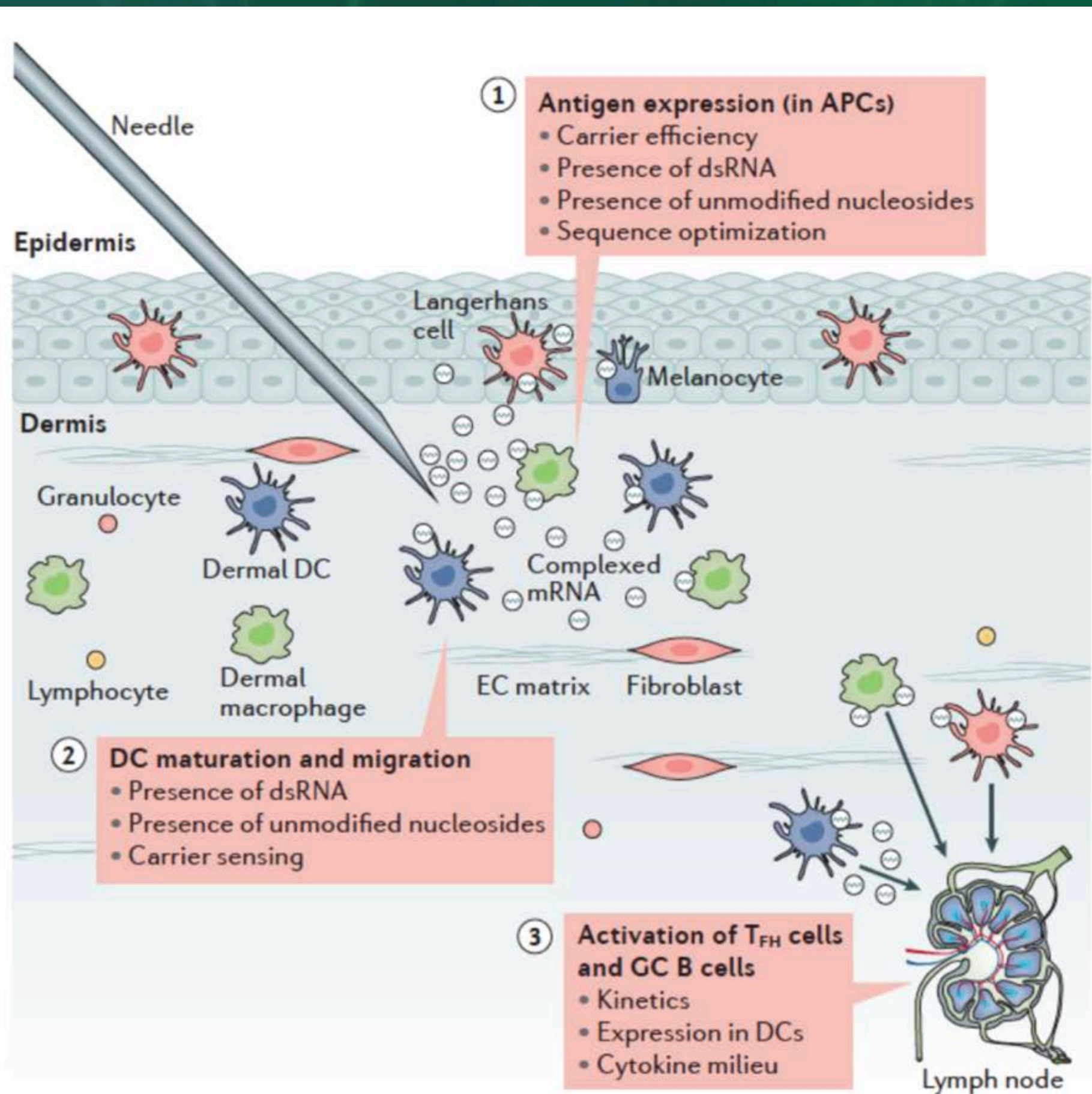


Figure 3 | **Considerations for effectiveness of a directly injected mRNA vaccine.** For an injected mRNA vaccine, major considerations for effectiveness include the following: the level of antigen expression in professional antigen-presenting cells (APCs), which is influenced by the efficiency of the carrier, by the presence of pathogen-associated molecular patterns (PAMPs) in the form of double-stranded RNA (dsRNA) or unmodified nucleosides and by the level of optimization of the RNA sequence (codon usage, G:C content, 5' and 3' untranslated regions (UTRs) and so on); dendritic cell (DC) maturation and migration to secondary lymphoid tissue, which is increased by PAMPs; and the ability of the vaccine to activate robust T follicular helper (T<sub>FH</sub>) cell and germinal centre (GC) B cell responses — an area that remains poorly understood. An intradermal injection is shown as an example. EC, extracellular.



See link to video on [\\*vaccines\\*](#) webpage



# UNITED STATES

JOHNS HOPKINS  
UNIVERSITY OF MEDICINE

CORONAVIRUS  
RESOURCE CENTER



## OVERVIEW



### VACCINE TRACKER

[Learn more about vaccines.](#)

Doses Administered

589,231,370

People Fully Vaccinated

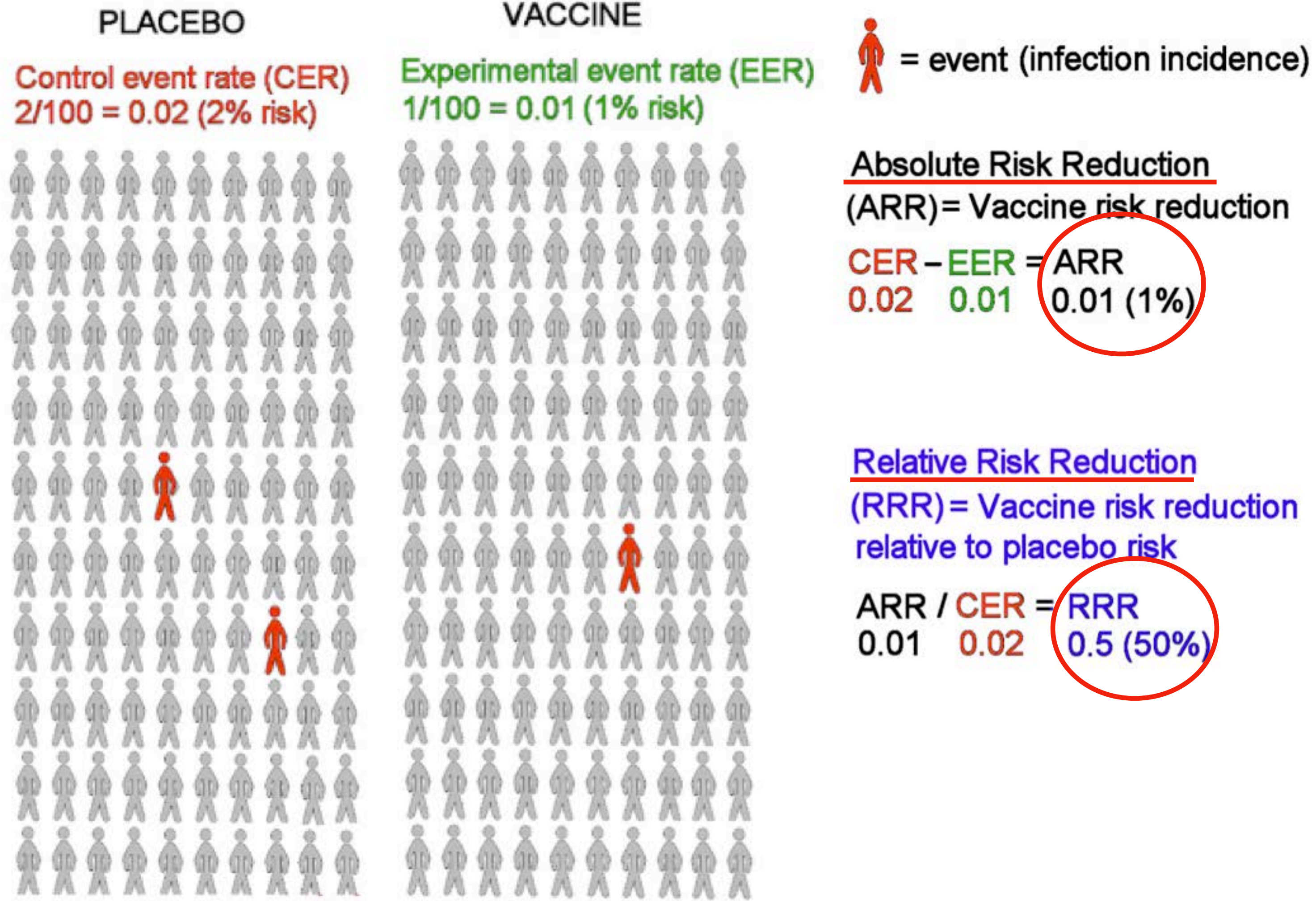
221,506,997

% of Population Fully  
Vaccinated

67.23%

... as of 6/7/22



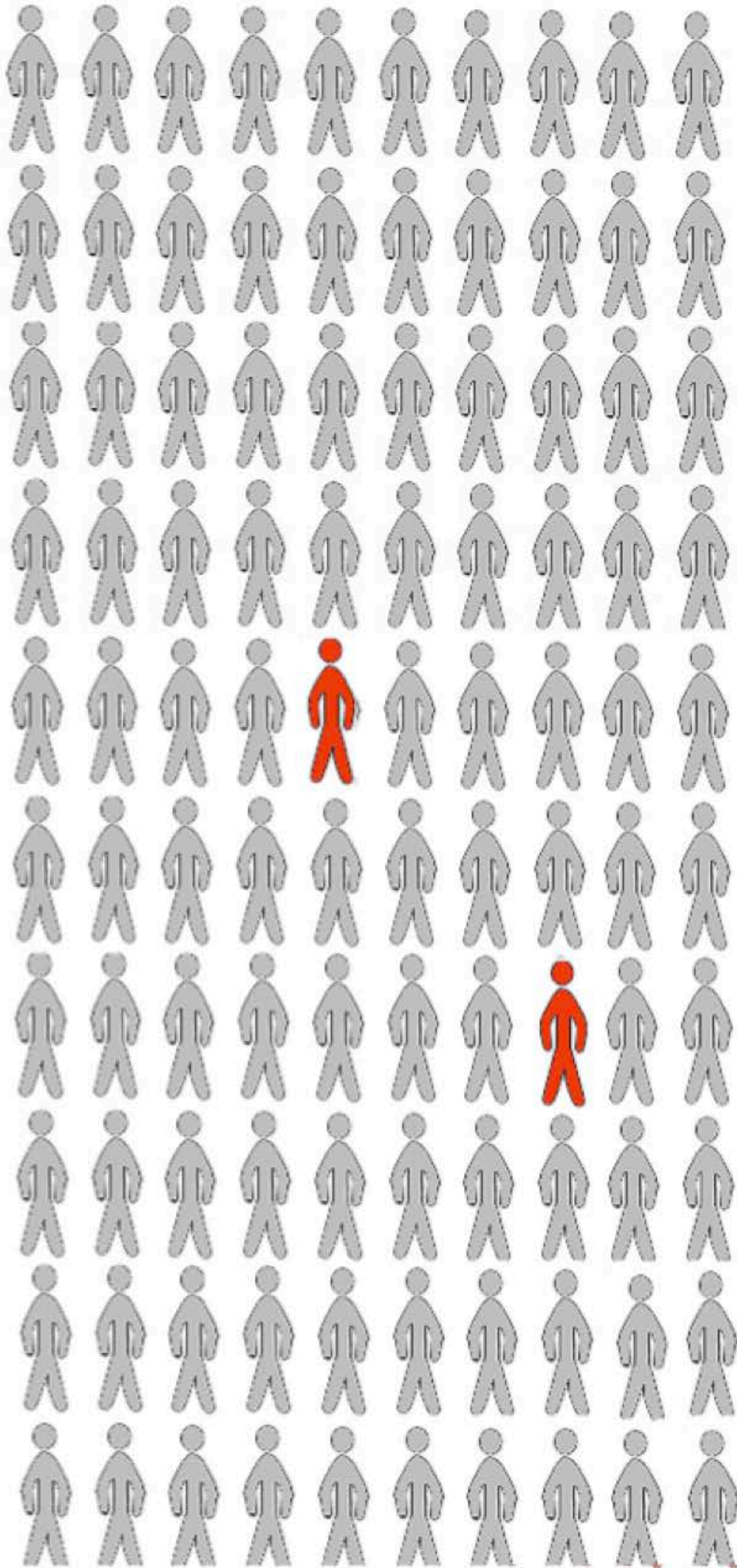


**Figure 1.** Example of a vaccine clinical trial for an infectious disease.

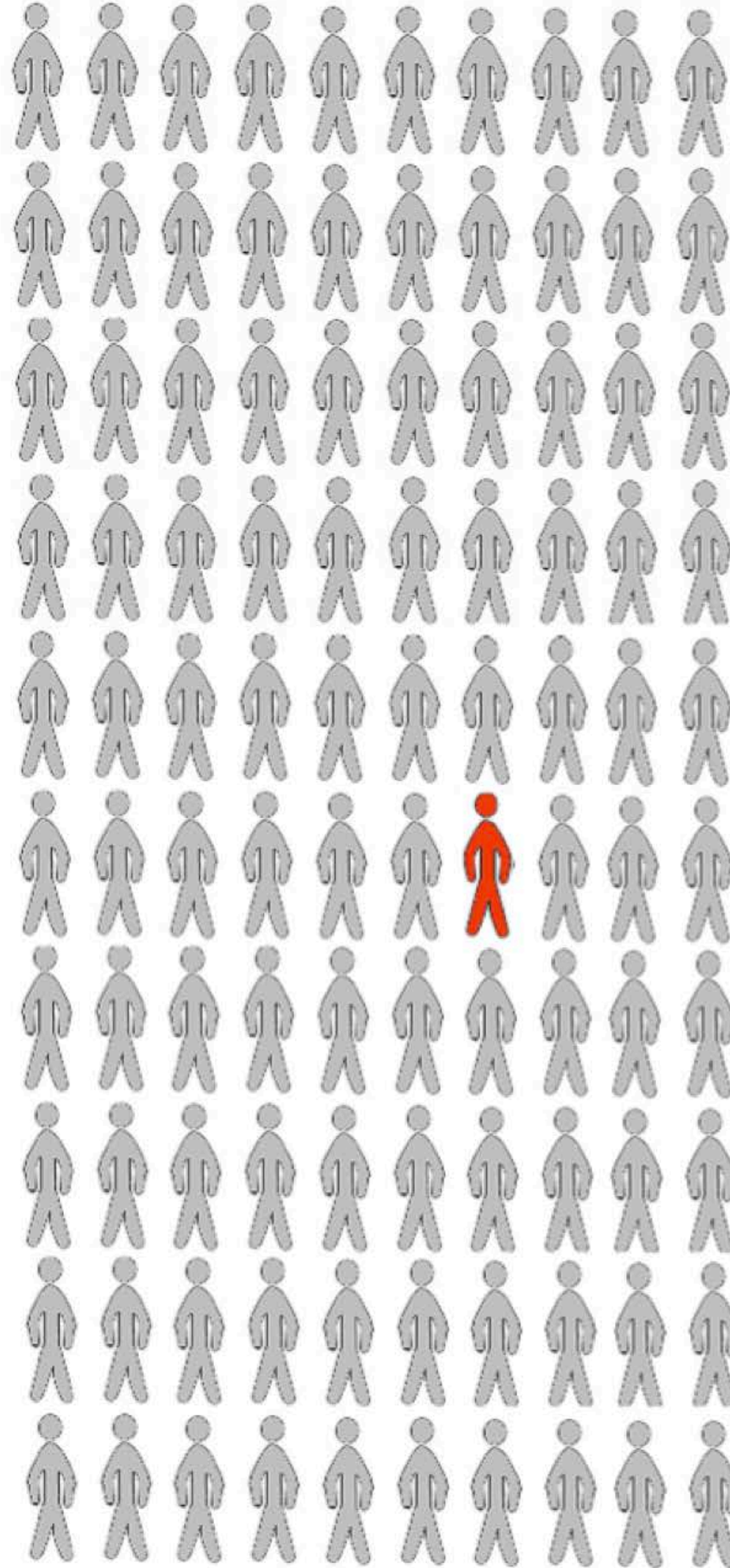
Citation: Brown, R.B. Outcome Reporting Bias in COVID-19 mRNA Vaccine Clinical Trials. *Medicina* 2021, 57, 199. <https://doi.org/10.3390/medicina57030199>



**Control event rate (CER)**  
 **$2/100 = 0.02$  (2% risk)**



**Treatment Event Rate**  
 **$1/100 = 0.01$  (1% risk)**



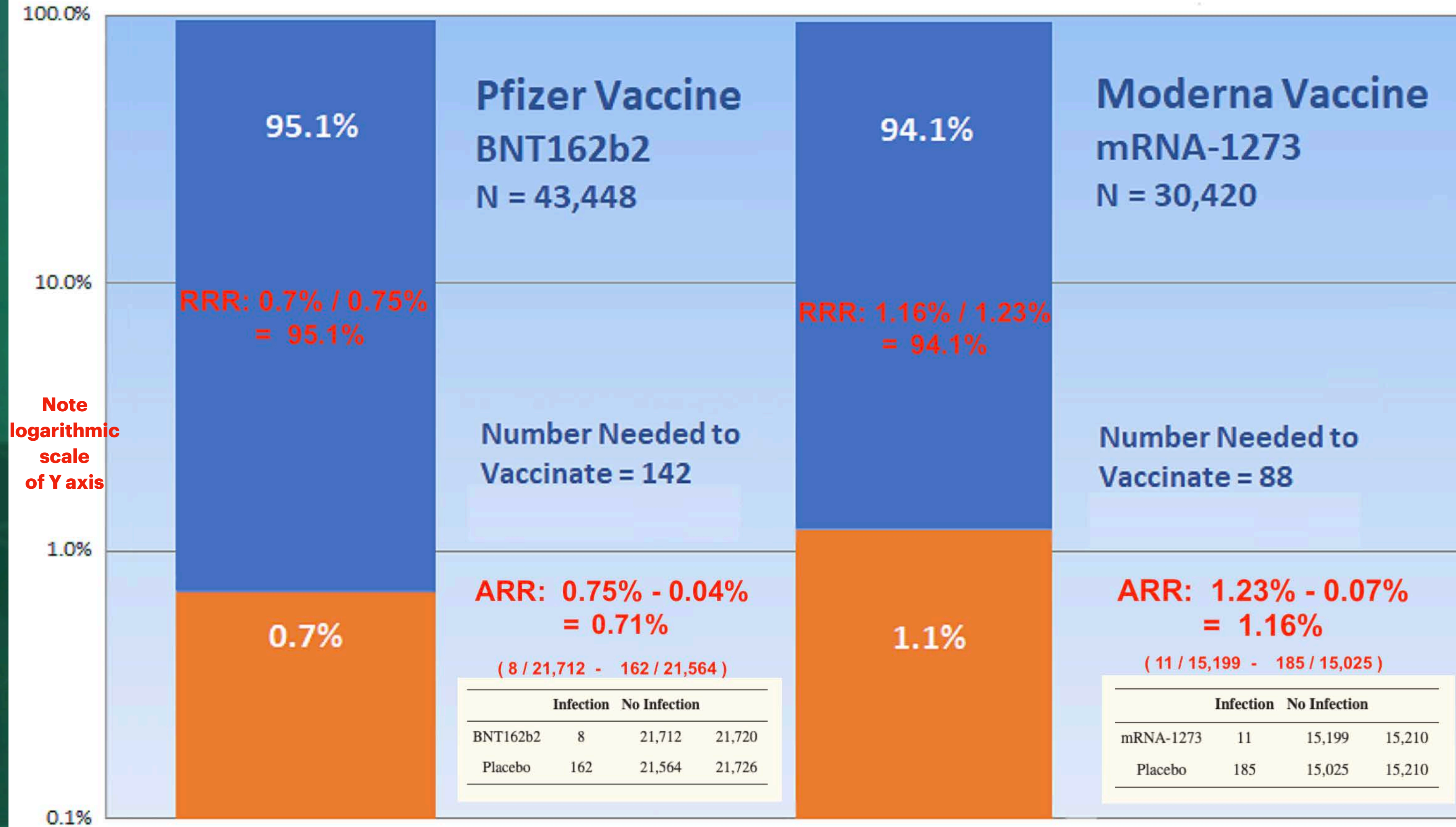
**Absolute Risk Reduction = 1%**

**Relative Risk Reduction = 50%**



## COVID-19 Vaccine Efficacy \*in preventing infection\*

■ Relative Risk Reduction    ■ Absolute Risk Reduction



Citation: Brown, R.B. Outcome Reporting Bias in COVID-19 mRNA Vaccine Clinical Trials. *Medicina* 2021, 57, 199. <https://doi.org/10.3390/medicina57030199>

From the article:

“Unreported absolute risk reduction measures of 0.7% and 1.1% for the Pfizer and Moderna vaccines, respectively, are very much lower than the reported relative risk reduction measures.”

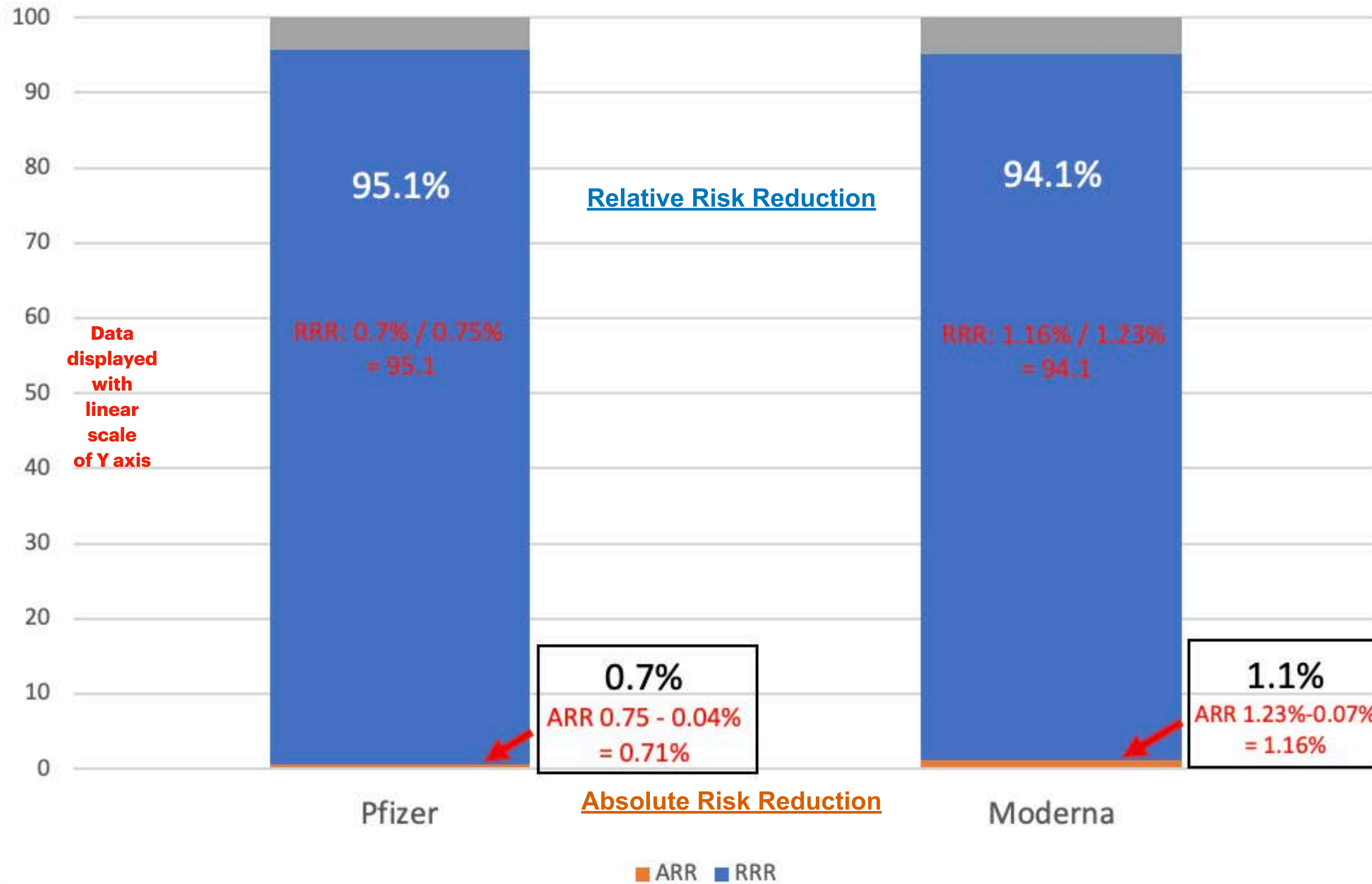
\*\*\*in preventing infection\*\*\*

“Reporting absolute risk reduction measures is essential to prevent outcome reporting bias in evaluation of COVID-19 vaccine efficacy.”

Figure 2. The chart shows critical appraisal results of mRNA COVID-19 vaccine efficacy.



# COVID-19 vaccine efficacy \*\*\*in preventing infection\*\*\*



Citation: Brown, R.B. Outcome Reporting Bias in COVID-19 mRNA Vaccine Clinical Trials. *Medicina* 2021, 57, 199. <https://doi.org/10.3390/medicina57030199>

## From the article:

“Unreported absolute risk reduction measures of 0.7% and 1.1% for the Pfizer and Moderna vaccines, respectively, are very much lower than the reported relative risk reduction measures.”

“Reporting absolute risk reduction measures is essential to prevent outcome reporting bias in evaluation of COVID-19 vaccine efficacy.”



### COVID-19 vaccine efficacy and effectiveness—the elephant (not) in the room

Piero Olliaro · Els Torrele · Michel Vaillant

Open Access · Published: April 20, 2021

## Vaccine efficacy is generally reported

as a Relative Risk Reduction (RRR), which is: 1 - Relative Risk

**\*\*\* RR (relative risk) is the ratio of attack rates with and without a vaccine. \*\*\***

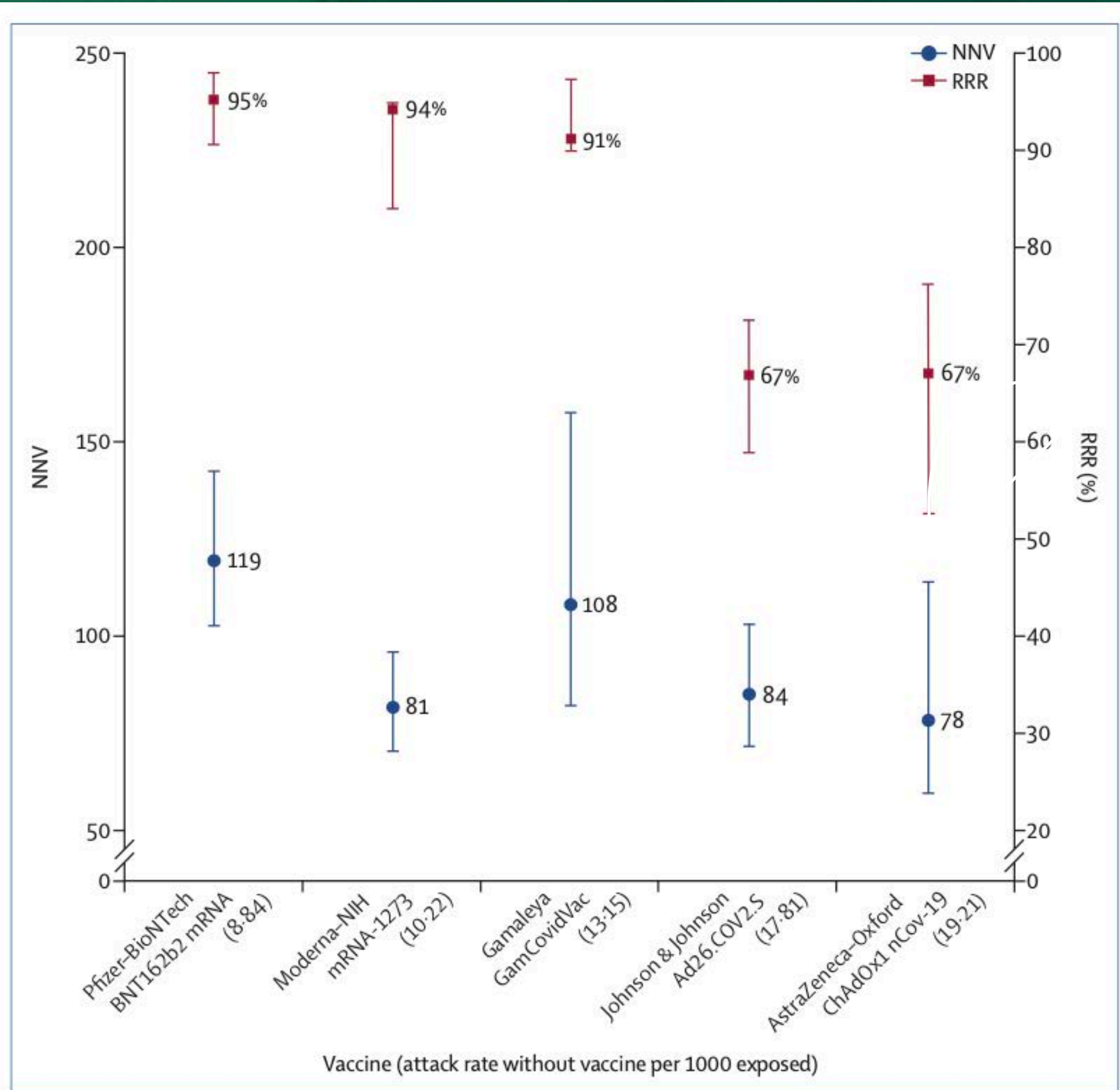


Figure: RRR and NNV with 95% CI ranked by attack rate in the unvaccinated (placebo) group for five COVID-19 vaccines

The lower the NNV and the higher the RRR, the better the vaccine efficacy. Details are in the appendix (p 3). RRR=relative risk reduction. NNV=numbers needed to vaccinate. NIH=US National Institutes of Health.

RRR should be seen against the background risk of being infected and becoming ill with COVID-19, which varies between populations and over time.

Although the RRR considers only participants who could benefit from the vaccine, the absolute risk reduction (ARR), which is the difference between attack rates with and without a vaccine, considers the whole population.


ARRs tend to be ignored because they give a much less impressive effect size than RRRs:

1-2% for the Moderna-NIH, 0-84% for the Pfizer-BioNTech vaccines. **\*\*\*in preventing infection\*\*\***



Perspective

## Outcome Reporting Bias in COVID-19 mRNA Vaccine Clinical Trials

Ronald B. Brown 

School of Public Health and Health Systems, University of Waterloo, Waterloo, ON N2L3G1, Canada;  
r26brown@uwaterloo.ca

**Abstract:** Relative risk reduction and absolute risk reduction measures in the evaluation of clinical trial data are poorly understood by health professionals and the public. The absence of reported absolute risk reduction in COVID-19 vaccine clinical trials can lead to outcome reporting bias that affects the interpretation of vaccine efficacy. The present article uses clinical epidemiologic tools to critically appraise reports of efficacy in Pfizer/BioNTech and Moderna COVID-19 mRNA vaccine clinical trials. Based on data reported by the manufacturer for Pfizer/BioNTech vaccine BNT162b2,

Ironically, the omission of absolute risk reduction measures in data reviewed by the VRBPAC overlooks FDA guidelines for communicating evidence-based risks and benefits to the public [11]. The FDA's advice for information providers includes:

"Provide absolute risks, not just relative risks. Patients are unduly influenced when risk information is presented using a relative risk approach; this can result in suboptimal decisions. Thus, an absolute risk format should be used."

The *New England Journal of Medicine* also published clinical trial data on safety and efficacy for the BNT162b2 vaccine [12] and the mRNA-1273 vaccine [13], but with no mention of absolute risk reduction measures.



*The* NEW ENGLAND JOURNAL *of* MEDICINE

ORIGINAL ARTICLE

# Effectiveness of Covid-19 Vaccines over a 9-Month Period in North Carolina

Dan-Yu Lin, Ph.D., Yu Gu, B.S., Bradford Wheeler, M.P.H., Hayley Young, M.P.H.,  
Shannon Holloway, Ph.D., Shadia-Khan Sunny, M.D., Ph.D., M.P.H.,  
Zack Moore, M.D., M.P.H., and Donglin Zeng, Ph.D.

**March 10, 2022**

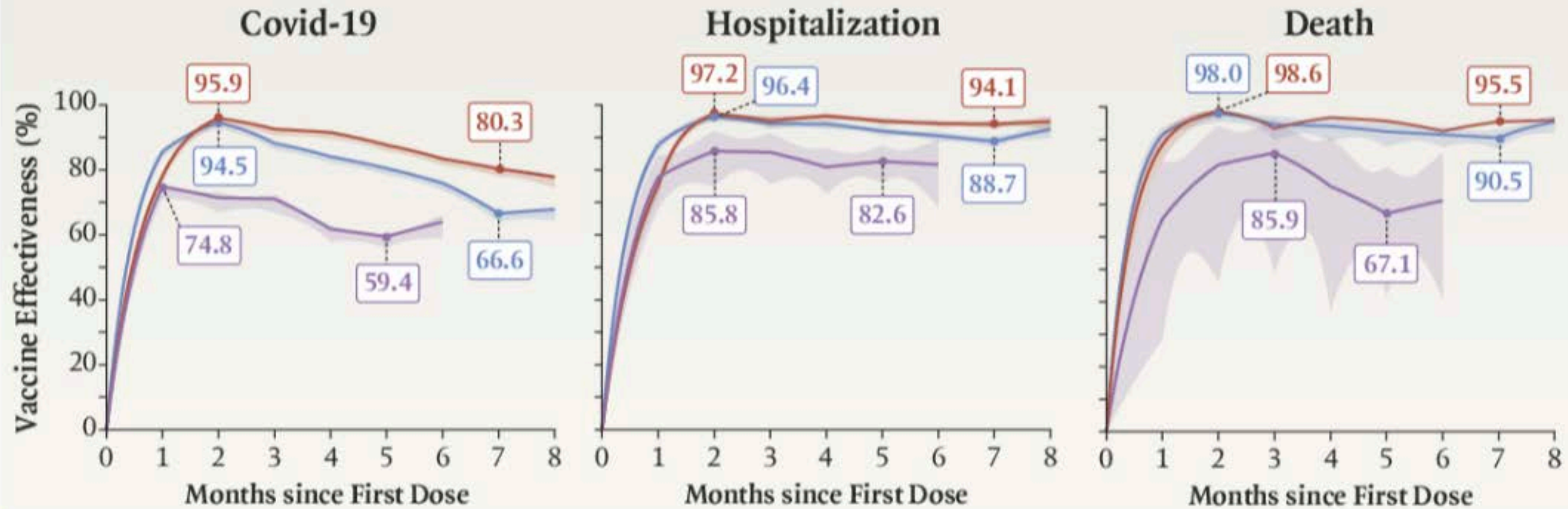


# Effectiveness of Covid-19 Vaccines over a 9-Month Period

OBSERVATIONAL STUDY USING SURVEILLANCE DATA FROM NORTH CAROLINA

Residents vaccinated between December 11, 2020, and September 8, 2021

— mRNA-1273 — BNT162b2 — Ad26.COV2.S



All three vaccines reduced risks of hospitalization and death; protection against infection waned with declining immunity and emergence of the delta variant.



# COVID-19 Cases, Hospitalizations, and Deaths by Vaccination Status

Washington State Department of Health

June 22, 2022



Disease Control and Health Statistics  
Public Health Outbreak Coordination, Information, and Surveillance  
1610 NE 150th Street, MS: K17-9  
Shoreline, WA 98155

- On April 20, 2022, DOH updated COVID-19 vaccination language, changing the terms "initiating vaccination" and "fully vaccinated" to "initiated primary series" and "completed primary series." This change in language allows for better differentiation between original vaccine series and boosters.

## Unvaccinated 12-34 year-olds in Washington are

- 1.9 times more likely to get COVID-19 compared with 12-34 year-olds who have completed the primary series.
- 2.9 times more likely to be hospitalized with COVID-19 compared with 12-34 year-olds who have completed the primary series.

## Unvaccinated 35-64 year-olds are

- 2.1 times more likely to get COVID-19 compared with 35 - 64 year-olds who have completed the primary series.
- 3.7 times more likely to be hospitalized with COVID-19 compared with 35 - 64 year-olds who have completed the primary series.

## Unvaccinated 65+ year-olds are

- 3.1 times more likely to get COVID-19 compared with 65+ year-olds who have completed the primary series.
- 3.6 times more likely to be hospitalized with COVID-19 compared with 65+ year-olds who have completed the primary series.
- 3.9 times more likely to die of COVID-19 compared with 65+ year-olds who have completed the primary series.



**COVID-19 Cases, Hospitalizations, and Deaths by Vaccination Status**

Washington State Department of Health

June 22, 2022

**COVID-19 case rates per 100,000 population from May 18 to June 14, 2022**

Age group	Age-specific rate per 100,000 in unvaccinated individuals	Age-specific rate per 100,000 in individuals who completed the primary series	Impact
12-34	1,813.5	941.9	1.9 times higher in unvaccinated
35-64	1,906.3	890.4	2.1 times higher in unvaccinated
65+	2,232.5	712.9	3.1 times higher in unvaccinated

- Case rates are calculated using population data for the specified age group

**COVID-19 hospitalization rates per 100,000 population from May 11 to June 07, 2022**

Age group	Age-specific rate per 100,000 in unvaccinated individuals	Age-specific rate per 100,000 in individuals who completed the primary series	Impact
12-34	26.6	9.2	2.9 times higher in unvaccinated
35-64	71.7	19.3	3.7 times higher in unvaccinated
65+	374.5	103.5	3.6 times higher in unvaccinated

- Case rates are calculated using population data for the specified age group



# COVID-19 Cases, Hospitalizations, and Deaths by Vaccination Status

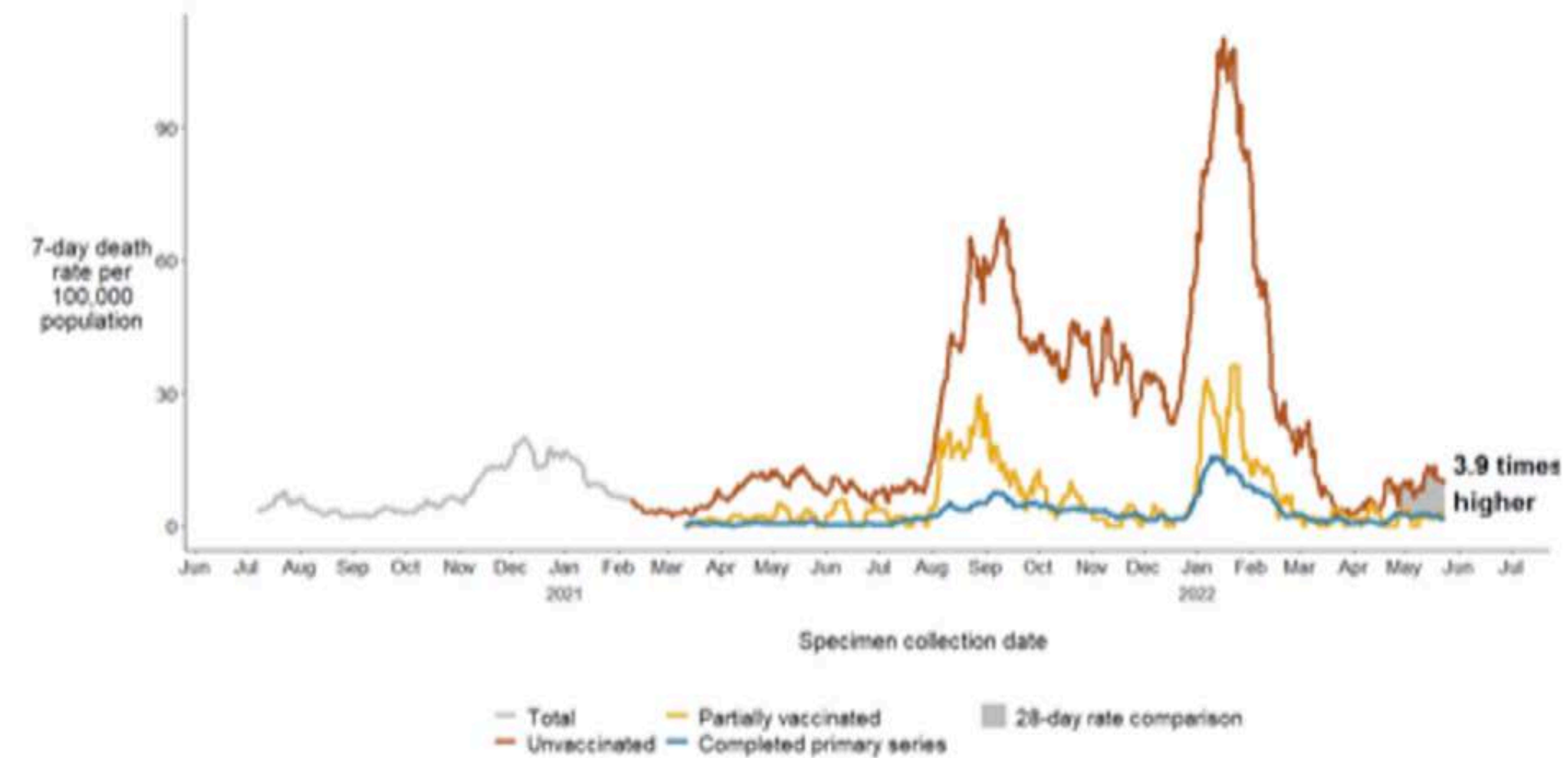
Washington State Department of Health

June 22, 2022

## COVID-19 Deaths

Deaths are only shown for Washingtonians 65 years old and older due to the relatively smaller number of deaths in other age groups and associated instability in rates when assessing by vaccination status.

**COVID-19 death rates among 65+ year-old individuals are 3.9 times higher in the unvaccinated population than in the population of those who have completed the primary series**



## COVID-19 death rates per 100,000 population from April 27 to May 24, 2022

Age group	Age-specific rate per 100,000 in unvaccinated individuals	Age-specific rate per 100,000 in individuals who completed the primary series	Impact
65+	49.3	12.5	3.9 times higher in unvaccinated

- Case rates are calculated using population data for the specified age group



# Effectiveness of mRNA Vaccination in Preventing COVID-19–Associated Invasive Mechanical Ventilation and Death — United States, March 2021–January 2022

**TABLE 2. Effectiveness of COVID-19 mRNA vaccines against COVID-19–associated invasive mechanical ventilation or in-hospital death — 21 hospitals, 18 states,\*† March 2021–January 2022**

Group/Characteristic	No. of vaccinated case-patients with IMV or death/ total no. of case-patients (%)	No. of vaccinated control-patients/ total no. of control-patients (%)	Vaccine effectiveness, % (95% CI)
All variant periods <sup>§</sup>	307/1,440 (21.3)	4,020/6,104 (65.9)	90 (88–91)
<b>No. of mRNA vaccine doses received</b>			
2	277/1,410 (19.6)	3,488/5,572 (62.6)	88 (86–90)
14–150 days after dose 2	92/1,225 (7.5)	2,039/4,123 (49.5)	92 (90–94)
>150 days after dose 2	185/1,318 (14.0)	1,449/3,533 (41.0)	84 (80–87)
3	30/1,163 (2.6)	532/2,616 (20.3)	94 (91–96)
<b>Age group, yrs</b>			
18–64	115/931 (12.4)	1,807/3,326 (54.3)	91 (89–93)
≥65	192/509 (37.7)	2,213/2,778 (79.7)	88 (84–90)
<b>Health status</b>			
Immunocompromised	123/232 (53.0)	1,090/1,504 (72.5)	74 (64–81)
Immunocompetent	184/1,208 (15.2)	2,930/4,600 (63.7)	92 (91–94)
<b>No. of chronic conditions among immunocompetent</b>			
None	12/368 (3.3)	322/642 (50.2)	98 (97–99)
1	34/337 (10.1)	647/1,094 (59.1)	95 (92–96)
2	60/264 (22.7)	886/1,320 (67.1)	89 (85–93)
≥3	78/239 (32.6)	1,075/1,544 (69.6)	84 (78–89)
<b>Variant period,<sup>¶</sup> no. of doses</b>			
Pre-Delta, 2 doses	13/259 (5.0)	893/1,738 (51.4)	95 (90–97)
<b>Delta, 2 or 3 doses</b>			
2 doses, median = 159 days after dose 2	235/1,027 (22.9)	2,741/3,865 (70.9)	89 (87–91)
2 doses, median = 159 days after dose 2	218/1,010 (21.6)	2,402/3,526 (68.1)	88 (86–90)
3 doses, median = 35 days after dose 3	17/809 (2.1)	339/1,463 (23.2)	95 (91–97)
<b>Omicron, 2 or 3 doses</b>			
2 doses, median = 256 days after dose 2	59/154 (38.3)	386/501 (77.0)	86 (79–91)
2 doses, median = 256 days after dose 2	46/141 (32.6)	193/308 (62.7)	79 (66–87)
3 doses, median = 60 days after dose 3	13/108 (12.0)	193/308 (62.7)	94 (88–97)

Abbreviations: IMV = invasive mechanical ventilation; VE = vaccine effectiveness.

**Summary**

What is already known about this topic?

COVID-19 mRNA vaccines provide protection against COVID-19 hospitalization among adults. However, how well mRNA vaccines protect against the most severe outcomes of COVID-19–related illness, including use of invasive mechanical ventilation (IMV) or death, is uncertain.

What is added by this report?

Receiving 2 or 3 doses of an mRNA COVID-19 vaccine was associated with a 90% reduction in risk for COVID-19–associated IMV or death. Protection of 3 mRNA vaccine doses during the period of Omicron predominance was 94%.

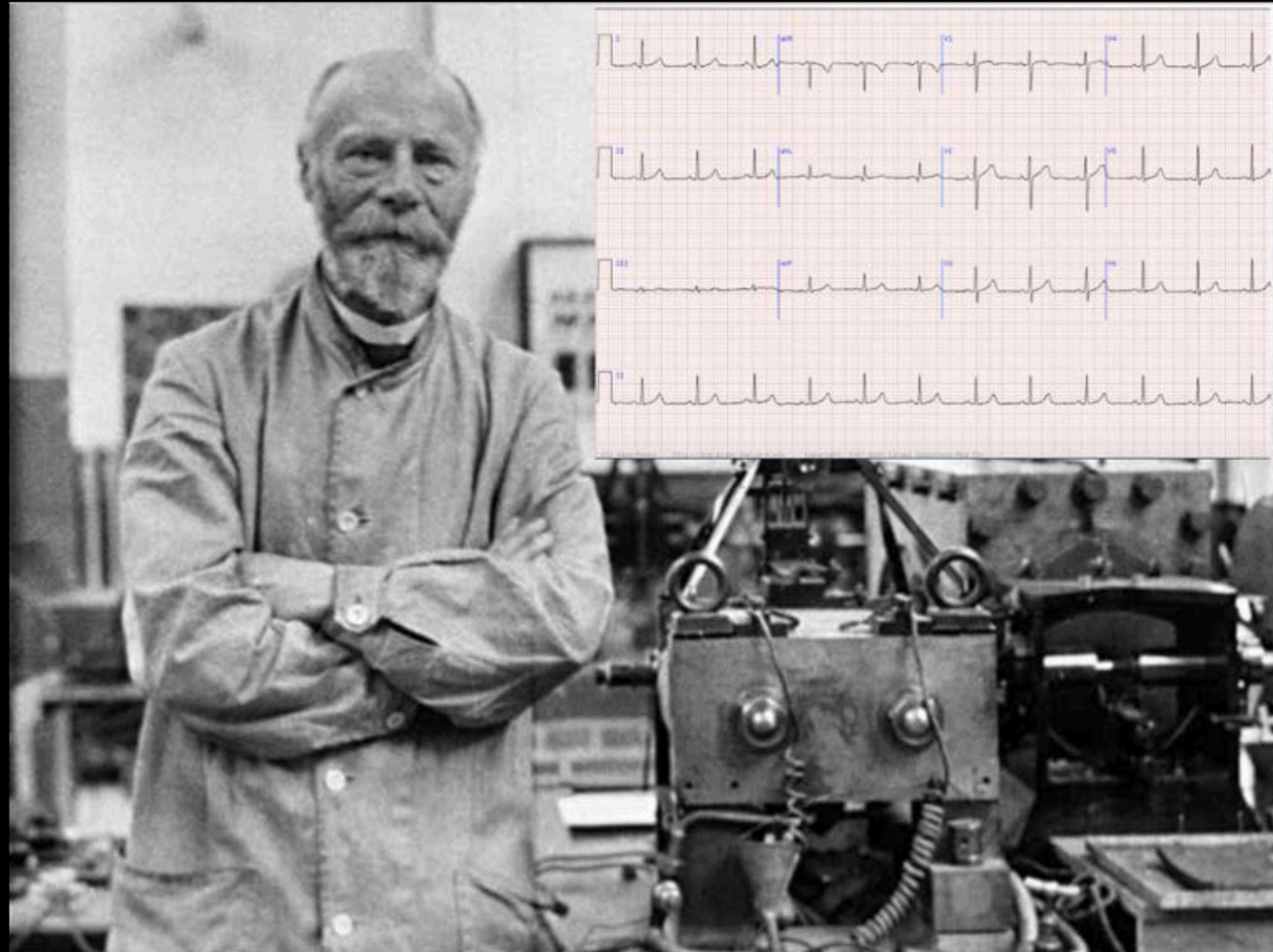
What are the implications for public health practice?

COVID-19 mRNA vaccines are highly effective in preventing the most severe forms of COVID-19. CDC recommends that all persons eligible for vaccination get vaccinated and stay up to date with COVID-19 vaccination.



# images essays

# imageessays



ECG

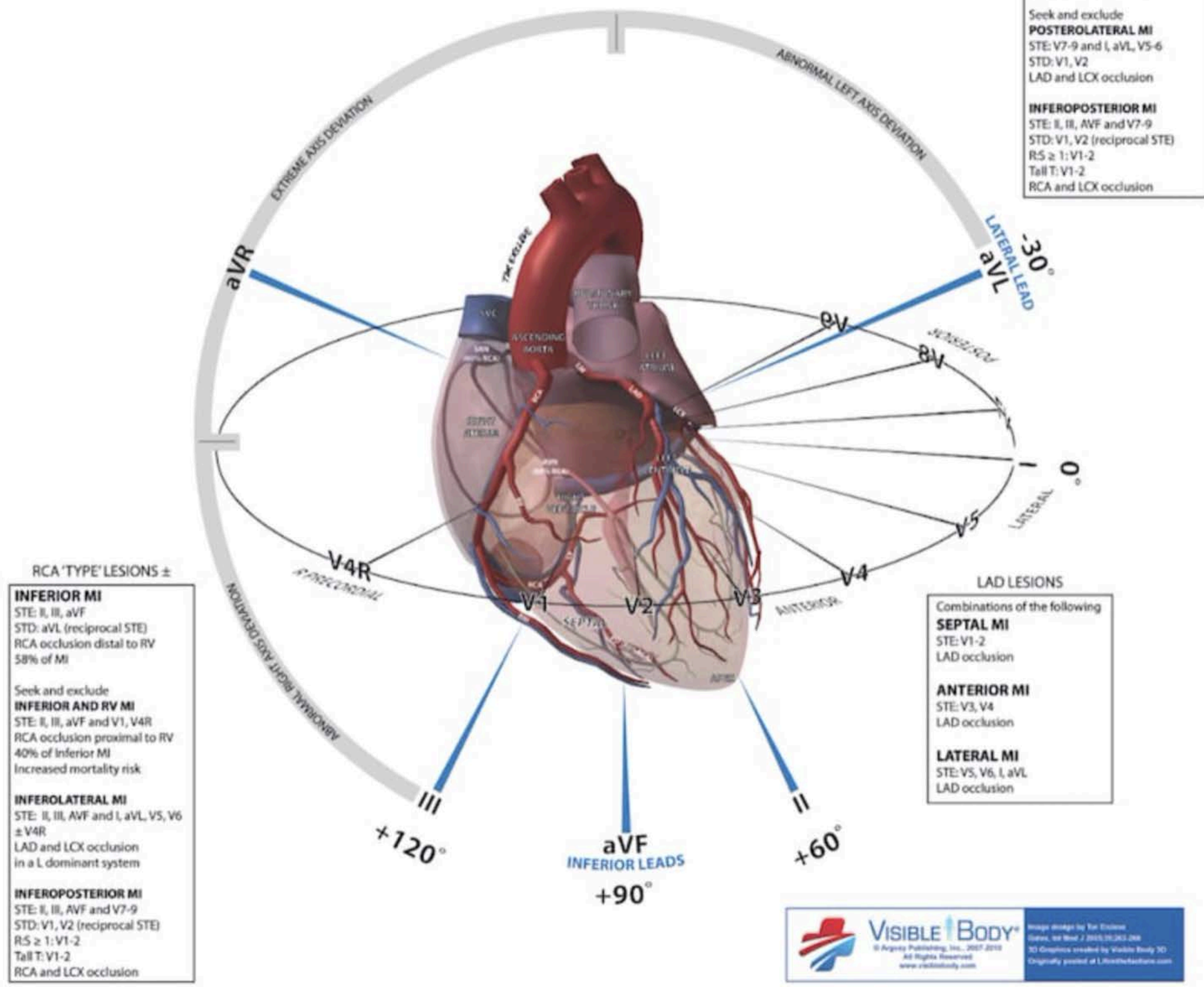
See:

**\*ECG\***

webpage  
on  
[imageessays.com](http://imageessays.com)



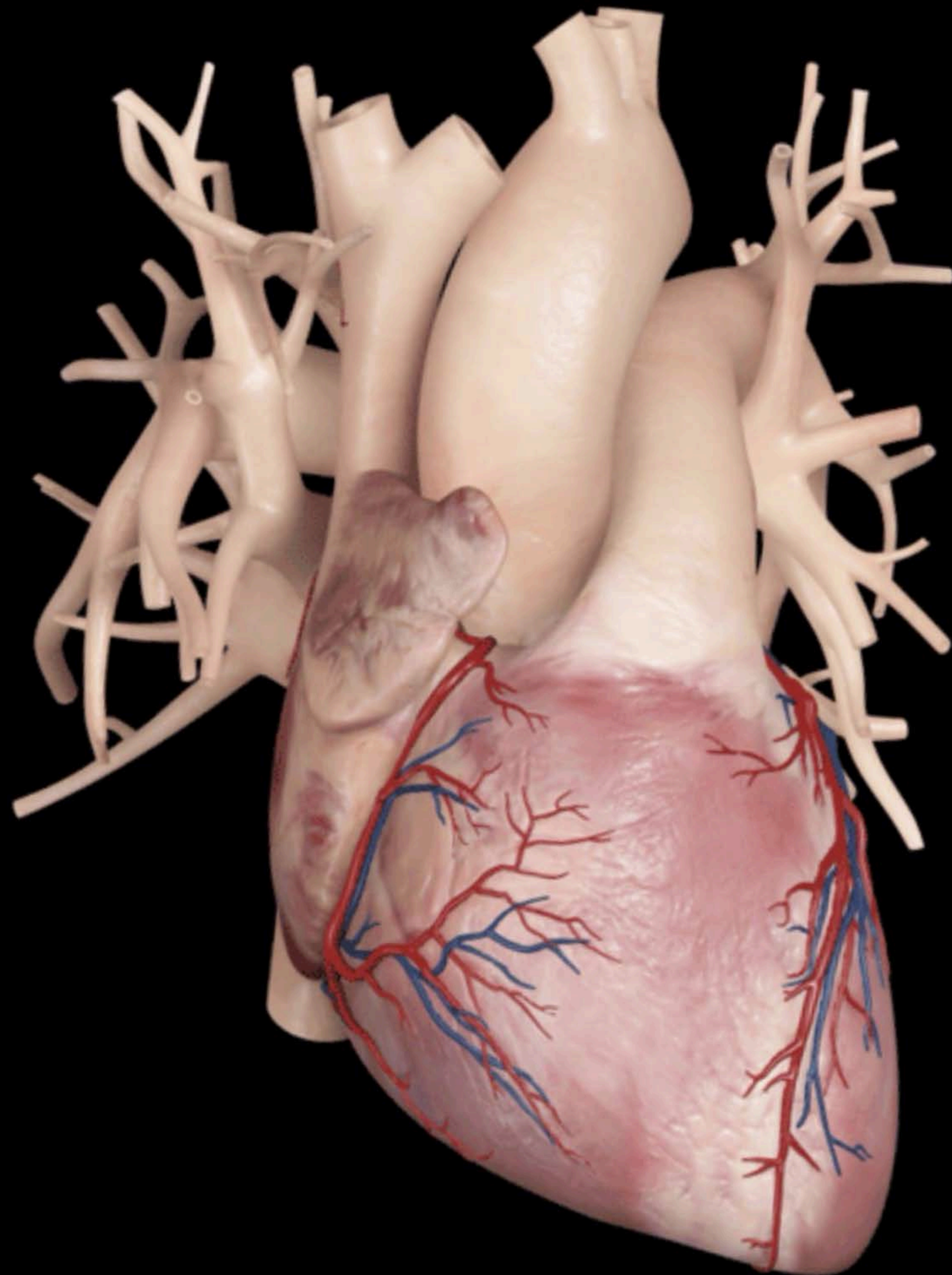
# AMI ECG, ANATOMY AND PATHOLOGY



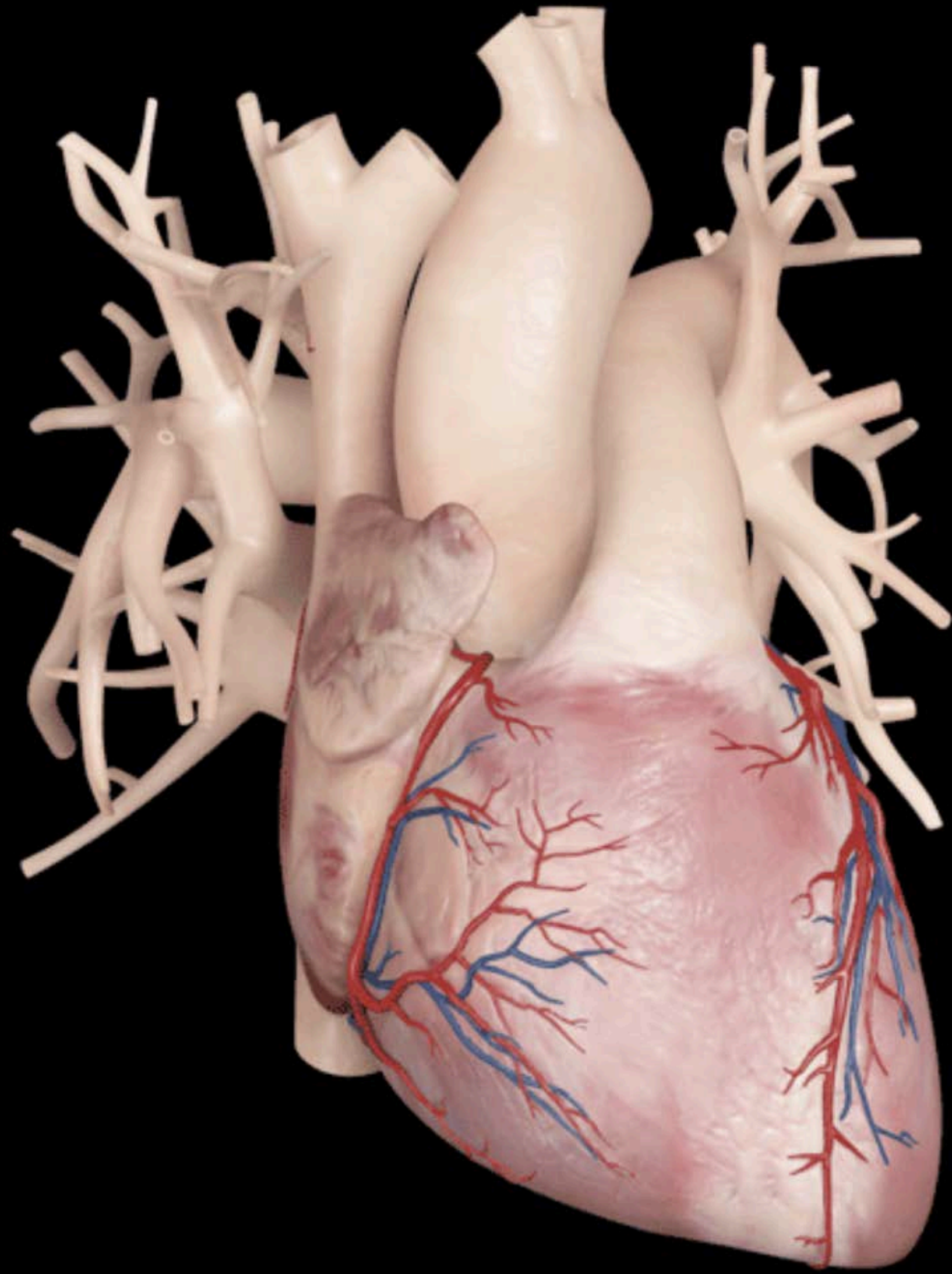
The 12-lead ECG records the electrical activity of the heart (depolarization / repolarization) from 12 different viewpoints *perspective*

See: [ECG Library](#) - [LITFL](#) - [ECG Library Basics](#) - excellent interactive website

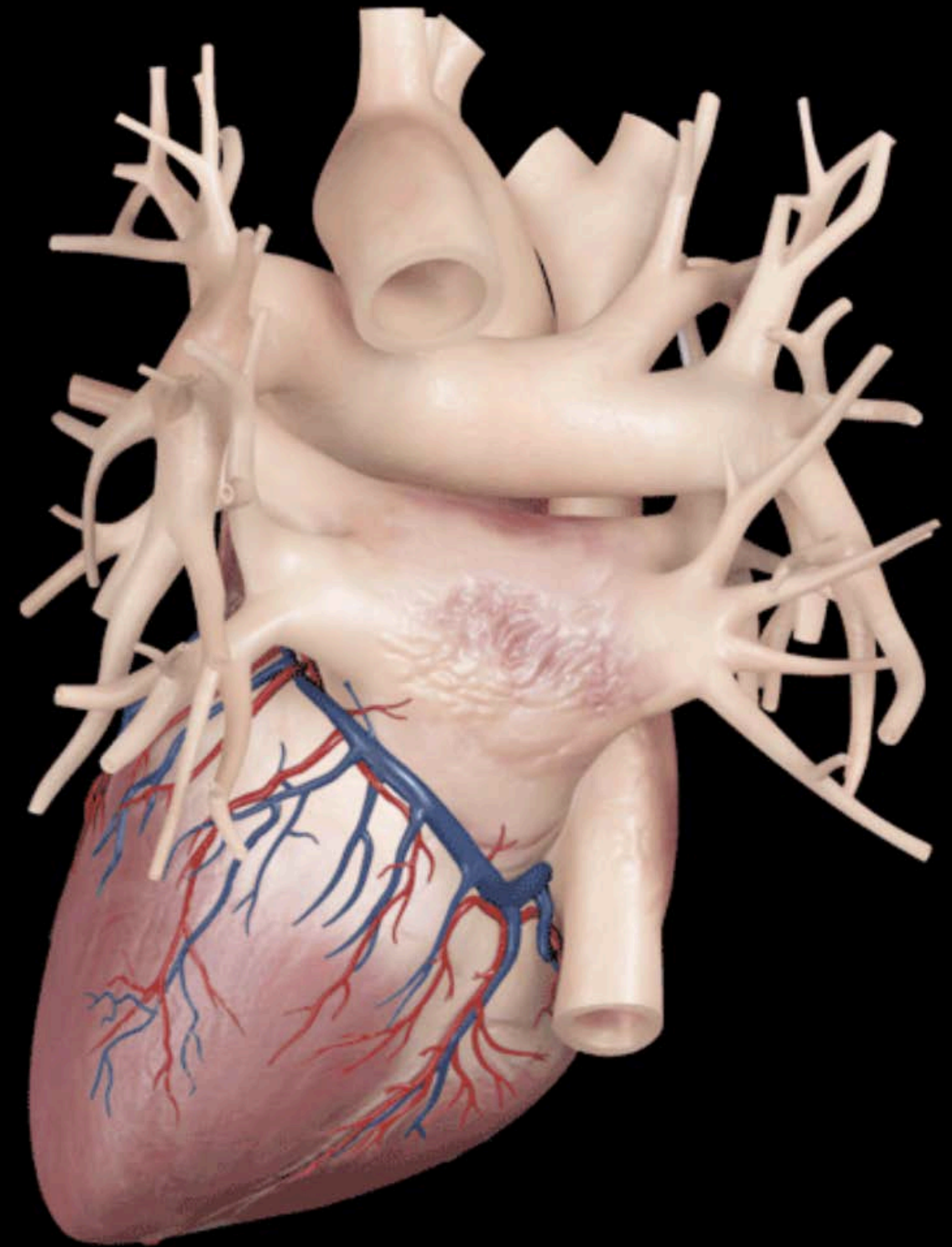






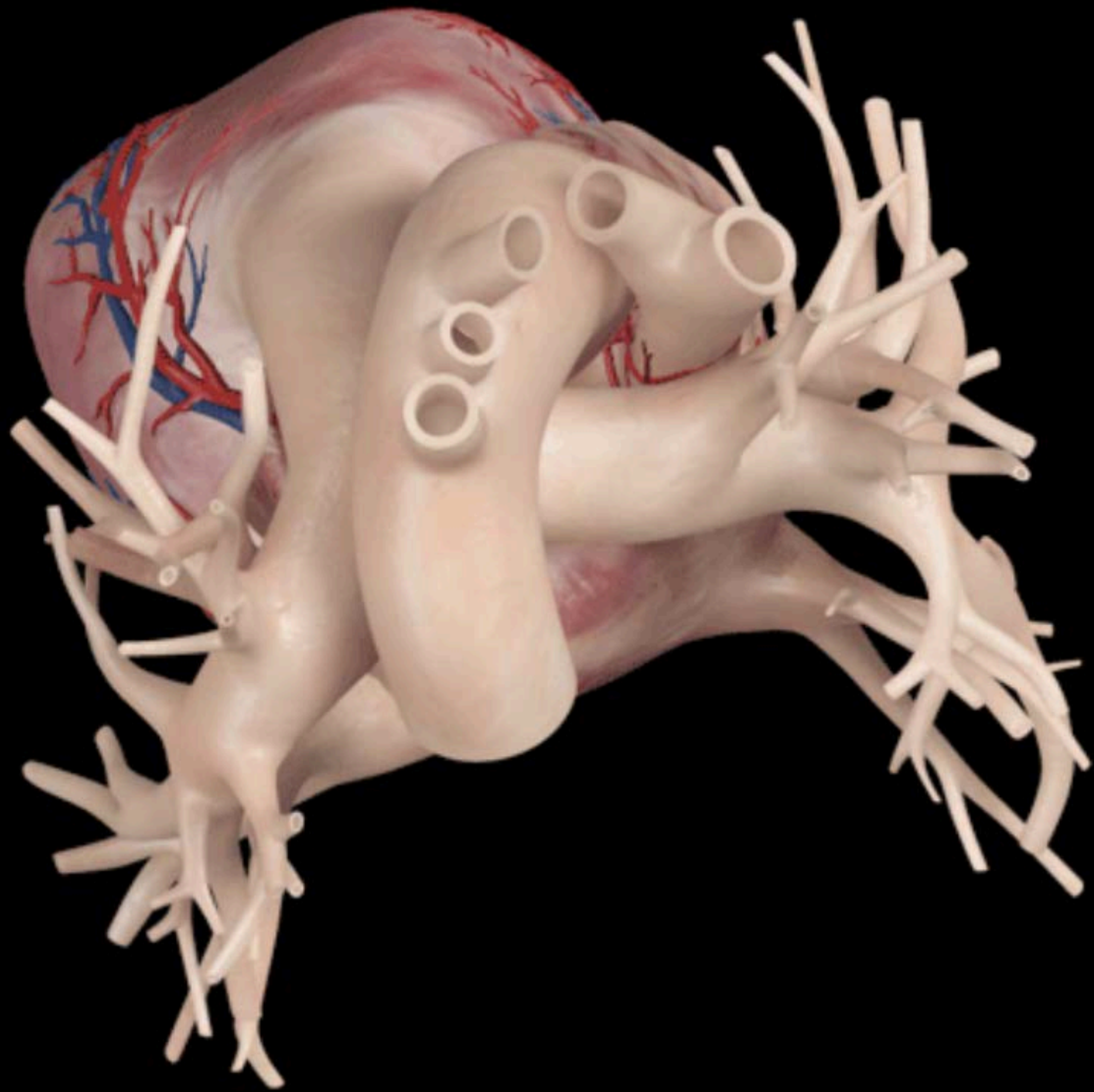


**anterior view**

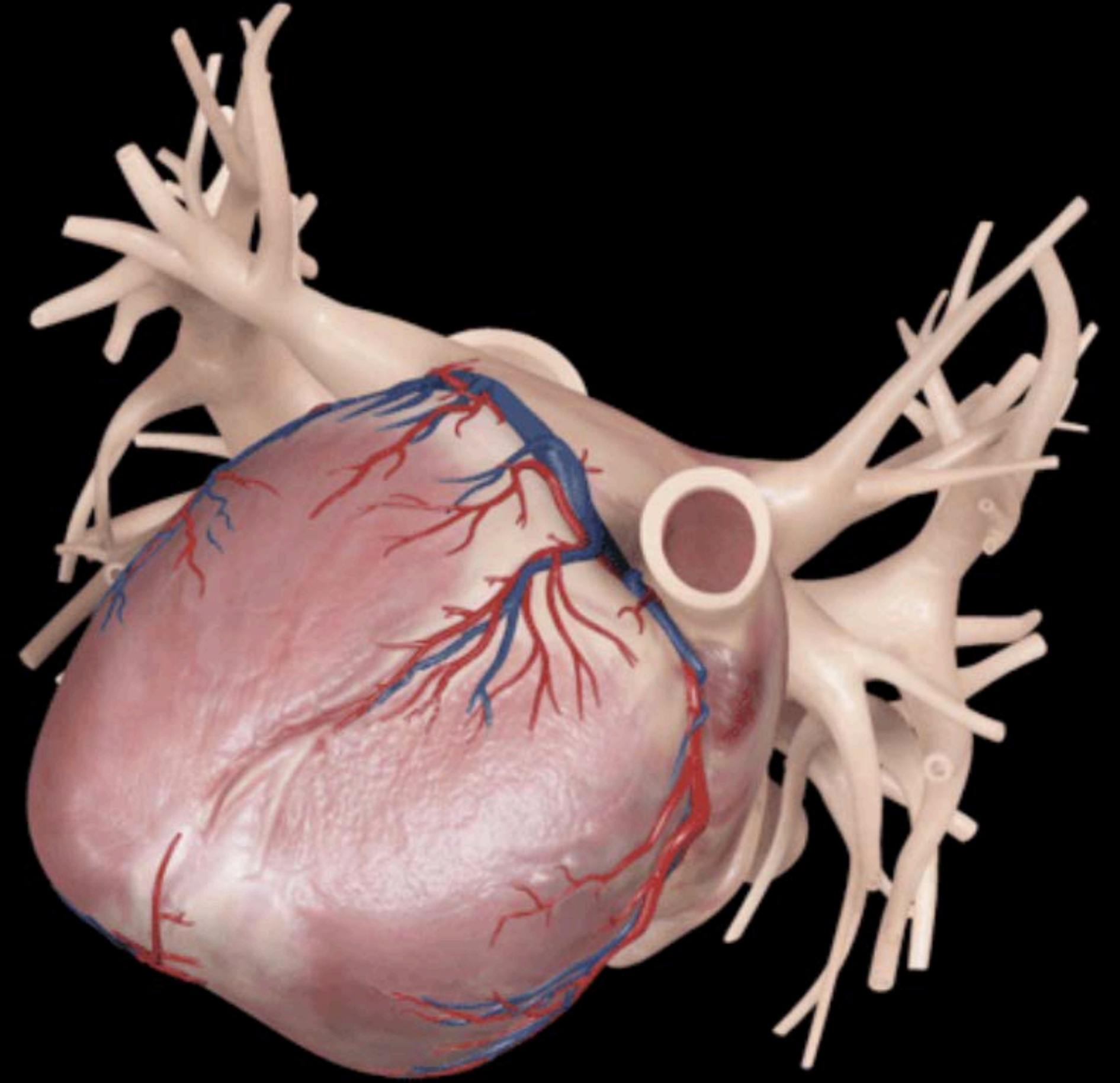


**posterior view**





**superior view**



**inferior view**



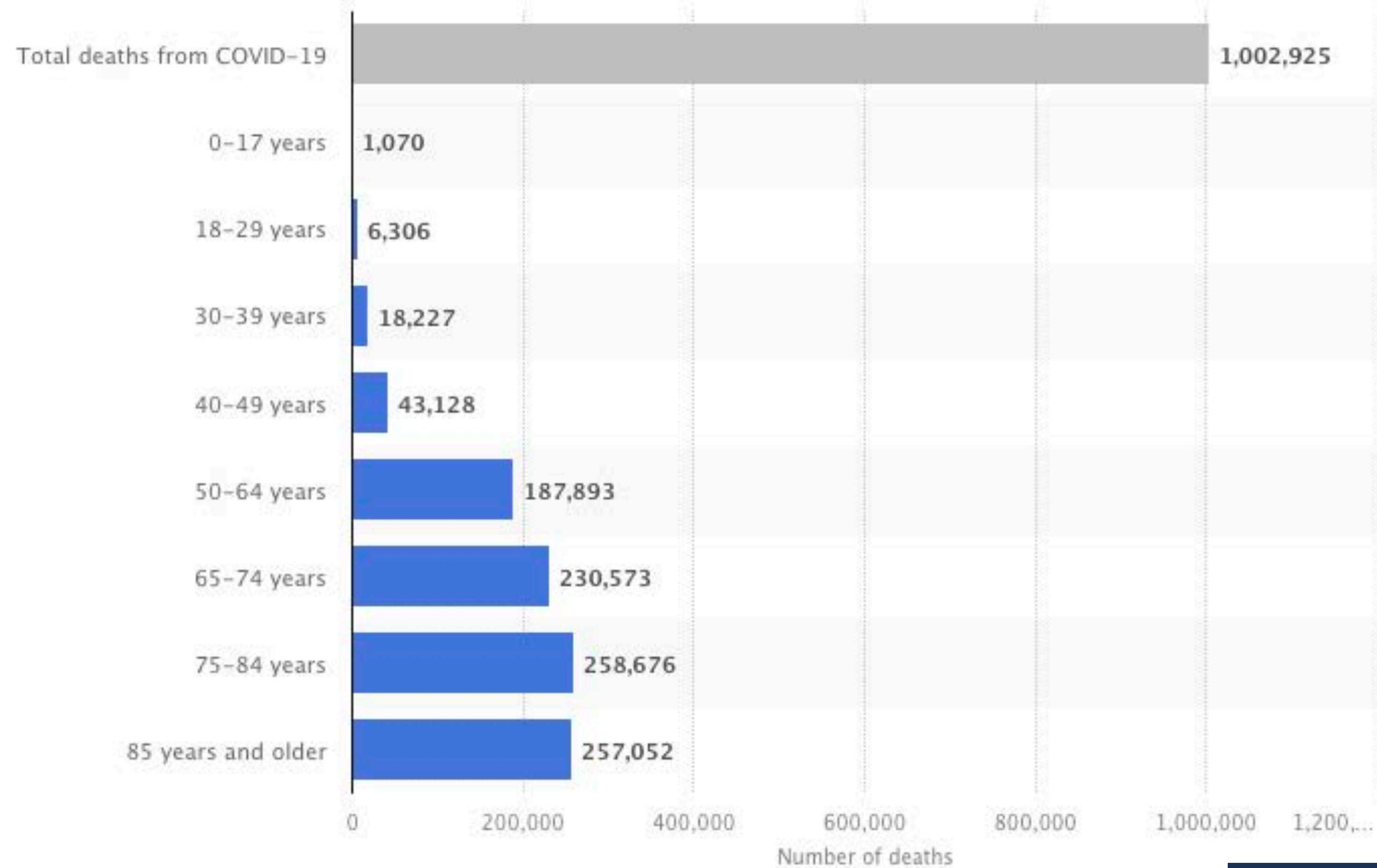
2 ways of thinking about the ongoing COVID-19 pandemic: *perspective ... perception*

**Personal Health ... Me**

**Public Health ... Us**



# Number of coronavirus disease 2019 (COVID-19) deaths in the U.S. as of May 25, 2022, by age\*



statista



# Risk for COVID-19 Infection, Hospitalization, and Death By Age Group

Updated June 2, 2022



Centers for Disease Control and Prevention  
 CDC 24/7: Saving Lives, Protecting People™

## Age group rate ratios compared to ages 18 to 29 years<sup>1</sup>

Rate compared to 18-29 years old <sup>1</sup>	0-4 years old	5-17 years old	18-29 years old	30-39 years old	40-49 years old	50-64 years old	65-74 years old	75-84 years old	85+ years old
<b>Cases<sup>2</sup></b>	<1x	1x	Reference group	1x	1x	1x	1x	1x	1x
<b>Hospitalization<sup>3</sup></b>	1x	<1x	Reference group	2x	2x	3x	5x	8x	10x
<b>Death<sup>4</sup></b>	<1x	<1x	Reference group	4x	10x	25x	65x	140x	330x

All rates are relative to the 18 to 29 years age group. This group was selected as the reference group because it has accounted for the largest cumulative number of COVID-19 cases compared to other age groups. Sample interpretation: Compared with ages 18 to 29 years, the rate of death is four times higher in ages 30 to 39 years, and 330 times higher in those who are ages 85 years and older. (In the table, a rate of 1x indicates no difference compared to the 18 to 29 years age group.)



**Infectious Disease**

**Transmissible**



2 ways of thinking about the ongoing COVID-19 pandemic

**Personal Health ... Me**

**Public Health ... Us**



As an example of an infected (and infectious) person who was not allowed to "do what she wanted to do", [Mary Mallon](#) was an asymptomatic carrier (in her gallbladder) of *Salmonella typhi*, which is infectious and causes [typhoid fever](#). She chose and preferred to continue to work in her job as a cook (and to continue to spread typhoid fever to others who could become sick and die). She was not permitted to do so, however, because of the public health implications of this.



Mary Mallon, also called Typhoid Mary THE NEW YORK AMERICAN

The **COVID-19** pandemic is a public health issue in addition to being a "personal choice", "freedom", "my decision" issue.

The [health technology](#) of the era did not have a completely effective solution: there were no antibiotics to fight the infection, and gallbladder removal was a dangerous, sometimes fatal operation. Some modern specialists claim that the typhoid bacteria can become integrated in [macrophages](#) and then reside in intestinal [lymph nodes](#) or the [spleen](#).<sup>[50][51]</sup>

**Mary Mallon** (September 23, 1869 – November 11, 1938), commonly known as **Typhoid Mary**, was an [Irish-born American](#) cook believed to have infected between 51 to 122 people with [typhoid fever](#). The infections caused three confirmed deaths, with unconfirmed estimates of up to 50. She was the first person in the United States identified as an [asymptomatic carrier](#) of the pathogenic [bacteria \*Salmonella typhi\*](#).<sup>[1][2]</sup> She persisted in working as a cook and thereby exposed others to the disease. Because of that, she was twice forcibly [quarantined](#) by authorities, eventually for the final two decades of her life. Mallon died after a total of nearly 30 years in isolation.<sup>[3][4]</sup> Her popular nickname has since gained currency as a term for persons who spread disease or other misfortune, not always aware that they are doing so.

In 1909, Mary unsuccessfully sued the health department. During her two-year period of confinement, she had 120/163 stool samples test positive. No one ever attempted to explain to Mary the significance of being a "carrier", instead they had offered to remove her gallbladder, something she had denied. She was unsuccessfully treated with Hexamethylenamin, laxatives, Urotropin, and brewer's yeast. In 1910, a new health commissioner vowed to free Mary and assist her with finding suitable employment as a domestic but not as a cook. Mary was released but never intended to abide by the agreement. She started working again in the cuisines of her unsuspecting employers, threatening public health once more [4].

As a cook of Sloane Maternity in Manhattan, she contaminated, in three months, at least 25 people, doctors, nurses and staff. Two of them died. She had managed to be hired as "Mary Brown" [8]. Since then she was stigmatized as "Typhoid Mary"





## U.S. Population

332,749,749



## World Population

7,900,634,465

### Components of Population Change

16:26:51 UTC

One birth every 9 seconds



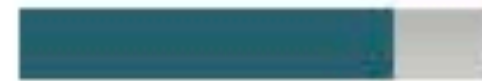
One death every 13 seconds



One international migrant (net) every 126 seconds



Net gain of one person every 23 seconds



### TOP 10 MOST POPULOUS COUNTRIES (July 1, 2022)

1. China	1,410,539,758	6. Nigeria	225,082,083
2. India	1,389,637,446	7. Brazil	217,240,060
3. United States	332,838,183	8. Bangladesh	165,650,475
4. Indonesia	277,329,163	9. Russia	142,021,981
5. Pakistan	242,923,845	10. Mexico	129,150,971



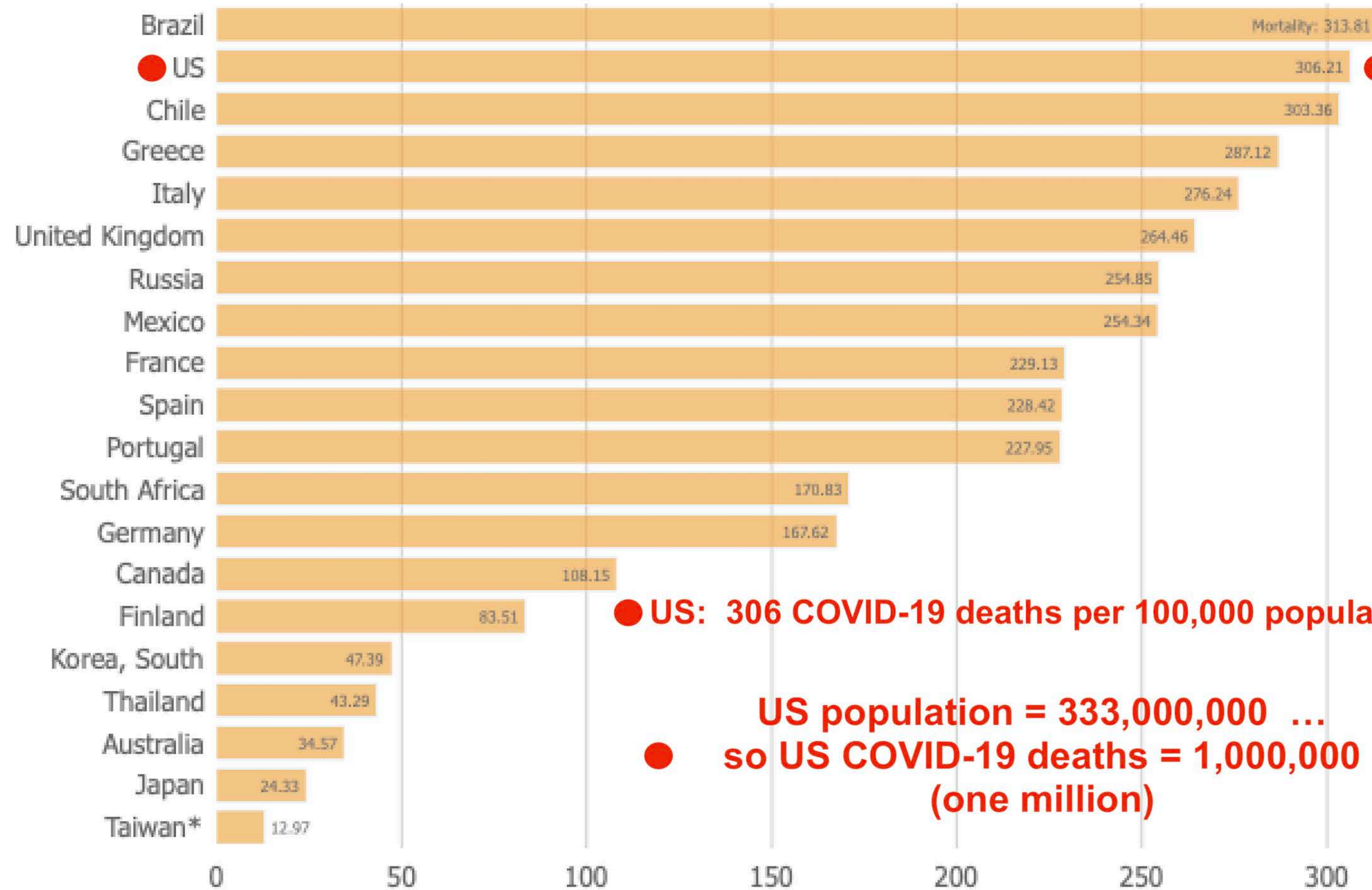
Select a Date

The United States population on **June 6, 2022** was: **332,744,033**

Select a Date



Deaths per 100,000 population



● US: 306 COVID-19 deaths per 100,000 population ●

US population = 333,000,000 ...  
● so US COVID-19 deaths = 1,000,000 ●  
(one million)

Mortality: Deaths per 100,000 population



# UNITED STATES

JOHNS HOPKINS  
UNIVERSITY OF MEDICINE

CORONAVIRUS  
RESOURCE CENTER



## OVERVIEW

All Time

Past Day

Past Week

Past Month

Confirmed Cases  
84,882,287

Deaths  
1,008,857

... as of 6/7/22



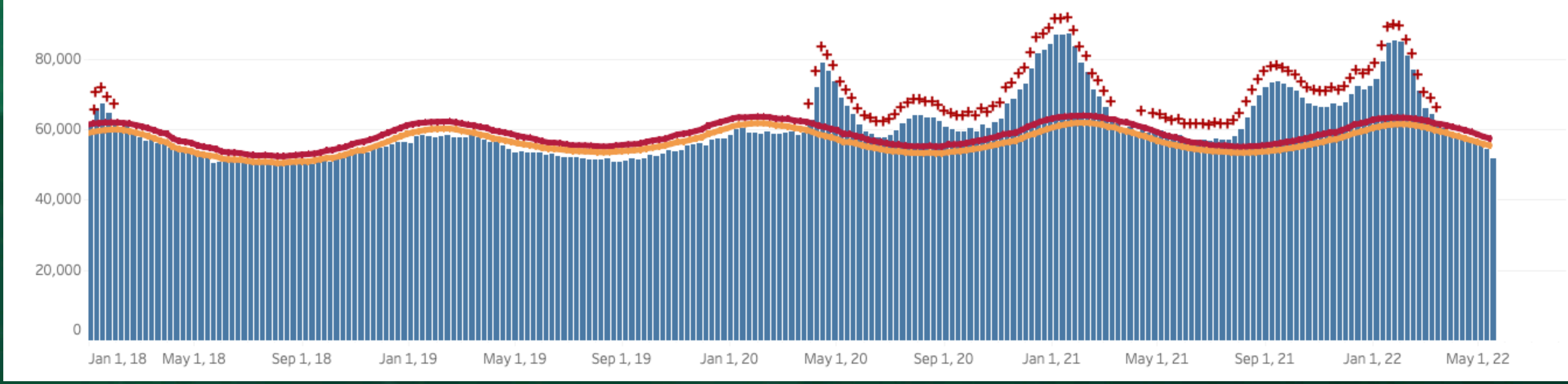
# Deaths Attributed to COVID-19 on Death Certificates

Data as of 6/3/2022	Total	2022	2021	2020
Deaths through week ending 5/28/2022		In at least 90% of these deaths, COVID-19 was listed as the underlying cause of death. For the remaining deaths, COVID-19 was listed as a contributing cause of death.		
<b>1,005,633</b>				

## US deaths

- + indicates observed count above threshold
- Predicted number of deaths from all causes
- average expected number of deaths
- upper bound threshold for excess deaths

Weekly number of deaths (from all causes)



## Total Excess Deaths

Total Excess Deaths from 2/1/2020 to 5/14/2022	This number reflects the total estimated number of excess deaths occurring since February 1, 2020.
<b>1,125,080</b>	Refer to " <a href="#">Number of Excess Deaths</a> " dashboard listed under "Options."



# COVID-19 DEATHS

## Death by Age Group

Data as of 6/2/2022	Total	2022	2021	2020
65-and-over age group				
74.4% (748,084 deaths)				
45-64 age group				
21.3% (214,550 deaths)				
Under 45 age group				
4.2% (42,602 deaths)				

## Death by Age Group

Data as of 6/2/2022	Total	2022	2021	2020
65-and-over age group				
75.9% (119,085 deaths)				
45-64 age group				
20.3% (31,851 deaths)				
Under 45 age group				
3.7% (5,865 deaths)				

## Death by Age Group

Data as of 6/2/2022	Total	2022	2021	2020
65-and-over age group				
68.6% (317,453 deaths)				
45-64 age group				
25.7% (118,762 deaths)				
Under 45 age group				
5.7% (26,554 deaths)				

## Death by Age Group

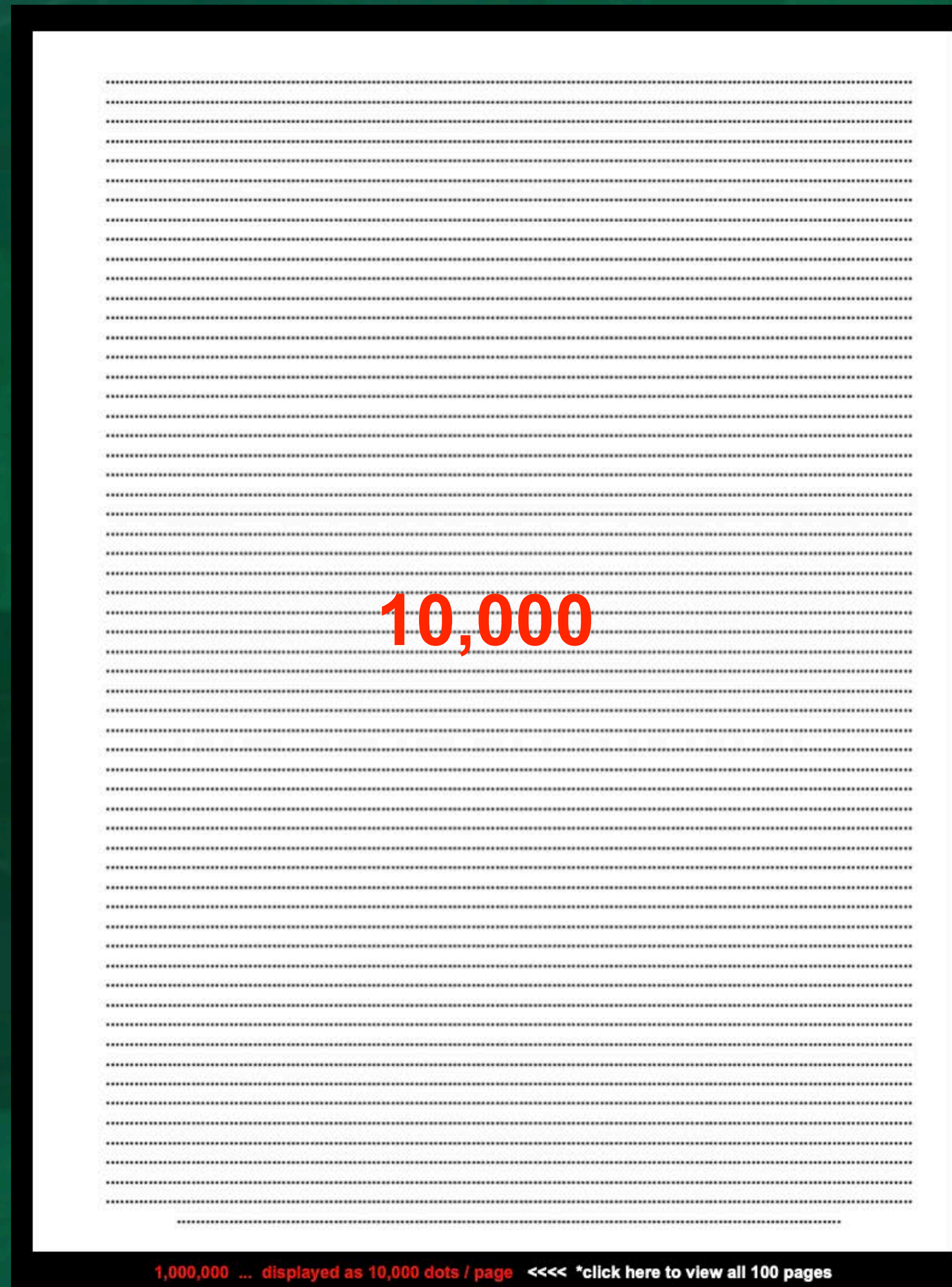
Data as of 6/2/2022	Total	2022	2021	2020
65-and-over age group				
80.8% (311,546 deaths)				
45-64 age group				
16.6% (63,937 deaths)				
Under 45 age group				
2.6% (10,183 deaths)				







# 1 million ... how to conceptualize that large number: *perception*





20,000

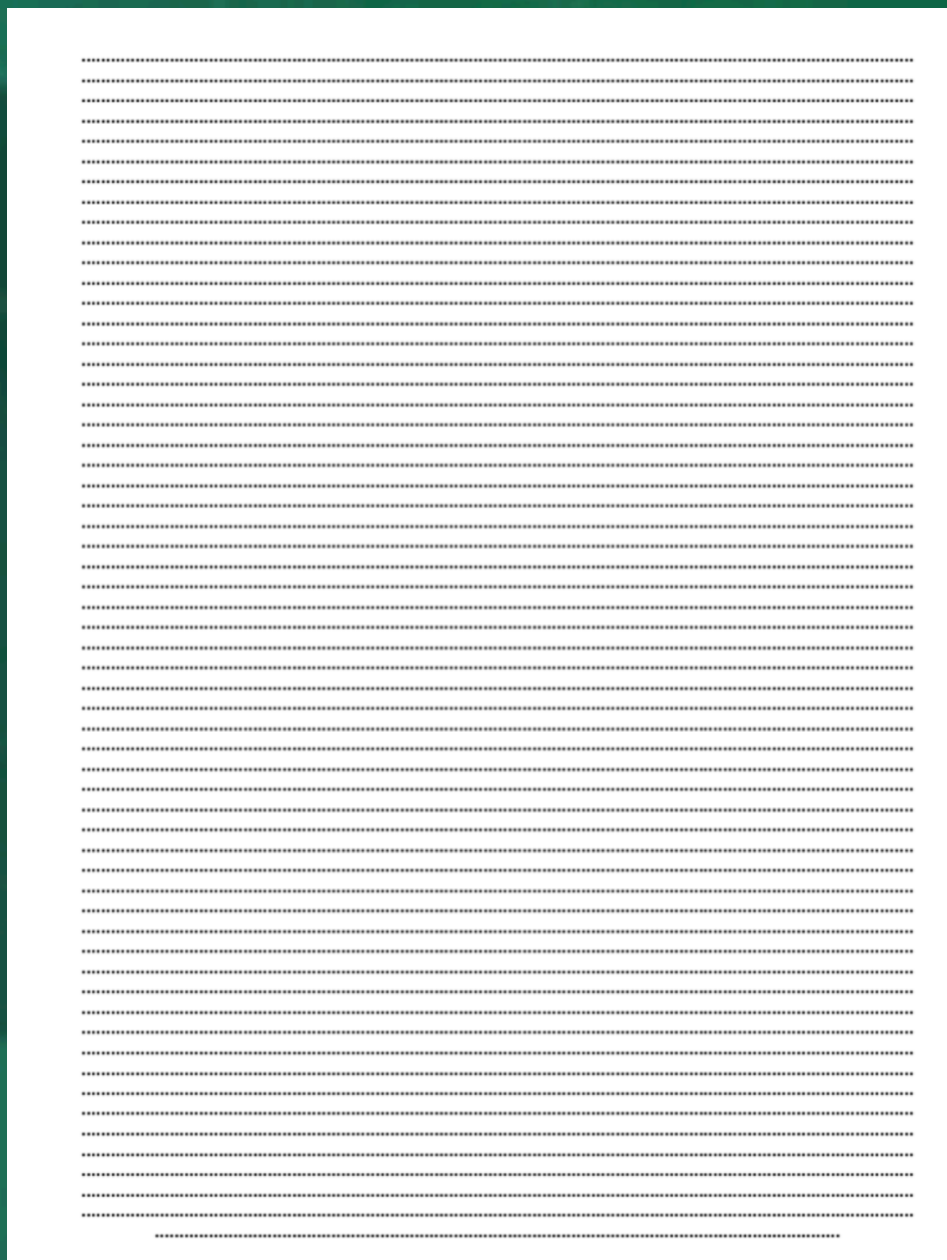
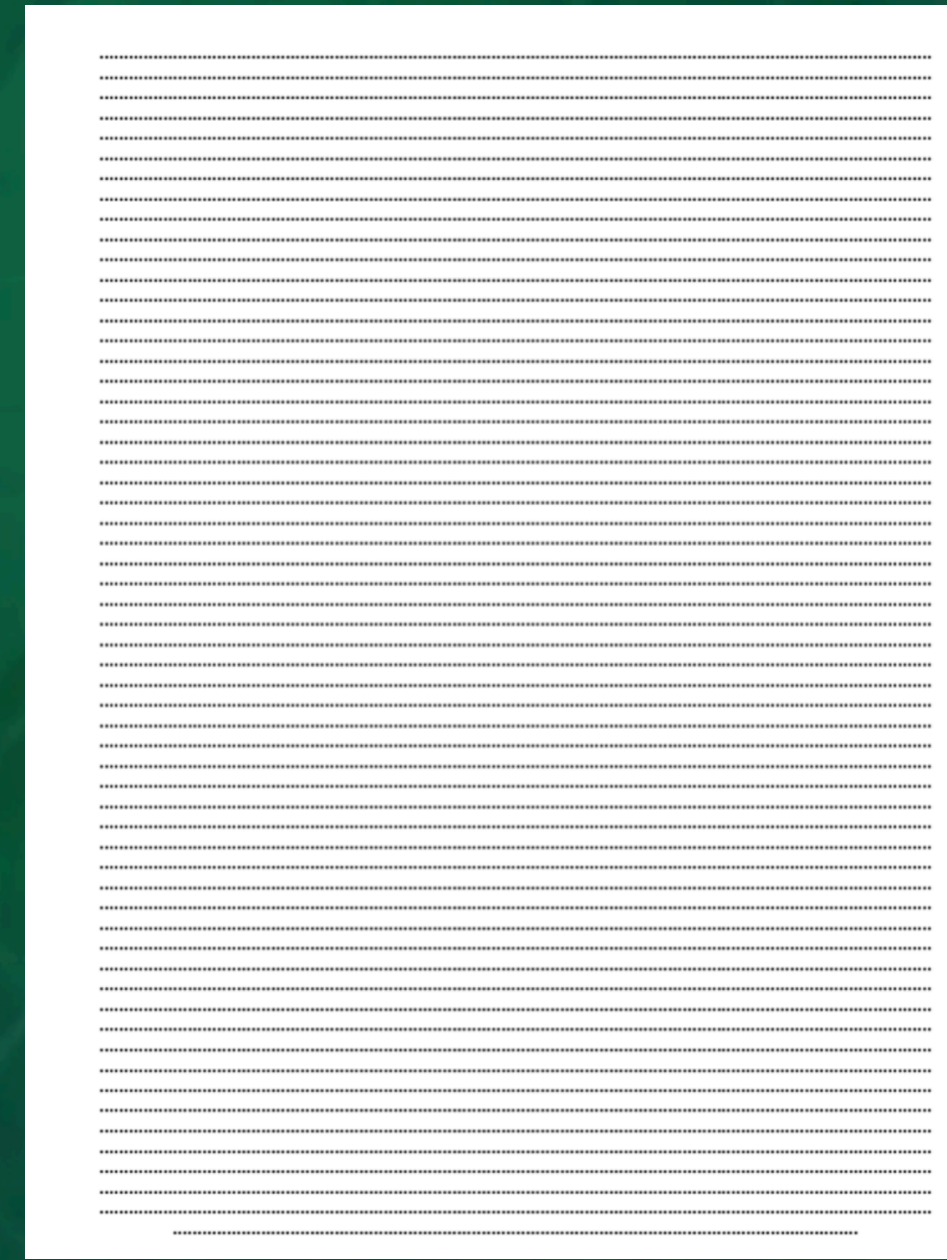
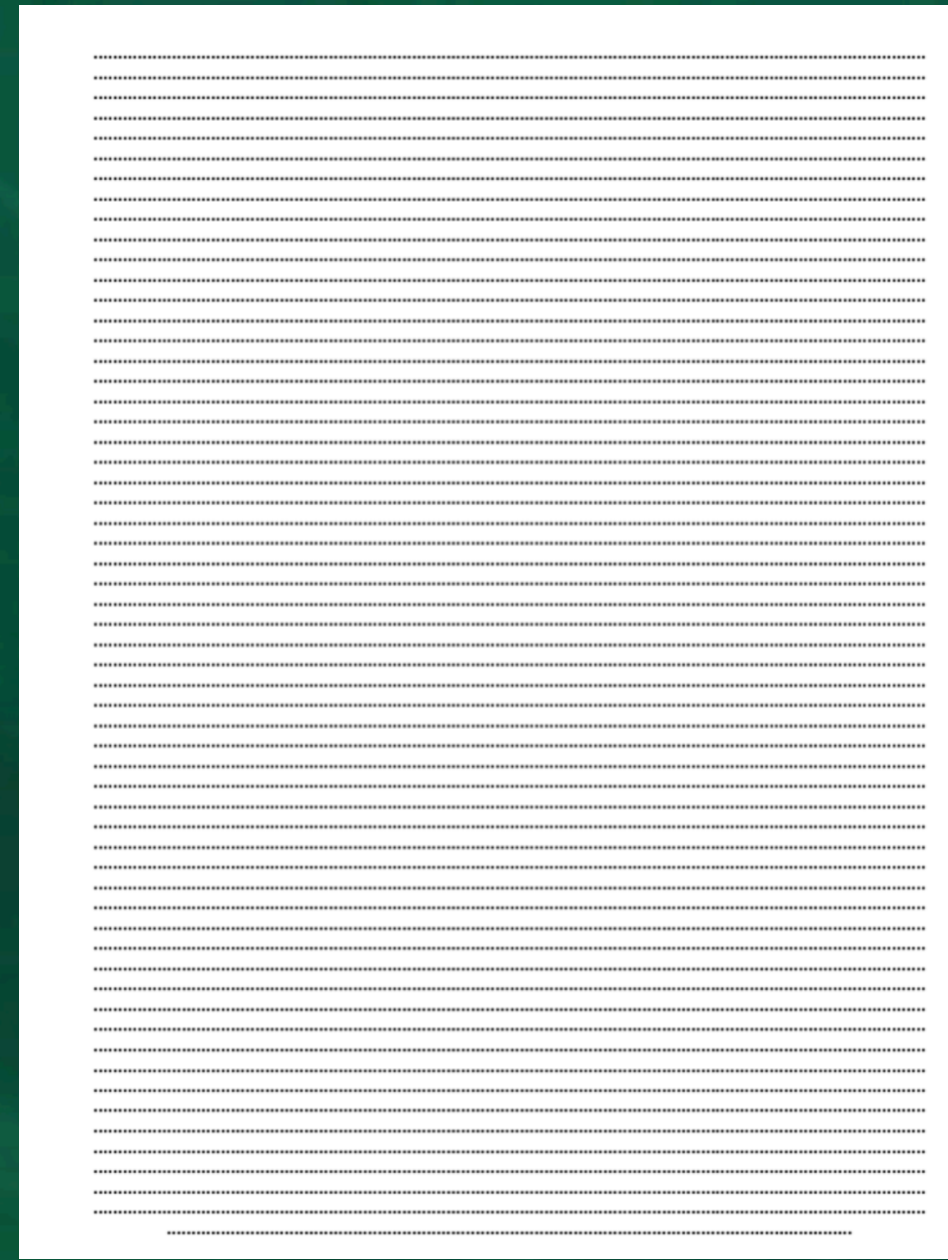
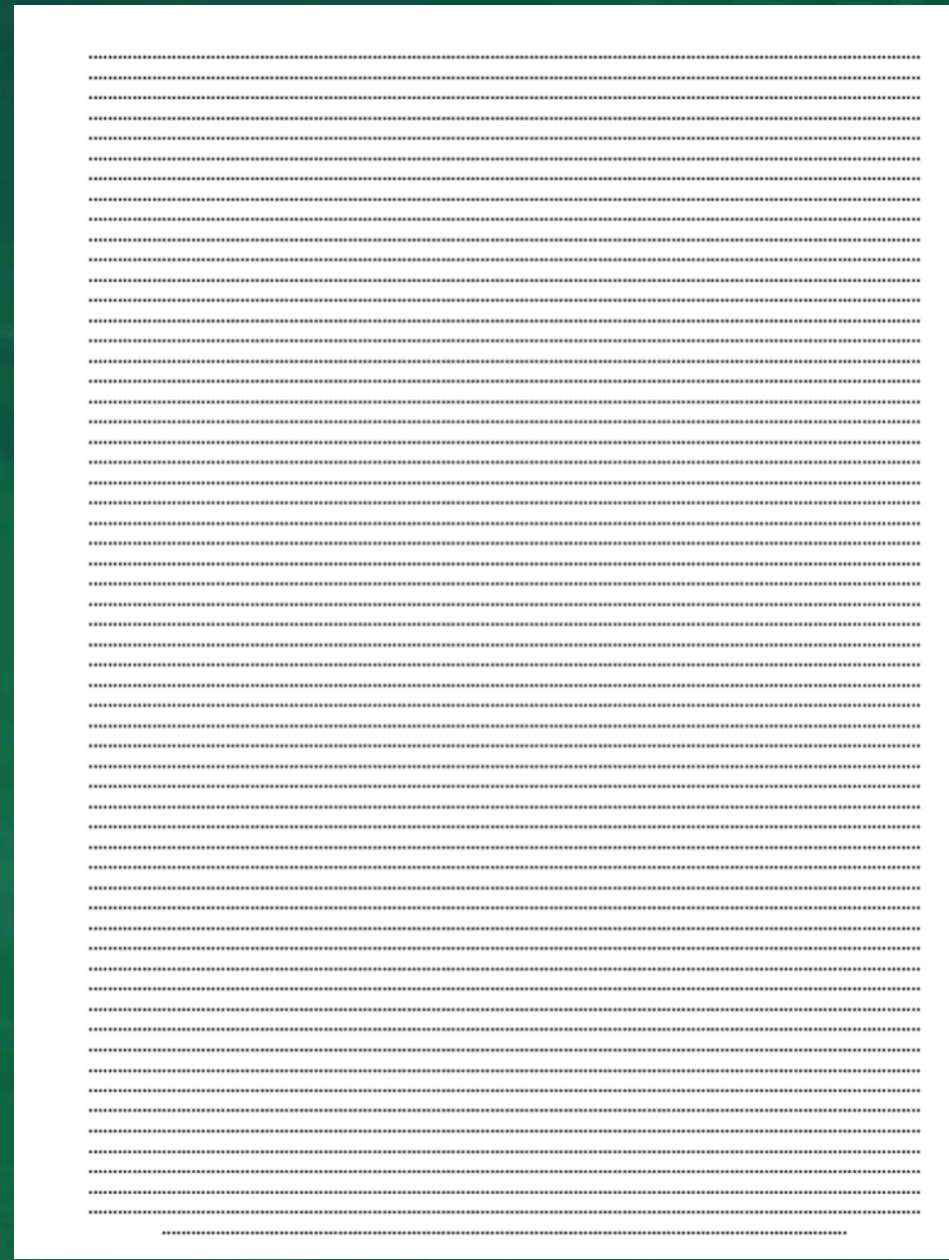
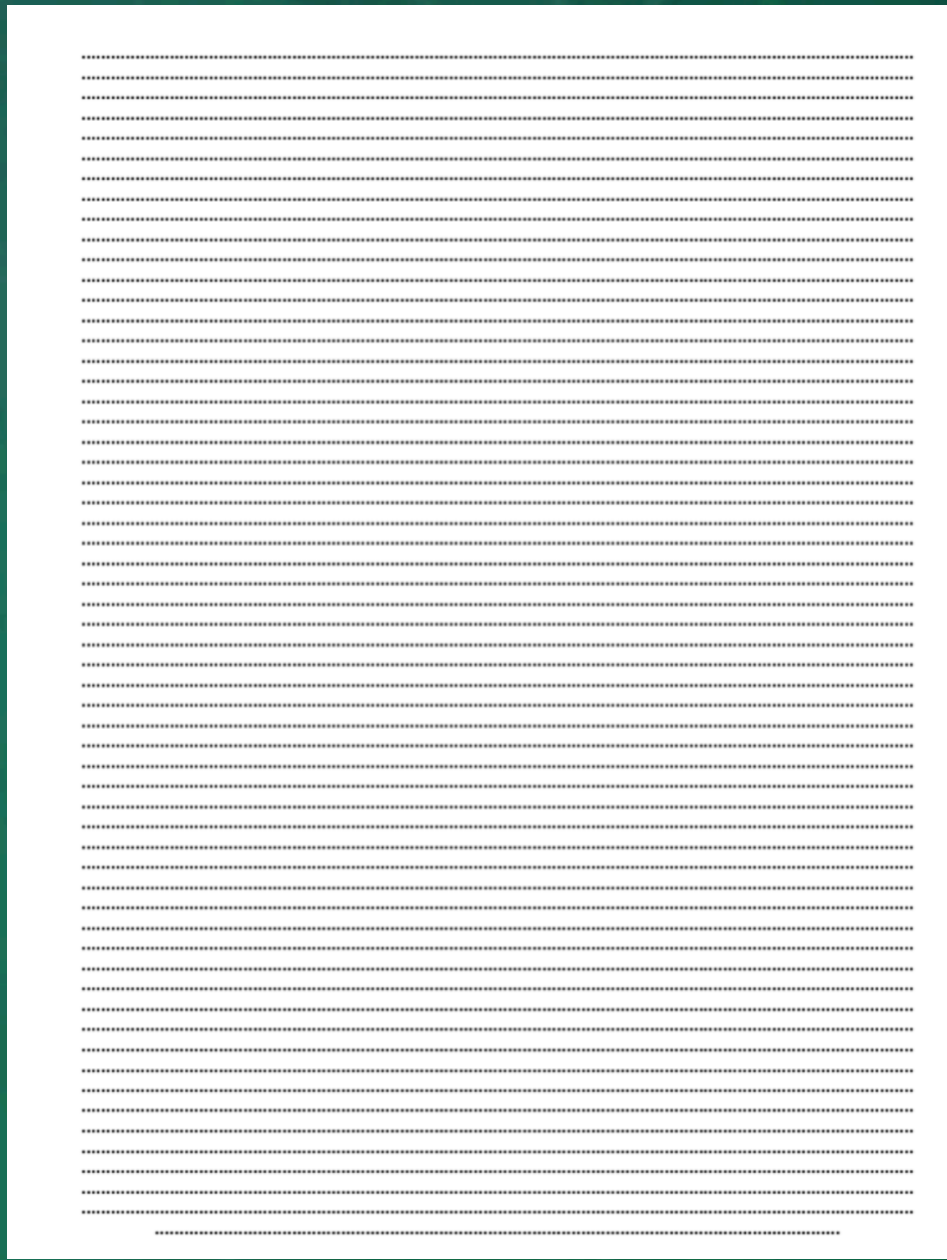












50,000





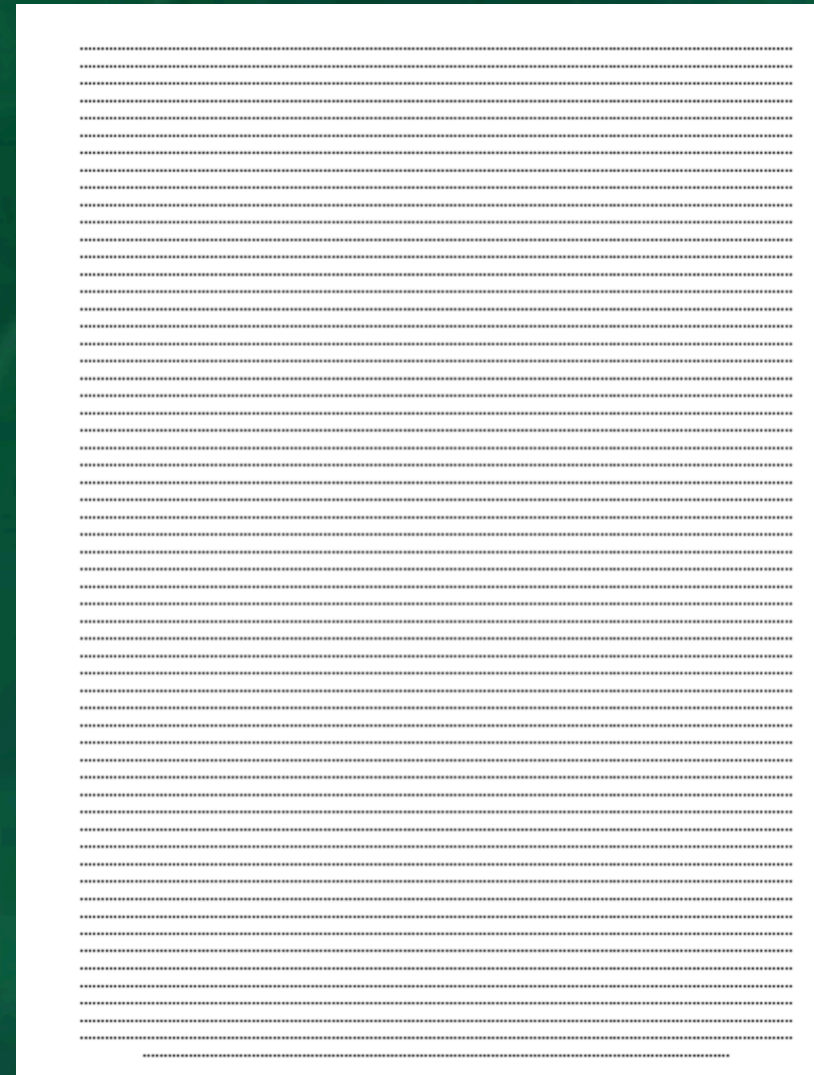
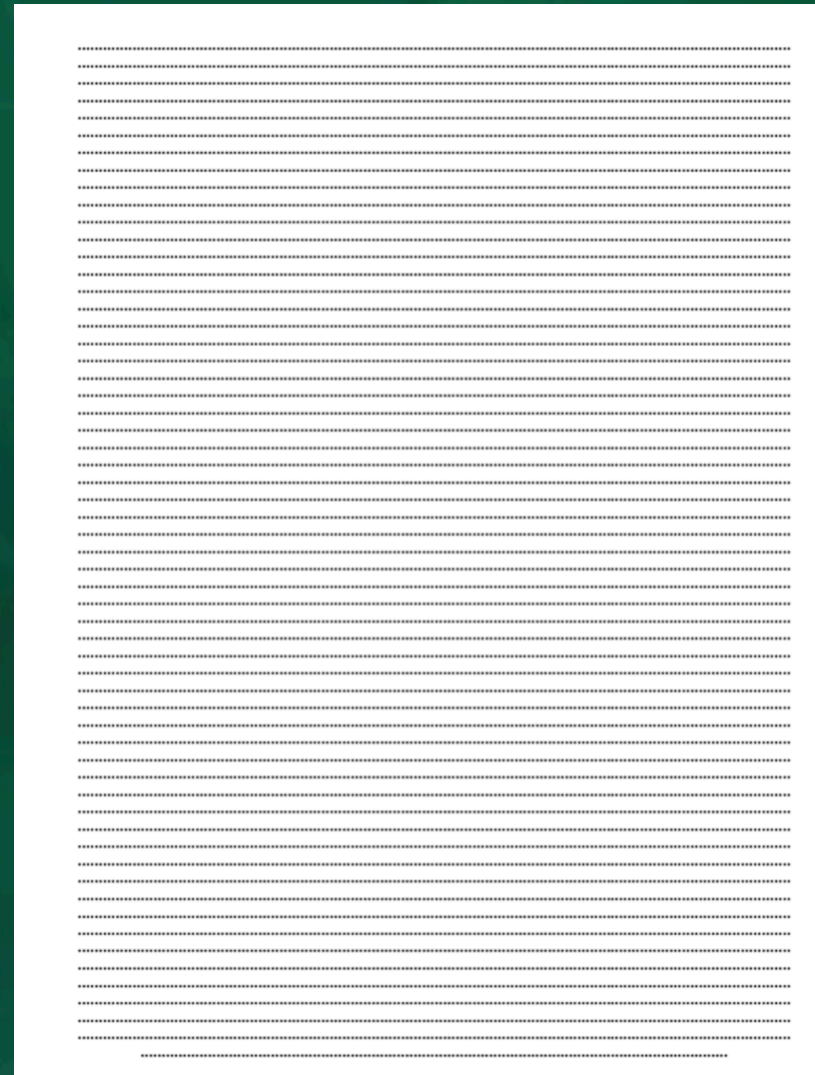
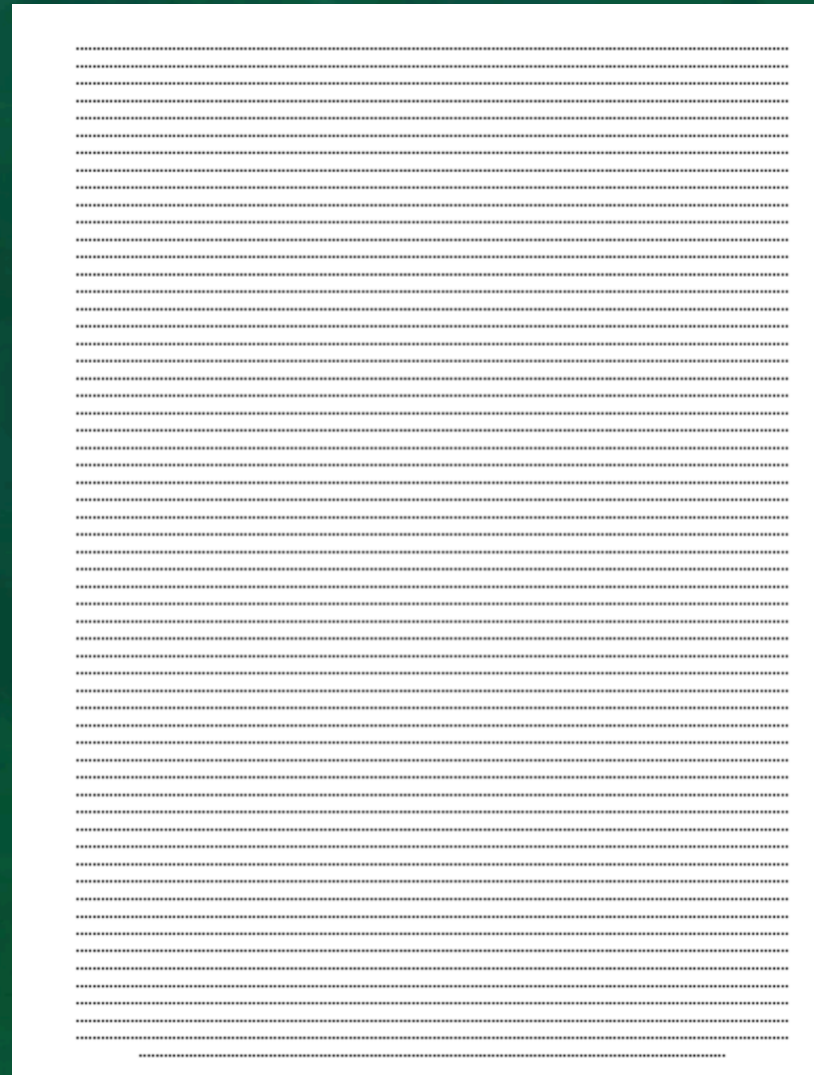
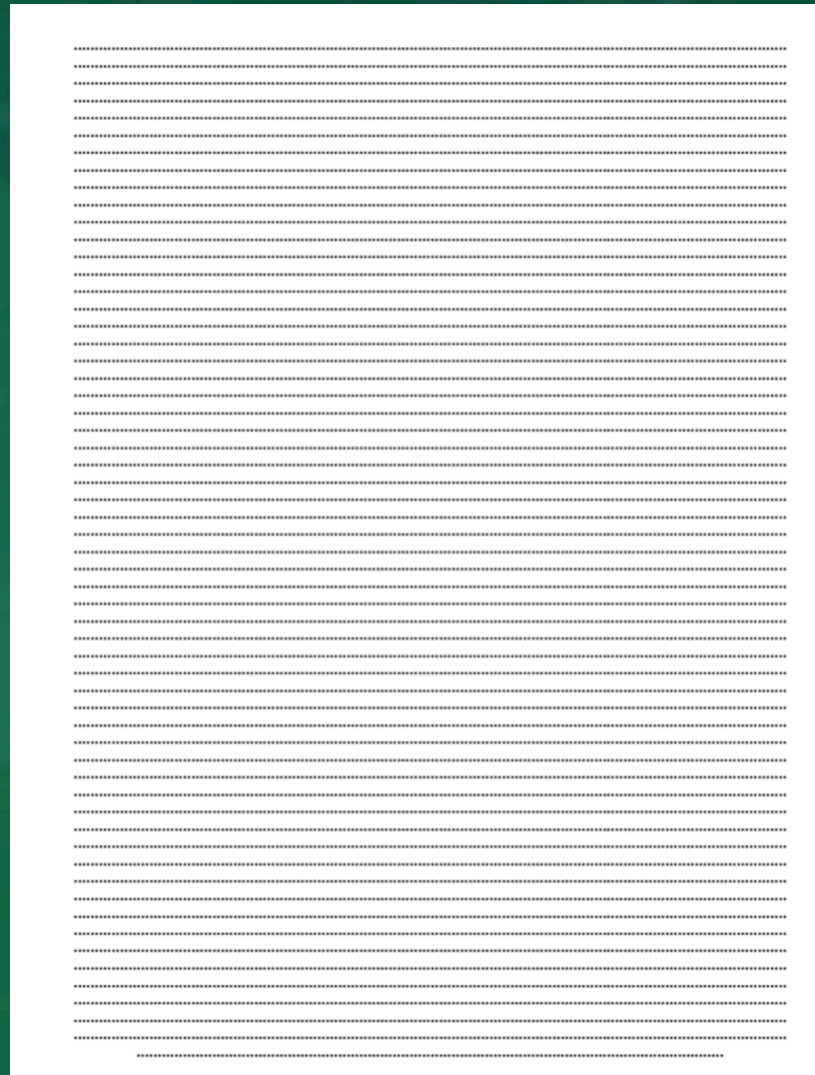
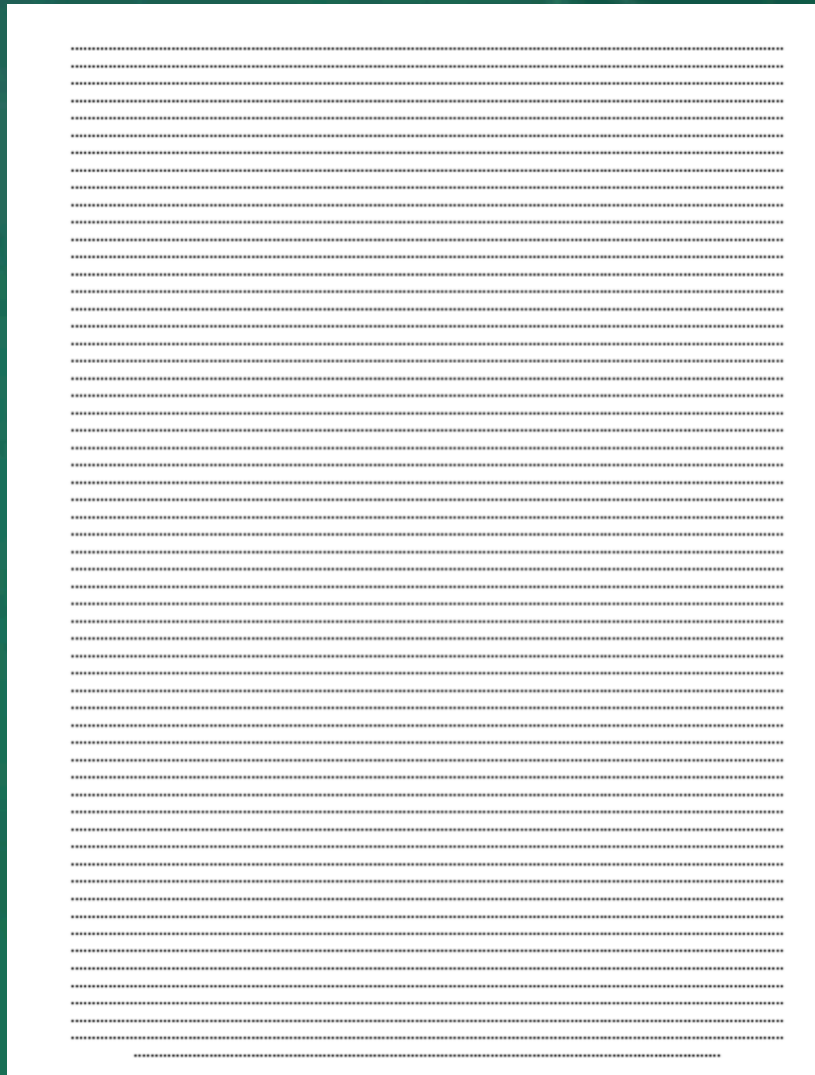




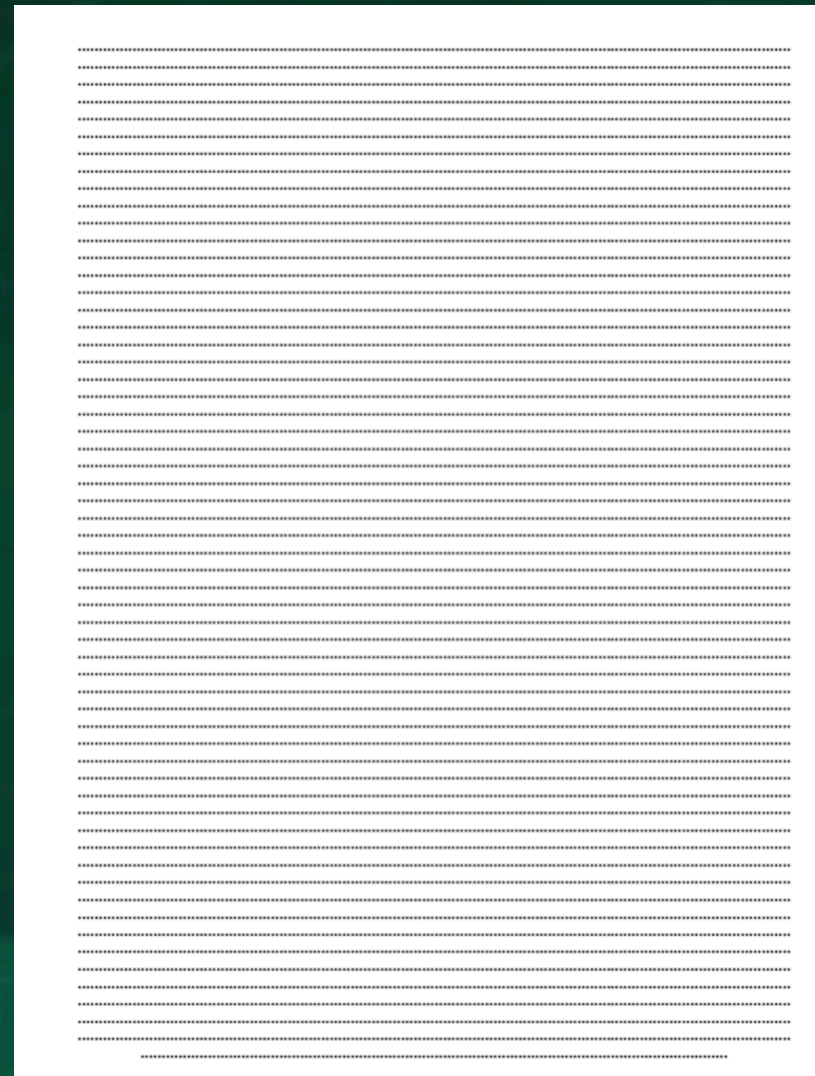
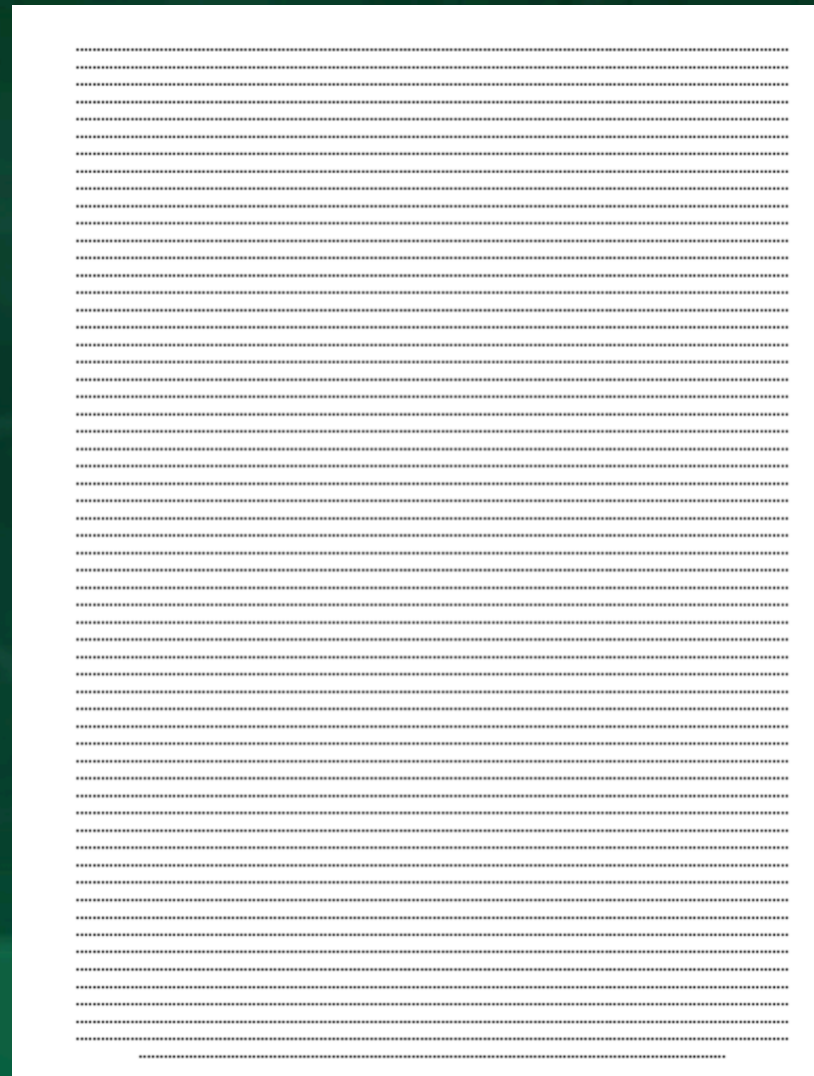
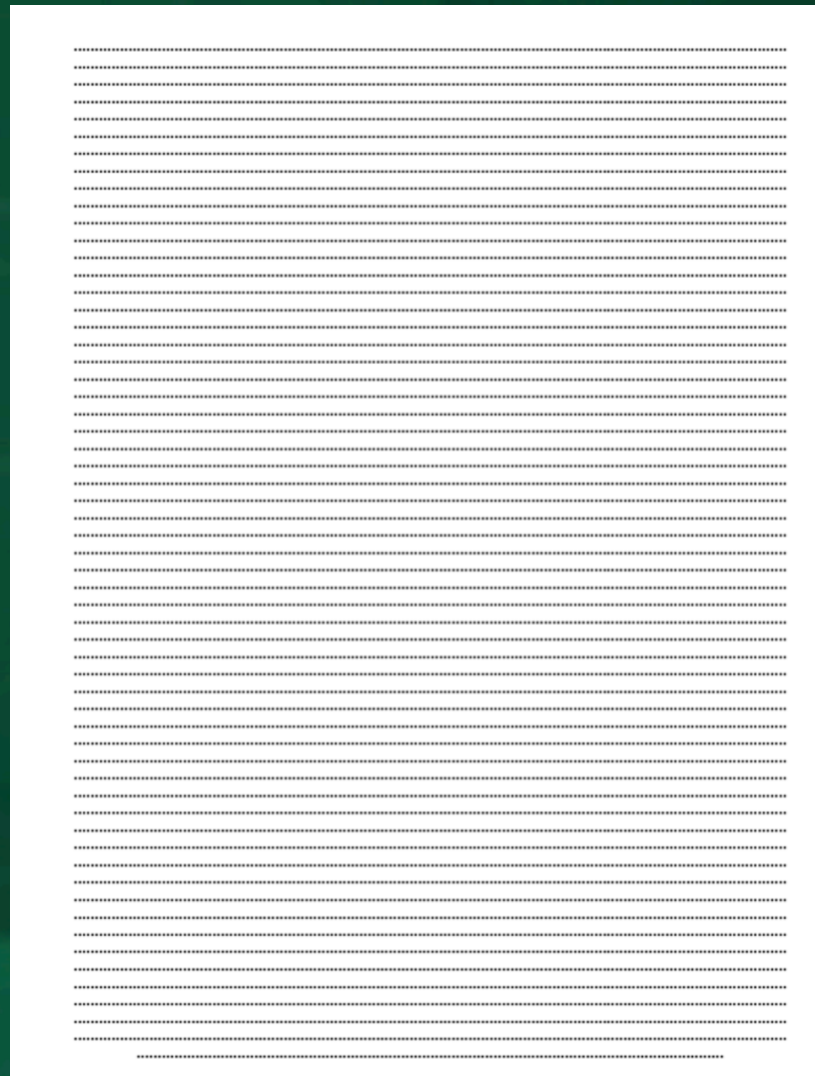
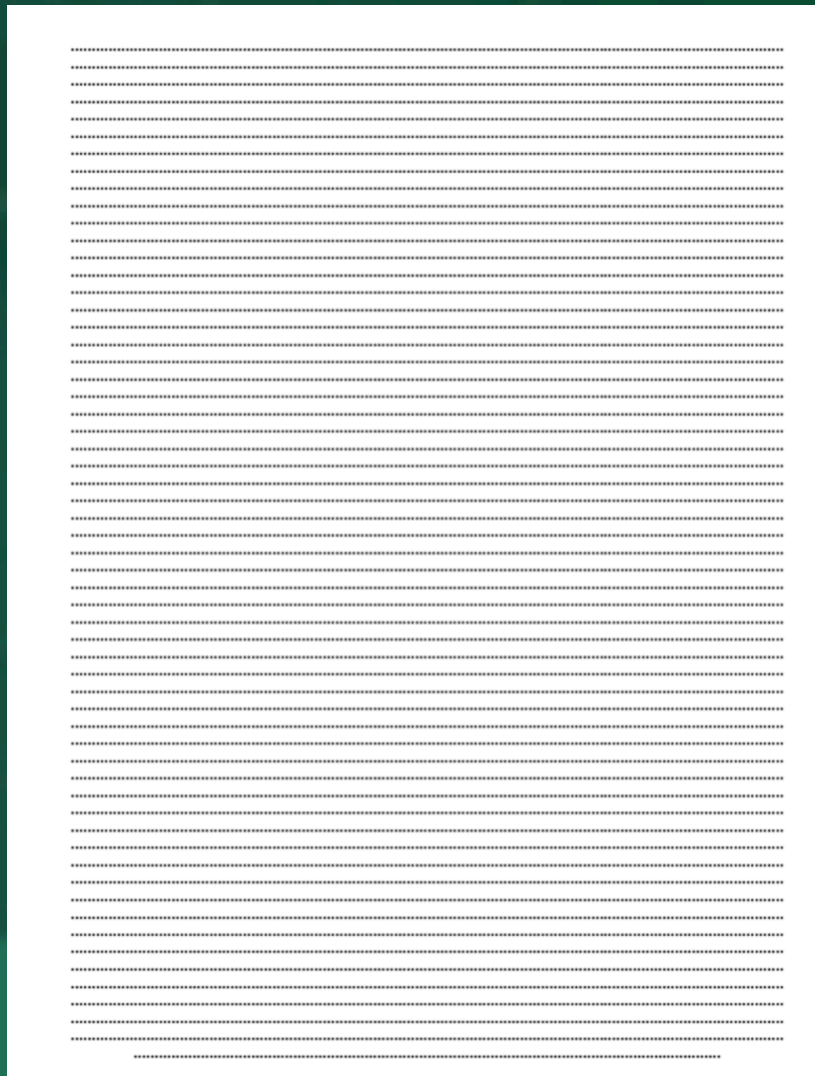




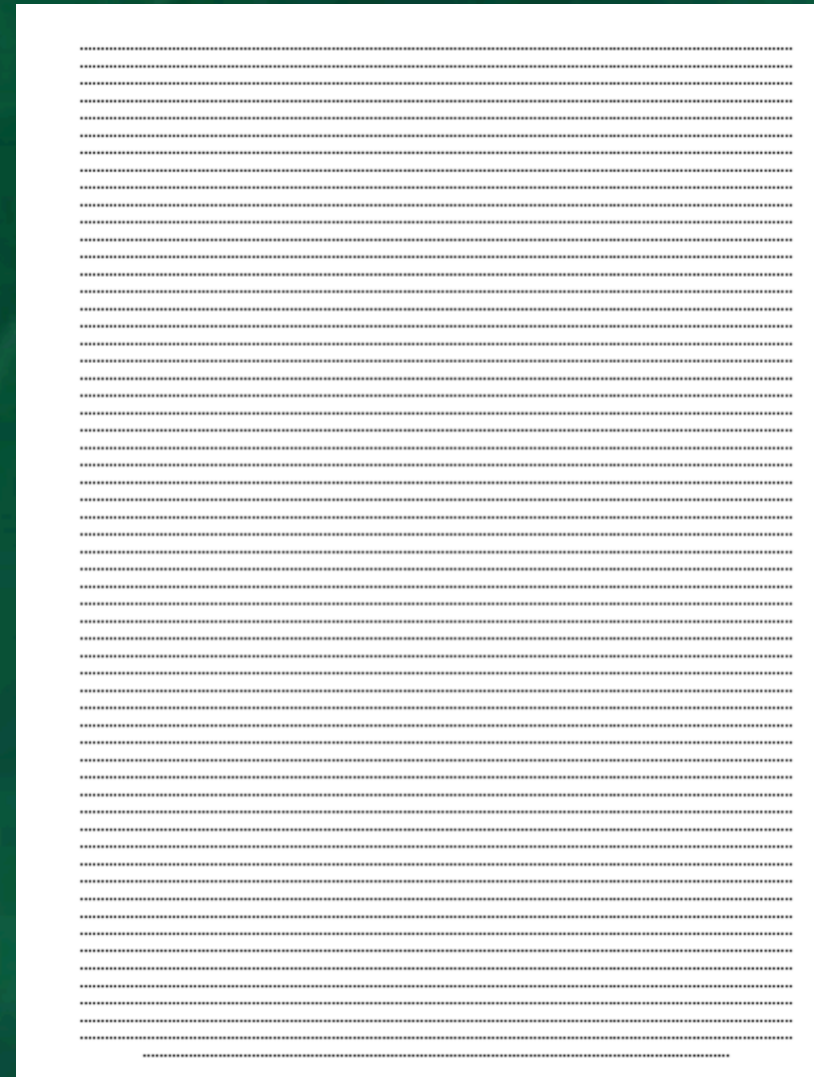
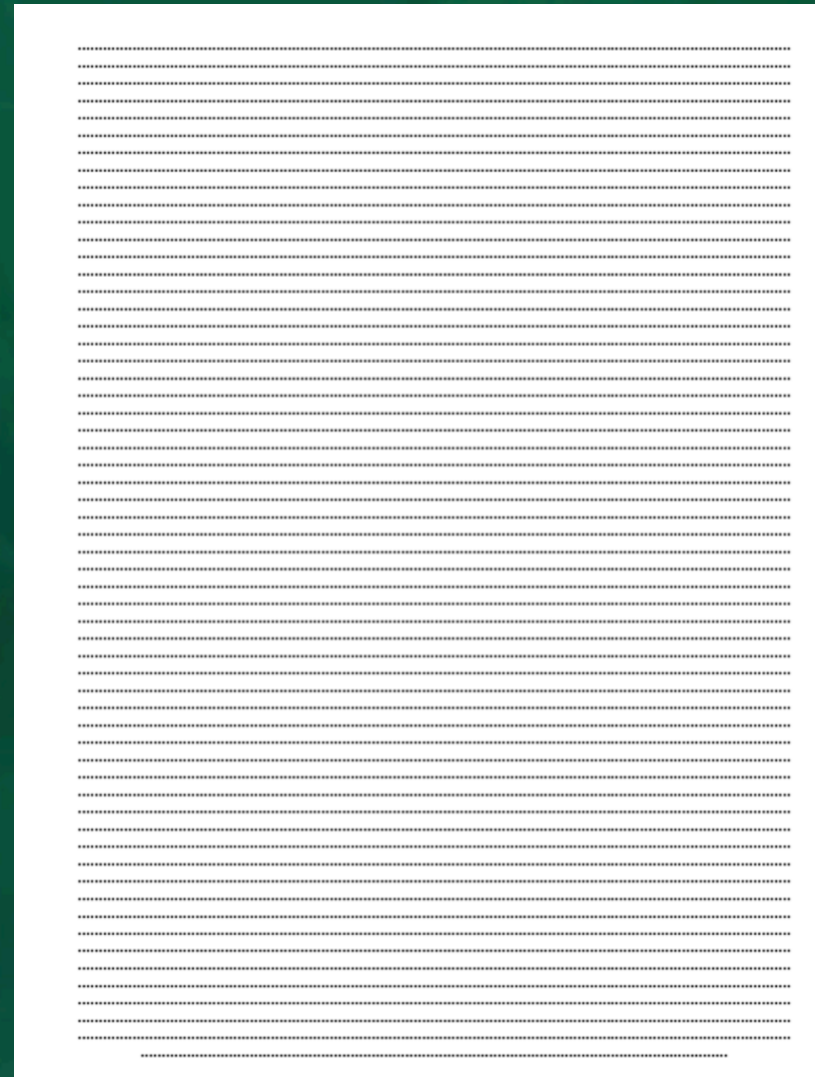
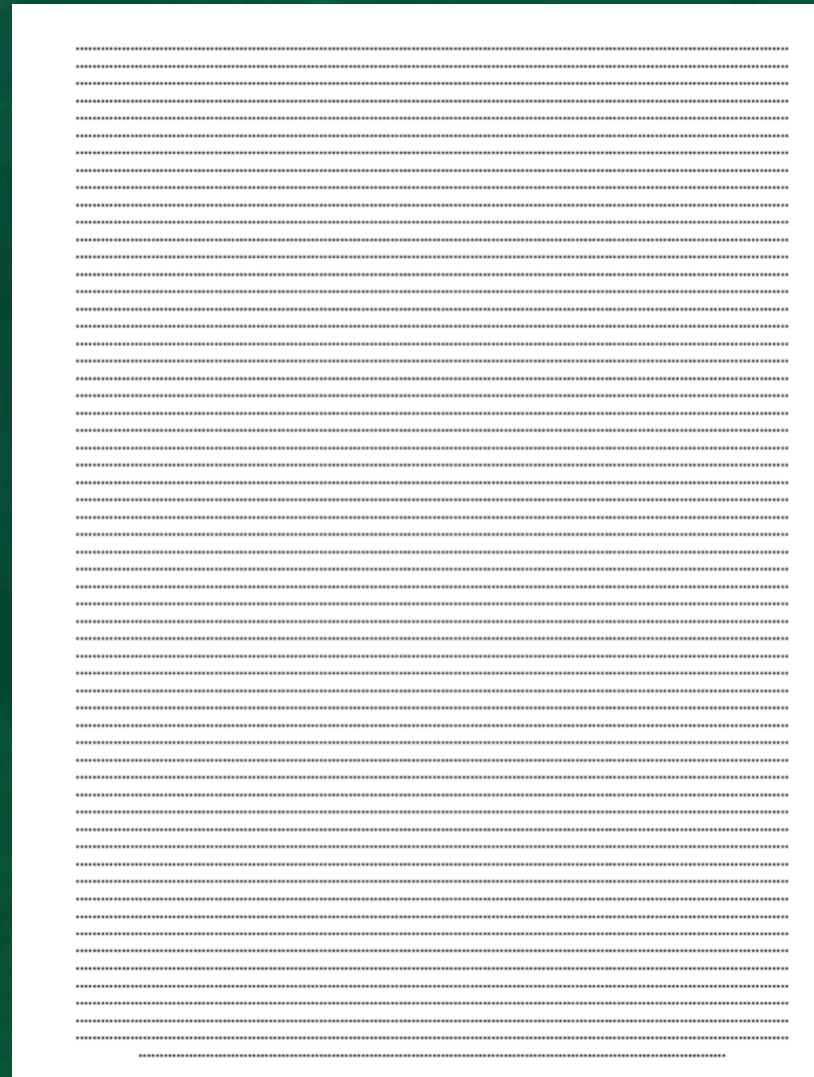
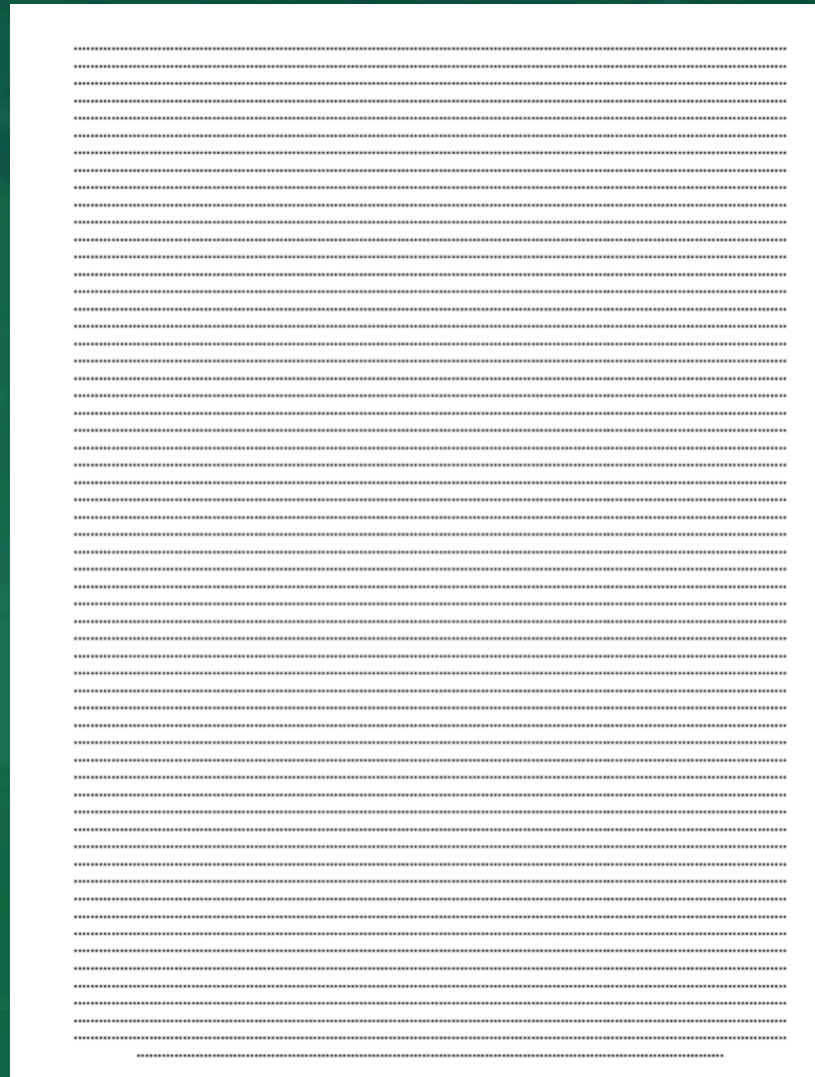
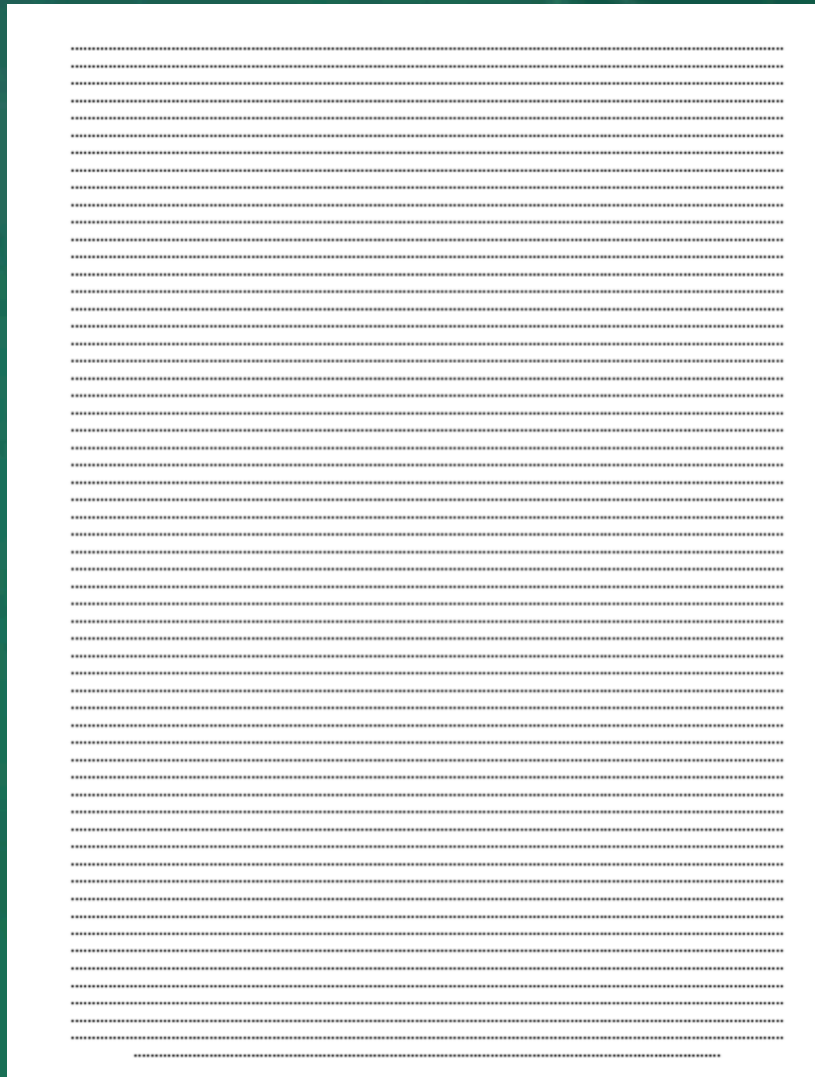




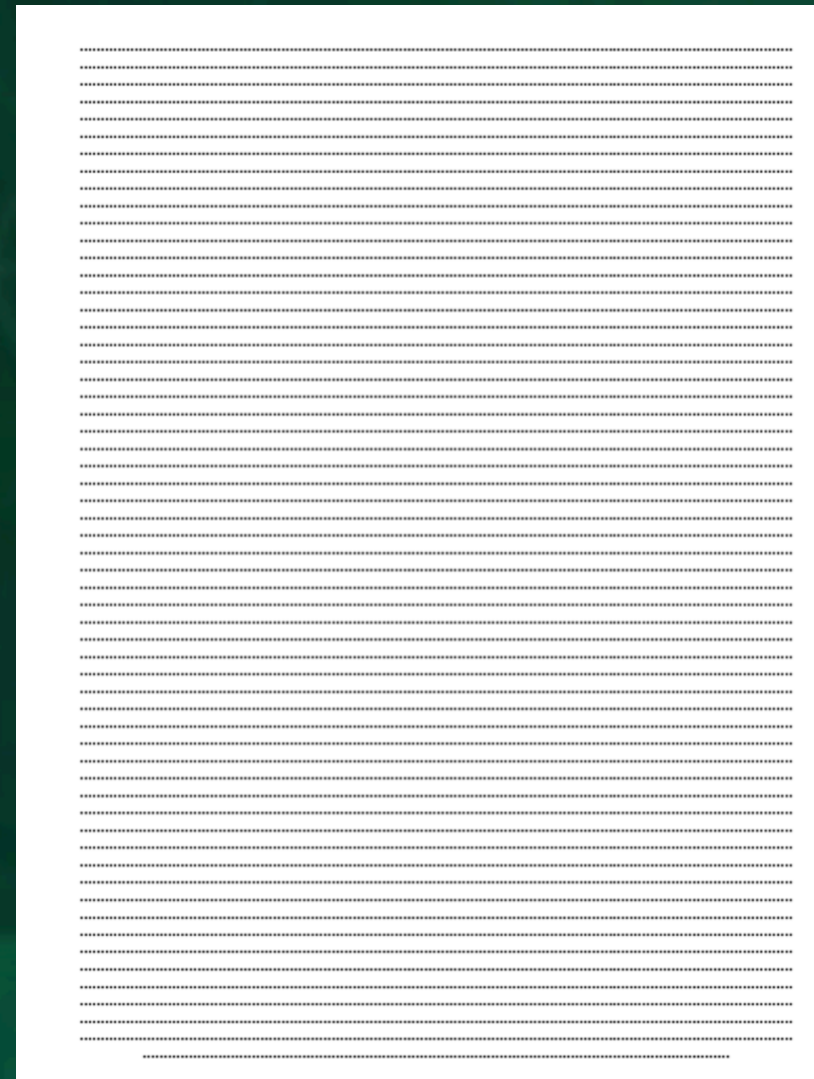
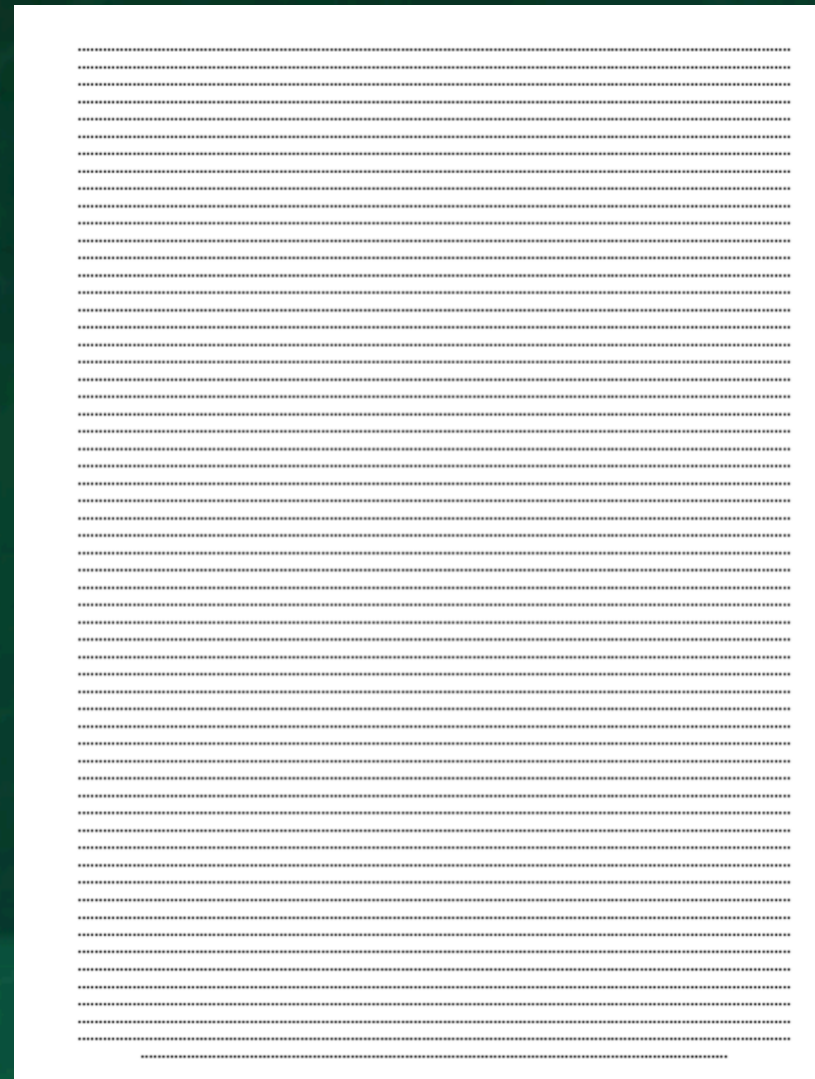
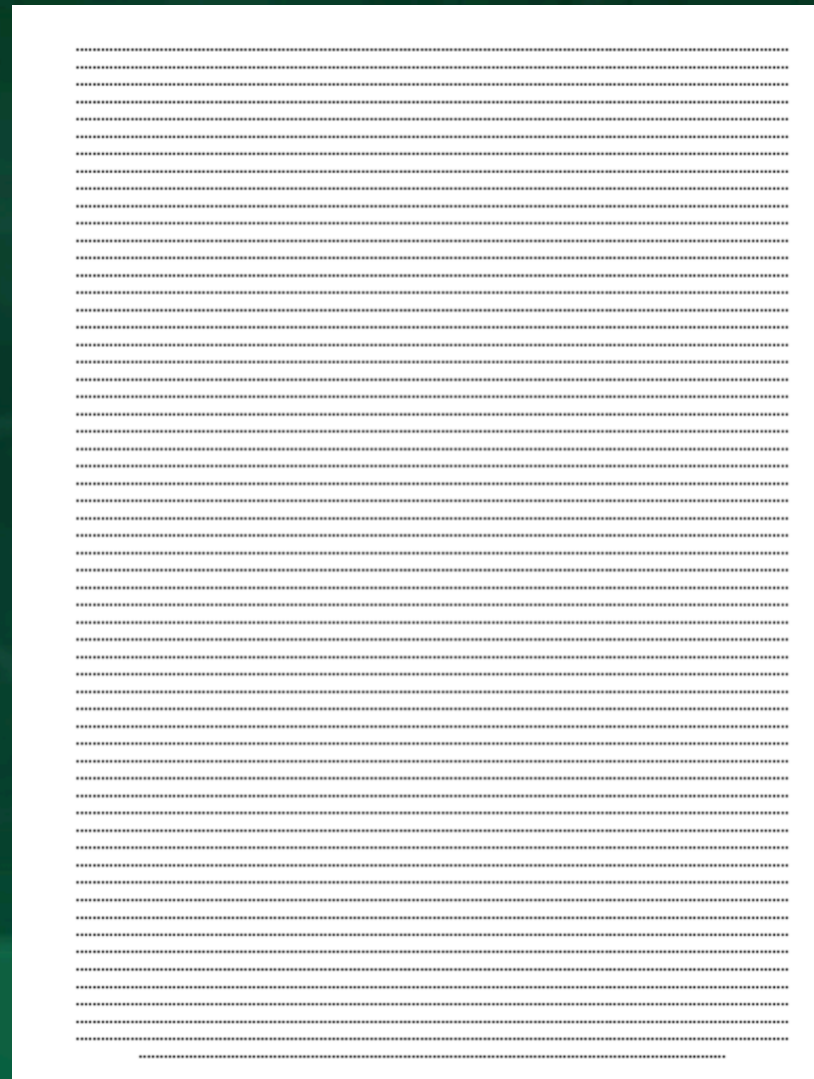
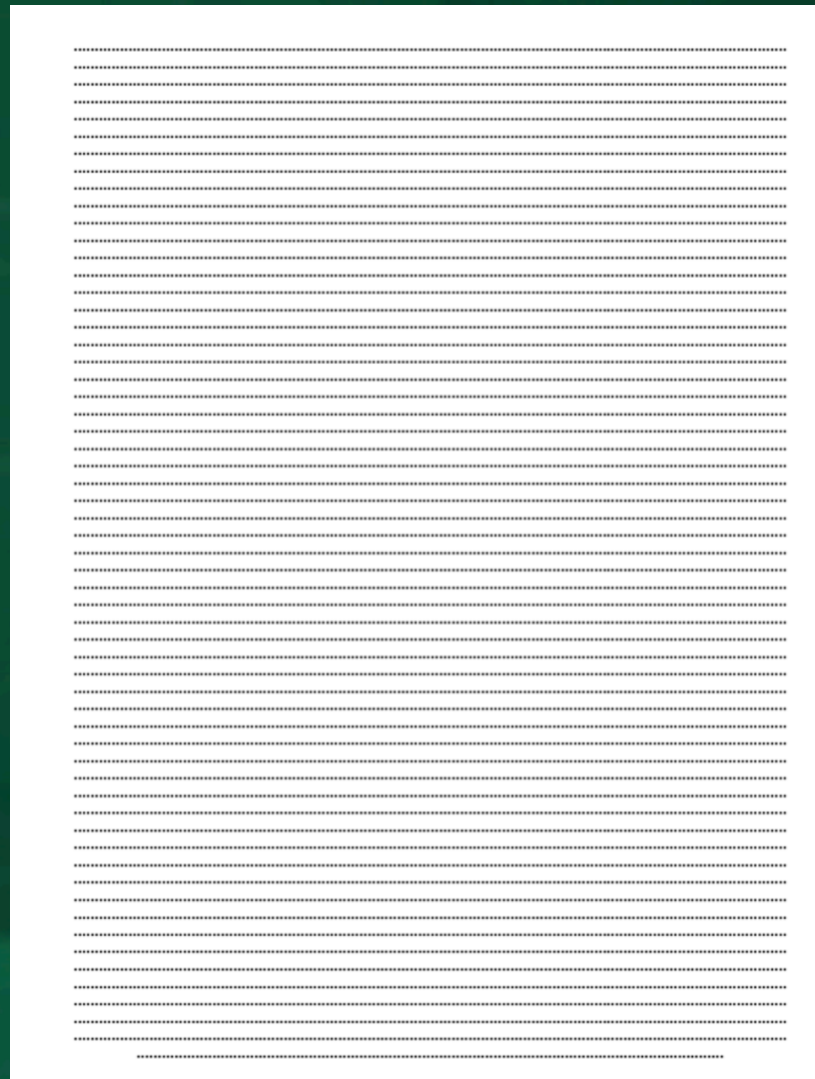
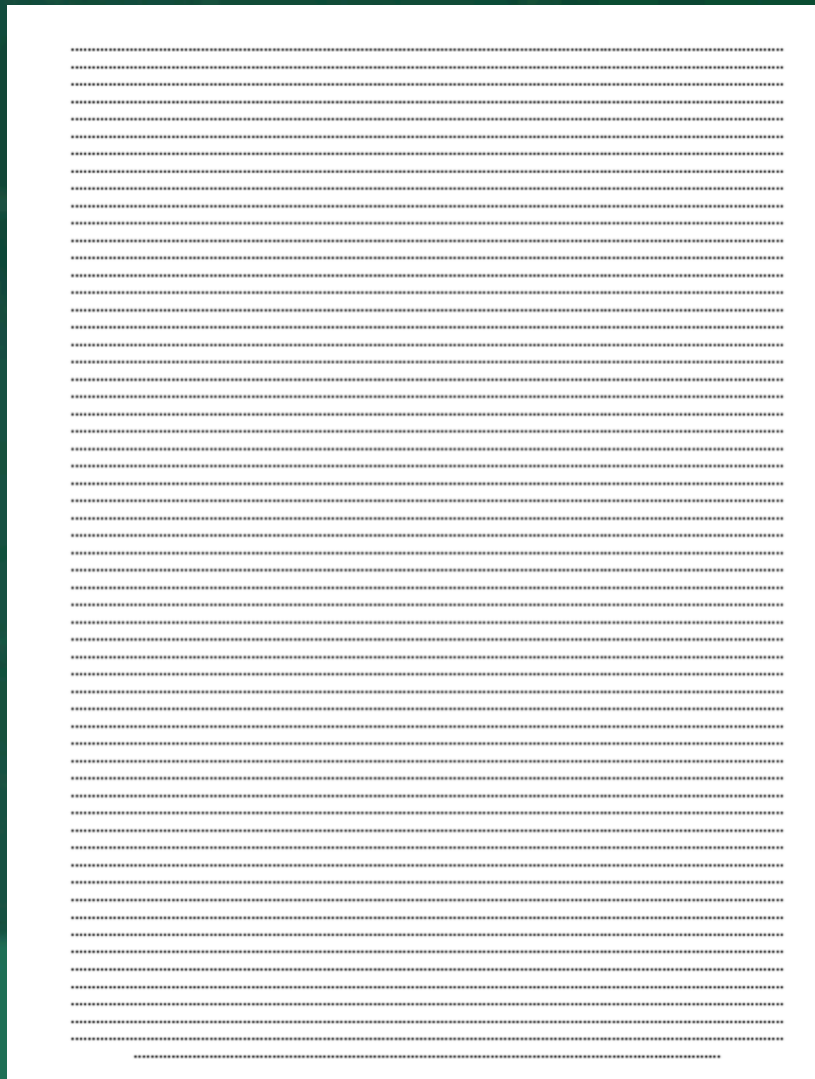
90,000







100,000





# 1 million ... how to conceptualize that large number

## Million Dot Project

A central issue that confuses discussions of the human population on our planet is the inherent difficulty involved in intuitively grasping the size of large numbers. It is interesting that these numbers (million, billion, even trillion) have common usage, for example, in the press, usually when discussing cost, in dollars, of some governmental program. In the digital world, *mega-*, *giga-*, and *tera-* denote sizes of invisible processes that we take for granted. However, these words do not translate adequately or meaningfully into our perception of their true size, since they are so far outside any range with which we have direct experience. When we then incorporate these words (million, billion) into sentences describing groups of enormous size (when our own personal experience of a group is less than a hundred thousand or so), the ability to communicate important concepts on an intuitive level is exceedingly difficult.

Using a simple graphical demonstration, the reality of this conceptual difficulty may be illustrated. By creating a new *Word* document, and setting the format to a size 11 font, then entering dots (periods) as ".....", one can fill a standard 8 ½" X 11" page with **10,000 dots**.

Copying this sheet 100X will yield 100 pages - each containing 10,000 dots - **1 million dots** total. Positioned **side by side**, these 100 sheets can be stretched out in a hallway to a length of **71 feet** (8 ½" X 100). Walking along this display, one may observe 1,000,000 dots. [ Hint : *actually doing* this simple physical exercise – to view one million dots – is the point here. ]

This gives a visual method to begin to obtain an intuitive concept of terms used when discussing the enormity of Earth's human population.

<b>10,000</b>	<b>8.5 inches</b>
100 thousand	7 feet
<b>1 million</b>	<b>71 feet</b>
19 million	0.25 miles
<b>300 million</b>	<b>4 miles</b>
1 billion	13 miles
<b>7 billion</b>	<b>94 miles</b>
10 billion	134 miles

Imagining these visual comparisons and then translating them into the relative size of human groups ( filled megachurch @ 10,000, largest football stadium filled to capacity @ 100,000, large U.S. city @ 1 million, largest megalopolis areas @ 19 million, total U.S. population @ 300 million, populations of India or China @ 1 billion) gives a starting point to understand the enormity of Earth's human population ( 7 billion ).

### million dot project:

Open a *Word* document and use size 11 font to apply **10,000 periods (dots)** to a 8-1/2" x 11" page.

Print 100 copies to generate **100 pages** then place all **100 pages** side-by-side in a hallway: **71 feet long**.

Walk along the pages and observe **1 million dots**.

See:

**\*million\***

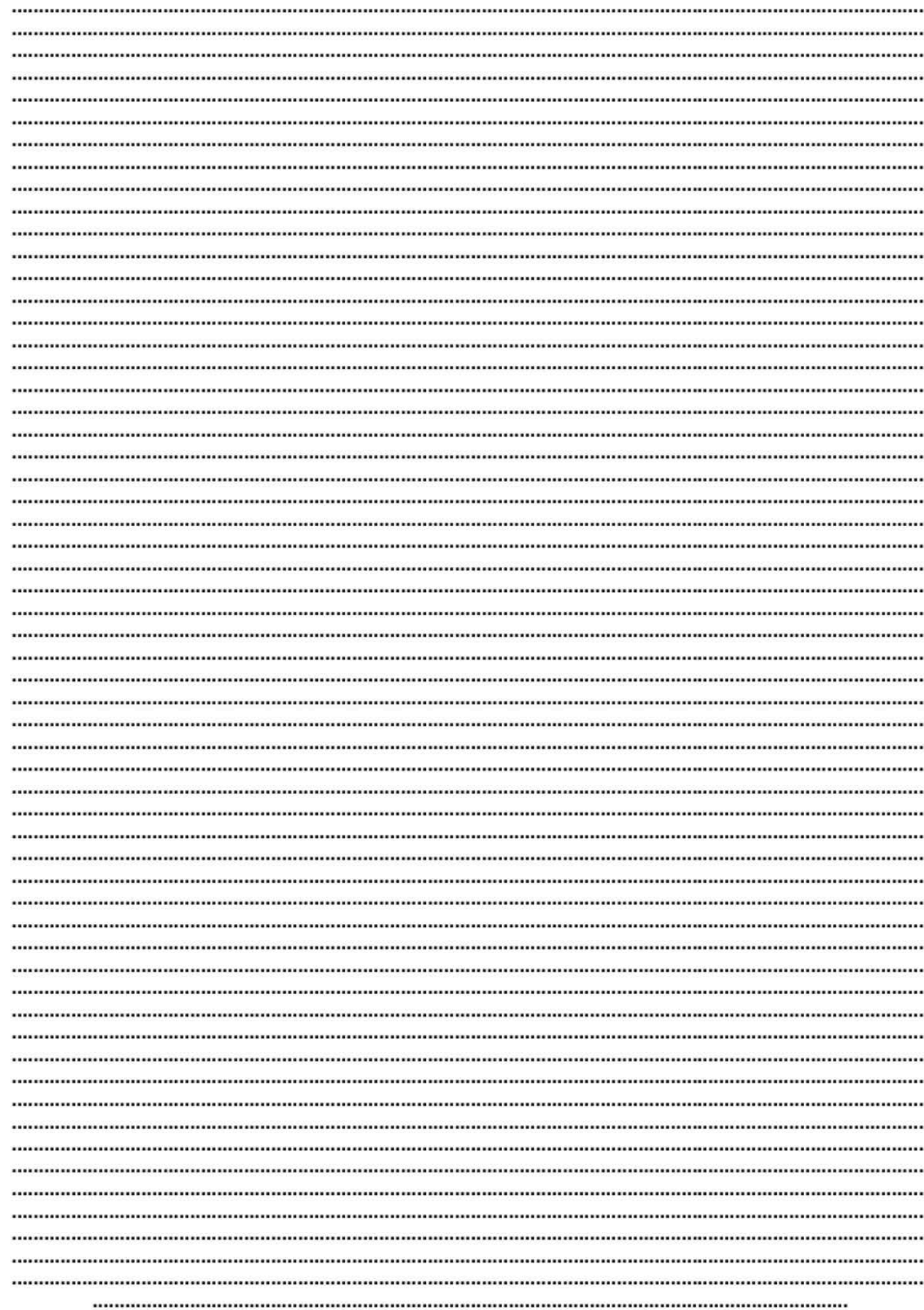
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on  
[imageessays.com](http://imageessays.com)



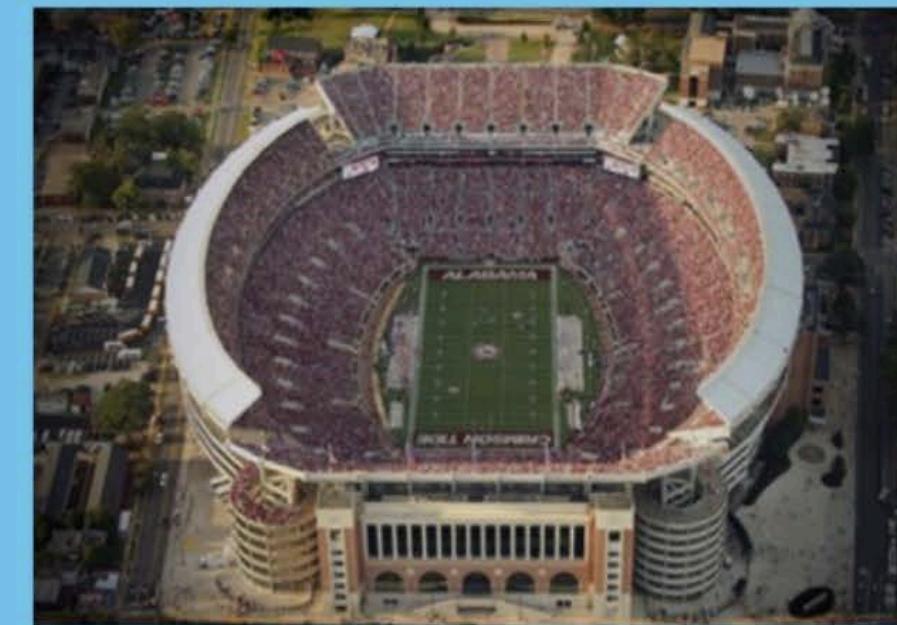
600,000



600,000 dead: With normal life in reach, covid's late-stage victims lament what could have been



600,000 ... displayed as 10,000 dots / page <<<< \*click here to view all 60 pages



Bryant-Denny stadium: 101,821



Jordan-Hare stadium: 87,451



Tiger stadium: 102,231



Neyland stadium: 102,455



Sanford stadium: 92,746



Kyle stadium: 102,733

June 11, 2021



# US set to pass 800,000 COVID-19 deaths by late December

Deaths in 2021 greater than in 2020

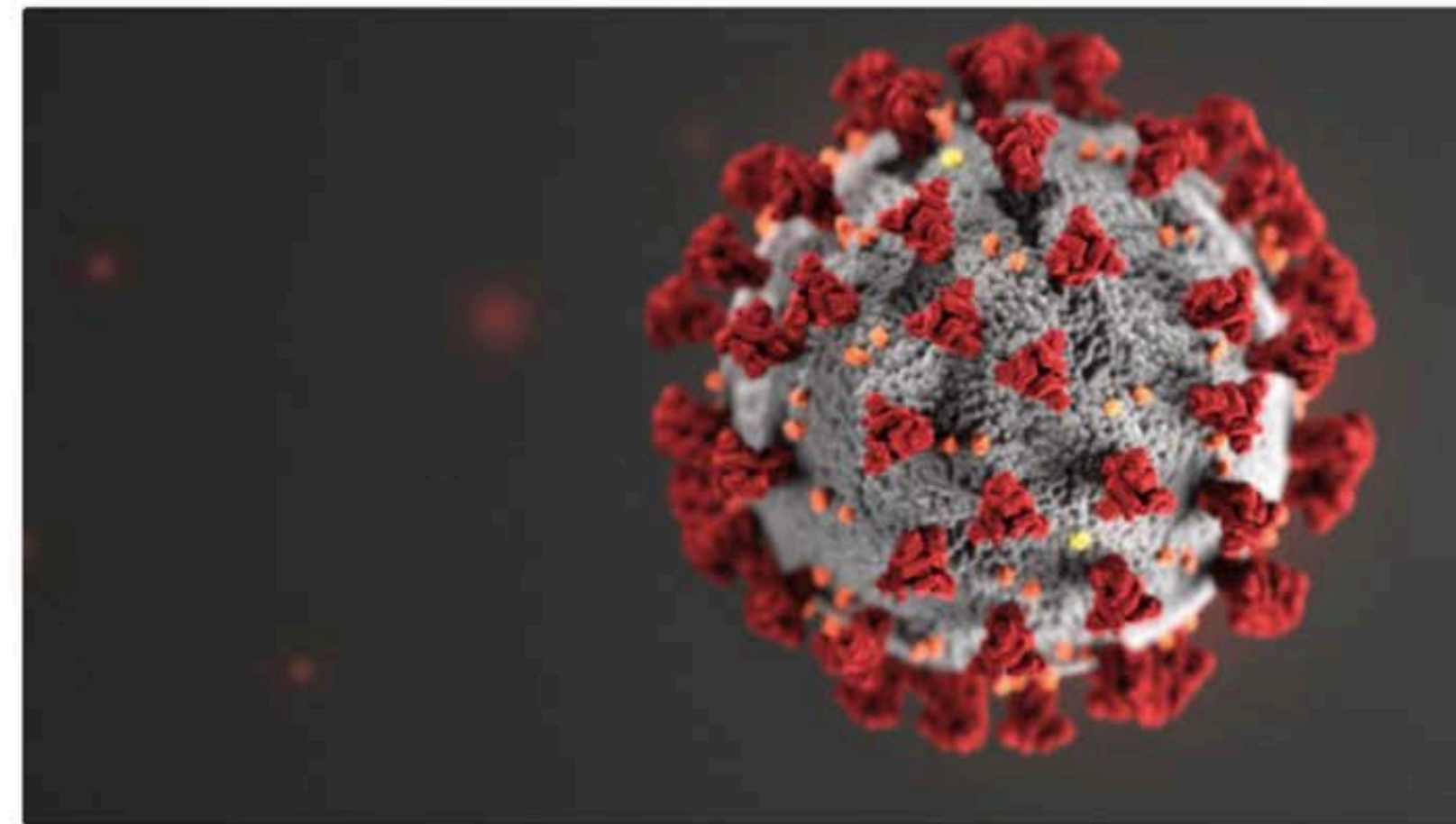


Photo by: Centers for Disease Control and Prevention (CDC)

COVID-19

By: [Tim Kephart](#)

Posted at 11:41 AM, Nov 22, 2021 and last updated 10:41 AM, Nov 22, 2021

TAMPA, Fla. — The full picture of the COVID-19 pandemic will take decades to fully sort out, but we can see the grim number of deaths in real-time and it's about to cross over another threshold once thought too high to reach.





# Covid's toll in the U.S. reaches a once unfathomable number: 1 million deaths

PUBLISHED WED, MAY 4 2022 4:37 PM EDT UPDATED WED, MAY 4 2022 6:20 PM EDT

**NBC NEWS** Elizabeth Chuck and Corky Siemaszko

WATCH LIVE



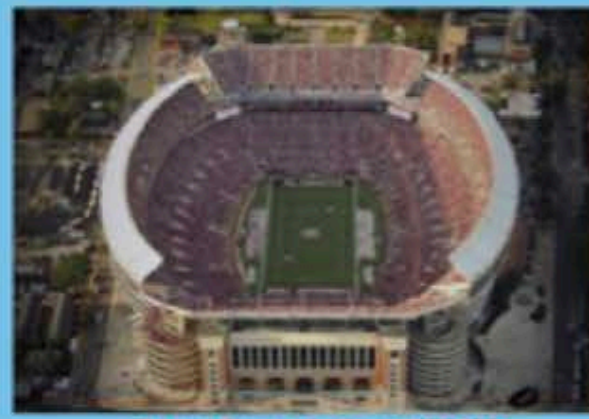
A white flag with a memorial written on it is one of the thousands of white flags representing Americans who have died of the coronavirus disease (COVID-19) placed over 20 acres of the National Mall in Washington, September 26, 2021.

*Joshua Roberts | Reuters*

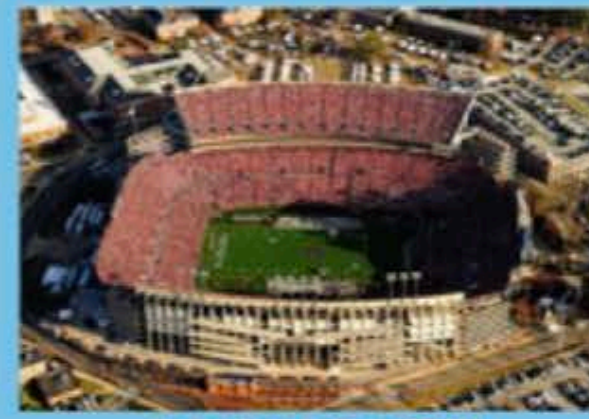
The United States on Wednesday surpassed 1 million Covid-19 deaths, according to data compiled by NBC News — a once unthinkable scale of loss even for the country with the world's highest [recorded toll](#) from the virus.

The number — equivalent to the population of San Jose, California, the 10th largest city in the U.S. — was reached at stunning speed: 27 months after the country confirmed its [first case](#) of the virus.





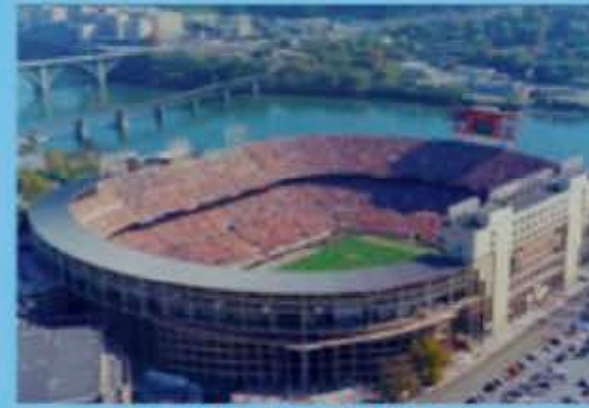
Bryant-Denny stadium: 101,821



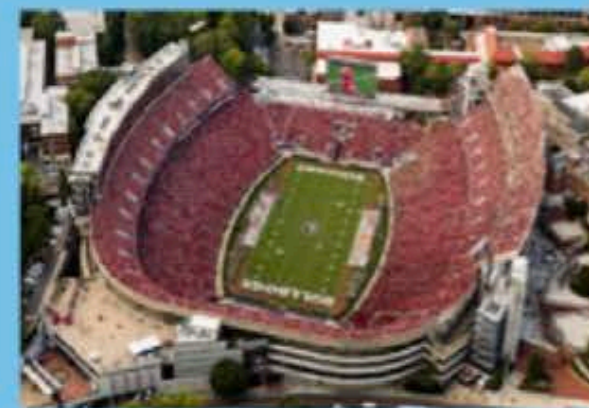
Jordan-Hare stadium: 87,451



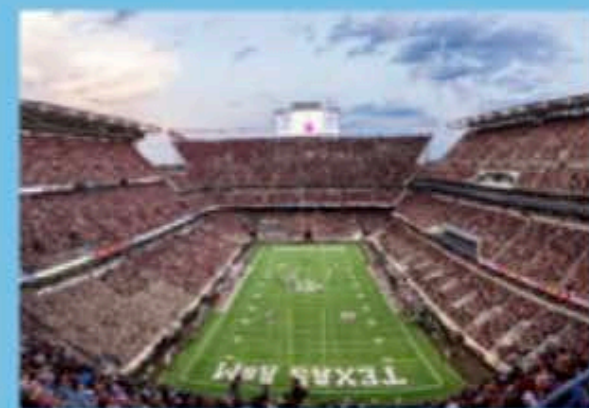
Tiger stadium: 102,231



Neyland stadium: 102,455



Sanford stadium: 92,746



Kyle stadium: 107,733

1,000,000



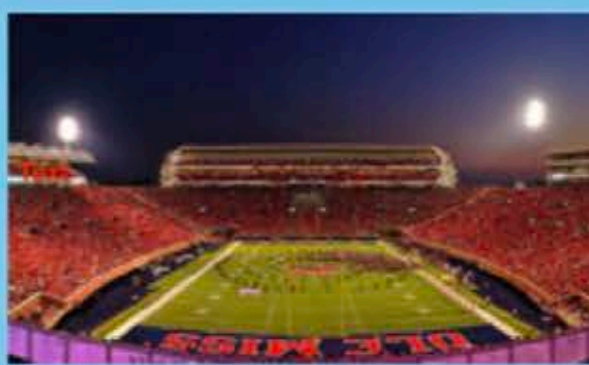
Ben Hill Griffin stadium: 88,548



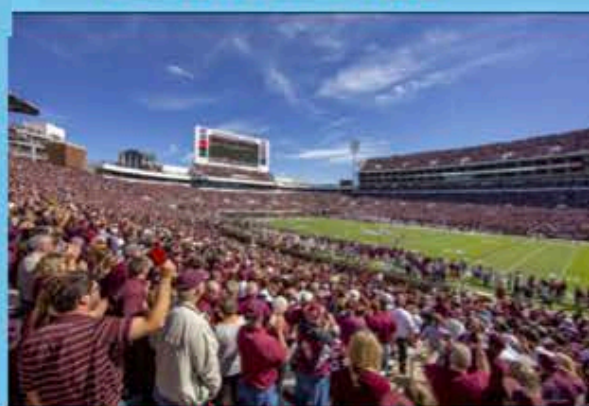
Williams-Brice stadium: 80,250



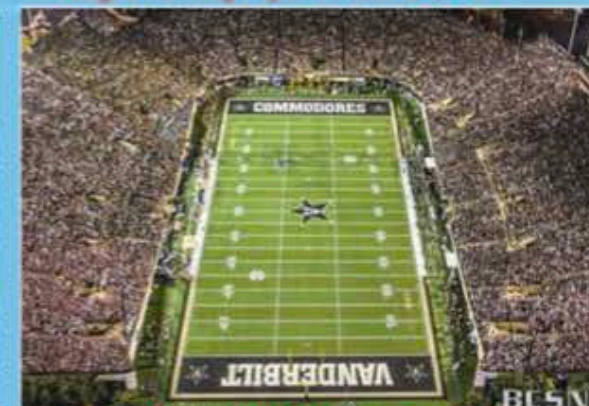
Razorback stadium: 76,212



Vaught-Hemingway stadium: 64,038



Davis Wade stadium: 61,337



Vanderbilt stadium: 40,350

1,000,000







## Zhou Youguang, Who Made Writing Chinese as Simple as ABC, Dies at 111

Give this article



Zhou Youguang in Beijing in 2011. Late in life, he became an outspoken critic of the Chinese government. Shiho Fukada for The New York Times

By Margalit Fox

Jan. 14, 2017

***When you encounter difficulties, you need to be optimistic.***

***The pessimists tend to die.***

... quote from **Zhou Yougang** - father of **Pinyin** writing, who died at 111 (from 1/14/17 **NYT** obit )









## What was covered:

### 3 numbers to consider when evaluating results of a clinical trial:

- \* adverse event rate in untreated individuals (%)
- \* adverse event rate in treated individuals (%)
- \* absolute reduction in adverse event rate due to treatment (%)

### 2 ways of thinking about the ongoing COVID-19 pandemic:

- \* personal health ... me
- \* public health ... us

### 1 million ... how to conceptualize that number











