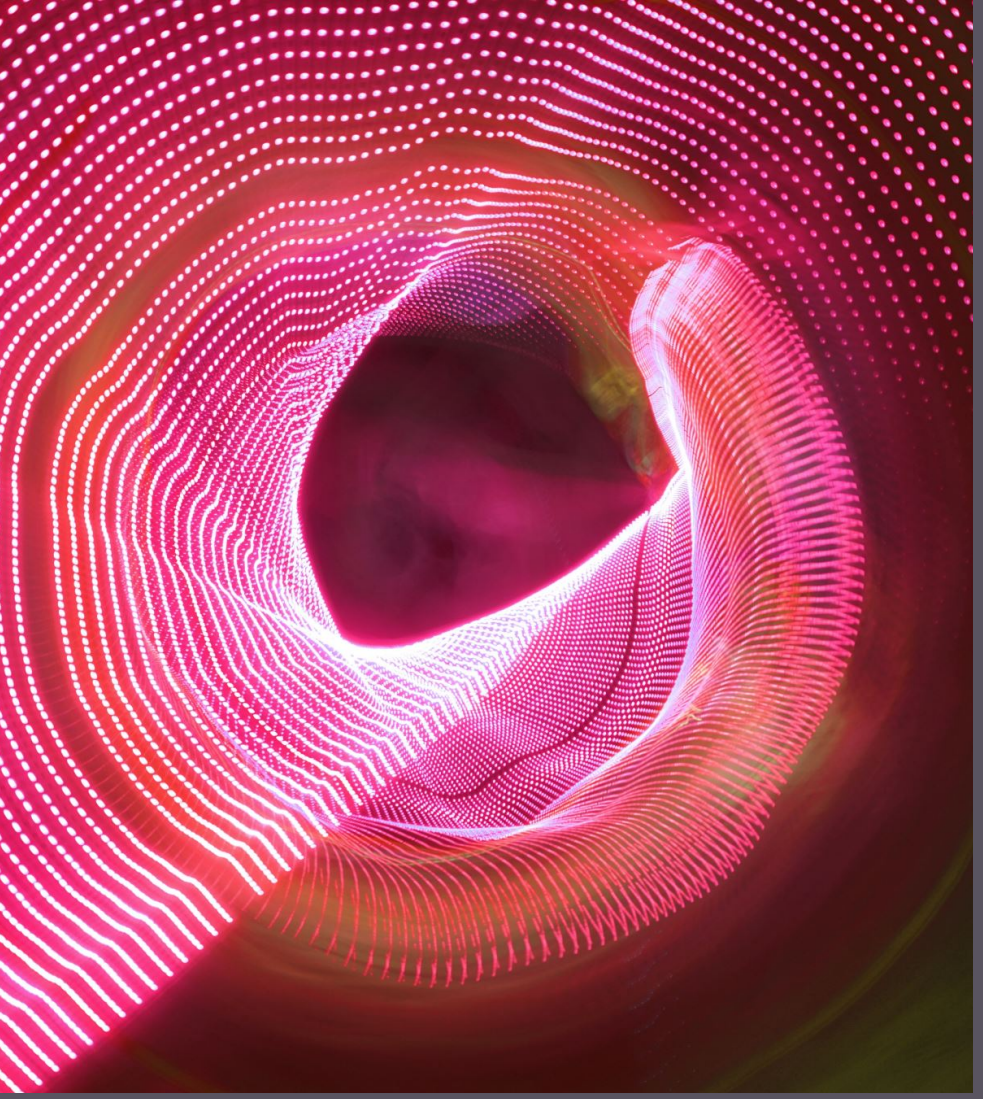


COVID-19 UPDATES

Ashwin Balagopal, M.D.

Associate Professor of Medicine

Division of Infectious Diseases

Johns Hopkins University School of Medicine

JOHNS HOPKINS MEDICINE

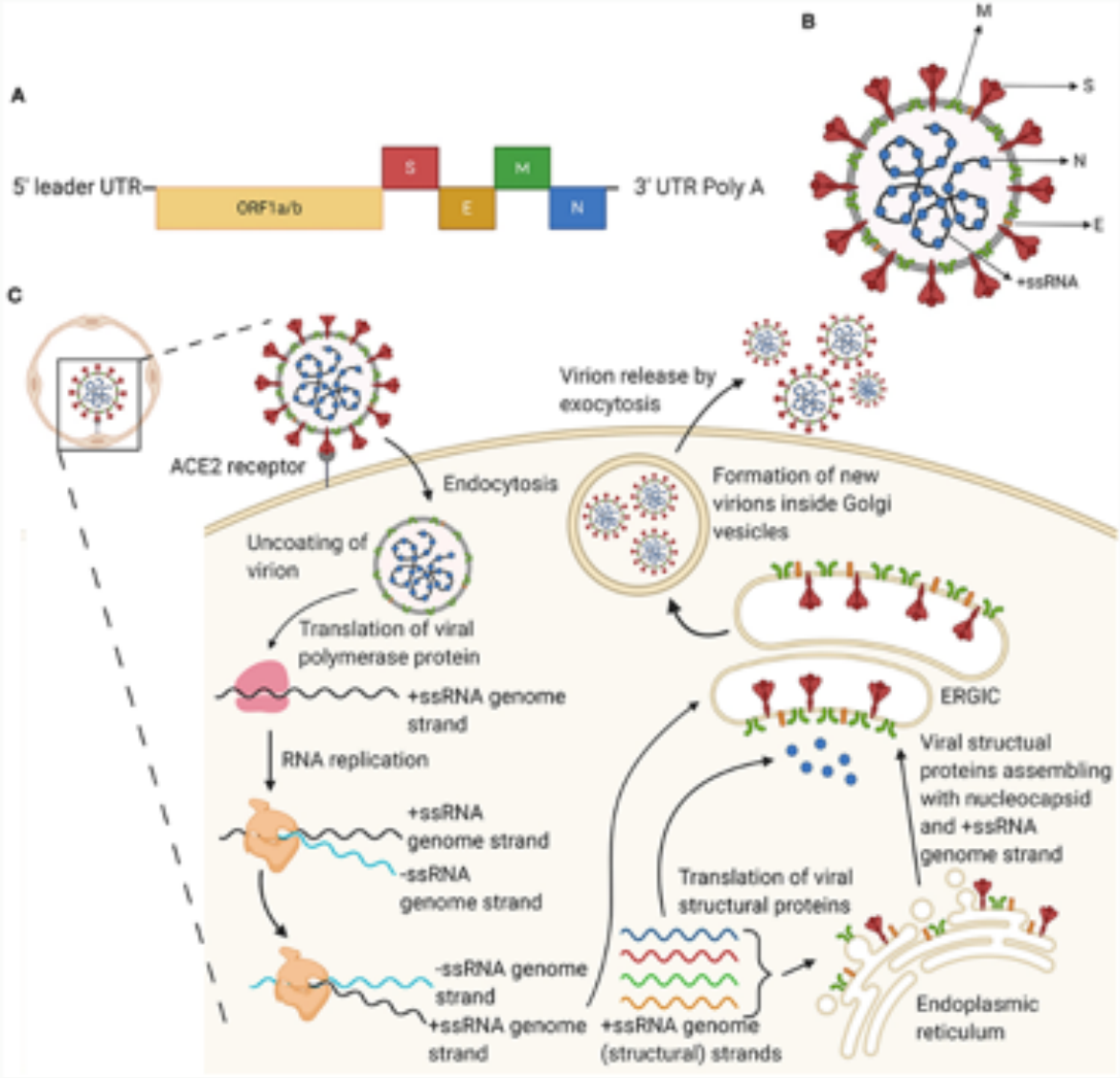
DISCLOSURES

JHU IS RECEIVING FUNDS FOR A CLINICAL TRIAL OF EIDD-2801-2004 FROM RIDGEBACK BIOTHERAPEUTICS (PI:Balagopal)

OBJECTIVES

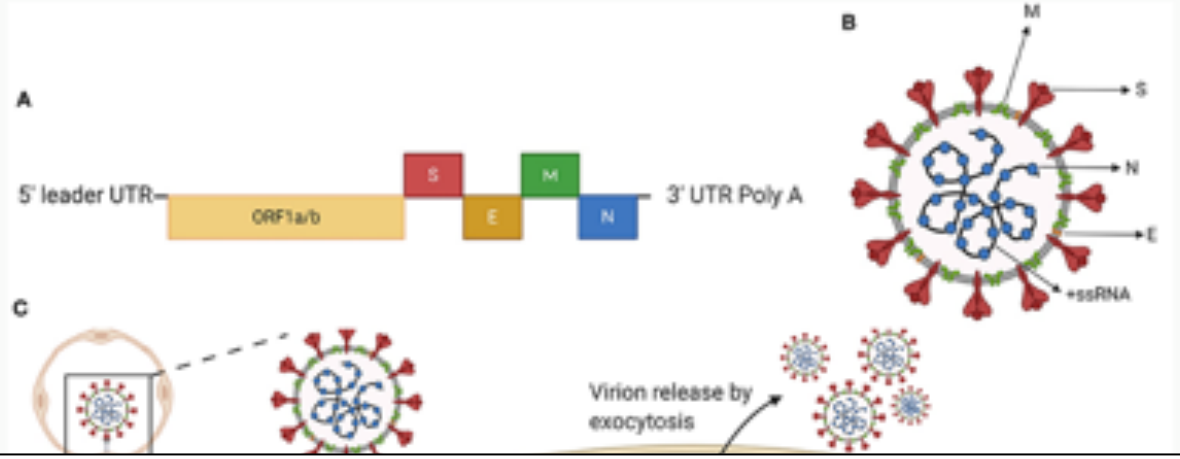
1. To discuss the changing trends of SARS-CoV-2 transmission globally and in the US
2. To discuss new and existing diagnostic platforms for SARS-CoV-2
3. To discuss emerging therapeutics for SARS-CoV-2
4. To discuss progress towards a SARS-CoV-2 vaccine

SARS-CoV-2

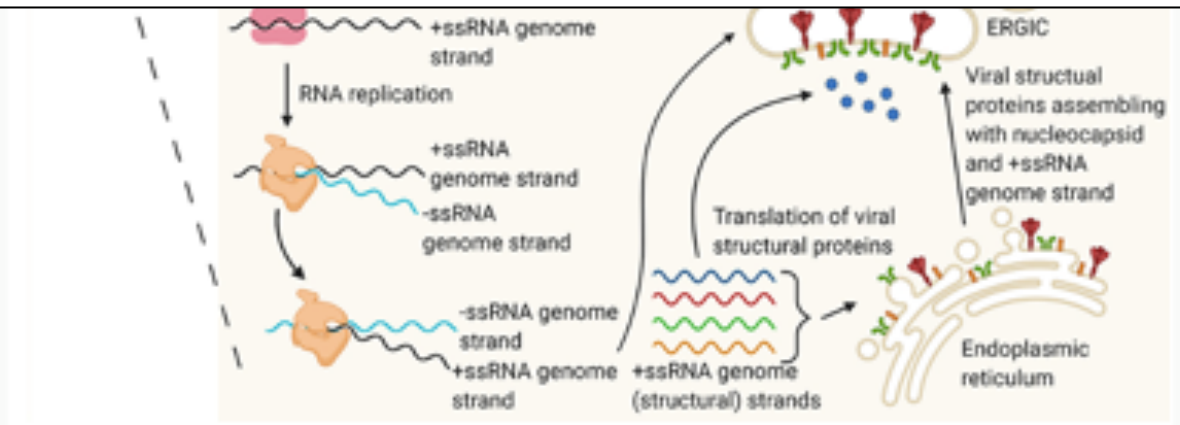


Frederiksen Front. Immunol., 21 July 2020

SARS-CoV-2

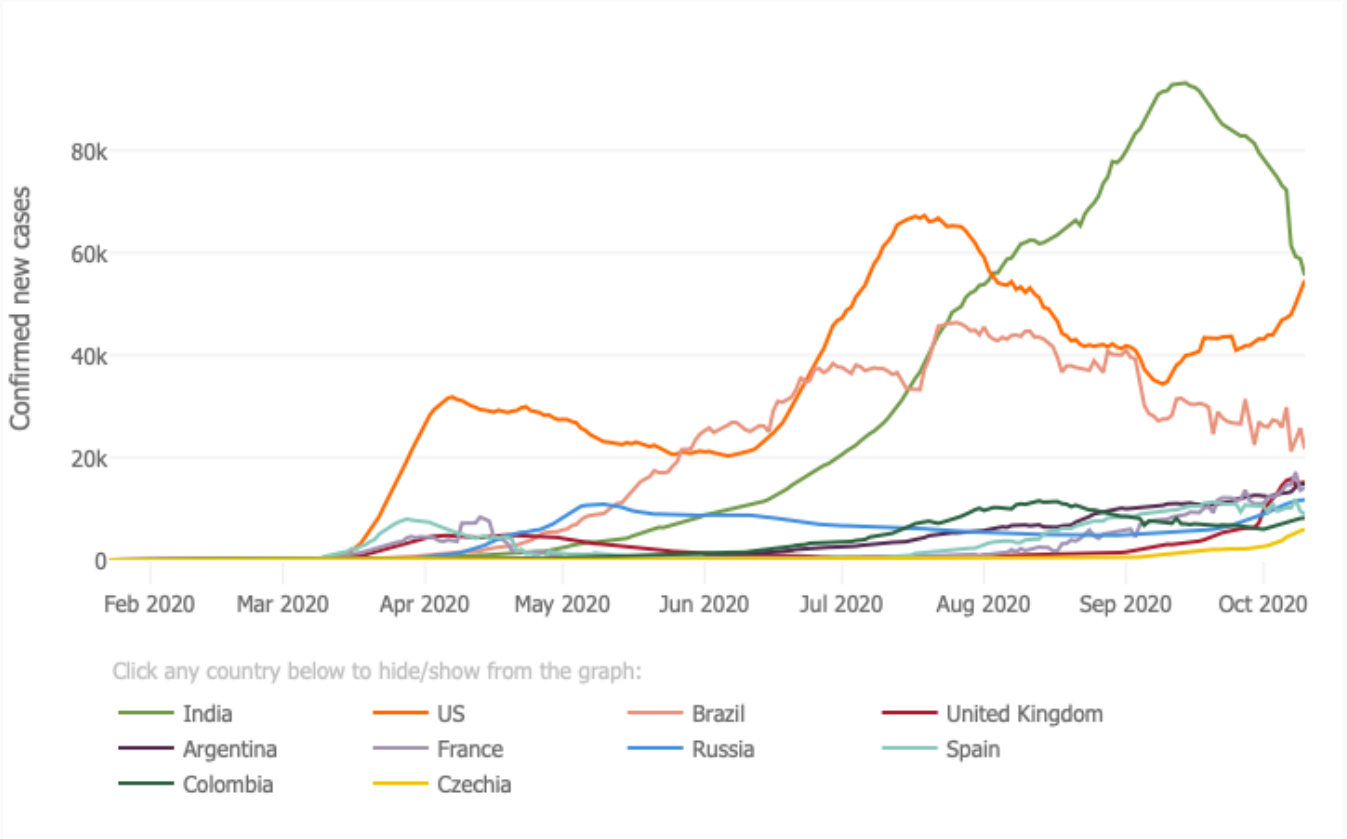


37,190 PubMed citations as of 10/16/2020



Frederiksen Front. Immunol., 21 July 2020

GLOBAL TRENDS



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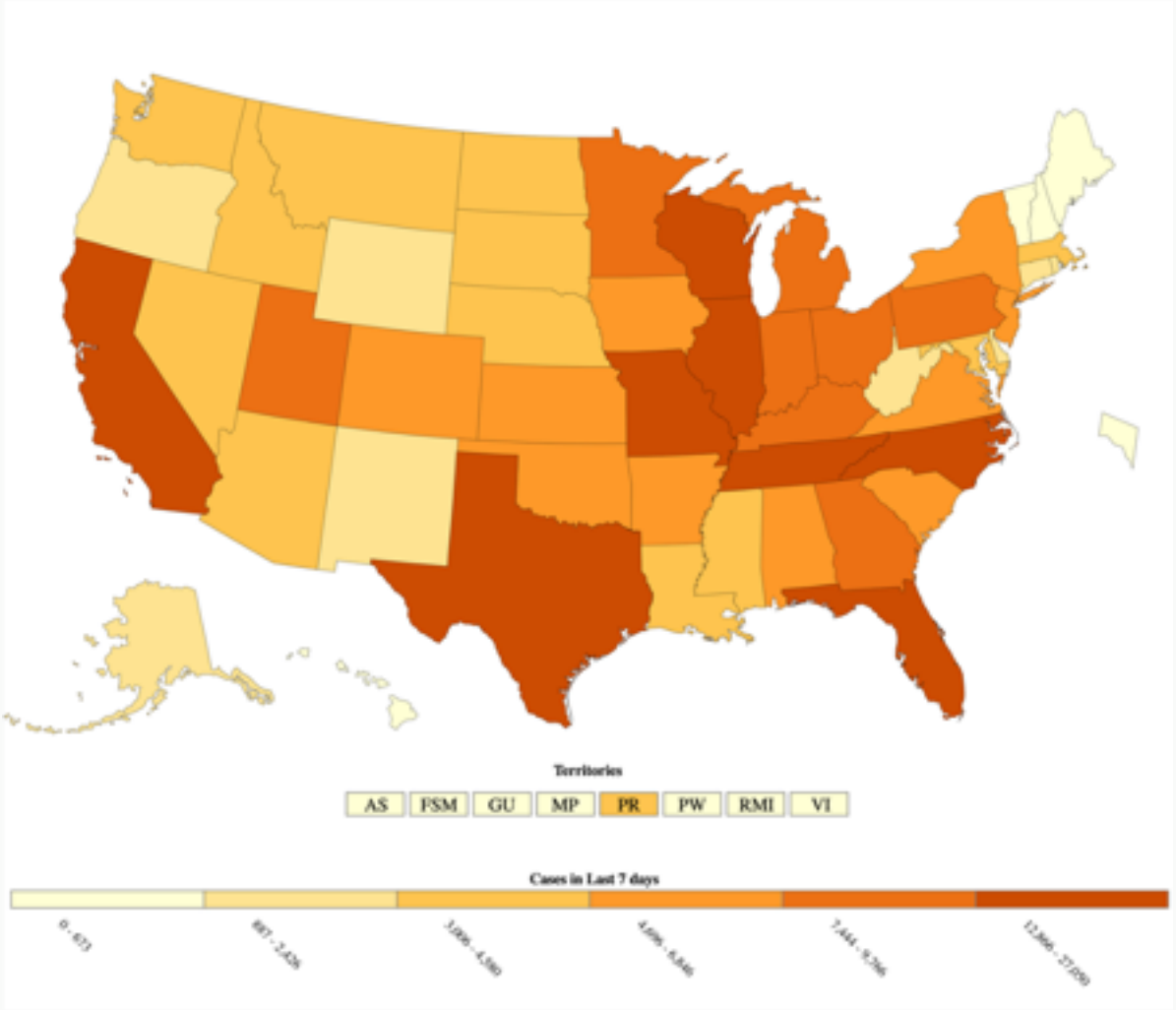
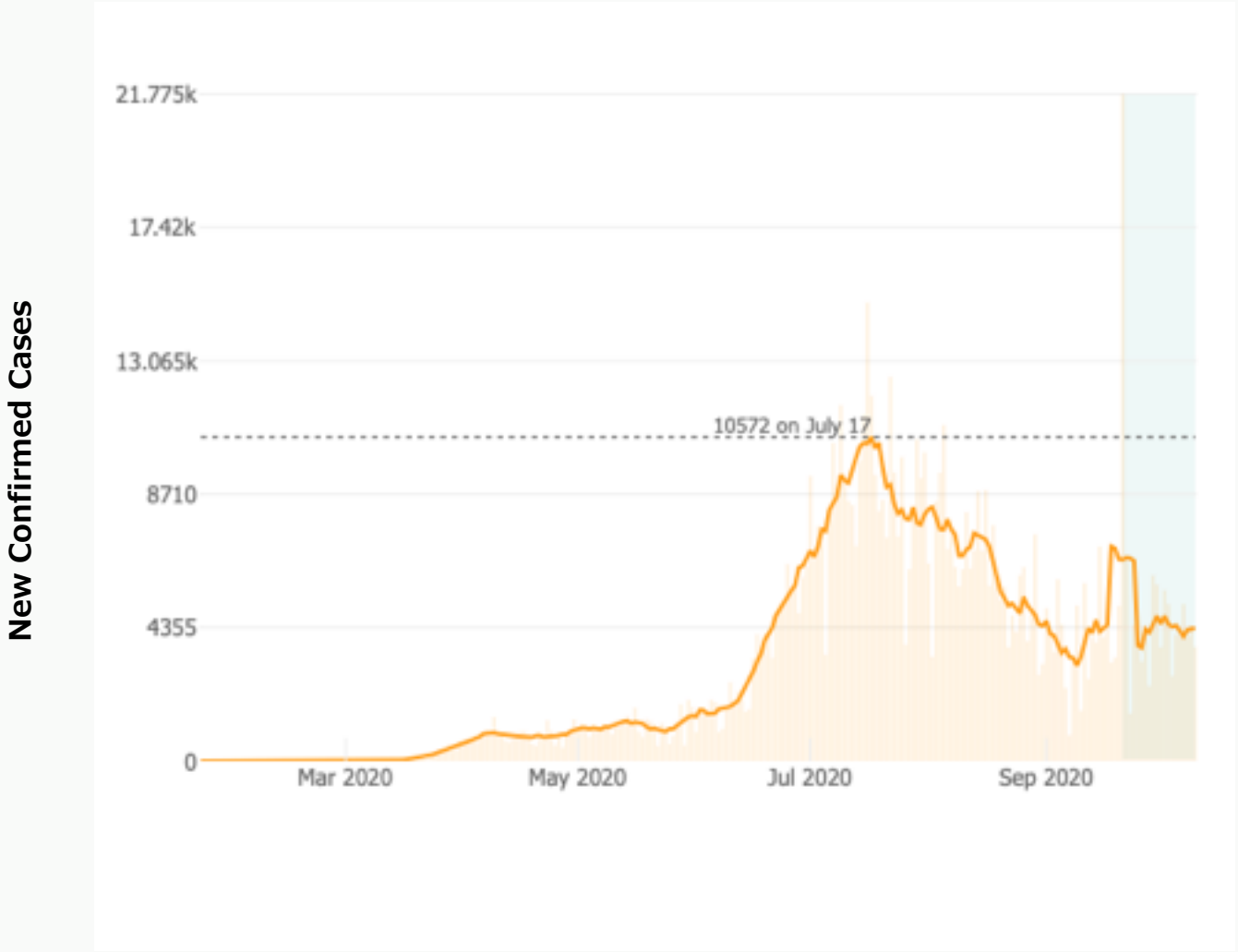
US TRENDS



cdc.gov

TEXAS TRENDS



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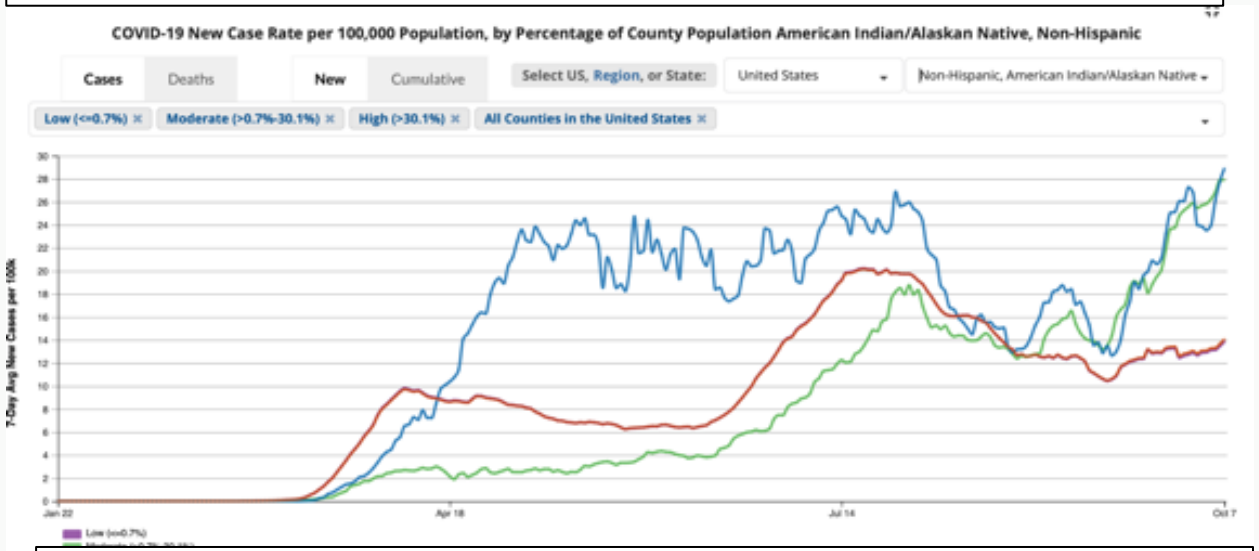
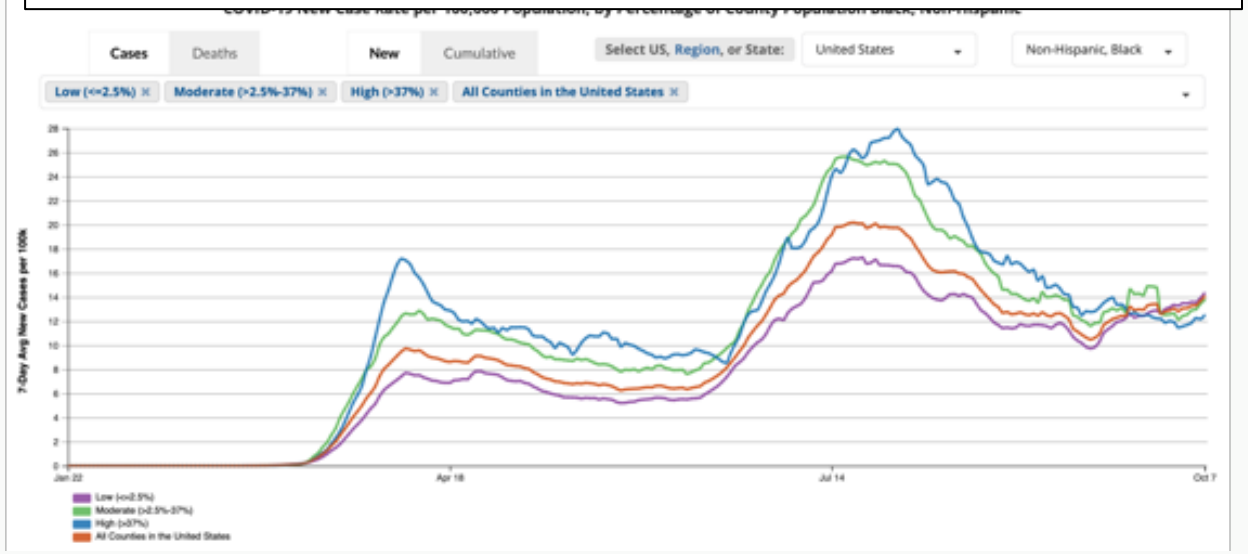
In which communities is SARS-CoV-2 spreading?

cdc.gov

Native American/Alaskan Native



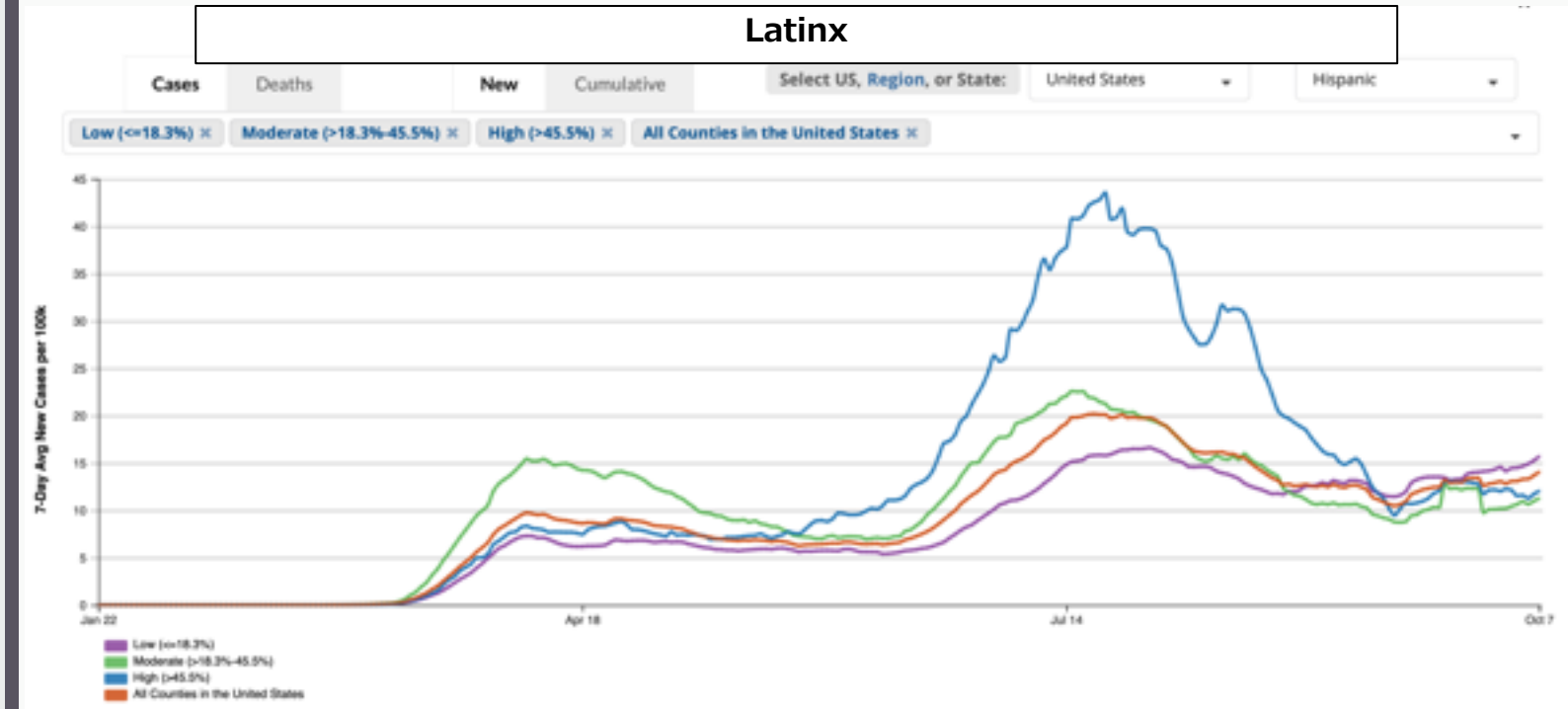
African-American



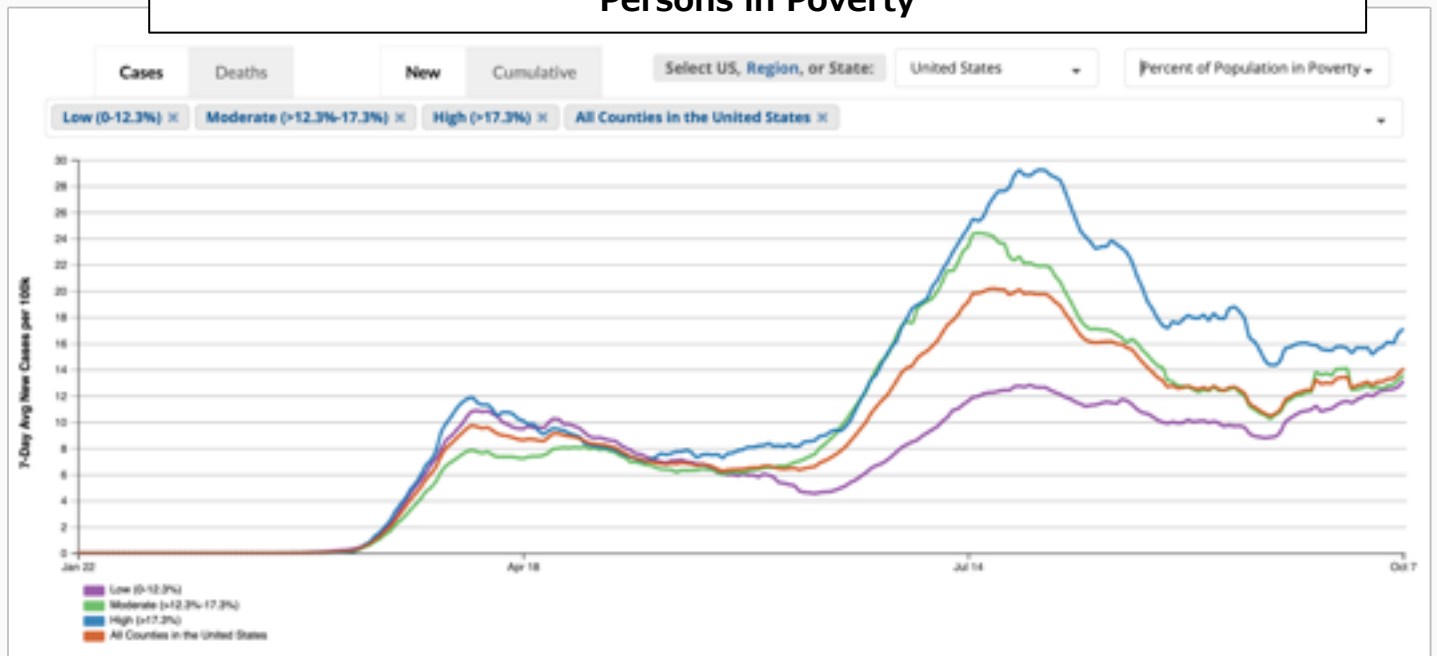
In which communities is SARS-CoV-2 spreading?

cdc.gov

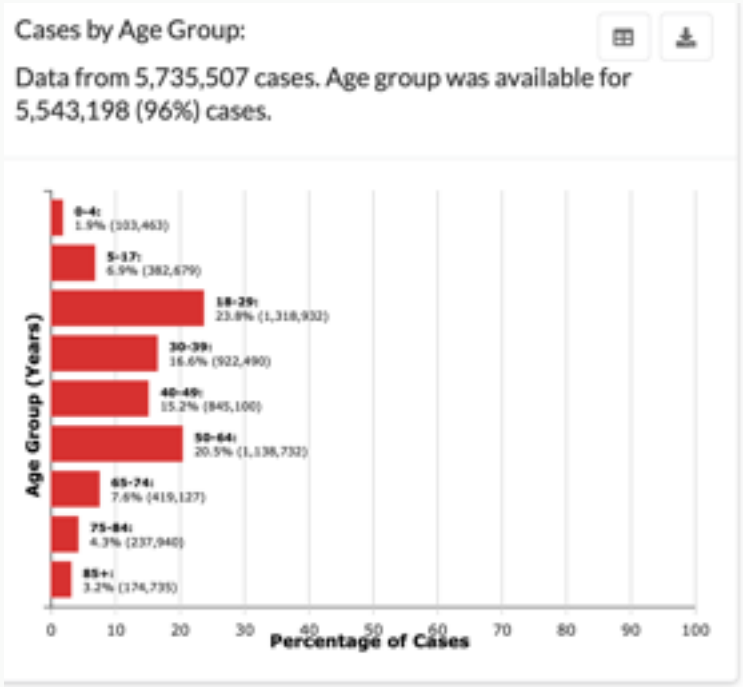
Latinx

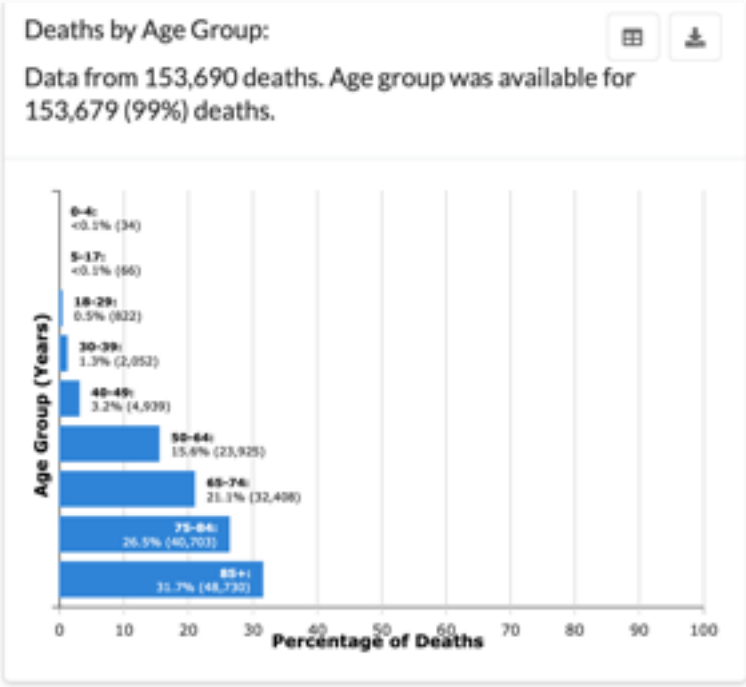


Persons in Poverty



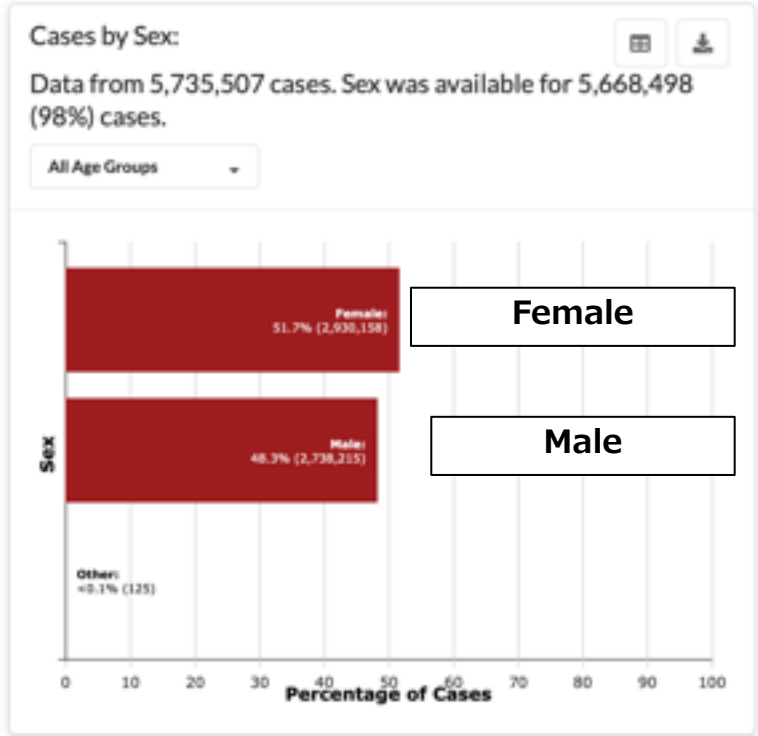
In which communities is SARS-CoV-2 spreading?

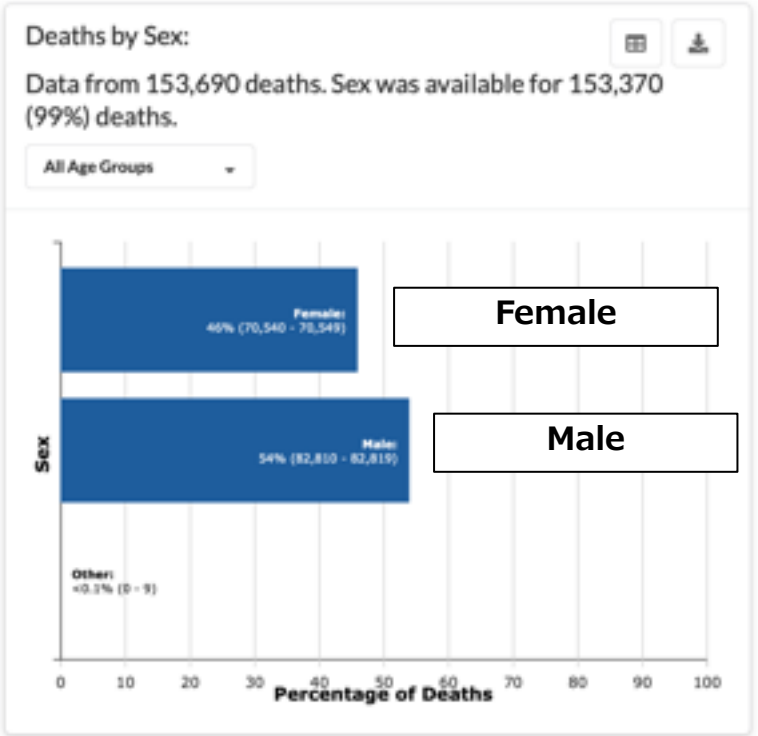




cdc.gov

In which communities is SARS-CoV-2 spreading?





cdc.gov

Is SARS-CoV-2 airborne?

CDC

"The epidemiology of SARS-CoV-2 indicates that most infections are spread through close contact, not airborne transmission…

Airborne transmission of SARS-CoV-2 can occur under special circumstances…

- **Enclosed spaces**
- **Prolonged exposure to respiratory particles**
- **Inadequate ventilation or air handling**

SARS-CoV-2 is a new virus, and we are still learning about how it behaves."

cdc.gov

DIAGNOSTICS

RNA

- NP swabs
- Oral/saliva

Antigen

Antibody

SARS-CoV-2 natural history

Wolfel, Nature, 2020

Article

Virological assessment of hospitalized patients with COVID-2019

https://doi.org/10.1038/s41586-020-2196-x

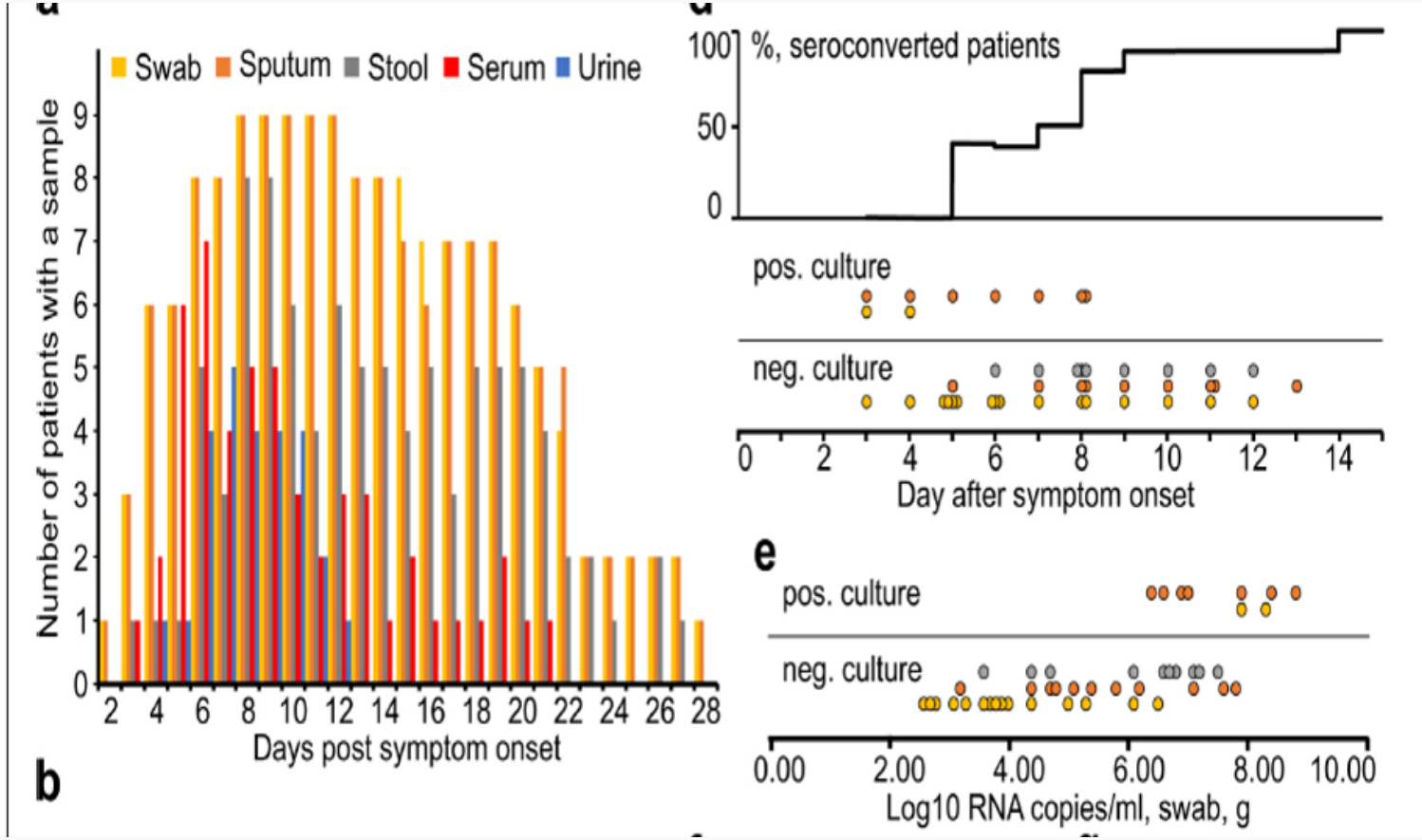
Received: 1 March 2020

Accepted: 24 March 2020

Published online: 1 April 2020

Roman Wölfel[1,8], Victor M. Corman[2,8], Wolfgang Guggemos[3,8], Michael Seilmaier[3], Sabino Zange[3], Marcel A. Müller[2], Daniela Niemeyer[2], Terry C. Jones[2,4], Patrick Vollmar[4], Camilla Rothe[5], Michael Hoelscher[5], Tobias Bleicker[2], Sebastian Brünink[2], Julia Schneider[2], Rosina Ehmann[3], Katrin Zwirglmaier[1], Christian Drosten[2,7,12] & Clemens Wendtner[3,7,12]

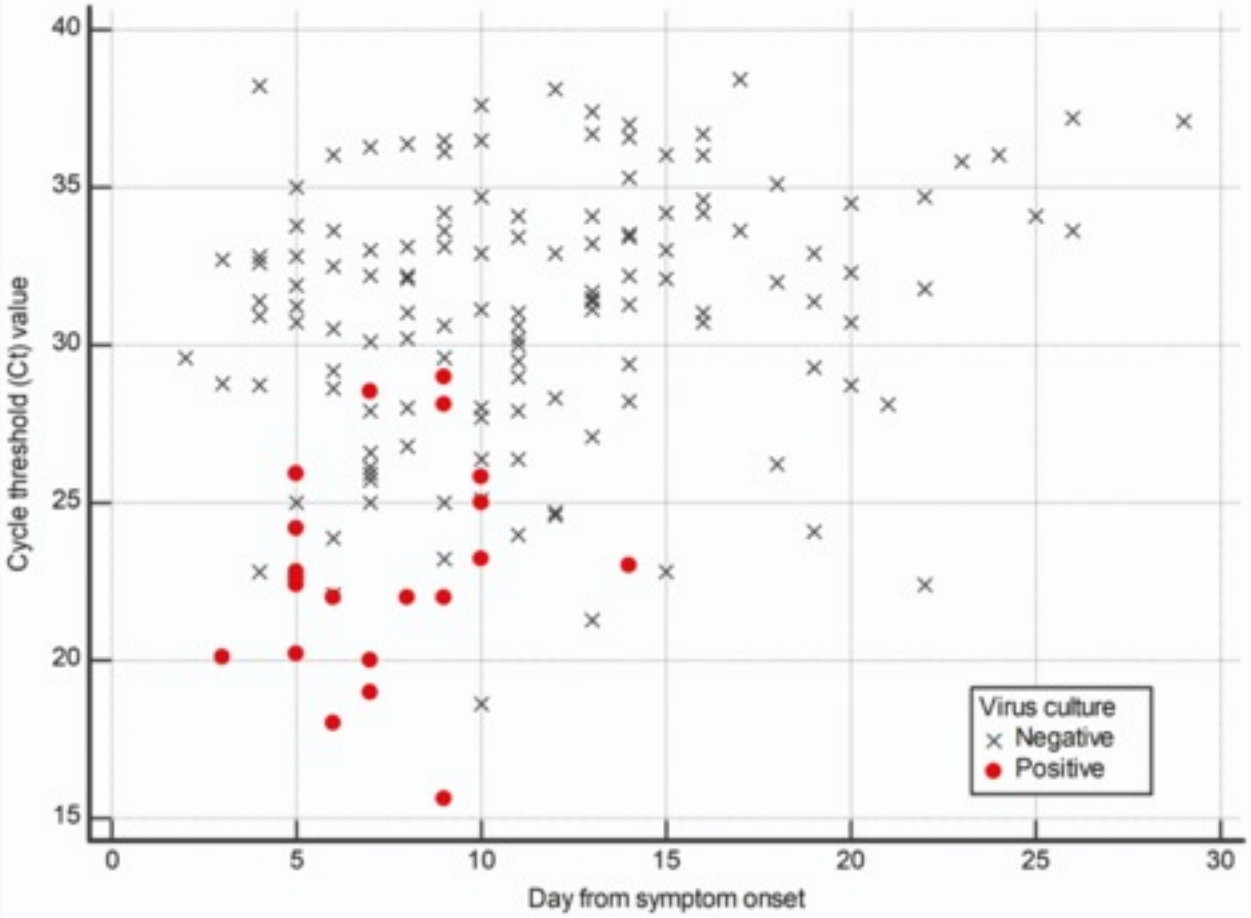
SARS-CoV-2 natural history



Wolfel, Nature, 2020

SARS-CoV-2 natural history

Scatterplot of viral culture results by day from symptom onset and PCR Ct value



Clin Infect Dis, ciaa1280, https://doi.org/10.1093/cid/ciaa1280

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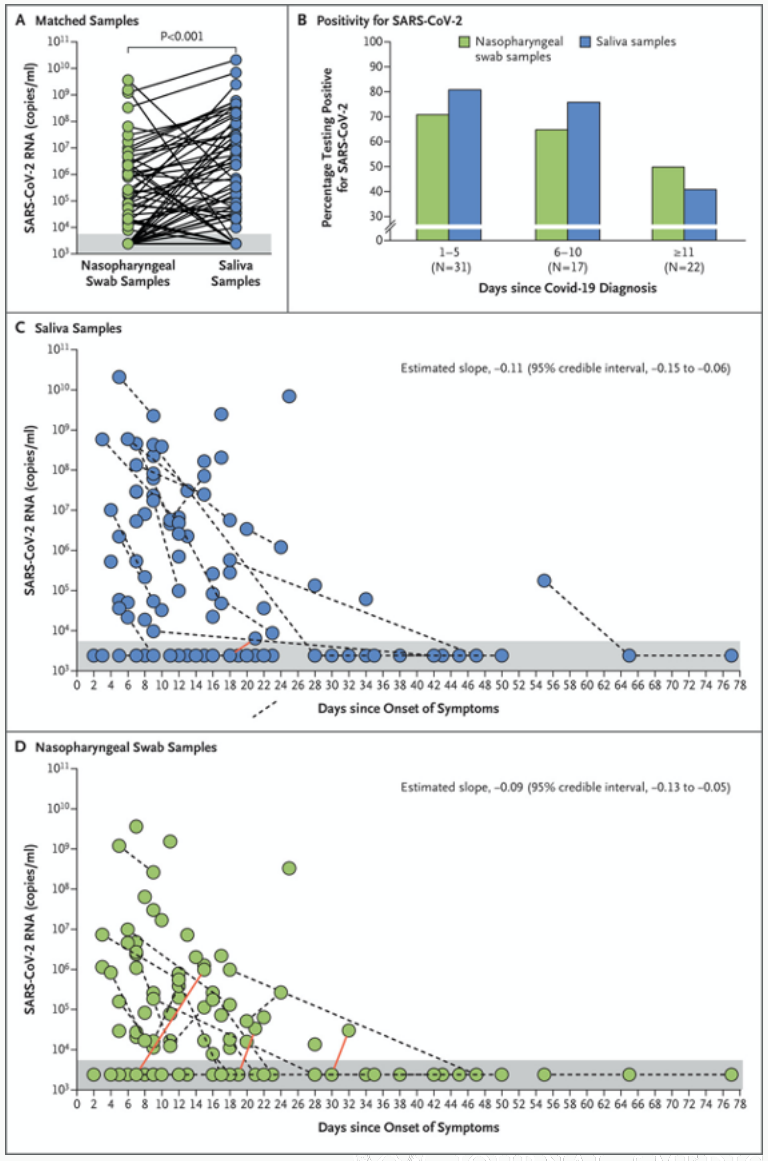
SARS-CoV-2 in saliva vs. NP swabs

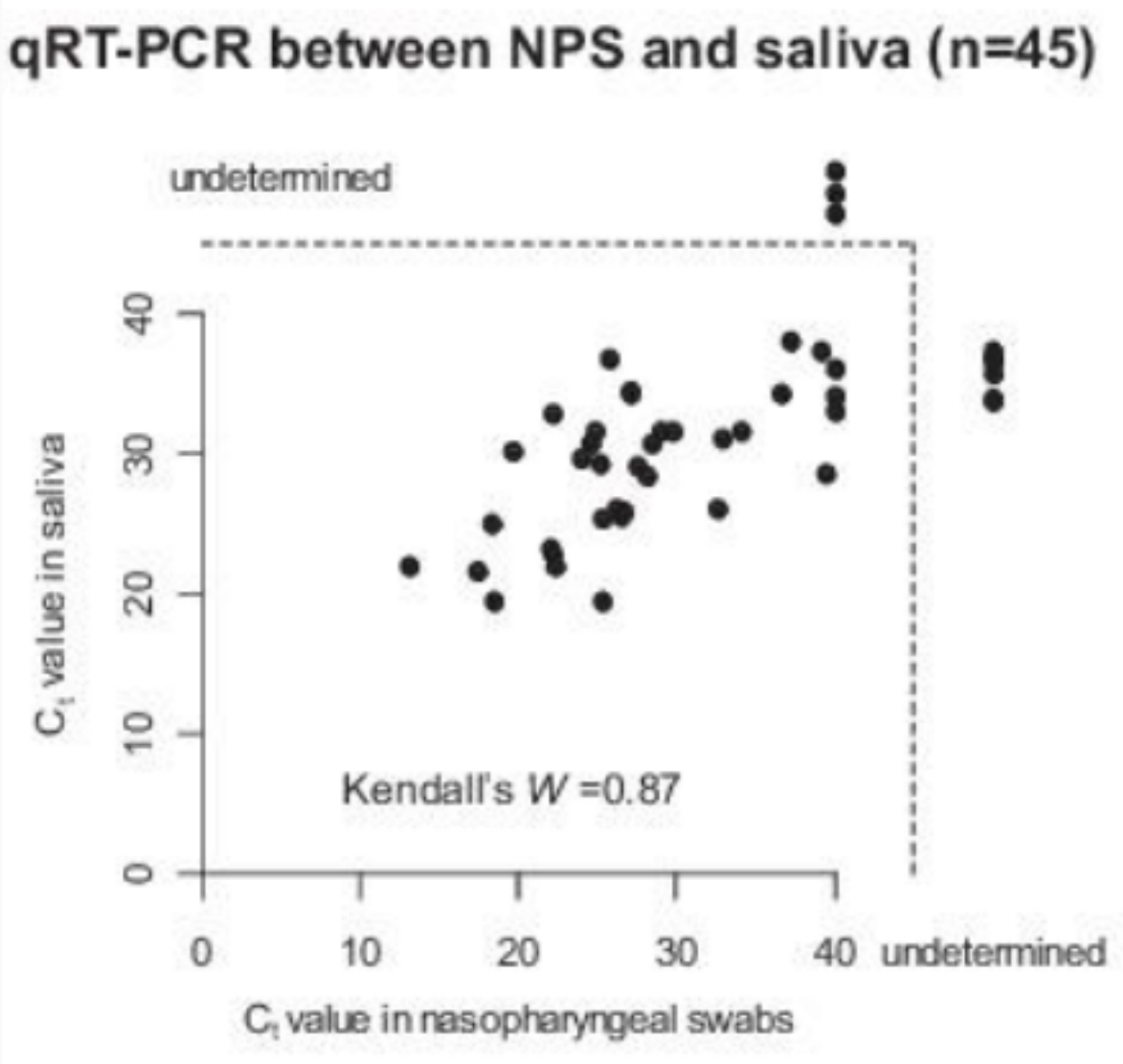
SARS-CoV-2 RNA Titers in Saliva Specimens and Nasopharyngeal Swab Specimens.



AL Wyllie et al. N Engl J Med 2020;383:1283-1286.

JOURNAL of MEDICINE

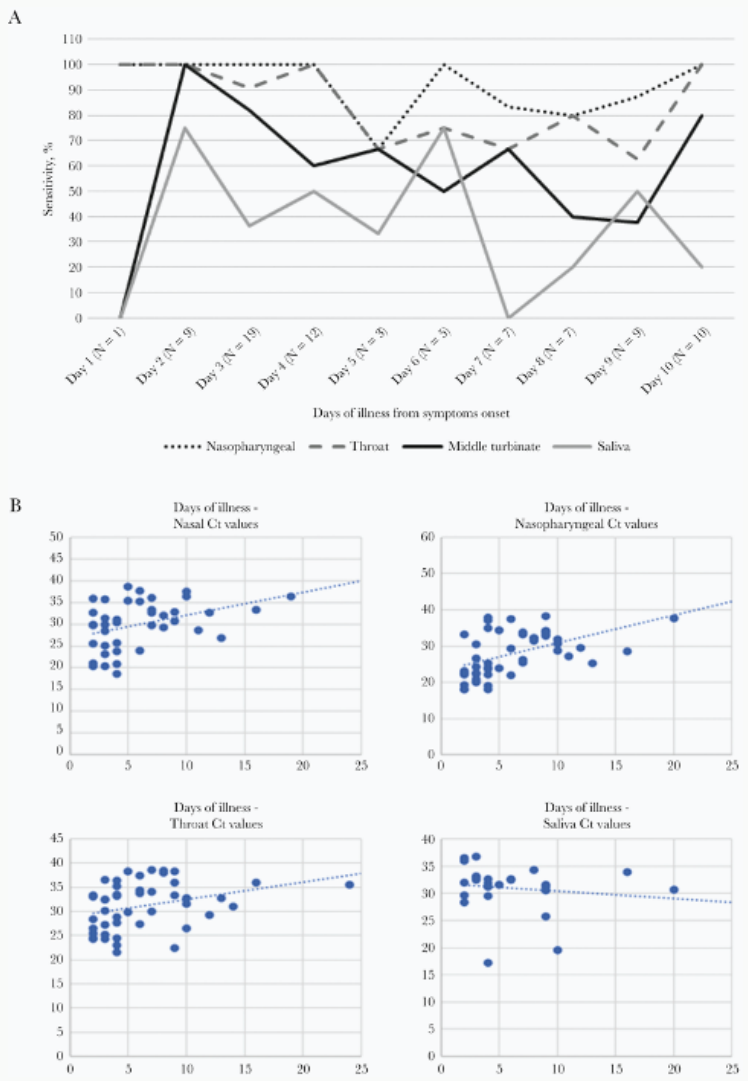
SARS-CoV-2 in saliva vs. NP swabs



Yokota et al., *CID,* September, 2020

SARS-CoV-2 in other body compartments

Performance of testing sites and Ct values over days of illness



Open Forum Infect Dis, Volume 7, Issue 9, September 2020, ofaa335, https://doi.org/10.1093/ofid/ofaa335

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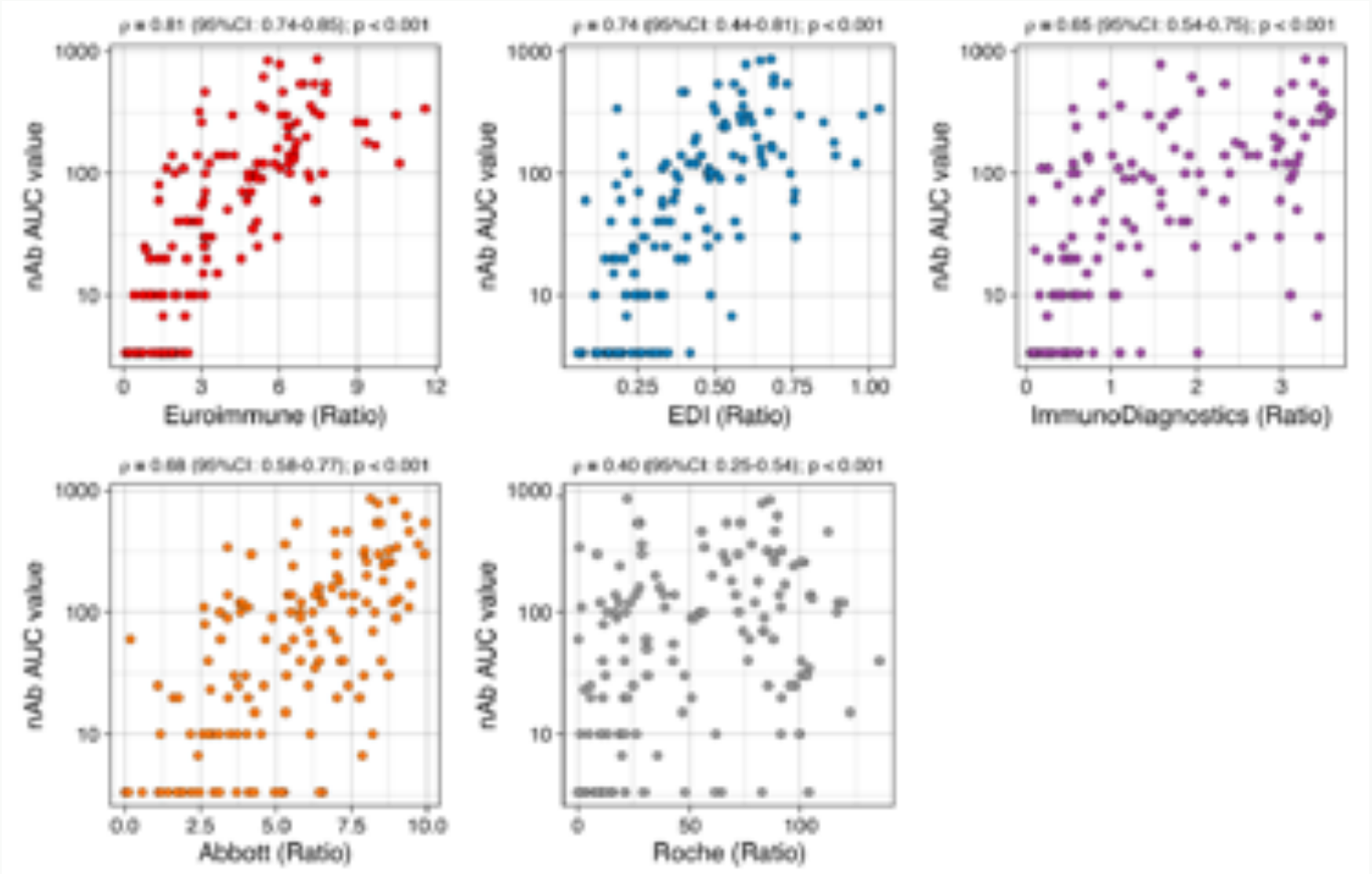
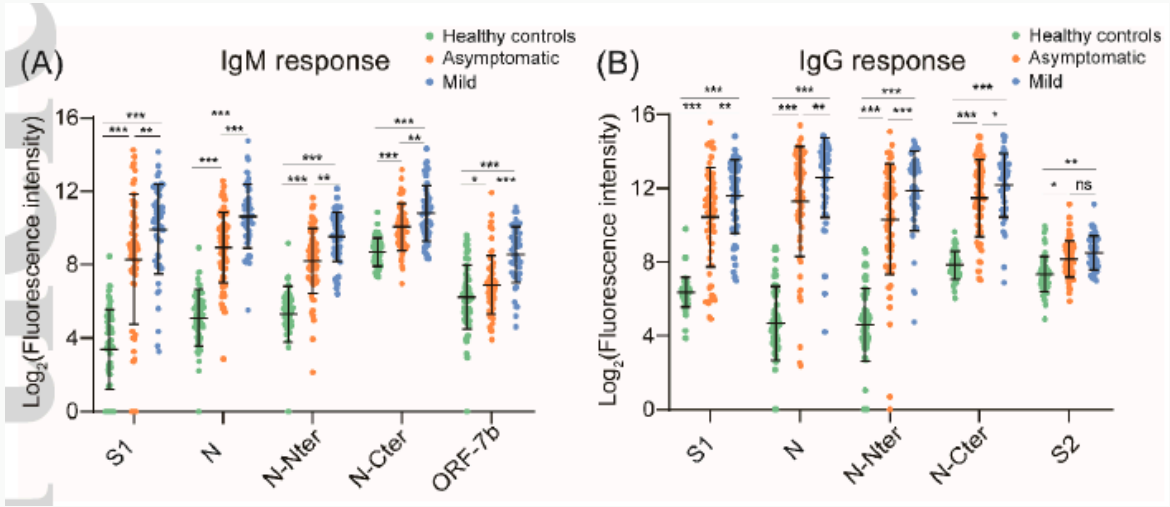
Antibody testing

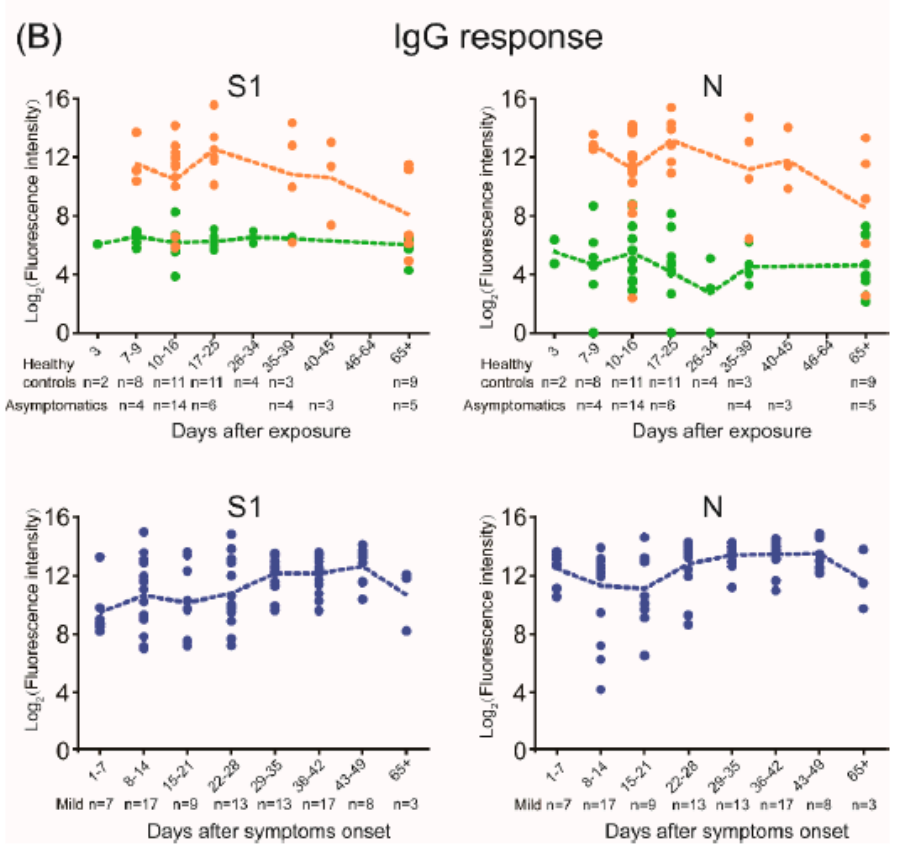
Are all anti-SARS-CoV-2 antibody tests equivalent?



Patel, medRxiv, 2020

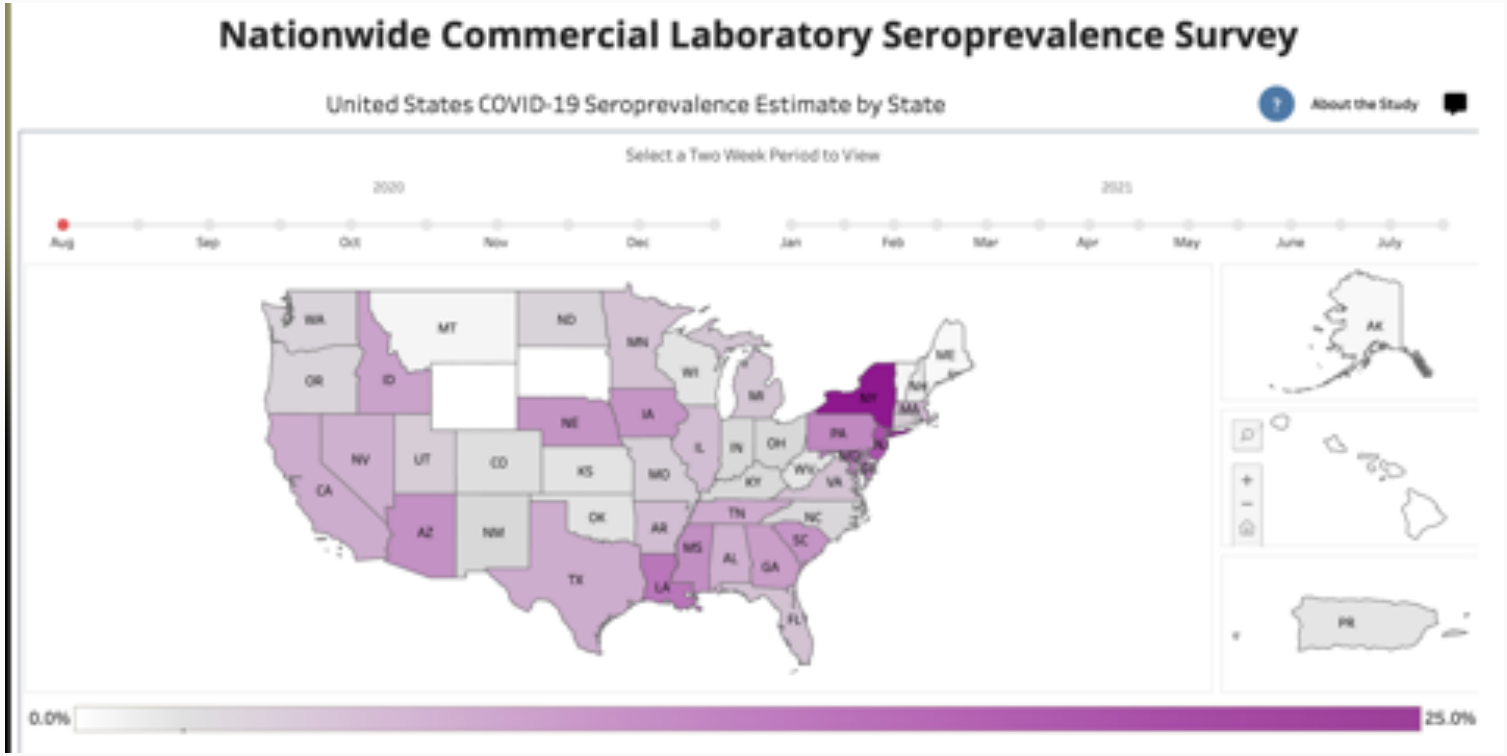
Anti-SARS-CoV-2 antibody dynamics





Lei, Allergy, 2020

National anti-SARS-CoV-2 seroprevalence



CDC guidelines for antibody testing

- Several serologic assays for SARS-CoV-2 have Emergency Use Authorization (EUA) by the U.S. Food and Drug Administration (FDA), which has independently reviewed their performance.
- Currently, there is no identified advantage whether the assays test for IgG, IgM and IgG, or total antibody.
- It is important to minimize false-positive test results by choosing an assay with high specificity and by testing populations and individuals with an elevated likelihood of previous exposure to SARS-CoV-2. Alternatively, an orthogonal testing algorithm (i.e., employing two independent tests in sequence when the first test yields a positive result) can be used when the expected positive predictive value of a single test is low.
- Antibodies most commonly become detectable 1–3 weeks after symptom onset, at which time evidence suggests that infectiousness likely is greatly decreased and that some degree of immunity from future infection has developed. However, additional data are needed before modifying public health recommendations based on serologic test results, including decisions on discontinuing physical distancing and using personal protective equipment.

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Antigen testing

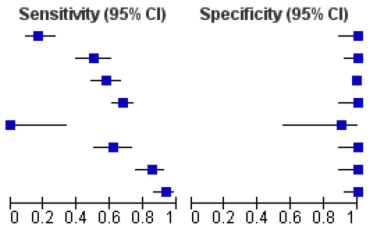
SARS-CoV-2 nucleocapsid protein

	Ct≤40 as NA testing positive[a]	Ct≤37 as NA testing positive[b]
Prevalence (%)	80.1 (201/251)	61.7 (155/251)
95% CI	74.5-84.7	55.4-67.7
Sensitivity (%)	75.6 (152/201)	91.0 (141/155)
95% CI	69.0-81.3	85.0-94.8
Specificity (%)	100 (50/50)	88.5 (85/96)
95% CI	91.1-100	80.0-93.9
Positive predictive value (%)	100 (152/152)	92.8 (141/152)
95% CI	96.9-100	87.1-96.2
Negative predictive value (%)	50.5 (50/99)	85.9 (85/99)
95% CI	40.3-60.6	77.1-91.8
Percent agreement	80.5 (202/251)	90.0 (226/251)
95% CI	75.1-84.9	85.7-93.2

Diao, CMI, 2020

Antigen testing

Study	TP	FP	FN	TN	Test	Sample type	Sensitivity (95% CI)	Specificity (95% CI)
Weitzel 2020 [C]	13	0	65	31	Beijing Savant - FIA	NP + OP	0.17 [0.09, 0.27]	1.00 [0.89, 1.00]
Lambert-Niclot 2020	47	0	47	44	Coris BioConcept - CGIA	NP	0.50 [0.40, 0.60]	1.00 [0.92, 1.00]
Mertens 2020	76	1	56	195	Coris BioConcept - CGIA	NP	0.58 [0.49, 0.66]	0.99 [0.97, 1.00]
Diao 2020	141	0	67	31	In-house - FIA	NP	0.68 [0.61, 0.74]	1.00 [0.89, 1.00]
Weitzel 2020 [B]	0	1	9	9	Liming Bio-Products - CGIA	NP + OP	0.00 [0.00, 0.34]	0.90 [0.55, 1.00]
Weitzel 2020 [A]	49	0	30	30	RapiGEN Inc - CGIA	NP + OP	0.62 [0.50, 0.73]	1.00 [0.88, 1.00]
Weitzel 2020 [D]	68	0	12	31	Shenzhen Bioeasy - FIA	NP + OP	0.85 [0.75, 0.92]	1.00 [0.89, 1.00]
Porte 2020	77	0	5	45	Shenzhen Bioeasy - FIA	NP + OP	0.94 [0.86, 0.98]	1.00 [0.92, 1.00]

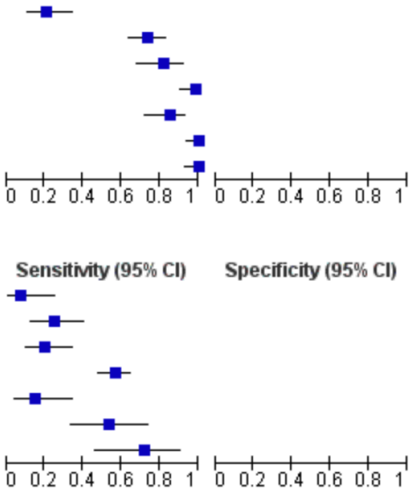


Antigen tests - high viral load

Study	TP	FP	FN	TN	Test	Sensitivity (95% CI)	Specificity (95% CI)
Weitzel 2020 [C]	11	0	41	0	Beijing Savant - FIA	0.21 [0.11, 0.35]	Not estimable
Mertens 2020	65	0	23	0	Coris BioConcept - CGIA	0.74 [0.63, 0.83]	Not estimable
Lambert-Niclot 2020	37	0	8	0	Coris BioConcept - CGIA	0.82 [0.68, 0.92]	Not estimable
Diao 2020	55	0	1	0	In-house - FIA	0.98 [0.90, 1.00]	Not estimable
Weitzel 2020 [A]	45	0	8	0	RapiGEN Inc - CGIA	0.85 [0.72, 0.93]	Not estimable
Weitzel 2020 [D]	54	0	0	0	Shenzhen Bioeasy - FIA	1.00 [0.93, 1.00]	Not estimable
Porte 2020	52	0	0	0	Shenzhen Bioeasy - FIA	1.00 [0.93, 1.00]	Not estimable

Antigen tests - low viral load

Study	TP	FP	FN	TN	Test	Sensitivity (95% CI)	Specificity (95% CI)
Weitzel 2020 [C]	2	0	24	0	Beijing Savant - FIA	0.08 [0.01, 0.25]	Not estimable
Mertens 2020	11	0	33	0	Coris BioConcept - CGIA	0.25 [0.13, 0.40]	Not estimable
Lambert-Niclot 2020	10	0	39	0	Coris BioConcept - CGIA	0.20 [0.10, 0.34]	Not estimable
Diao 2020	86	0	66	0	In-house - FIA	0.57 [0.48, 0.65]	Not estimable
Weitzel 2020 [A]	4	0	22	0	RapiGEN Inc - CGIA	0.15 [0.04, 0.35]	Not estimable
Weitzel 2020 [D]	14	0	12	0	Shenzhen Bioeasy - FIA	0.54 [0.33, 0.73]	Not estimable
Porte 2020	13	0	5	0	Shenzhen Bioeasy - FIA	0.72 [0.47, 0.90]	Not estimable



Cochrane Systematic Review, 2020

THERAPEUTICS

Antivirals

Immunomodulatory agents

Convalescent Plasma

Repurposed Medicines

Antivirals

- Remdesivir
- EIDD-2801
- Convalescent Plasma
- Monoclonal antibodies against the spike protein

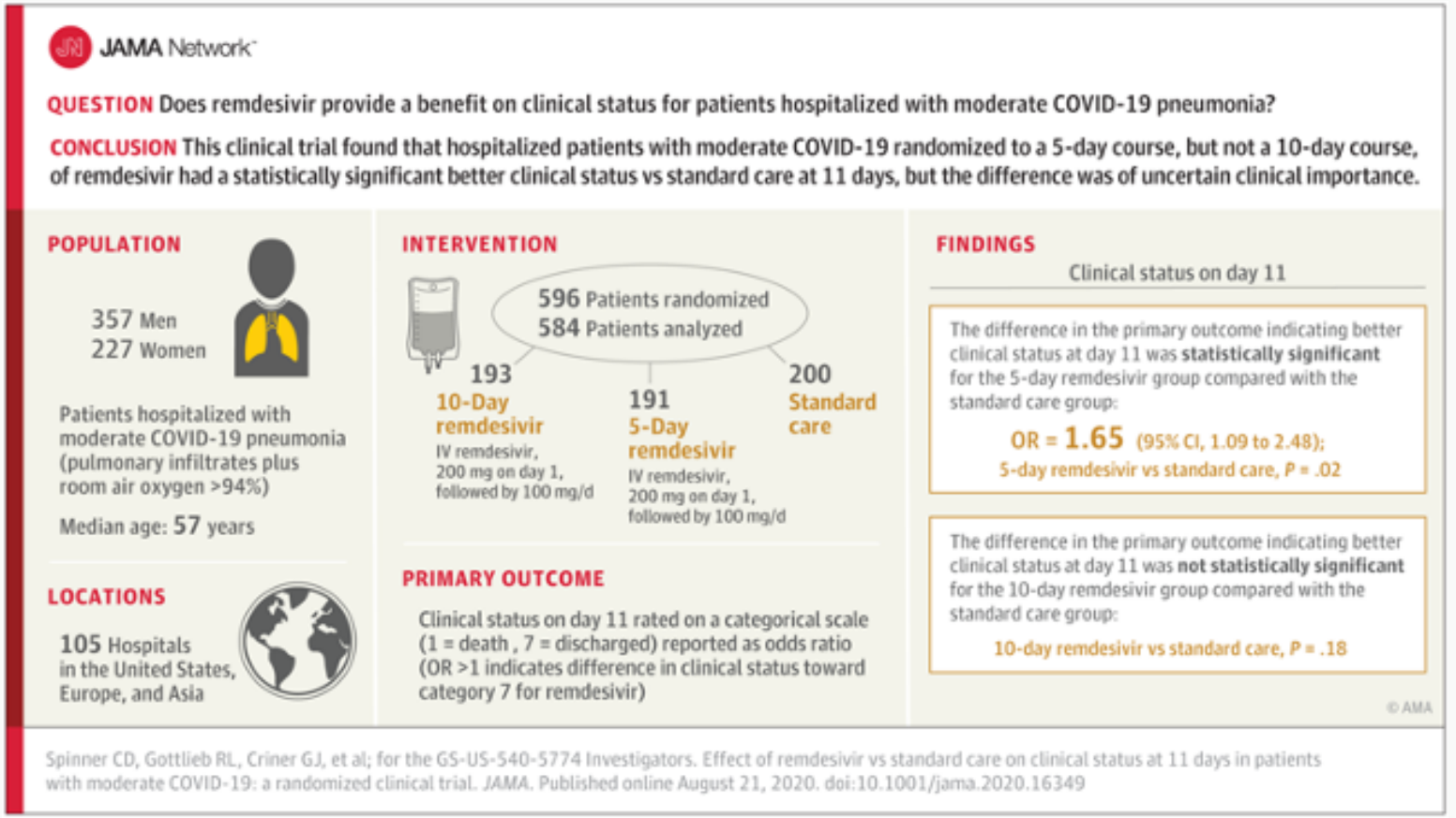
JAMA Network™

From: **Effect of Remdesivir vs Standard Care on Clinical Status at 11 Days in Patients With Moderate COVID-19: A Randomized Clinical Trial**

JAMA. 2020;324(11):1048-1057. doi:10.1001/jama.2020.16349

Antivirals

Remdesivir



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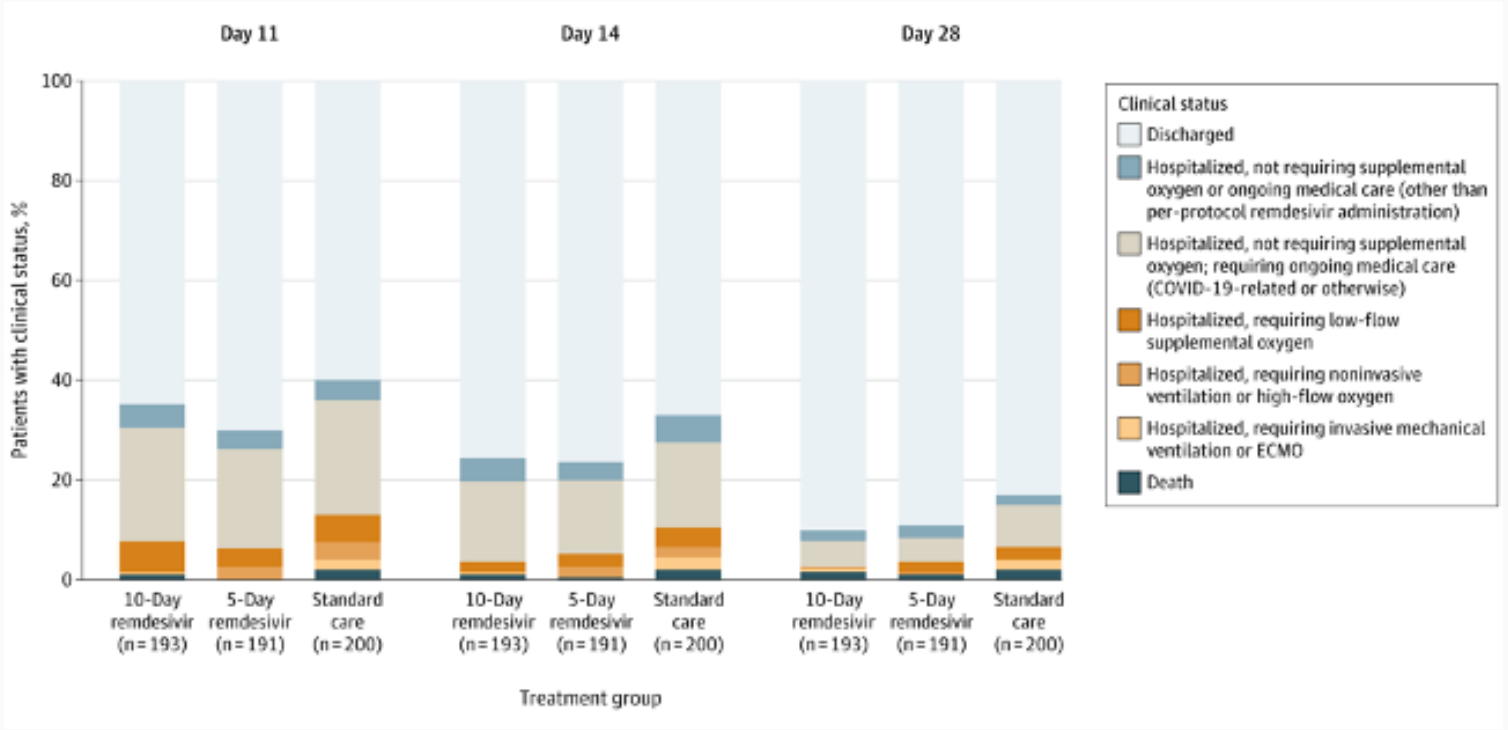
Antivirals

Remdesivir



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Antivirals

Remdesivir

Table 3. Adverse Event Summary[a]

Adverse events	No./total (%) 10-Day remdesivir (n = 193)	5-Day remdesivir (n = 191)	Standard care (n = 200)
Any adverse event	113 (59)	98 (51)	93 (47)
Any grade ≥3 adverse event	24 (12)	20 (10)	24 (12)
Any serious adverse event	10 (5)	9 (5)	18 (9)
Discontinuation of treatment because of adverse event	8 (4)	4 (2)	NA
Death[b]	3 (2)	2 (1)	4 (2)
Adverse events occurring in >5% of participants in any treatment group			
Nausea	18 (9)	19 (10)	6 (3)
Diarrhea	10 (5)	12 (6)	14 (7)
Hypokalemia	13 (7)	10 (5)	4 (2)
Headache	10 (5)	10 (5)	5 (3)
Laboratory abnormalities			
Any grade	128/179 (72)	131/180 (73)	136/186 (73)
Grade 3	25/179 (14)	18/180 (10)	25/186 (13)
Grade 4	4/179 (2)	5/180 (3)	9/186 (5)
Alanine aminotransferase increase			
Any grade	57/177 (32)	61/179 (34)	71/182 (39)
Grade 3 (>5 to 10 times ULN)	6/177 (3)	4/179 (2)	11/182 (6)
Grade 4 (>10 times ULN)	0	0	3 (2)
Aspartate aminotransferase increase			
Any grade	56/175 (32)	56/177 (32)	60/182 (33)
Grade 3 (>5 to 10 times ULN)	2/175 (1)	3/177 (2)	6/182 (3)
Grade 4 (>10 times ULN)	0	1/177 (1)	5/182 (3)
Creatinine clearance decrease			
Any grade	45/176 (26)	26/178 (15)	55/183 (30)
Grade 3 (30 to <60 mL/min or 30% to <50% decrease from baseline)	7/176 (4)	4/178 (2)	9/183 (5)
Grade 4 (<30 mL/min, ≥50% decrease from baseline, or dialysis needed)	2/176 (1)	0	5/183 (3)

Abbreviations: NA, not applicable; ULN, upper limit of normal.

[a] All safety analyses are inclusive of all available data for patients through the data cutoff time point.

[b] Through day 28 of the trial.

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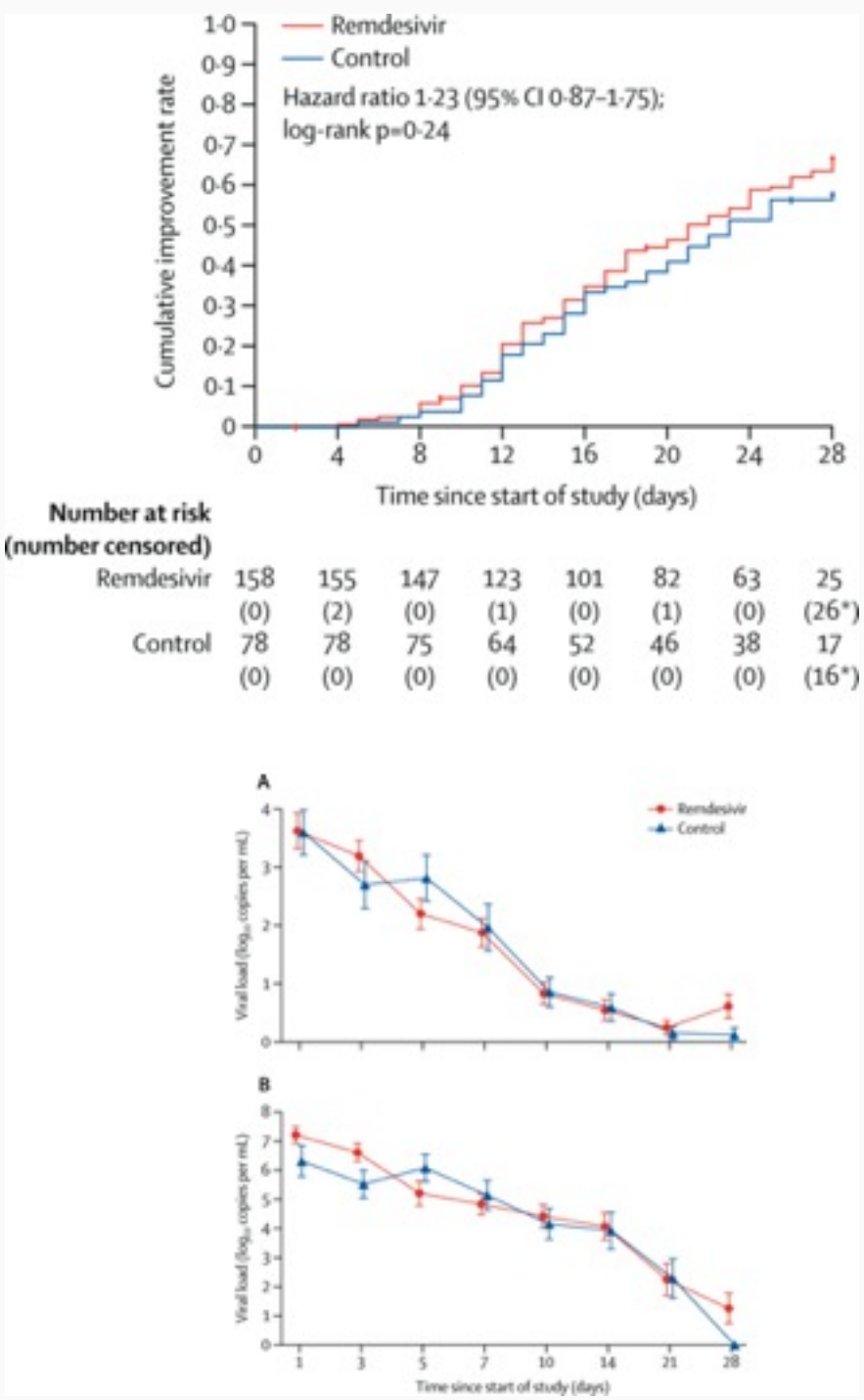
Antivirals

Remdesivir

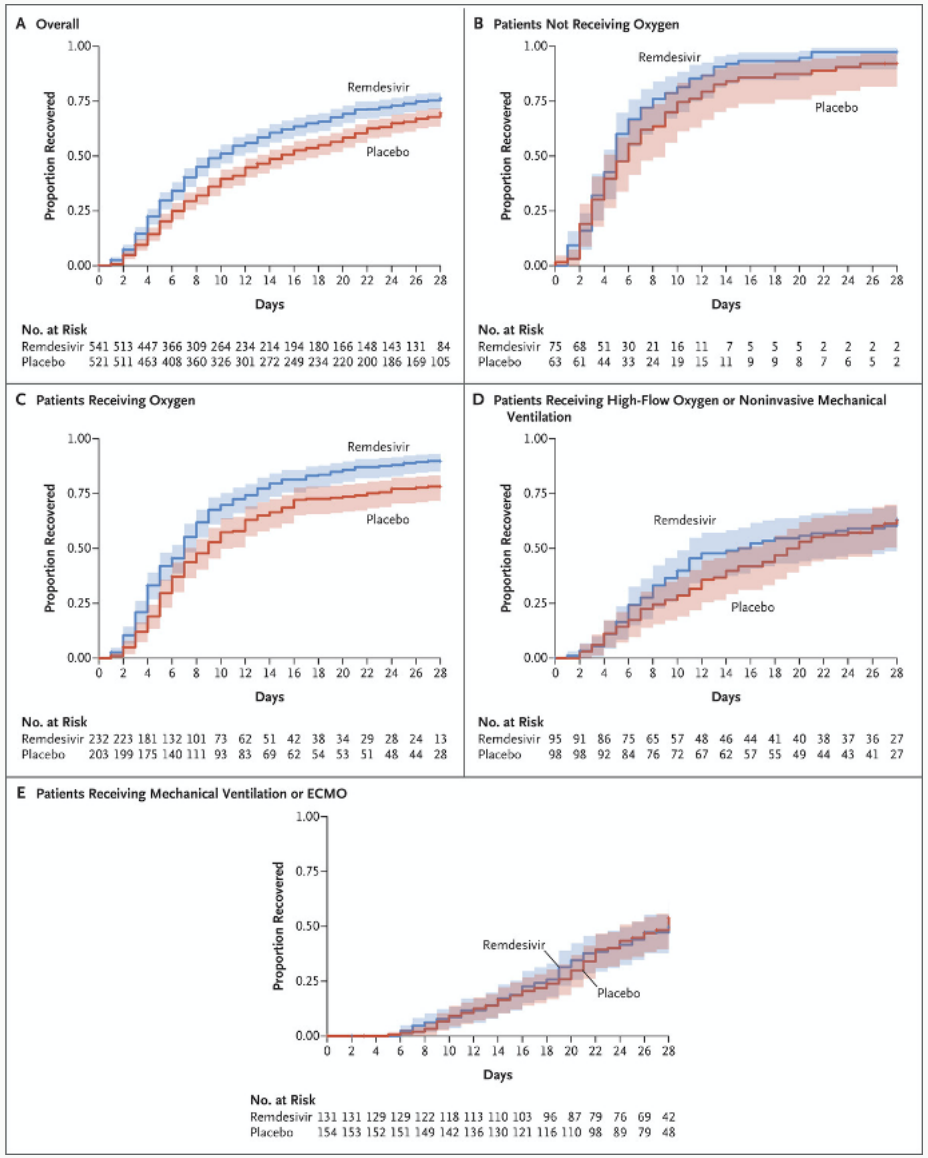


Wang, Lancet, 2020

Antivirals

Remdesivir

Kaplan–Meier Estimates of Cumulative Recoveries



JH Beigel et al. N Engl J Med 2020. DOI: 10.1056/NEJMoa2007764

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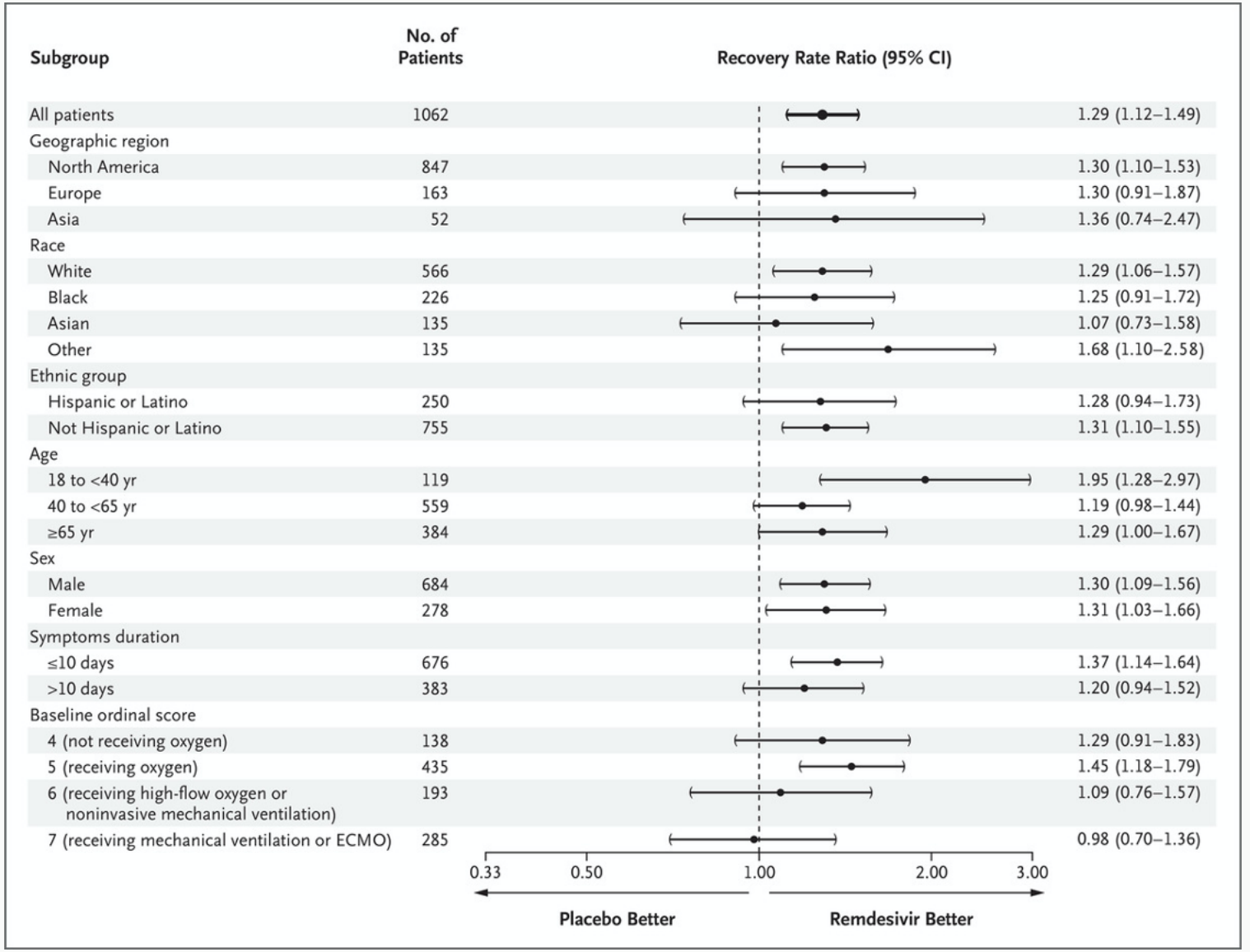
Antivirals

Remdesivir

Time to Recovery According to Subgroup



JH Beigel et al. N Engl J Med 2020. DOI: 10.1056/NEJMoa2007764

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Antivirals

Remdesivir

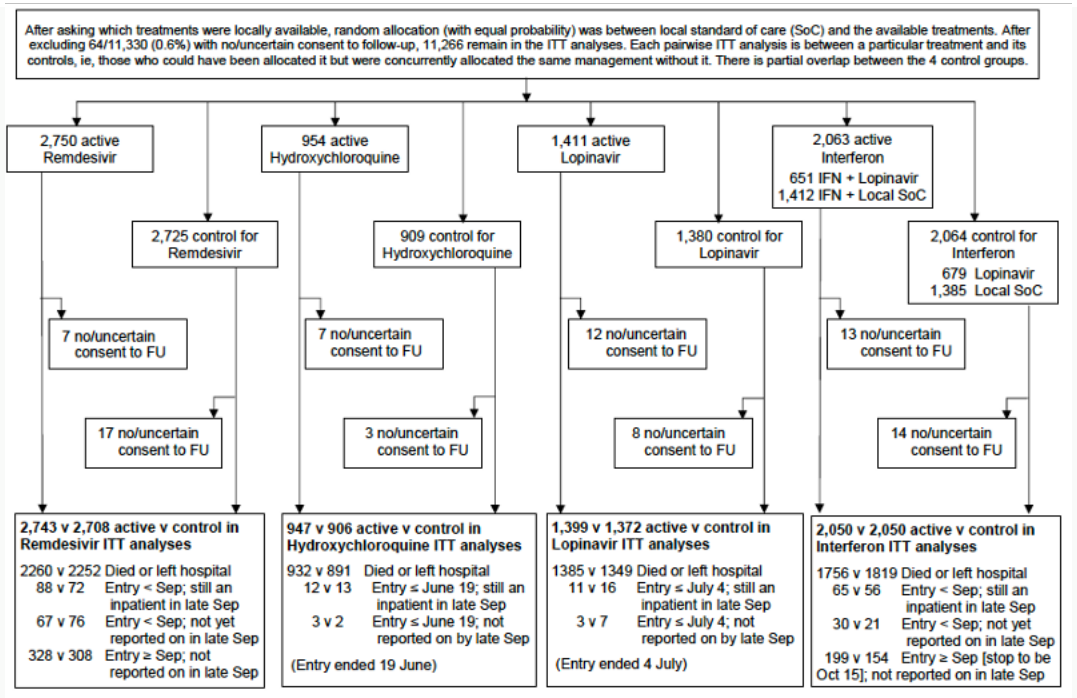
MedRxiv (October 15) version

Repurposed antiviral drugs for COVID-19 –interim WHO SOLIDARITY trial results

WHO Solidarity trial consortium*

*A complete list of SOLIDARITY Trial investigators is provided in the Supplementary Appendix.

Hongchao Pan, Ph.D., Richard Peto, F.R.S., Quarraisha Abdool Karim, Ph.D., Marissa Alejandria M.D., M.Sc., Ana Maria Henao-Restrepo, M.D., M.Sc., César Hernández García M.D., Ph.D., Marie-Paule Kieny Ph.D., Reza Malekzadeh M.D., Srinivas Murthy M.D. C.M., Marie-Pierre Preziosi M.D., Ph.D., Srinath Reddy M.D., D.M., Mirta Roses Periago M. D., Vasee Sathiyamoorthy B.M.B.Ch., Ph.D., John-Arne Røttingen M.D., Ph.D., and Soumya Swaminathan M.D. , as the members of the Writing Committee, assume responsibility for the content and integrity of this article.



Antivirals

Remdesivir

MedRxiv (October 15) version

Repurposed antiviral drugs for COVID-19 –interim WHO SOLIDARITY trial results

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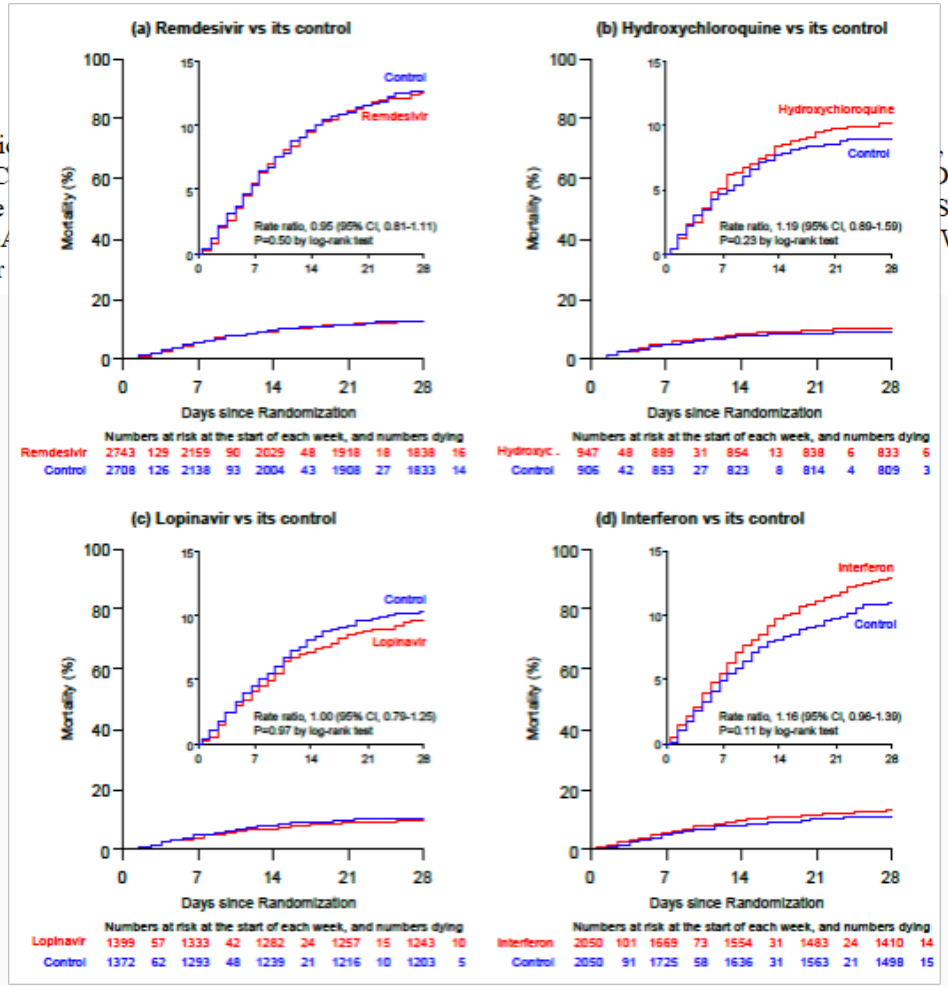
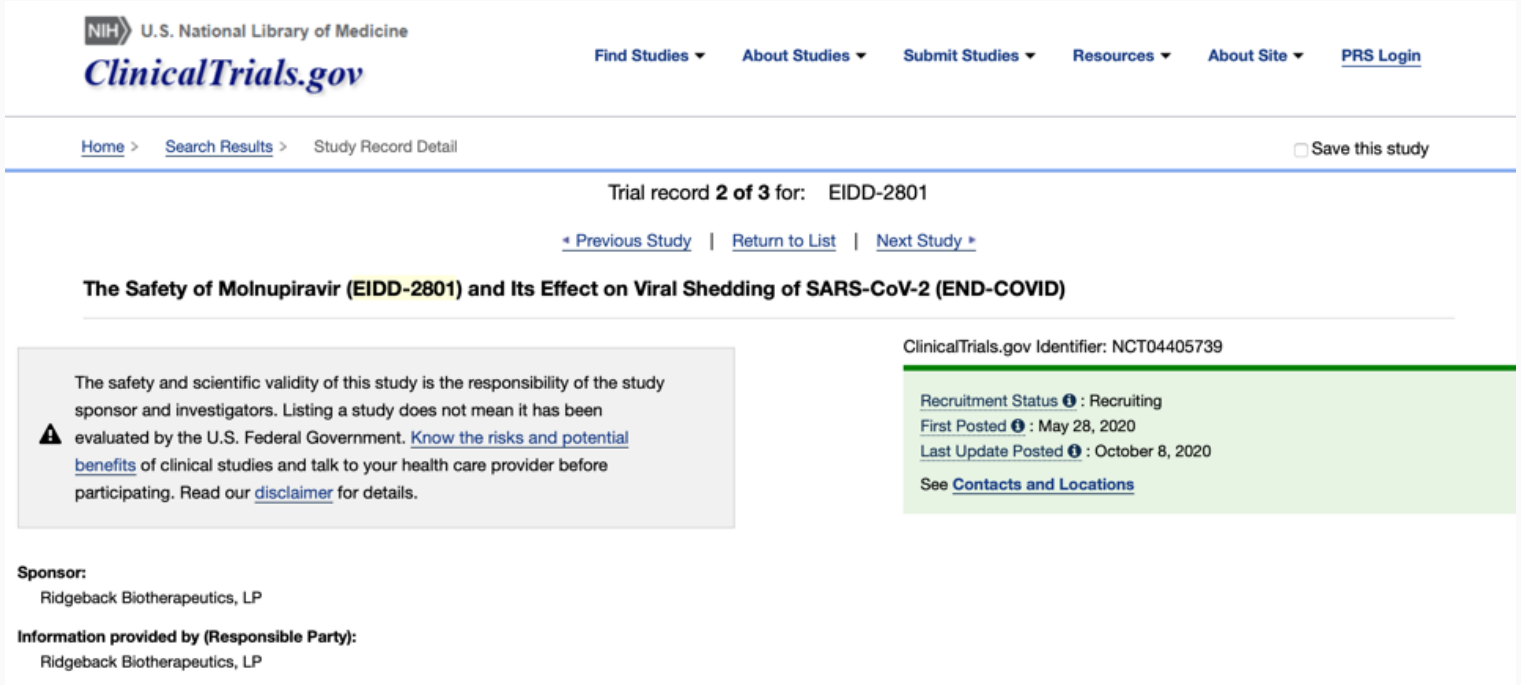


Antivirals

Molnupiravir (EIDD-2801)

Multiple ongoing international trials



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Trial record **2 of 3** for: EIDD-2801

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The Safety of Molnupiravir (EIDD-2801) and Its Effect on Viral Shedding of SARS-CoV-2 (END-COVID)

ClinicalTrials.gov Identifier: NCT04405739

The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Know the risks and potential benefits of clinical studies and talk to your health care provider before participating. Read our disclaimer for details.

Recruitment Status : Recruiting
First Posted : May 28, 2020
Last Update Posted : October 8, 2020
See Contacts and Locations

Sponsor:
Ridgeback Biotherapeutics, LP

Information provided by (Responsible Party):
Ridgeback Biotherapeutics, LP

Antivirals

Convalescent Plasma

medRxiv preprint doi: https://doi.org/10.1101/2020.08.12.20169359 this version posted August 12, 2020. The copyright holder for this prepr
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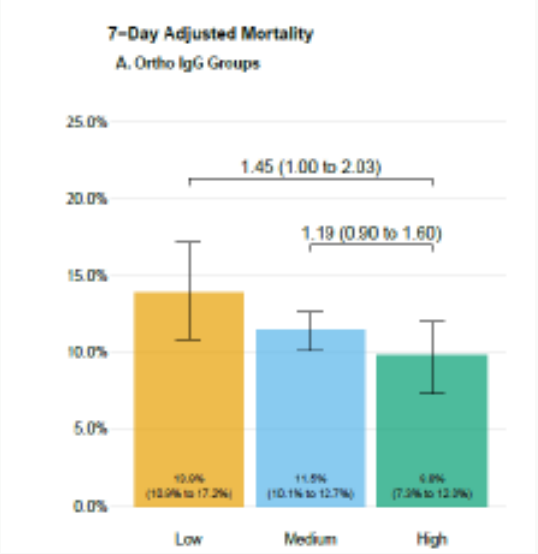
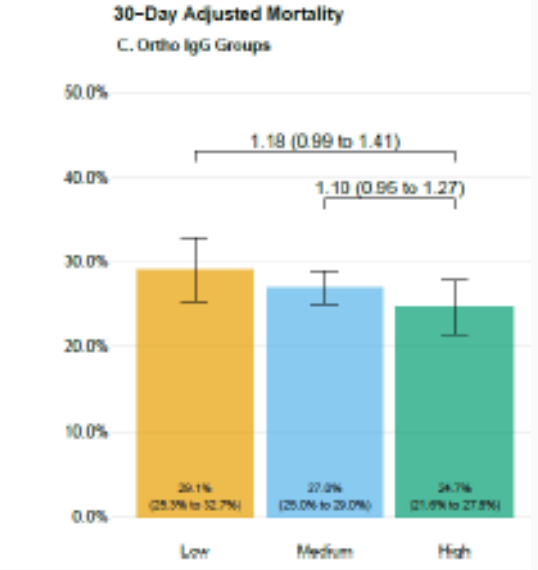
Effect of Convalescent Plasma on Mortality among Hospitalized Patients with COVID-19: Initial Three-Month Experience

Michael J. Joyner[1*], M.D., Jonathon W. Senefeld[1], Ph.D., Stephen A. Klassen[1], Ph.D., John R. Mills[2], Ph.D., Patrick W. Johnson[3], Elitza S. Theel[2], Ph.D., Chad C. Wiggins[1], Ph.D., Katelyn A. Bruno[4], Ph.D., Allan M. Klompas[1], M.B., B.Ch., B.A.O., Elizabeth R. Lesser[3], Katie L. Kunze[5], Ph.D., Matthew A. Sexton[1], M.D., Juan C. Diaz Soto[1], M.D., Sarah E. Baker[1], Ph.D., John R.A. Shepherd[1], M.D., Noud van Helmond[6], M.D., Nigel S. Paneth[7,8#], M.D., M.P.H., Ph.D., DeLisa Fairweather[4#], Ph.D., R. Scott Wright[9,10#], M.D., Rickey E. Carter[3#], Ph.D., Arturo Casadevall[11#], M.D., Ph.D., *the US EAP COVID-19 Plasma Consortium,*





Antivirals

Convalescent Plasma

Summary of Randomized Clinical Trials*

Study	Location	Mortality	Other Benefits	Status	Comment
Li et al (1)	China	26% → 16% (NS) n = (SOC) vs (CP) 51 vs 52	↓ Viral Load ↓ O2 Demand ↓Recovery time	Premature termination	Late Usage; efficacy in less critically ill patients
Gharbharan et al. (2)	Netherlands	24% → 14% (NS) 43 vs 43		Premature termination	Late Usage
Avendano-Sola et al. (3)	Spain	9% → 0 (p = 0.06) 43 vs 38	↓ Progression to ICU	Premature termination	Early use
Agarwal et al. (4)	India	14% → 14% (NS) 229 vs 235	↓Viral Load ↓FiO2 ↓Fever	Completed	A large proportion of units had low or no specific antibody
Rashid et al. (5)	Iraq	40% → 5% (p < 0.05) 28 vs 21	↓Recovery time	Completed	Small, not blinded, quirky randomization

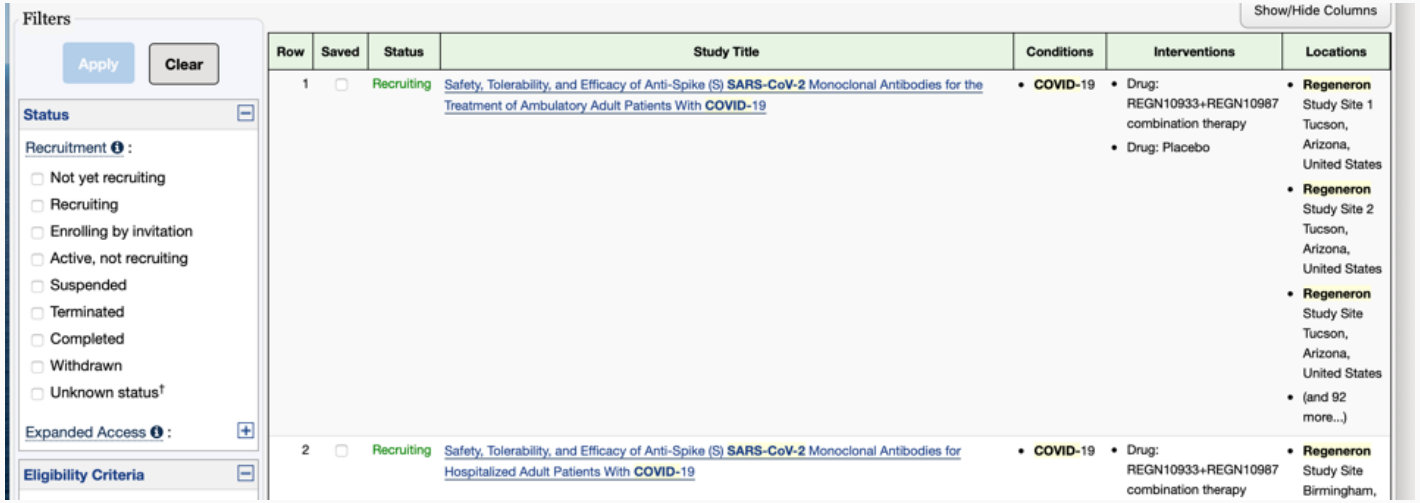
***Table provided by Dr. Arturo Casadevall and Dr. Stuart Ray**

1. Li L, Jama. 2020. Epub 2020/06/04. doi: 10.1001/jama.2020.10044. PubMed PMID: 32492084.
2. Gharbharan A, medRxiv. 2020:2020.07.01.20139857. doi: 10.1101/2020.07.01.20139857.
3. Avendano-Sola C, medRxiv. 2020:2020.08.26.20182444. doi:10.1101/2020.08.26.20182444.
4. Agarwal A, medRxiv. 2020:2020.09.03.20187252. doi: 10.1101/2020.09.03.20187252.
5. Rasheed AM, Le infezioni in medicina. 2020;28(3):357-66. Epub 2020/09/14. PubMed PMID: 32920571.

Antivirals

Monoclonal antibodies

Monoclonal antibodies against the spike protein



Filters

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Status

Recruitment :

- Not yet recruiting
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- Active, not recruiting
- Suspended
- Terminated
- Completed
- Withdrawn
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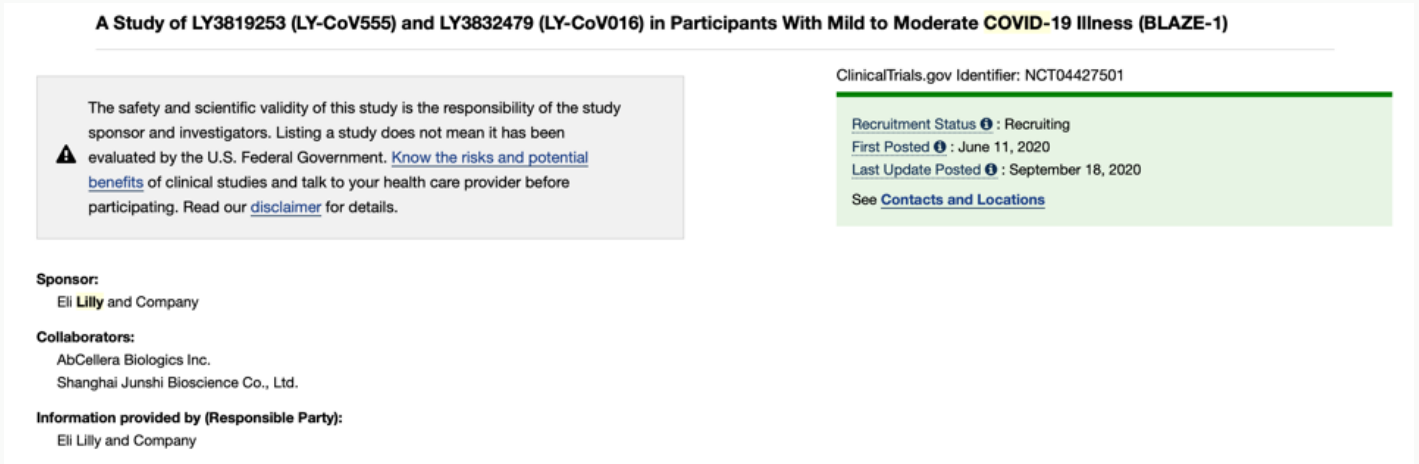
Expanded Access :

Eligibility Criteria

Show/Hide Columns

Row	Saved	Status	Study Title	Conditions	Interventions	Locations
1		Recruiting	Safety, Tolerability, and Efficacy of Anti-Spike (S) SARS-CoV-2 Monoclonal Antibodies for the Treatment of Ambulatory Adult Patients With COVID-19	• COVID-19	• Drug: REGN10933+REGN10987 combination therapy • Drug: Placebo	• Regeneron Study Site 1 Tucson, Arizona, United States • Regeneron Study Site 2 Tucson, Arizona, United States • Regeneron Study Site Tucson, Arizona, United States • (and 92 more...)
2		Recruiting	Safety, Tolerability, and Efficacy of Anti-Spike (S) SARS-CoV-2 Monoclonal Antibodies for Hospitalized Adult Patients With COVID-19	• COVID-19	• Drug: REGN10933+REGN10987 combination therapy	• Regeneron Study Site Birmingham,



A Study of LY3819253 (LY-CoV555) and LY3832479 (LY-CoV016) in Participants With Mild to Moderate COVID-19 Illness (BLAZE-1)

ClinicalTrials.gov Identifier: NCT04427501

⚠ The safety and scientific validity of this study is the responsibility of the study sponsor and investigators. Listing a study does not mean it has been evaluated by the U.S. Federal Government. Know the risks and potential benefits of clinical studies and talk to your health care provider before participating. Read our disclaimer for details.

Recruitment Status : Recruiting
First Posted : June 11, 2020
Last Update Posted : September 18, 2020
See Contacts and Locations

Sponsor:
Eli Lilly and Company

Collaborators:
AbCellera Biologics Inc.
Shanghai Junshi Bioscience Co., Ltd.

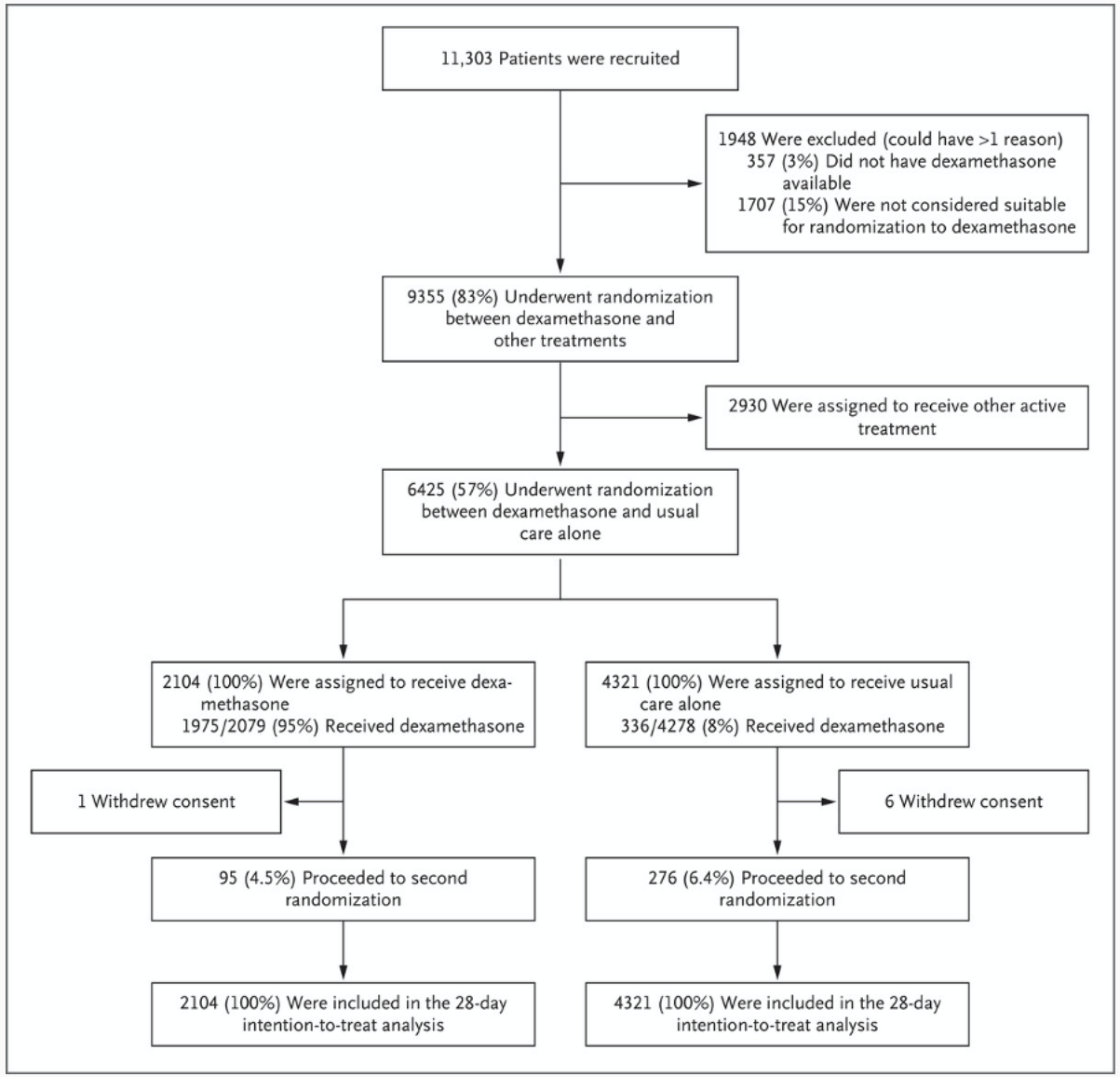
Information provided by (Responsible Party):
Eli Lilly and Company

Immunomodulatory agents

Immunomodulatory agents

Corticosteroids

Enrollment, Randomization, and Inclusion in the Primary Analysis



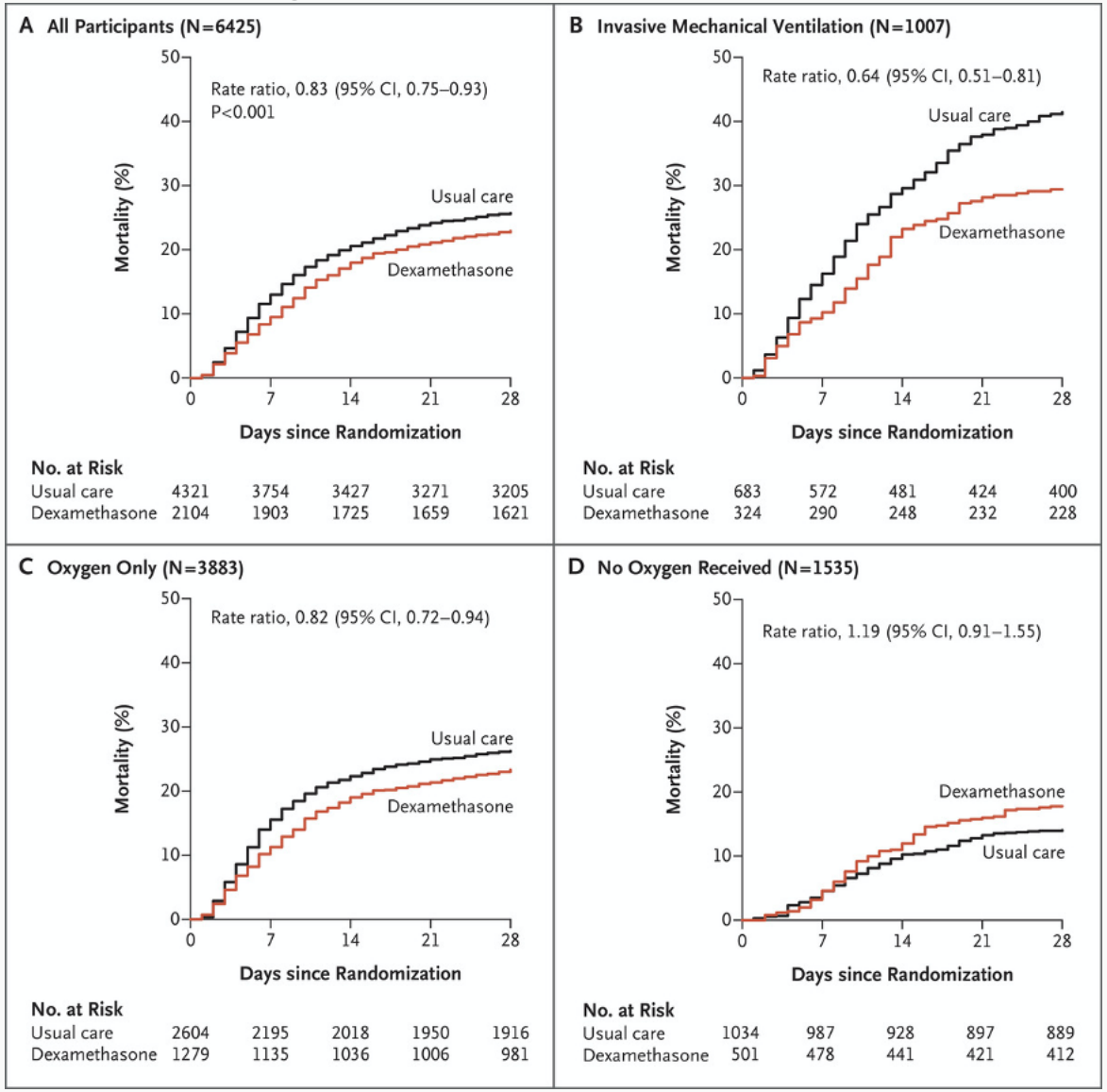
The RECOVERY Collaborative Group. N Engl J Med 2020. DOI: 10.1056/NEJMoa2021436

THE NEW ENGLAND JOURNAL of MEDICINE

Immunomodulatory agents

Corticosteroids

Mortality at 28 Days in All Patients and According to Respiratory Support at Randomization



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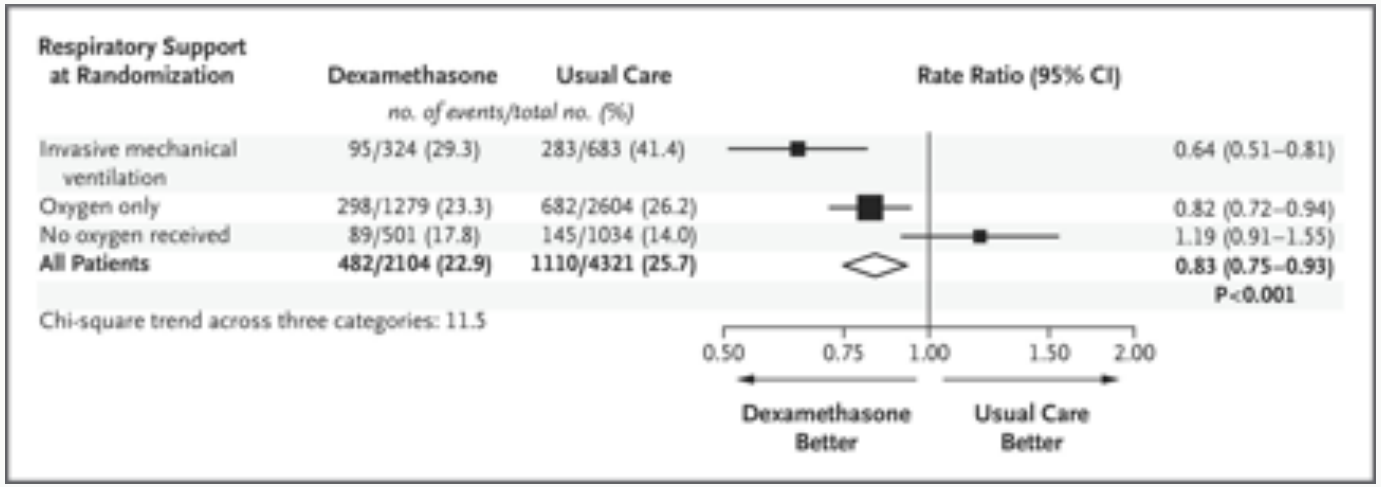
Immunomodulatory agents

Corticosteroids



The RECOVERY Collaborative Group. N Engl J Med 2020. DOI: 10.1056/NEJMoa2021436

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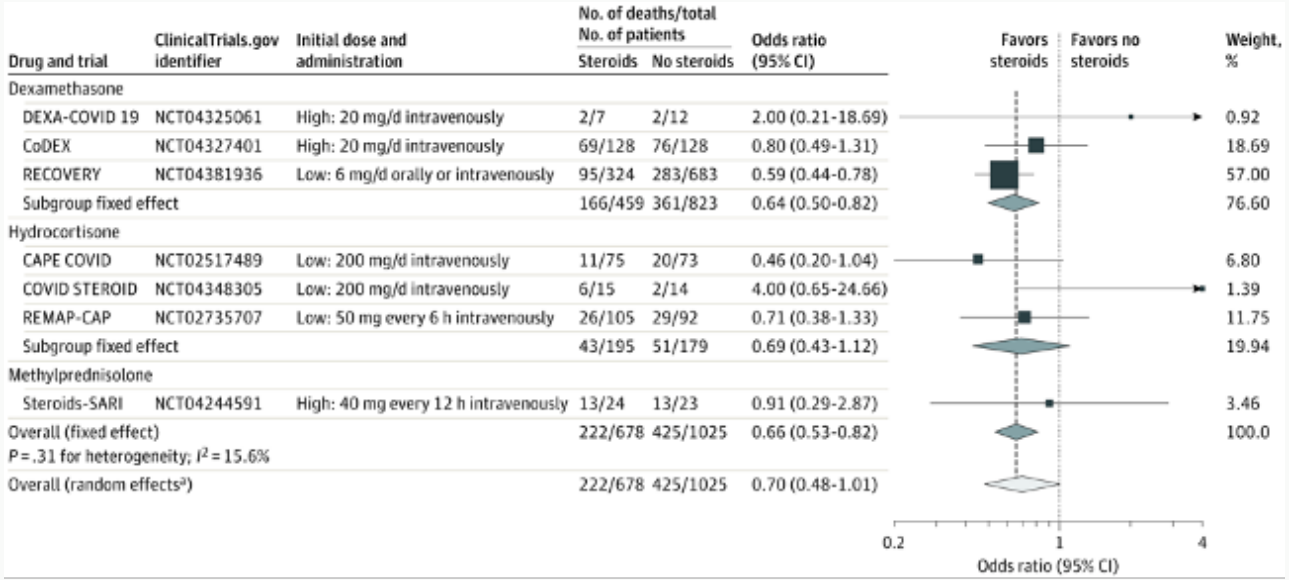
JAMA Network™

From: **Association Between Administration of Systemic Corticosteroids and Mortality Among Critically Ill Patients With COVID-19: A Meta-analysis**

JAMA. 2020;324(13):1330-1341. doi:10.1001/jama.2020.17023

Immunomodulatory agents

Corticosteroids



Drug and trial	ClinicalTrials.gov identifier	Initial dose and administration	No. of deaths/total No. of patients: Steroids	No. of deaths/total No. of patients: No steroids	Odds ratio (95% CI)	Weight, %
Dexamethasone						
DEXA-COVID 19	NCT04325061	High: 20 mg/d intravenously	2/7	2/12	2.00 (0.21-18.69)	0.92
CoDEX	NCT04327401	High: 20 mg/d intravenously	69/128	76/128	0.80 (0.49-1.31)	18.69
RECOVERY	NCT04381936	Low: 6 mg/d orally or intravenously	95/324	283/683	0.59 (0.44-0.78)	57.00
Subgroup fixed effect			166/459	361/823	0.64 (0.50-0.82)	76.60
Hydrocortisone						
CAPE COVID	NCT02517489	Low: 200 mg/d intravenously	11/75	20/73	0.46 (0.20-1.04)	6.80
COVID STEROID	NCT04348305	Low: 200 mg/d intravenously	6/15	2/14	4.00 (0.65-24.66)	1.39
REMAP-CAP	NCT02735707	Low: 50 mg every 6 h intravenously	26/105	29/92	0.71 (0.38-1.33)	11.75
Subgroup fixed effect			43/195	51/179	0.69 (0.43-1.12)	19.94
Methylprednisolone						
Steroids-SARI	NCT04244591	High: 40 mg every 12 h intravenously	13/24	13/23	0.91 (0.29-2.87)	3.46
Overall (fixed effect) P = .31 for heterogeneity; I^2 = 15.6%			222/678	425/1025	0.66 (0.53-0.82)	100.0
Overall (random effects[a])			222/678	425/1025	0.70 (0.48-1.01)	

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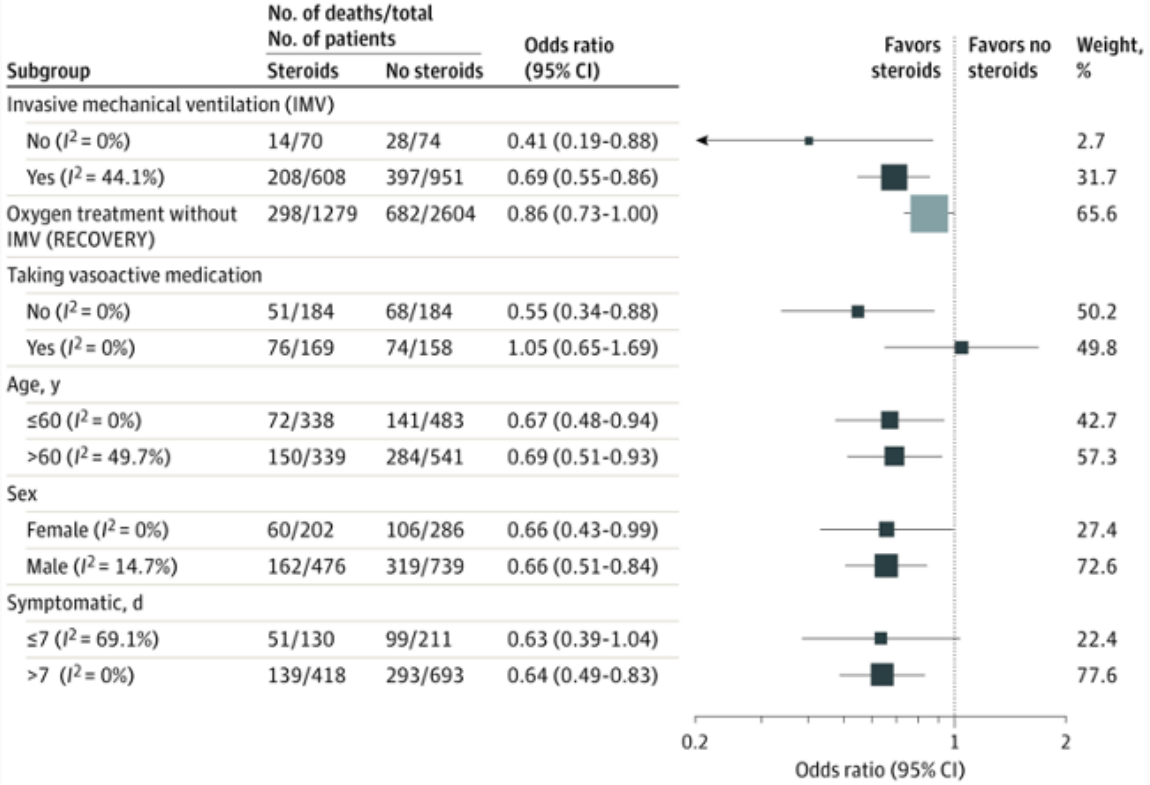
JAMA Network™

From: **Association Between Administration of Systemic Corticosteroids and Mortality Among Critically Ill Patients With COVID-19: A Meta-analysis**

JAMA. 2020;324(13):1330-1341. doi:10.1001/jama.2020.17023

Immunomodulatory agents

Corticosteroids



Subgroup	No. of deaths/total No. of patients: Steroids	No. of deaths/total No. of patients: No steroids	Odds ratio (95% CI)	Weight, %
Invasive mechanical ventilation (IMV)				
No (I^2 = 0%)	14/70	28/74	0.41 (0.19-0.88)	2.7
Yes (I^2 = 44.1%)	208/608	397/951	0.69 (0.55-0.86)	31.7
Oxygen treatment without IMV (RECOVERY)	298/1279	682/2604	0.86 (0.73-1.00)	65.6
Taking vasoactive medication				
No (I^2 = 0%)	51/184	68/184	0.55 (0.34-0.88)	50.2
Yes (I^2 = 0%)	76/169	74/158	1.05 (0.65-1.69)	49.8
Age, y				
≤60 (I^2 = 0%)	72/338	141/483	0.67 (0.48-0.94)	42.7
>60 (I^2 = 49.7%)	150/339	284/541	0.69 (0.51-0.93)	57.3
Sex				
Female (I^2 = 0%)	60/202	106/286	0.66 (0.43-0.99)	27.4
Male (I^2 = 14.7%)	162/476	319/739	0.66 (0.51-0.84)	72.6
Symptomatic, d				
≤7 (I^2 = 69.1%)	51/130	99/211	0.63 (0.39-1.04)	22.4
>7 (I^2 = 0%)	139/418	293/693	0.64 (0.49-0.83)	77.6

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Immunomodulatory agents

IL-6 inhibitors

NIH COVID-19 Treatment Guidelines
Last Updated: August 27, 2020

Interleukin (IL)-6 is a pleiotropic, pro-inflammatory cytokine produced by a variety of cell types, including lymphocytes, monocytes, and fibroblasts. Infection by the severe acute respiratory syndrome-associated coronavirus (SARS-CoV) induces a dose-dependent production of IL-6 from bronchial epithelial cells.[1] COVID-19-associated systemic inflammation and hypoxic respiratory failure can be associated with heightened cytokine release, as indicated by elevated blood levels of IL-6, C-reactive protein (CRP), D-dimer, and ferritin.[2-4]It is hypothesized that modulating the levels of IL-6 or its effects may alter the course of disease.

There are two classes of Food and Drug Administration (FDA)-approved IL-6 inhibitors: anti-IL-6 receptor monoclonal antibodies (e.g., sarilumab, tocilizumab) and anti-IL-6 monoclonal antibodies (siltuximab). These classes of drugs have been evaluated for the management of patients with COVID-19 who have systemic inflammation. The COVID-19 Treatment Guidelines Panel's (the Panel's) recommendations and clinical data to date are described below.

Recommendation

The Panel **recommends against** the use of anti-IL-6 receptor monoclonal antibodies (e.g., **sarilumab, tocilizumab**) or anti-IL-6 monoclonal antibody (**siltuximab**) for the treatment of COVID-19, except in a clinical trial **(BI)**.

Immunomodulatory agents

IL-6 inhibitors

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Immunomodulatory agents

Emerging agents

- Baricitinib (JAK1/2 inhibitor) – ACTT-2

Repurposed medicines

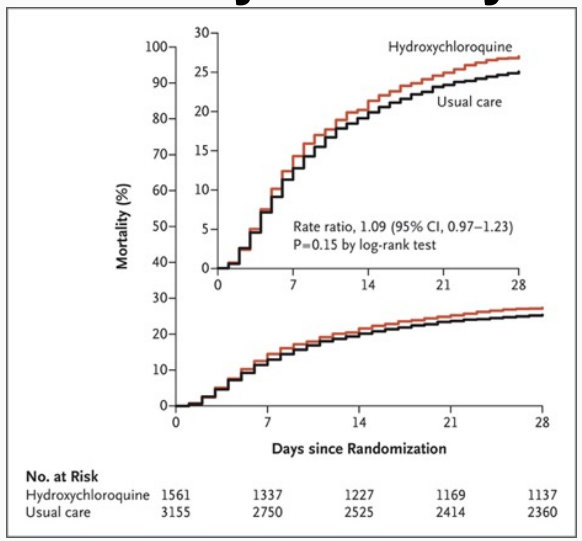
- Hydroxychloroquine
- Chloroquine
- Azithromycin
- Zinc
- Vitamin D
- Ivermectin
- Lopinavir/ritonavir

Repurposed medicines

Hydroxychloroquine

Mortality at 28 Days

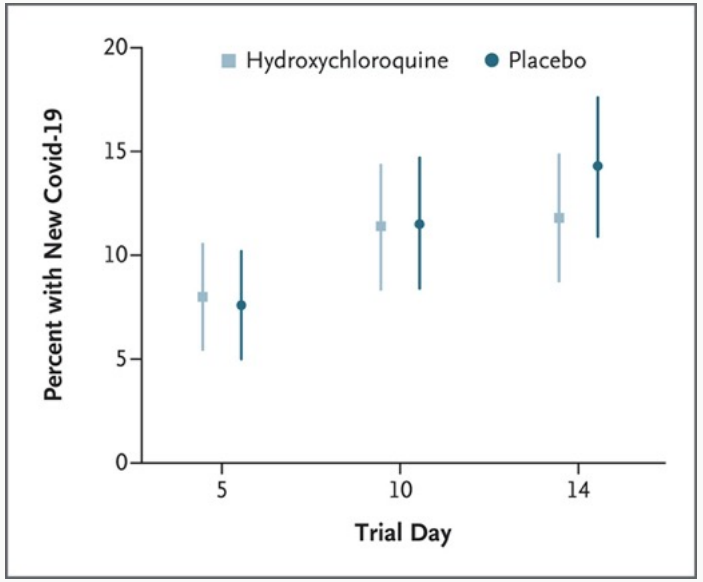
Treatment



The RECOVERY Collaborative Group. N Engl J Med 2020. DOI: 10.1056/NEJMoa2022926

Cumulative Incidence of Illness

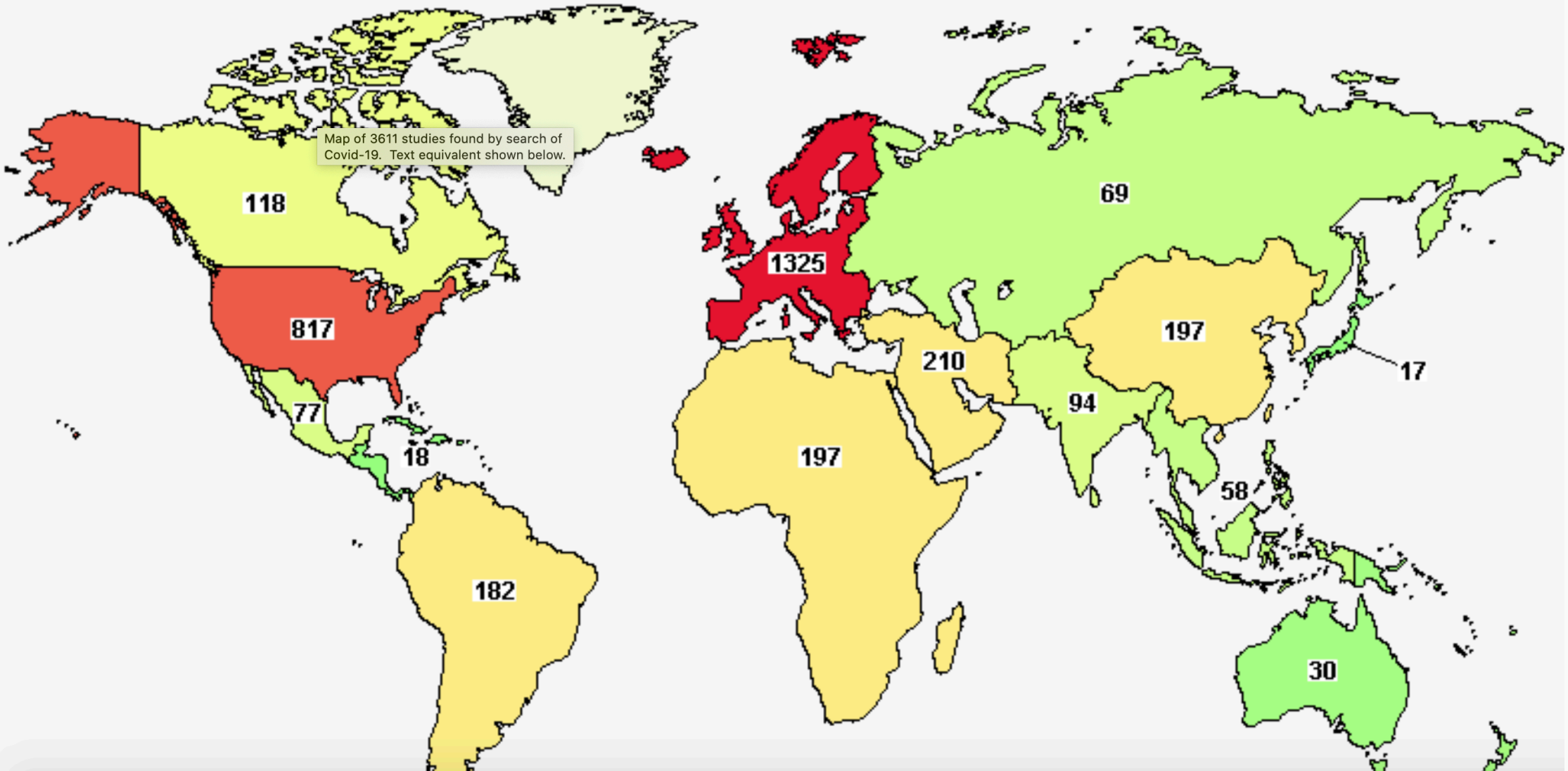
Prophylaxis



DR Boulware et al. N Engl J Med 2020;383:517-525.

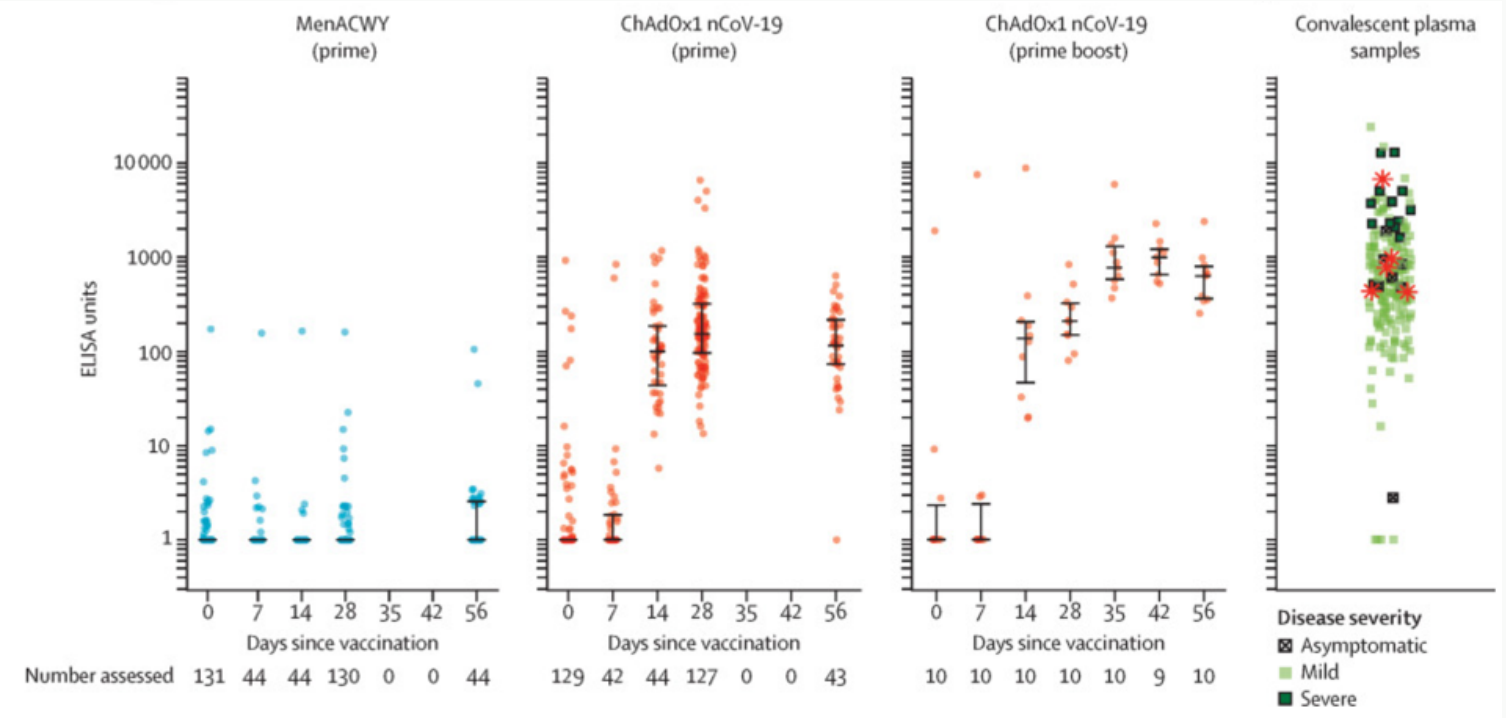
Therapeutic trials for SARS-CoV-2 Infection

Click on the map below to show a more detailed map (when available) or search for studies (when map not available).



VACCINES

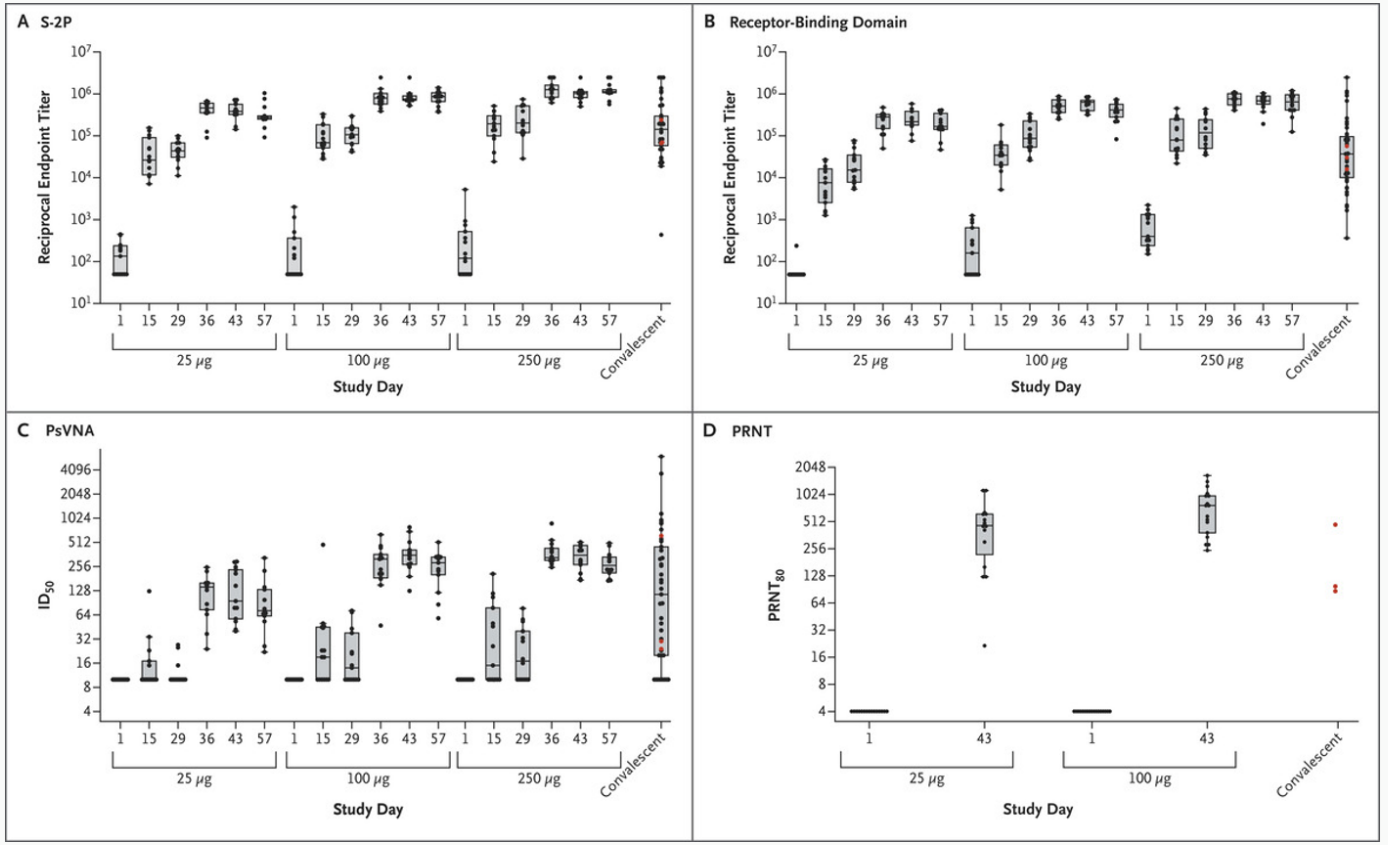
VACCINES



Folegatti, Lancet, 2020

VACCINES

SARS-CoV-2 Antibody and Neutralization Responses



LA Jackson et al. N Engl J Med 2020. DOI: 10.1056/NEJMoa2022483

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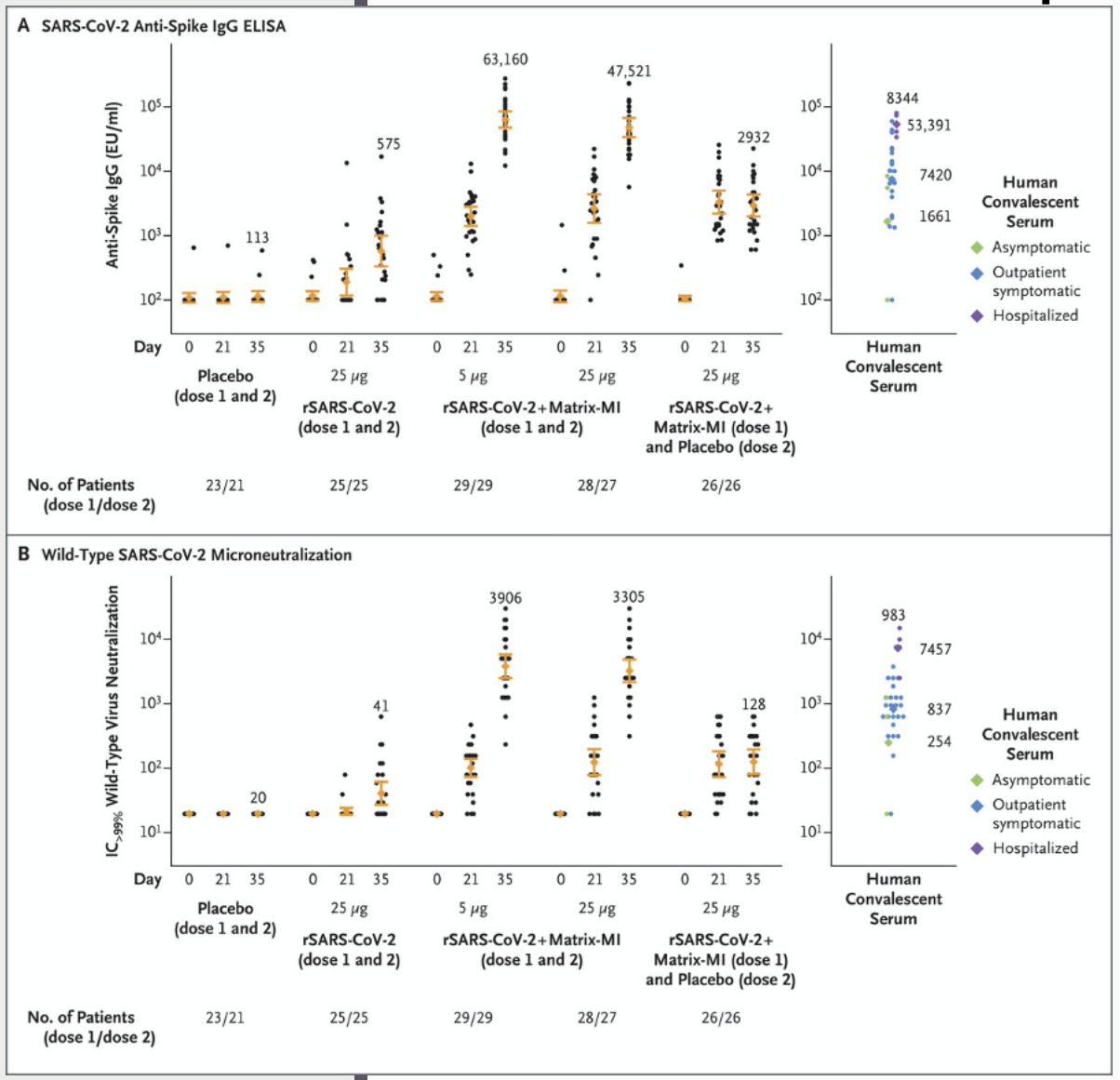
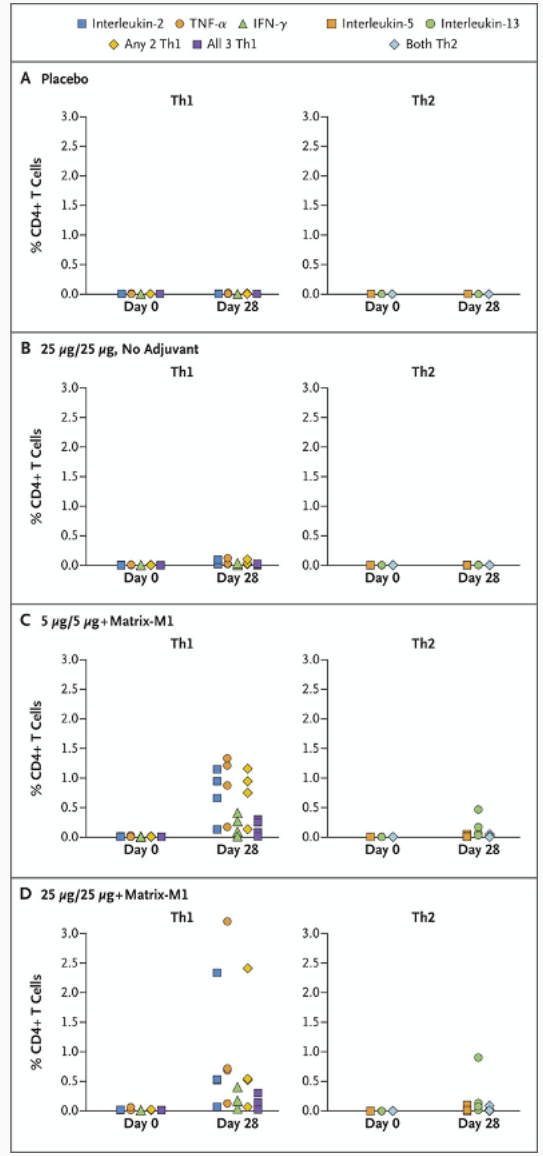
SARS-CoV-2 Anti-Spike IgG and Neutralizing Antibody Responses

VACCINES





C Keech et al. N Engl J Med 2020. DOI: 10.1056/NEJMoa2026920

THE NEW ENGLAND JOURNAL of MEDICINE

Is SARS-CoV-2 exposure protective?

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Clin Infect Dis, ciaa1275, https://doi.org/10.1093/cid/ciaa1275

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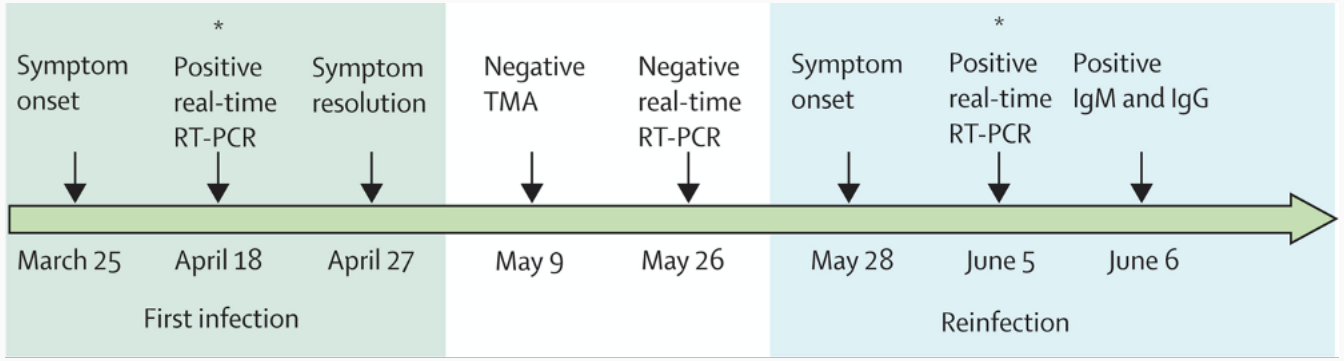

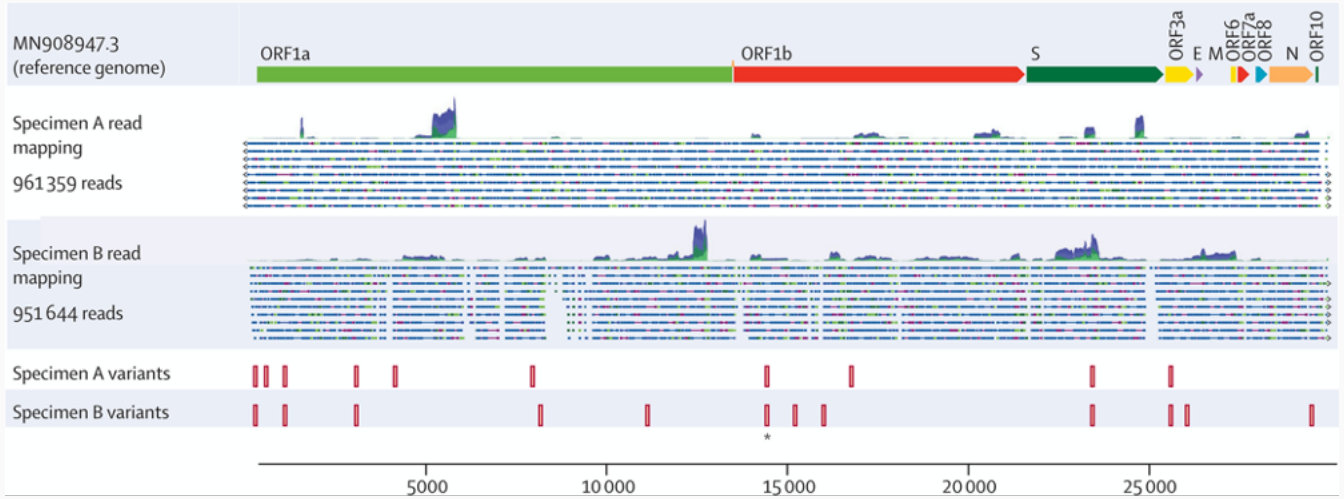

The Lancet Infectious Diseases DOI: (10.1016/S1473-3099(20)30764-7)

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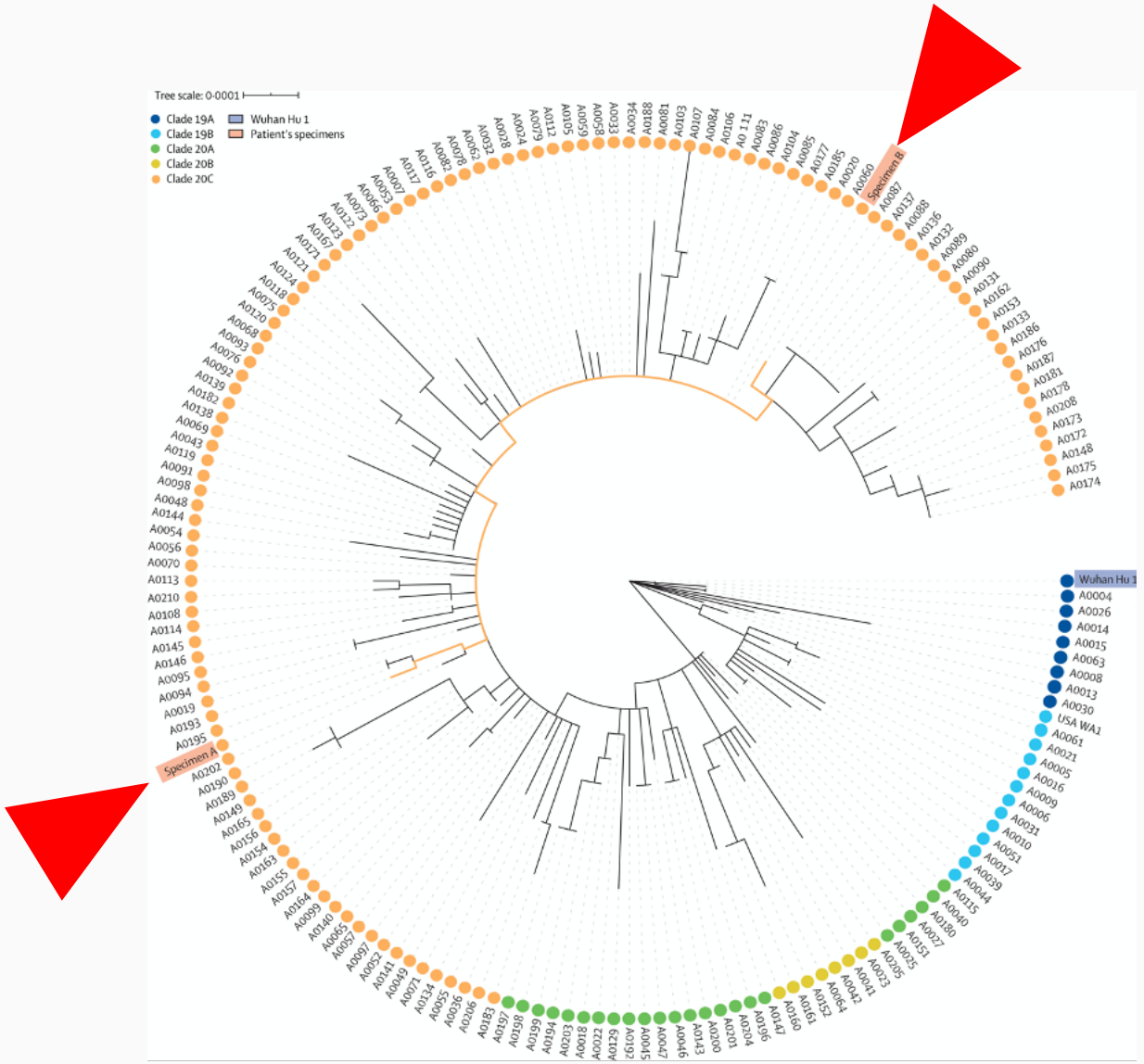

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CLOSING

- **Transmission trends**
  - *no signs that transmission is slowing down on its own*
  - *no evidence of an 'herd immunity' effect*
  - *how important is airborne transmission?*
- **Diagnostics**
  - *RNA testing is the gold standard*
  - *Antibody testing has variable accuracy*
  - *Antigen testing requires improvements*
  - *Testing needs to keep pace with the pandemic*
  - *Home testing?*
- **Therapeutics**
  - *Some progress with antivirals and immunomodulatory agents*
  - *No magic bullet (yet)*
  - *Repurposed drugs have been disappointing*
  - *Adaptive platforms and trials infrastructure has been encouraging*
- **Vaccines**
  - *Several show promising antibody and T cell responses*
  - *Concerns about the speed of development (safety?)*
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CLOSING

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