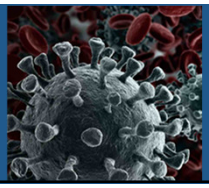
COVID-19 Update: What is Our Current Status?

Paul J Carson, MD, FACP

NDSU
CENTER FOR IMMUNIZATION RESEARCH AND EDUCATION



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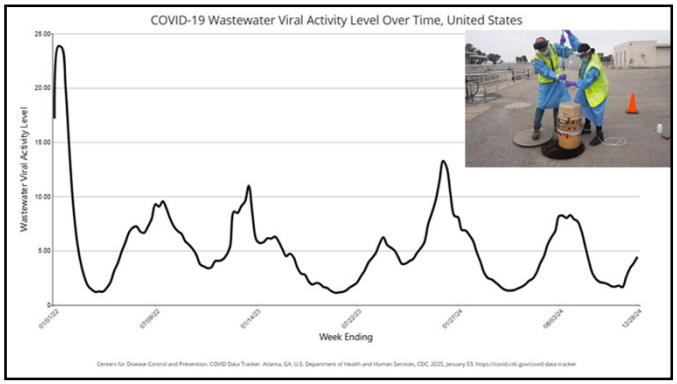

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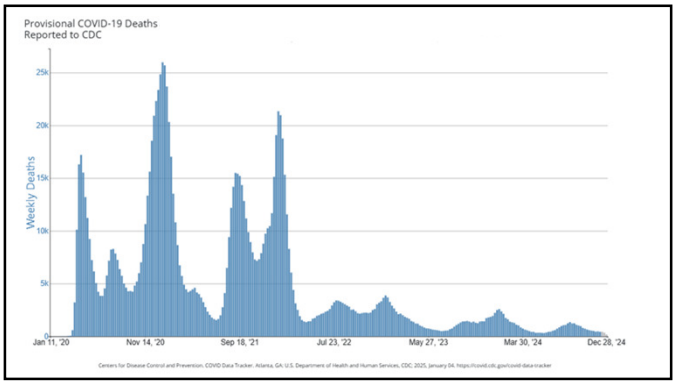

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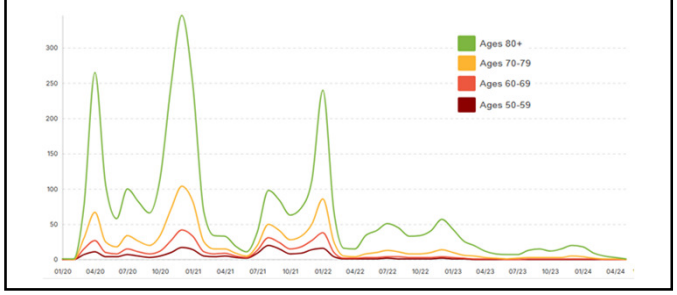
COVID-19 Deaths per 100k in Older Adult Age Groups



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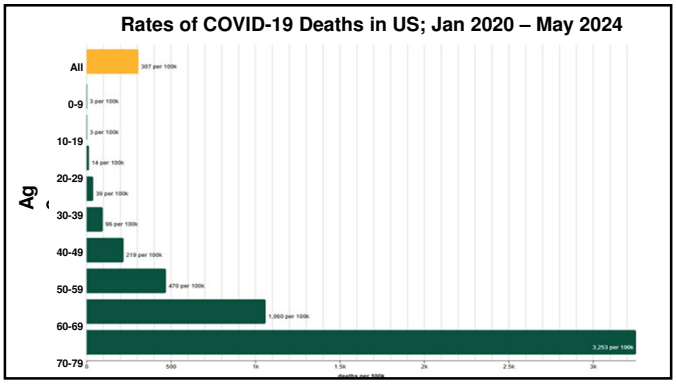

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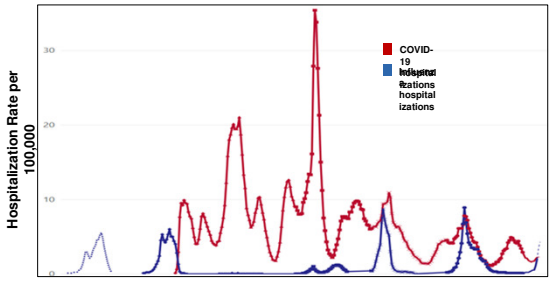
Hospitalization Rates for Influenza and COVID-19



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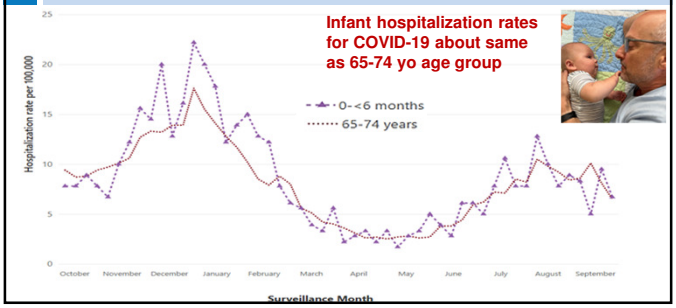
Weekly Rates of COVID-19 Hospitalization by Age Group: 2023-2024



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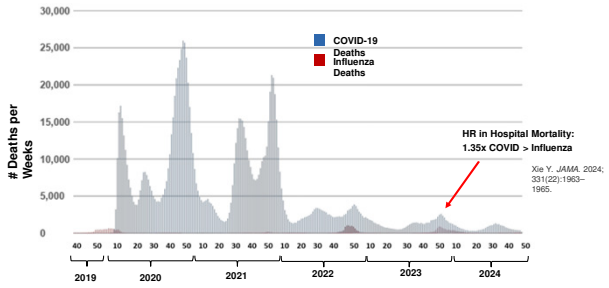
COVID-19 Continues to Kill Significantly More People than Influenza



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CDC recommends the 2024-25 COVID-19 vaccine for everyone 6 months and older

An updated vaccine protects against:

- COVID-19 variants spreading now
- Severe illness, hospitalization, and death

CDC

bit.ly/mm7337e2

SEPTEMBER 10, 2024

MMWR

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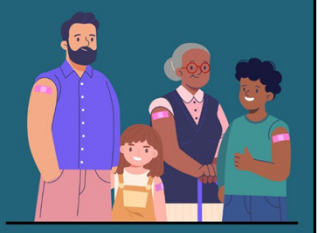
CDC recommends the 2024-25 COVID-19 vaccine for everyone 6 months and older

2 Doses of 2024-2025 Vaccine Recommended:

- Adults aged > 65
- 6 mos or older with moderate or severe immunosuppression



CDC

bit.ly/mm7337e2

SEPTEMBER 10, 2024

MMWR

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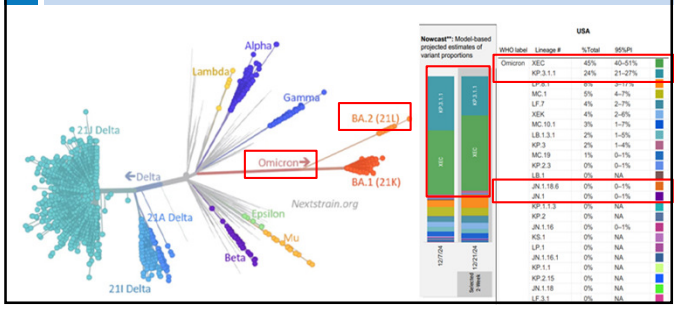
SARS CoV-2 Variant Evolution



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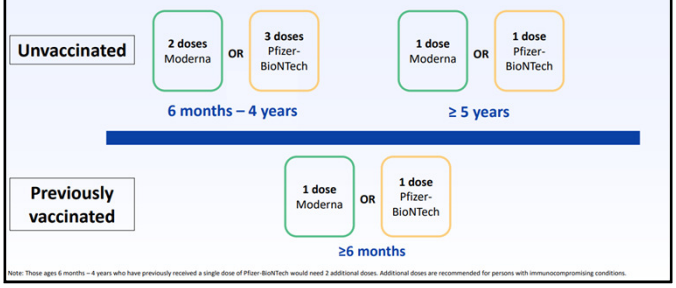
2024-2025 COVID-19 vaccine recommendations for mRNA COVID-19 vaccines



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Current Status of Vaccine Necessity and Efficacy

- Nearly all the population has some degree of immunity to SARS CoV-2 (> 97% seroprevalence by Fall 2022)
- Morbidity and mortality markedly reduced due to less virulent strains and baseline cross-protective immunity from prior infections +/- vaccines
- mRNA vaccine efficacy is limited due to rapid waning of immune response, changing variants, and overall less morbidity
  - 2023 Monovalent XBB.1.5 vaccine **VE = 60%** against symptomatic SARS Cov-2 infxn and **49%** against JN.1 strain in 2023-2024
  - **50%** protection against hospitalization and **67%** against critical illness for 4-6 mos in elderly and immunosuppressed

Roper LE. MMWR Morb Mortal Wkly Rep 2024;73:1118-1123
Link-Gelles R. MMWR Morb Mortal Wkly Rep 2024;73:77-83.

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Who's Getting Vaccinated? Vaccine Uptake with a Current Booster

Demographic ('23-'24)	% Vaccinated
6-23 mos	4.2%
5-17 yo	11.6%
18-49 yo	15%
50-64 yo	25%
65+ yo	39%
Nursing home residents ('24-'25)	37%
Pregnant women ('24-'25)	12.6%

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PC's Recommendations for COVID-19 Vaccines:

- To industry: Make a better vaccine!
- Until then, following should get annual variant-updated vaccine:
  - Everyone 65+ y.o. (especially 75+ yo) - ? 2 doses
  - LTCF residents
  - Anyone with moderate to severe immunosuppression – 2 doses
  - Newborn infants after 6 mos if no prior SARS CoV-2 infxn
  - Any adult frequently around newborn infant
  - ≥ 6 mos with chronic illness (DM, heart dz, asthma, chronic lung dz, obesity, etc.)
  - Pregnant women
  - Healthy children > 2-4 and adults > 65 yo ? – shared decision making

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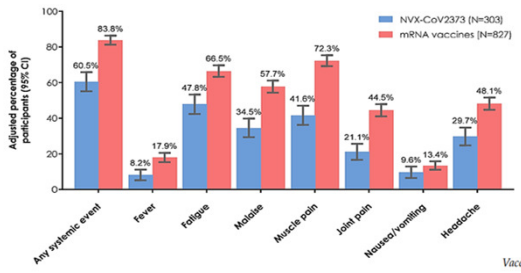
Don't Forget the Novavax Option



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Treatment of COVID-19

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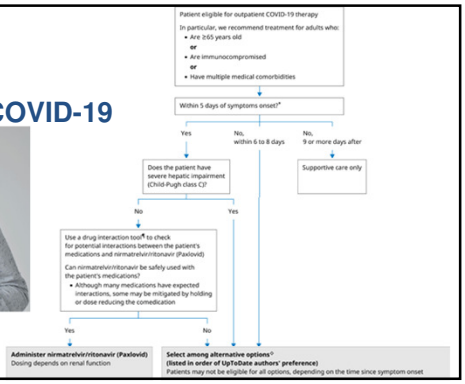
Algorithm for Outpatient Treatment of COVID-19



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Outpatient Management

- **Paxlovid:** 300mg/100mg bid x 5 days, symptoms ≤ 5 days
  - Outpatient only – no hypoxia
  - Use drug interaction checker: https://www.covid19-druginteractions.org/checker
  - Need renal adjustment for GFR <60
  - Efficacy only in high risk – 89% reduction in hosp'n or death in primary trials (high risk, mainly Delta variant, unvaccinated) N ENGL J MED 386;15 NEJM.ORG APRIL 14, 2022
- **Remdesivir**: 200 mg IV day 1, then 100 mg IV days 2&3, symptoms ≤ 7 days
  - Reduced risk of hosp'n by 87% in high risk unvaccinated during Delta wave
  - Good alternative if can't take Paxlovid and access/availability of OP IV Rx

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Paxlovid of No Benefit in Low-Risk Patients; Uncertain in High-Risk/Vaccinated

- Follow up study by Pfizer in lower risk patients during Delta
  - Vaccinated with ≥ 1 high-risk factor
  - Standard risk but unvaccinated or no vaccine in prior year
- Results:
  - No difference in symptom duration (~ 12 days), the primary endpoint
  - Trend towards less hospitalization and medical attendance in the high-risk group, but not statistically significant

N Engl J Med 2024;390:1186-1195 | DOI: 10.1056/NEJMoa2309003 | VOL. 390 NO. 13

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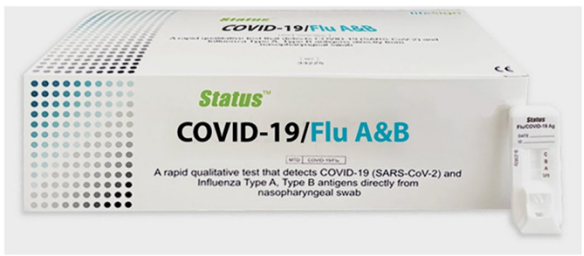
Consider Testing for Both Viruses if it Might Change Your Management



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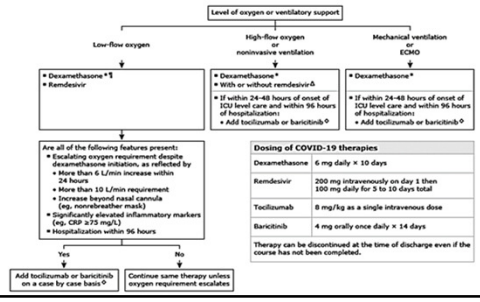
COVID-19 Management in the Hospitalized Patient



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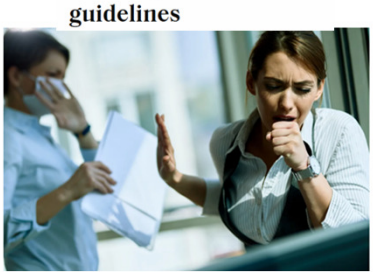
Got COVID? Here are the new 2024 isolation guidelines



Manage like other resp illnesses, resume normal activities when:

- Symptoms are overall getting better
- No fever > 24 h

As of March 2024, CDC no longer recommends 5 day isolation for COVID-19

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WHAT IS POST COVID SYNDROME?

-No universal definition

-World Health Organization – 10/6/2021
- A history of probable or confirmed SARS COV-2 infection
- Sx ≥ 3 months from onset of infection
- Sx ≥ 2 months
- Can't be explained by an alternative diagnosis

-CDC Definition
- Call it "Post-COVID Conditions"
- ≥ 4 weeks from acute infection start (symptoms or test)
- **ICD-10 - U09.9, and considered a disability covered under ADA**

1. Organization WH. A clinical case definition of post COVID-19 condition by a Delphi consensus. Accessed 10/6, 2021. https://www.who.int/publications/i/item/WHO-2019-nCoV-Post_COVID-19_condition-Clinical_case_definition-2021.1
2. @CDCgov. Post-COVID Conditions: Information for Healthcare Providers. @CDCgov. Updated 2021-09-10T04:38:34Z. https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-care/post-covid-conditions.html

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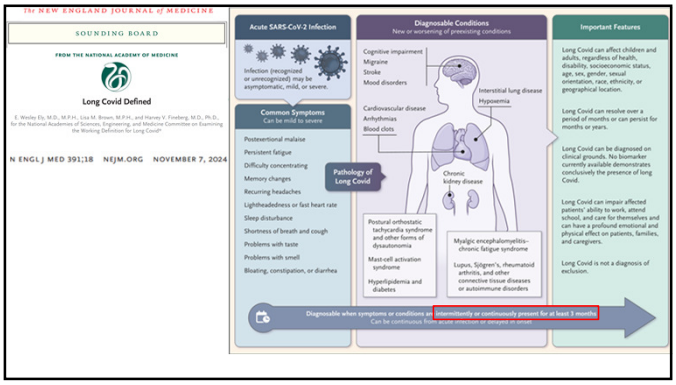

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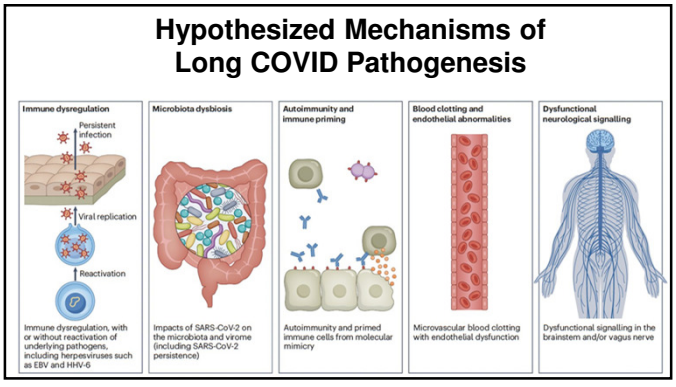

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What is the Prevalence of Long-COVID?

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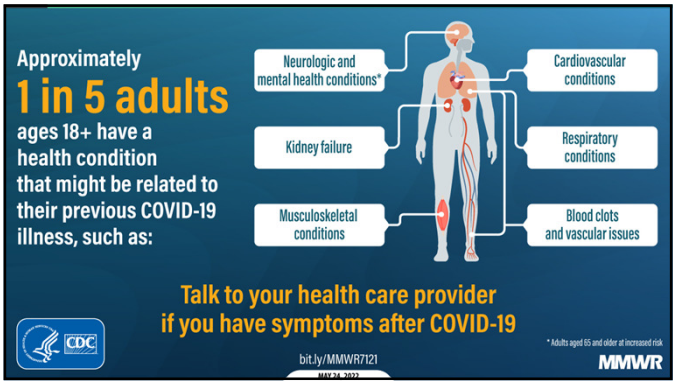

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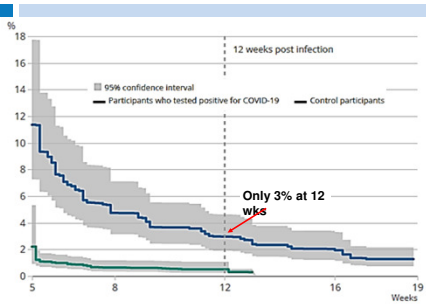
UK ONS Surveillance Data – Low Estimate



- People followed with serial testing (includes asymptomatic infections)
- Only asked about 12 symptoms, notably not cognitive impairment or mental health issues

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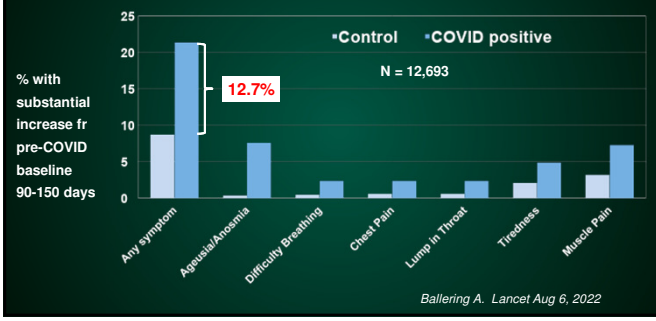
Netherlands "Lifeline" Cohort Study



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Risk Factors for Long-COVID

- Middle age and higher body mass index
- Females ≥ 20 years
- Pre-existing conditions (eg, depression, anxiety, allergies, obstructive lung disease, untreated obstructive sleep apnea, type 2 diabetes, connective tissue disorders)
- Infection pre-Omicron (2022)

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Articles

www.thelancet.com Vol 398 August 28, 2021

1-year outcomes in hospital survivors with COVID-19: a longitudinal cohort study

N = 1,276

Symptom or Problem	6 mos	12 mos
Any symptom	68%	49%
Fatigue or weakness	52%	40%
Sleep problems	27%	17%
Smell disorder	11%	12%
Anxiety or depression	23%	26%
Persistent abnormality on CT of the chest	100%	39%
Abnormal gas exchange in lungs	21%	23%
Ongoing shortness of breath	26%	30%

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U.K Biobank Study

Douaud G. Nature, Mar 2022

- Ongoing study of brain structure over time with serial functional / quantitative MRI scans of the brain
- Average time between scans, 141 days
- Compared 401 COVID patients (over 96% were outpatients) with 384 matched controls

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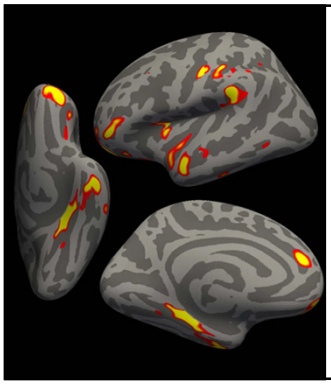

- Normal gray matter loss is ~ 0.2 – 0.3% / yr
- COVID patients lost additional 0.2 – 2.0% more than controls
- Lost overall more brain volume
- Showed evidence of tissue damage
- Main affected areas: orbitofrontal cortex, parahippocampal gyrus, olfactory cortex, temporal pyriform cortex

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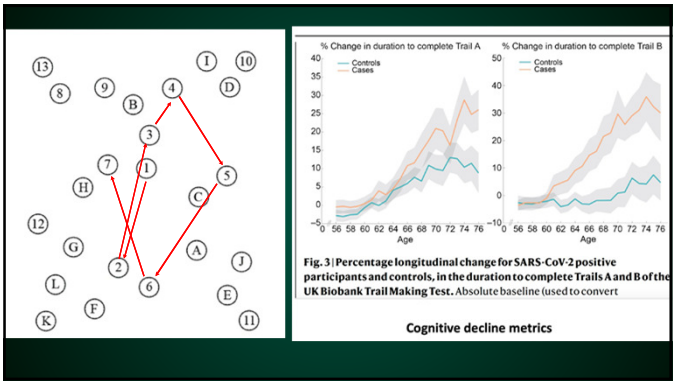

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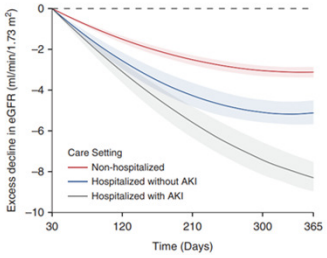
VA Cohort Study on COVID-19 and Kidney Injury



89,216 Veterans with COVID-19 c/w 1.7 million matched non-infected controls from 3/20 – 3/21

- 35% increased risk of long-lasting kidney damage in COVID survivors
- 5% of patients had a ≥ 30% decrease in kidney function

Bowe B. JASN 32: 2851-62, 2021

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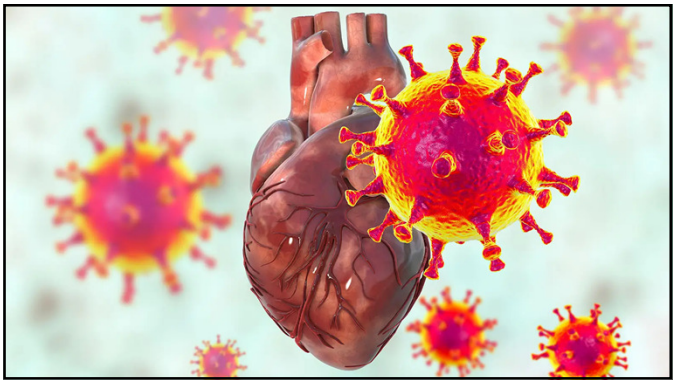

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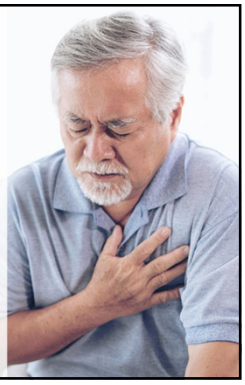
People with COVID exhibited increased risk AND 12-month burdens of cardiovascular disease. Including:

- ***Cerebrovascular disorders***
- ***Dysrhythmias***
- ***Inflammatory heart disease***
- ***Ischemic heart disease***
- ***Heart failure***
- ***Thromboembolic disease***
- ***Other cardiac disorders***



Xie et al, *Nature Medicine*, 2022.

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Study	Characteristics	CV outcomes at follow-up	Citation
Veterans Administration	90% males, mean age 61	1.7-fold risk of heart attack; 1.6-fold risk of stroke	Xie et al, Nature Medicine 2022
TriNetX Network	Unvaccinated, mean age 44	2-fold risk of heart attack; 1.6-fold risk of stroke	Wang et al, E Clinical Medicine, 2022
US Insurance Claims Database	Unvaccinated, mean age 50	2-fold risk of stroke, PE, DVT, all-cause death	Devries et al, JAMA Health Forum, 2023
US pandemic through March 2022	US population across 5 Covid waves	4.9% more cardiovascular deaths than expected (2 years)	Han, Nature Cardiovascular Research, 2023
Korea National Database	>62,000 unvaccinated >168,000 vaccinated Mean age ~50	>2-fold risk of heart attack and stroke for unvaccinated vs vaccinated	Kim Y-E, JAMA, 2022
NCATS (US Consortium, NIH)	Mean age 45 >1.9 million patients	2-fold risk of heart attack and stroke for unvaccinated vs vaccinated	Jiang, JACC, 2023

Korea and NCATS studies compare vaccinated vs unvaccinated @erictopol

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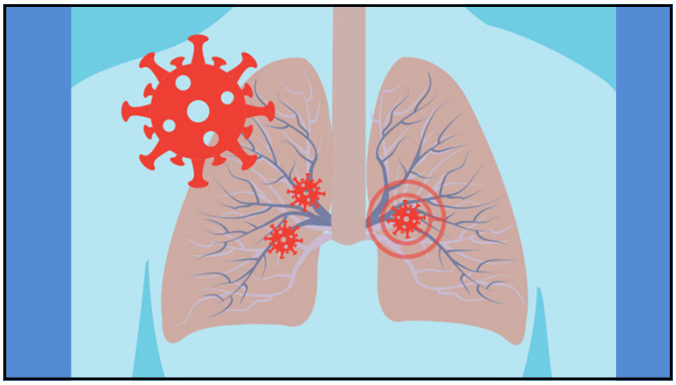

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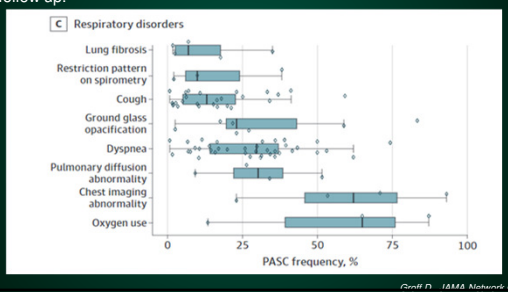
Systematic Review of "Long-COVID"

- 57 eligible studies out of 2100; 250,351 patients – majority were inpatient, at least 60 days of follow up.



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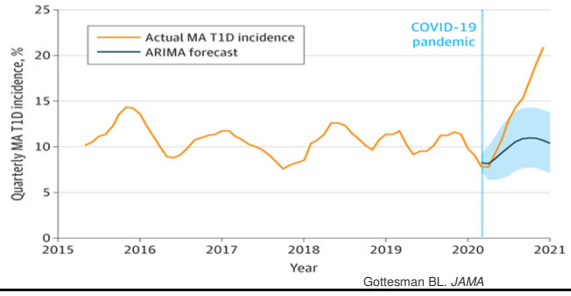
Increased Risk of T1DM in US Children During Pandemic



Gottesman BL. *JAMA*

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Now 12 Studies Showing Increased Risk of Diabetes Post-Acute COVID19

Study Cohort	N People w/ Covid	Increased Risk vs Controls	Age Mean	Male %	Citation
British Columbia	125,987	17%	32	49%	Naveed, JAMA Network Open 18 April 2023
Veteran Affairs	181,280	40%	61	88%	Xie, Lancet Diabetes Endo 2022:311-21
US, United Health	266,586	39%	42	52%	Daugherty, BMJ 2021:373:n1098
US TriNetX, 63 health systems	600,055	54%^	NA	NA	Birabaharan, Diabetes Obes Metab 2022: 1176-9
Germany	35,865	28%			949-954
US HealthVerity*	80,893	31%			
Veteran Affairs	126,710	95%—men 4% —women (NS)	59	86%	Wander, Diabetes Care 2022:872-788
UK (hospitalized)	47,780	50%	64	55%	Ayoubkhani, BMJ 2021: 372:n693
US, Medicare	133,366	97%	76	44%	Cohen, BMJ 2022: 376:e068414
UK (hospitalized)	77,347	65%	77	47%	Tazare, Wellcome Open Research 2022 7:142
US, Cedars-Sinai	23,709	58%	47	56%	Kwan, JAMA Network Open 14 February 2023
UK	428,650	27%	35	44%	Rezel-Potts, PLOS Medicine 2022 19: e1004052

Average ~ 59% Increase Risk

*Type 1 and 2 diabetes not partitioned in this age < 18 population; NA-not available; NS-not significant

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JAMA Network Open

Research Letter | Infectious Diseases

Association of COVID-19 Vaccination With Risk for Incident Diabetes After COVID-19 Infection

Alan C. Kwan, MD, MSc; Joseph E. Ebinger, MD; Patrick Botting, MSPH; Jesse Navarrette, MPA; Brian Claggett, PhD; Susan Cheng, MD, MPH, MMSc

- Cohort study of 23,709 adult patients in Cedars-Sinai Health System
- Risk of diabetes in 90 day interval after COVID-19 infection vs 90 days before infection

- Results:
  - 78% increased risk of diabetes following COVID-19 infection in unvaccinated after adjusting for multiple risk factors
  - No increased risk in vaccinated cohort

JAMA Network Open. 2023;6(2):e2255965. doi:10.1001/jamanetworkopen.2022.55965 February 14, 2023

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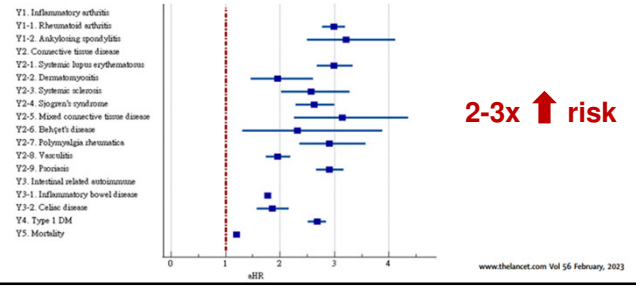
Risk of Autoimmune Dz in COVID vs Controls



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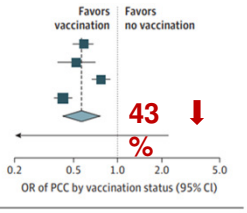
Meta-Analysis of Studies Showing Lowered Risk of Long-COVID per Vaccination Status

Figure 4. Association of Vaccination Status With Post–COVID-19 Condition (PCC), 2021 to 2022

Source	OR (95% CI)
Ayoubkhani et al[18]	0.59 (0.50-0.69)
Emecen et al[26]	0.53 (0.40-0.71)
Ioannou et al[34]	0.78 (0.68-0.90)
Zisis et al[12]	0.43 (0.37-0.49)
Total (random effects)	0.57 (0.43-0.76)
Prediction interval	(0.15-2.22)
Heterogeneity: $\chi^2_3 = 35.00$ ($P<.001$); $I^2 = 91\%$	



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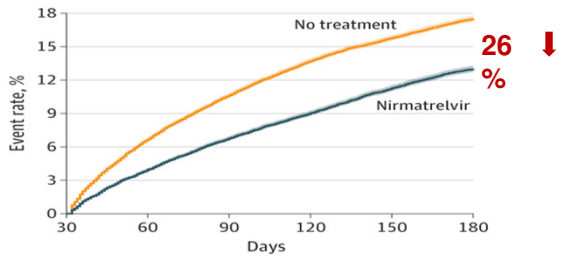
Nirmatrelvir (Paxlovid) with Acute Infection Reduces Risk of Long-COVID



Xie et al. JAMA Int Med, Mar

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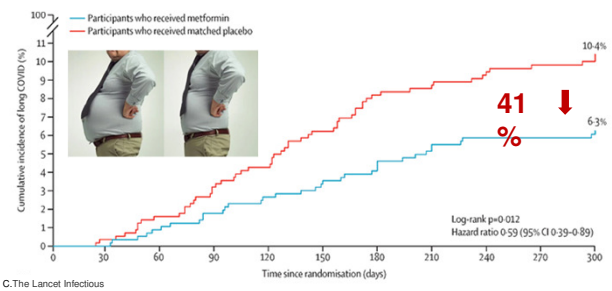
Incidence of Long-COVID cut nearly in half in obese/overweight patients when Metformin given with acute Infection



Bramante C.The Lancet Infectious Diseases, Volume 23, Issue 10, 1119 - 1129

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COVID-19 Summary:

- Transmission is still widely prevalent without typical resp virus seasonality
- Widespread population immunity and trend towards less virulent strains has markedly reduced the morbidity and mortality
- SARS CoV-2 still causes more morbidity, mortality and chronic sequelae than influenza, particularly at the extremes of age
- Continued vaccine updates target evolving strains
- Vaccine uptake and treatment is poor, even among high-risk groups
- Serious illness and Long-COVID may be prevented by vaccination and early treatment of

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Clinical management of COVID-19

LIVING GUIDELINE

13 JANUARY 2023

World Health Organization

https://www.who.int/publications/i/item/WHO-2019-nCoV-therapeutics-2023.2

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LONG COVID PHYSIO

Our website is for everybody living with Long COVID and anyone wanting to learn more

https://longcovid.physio/

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EXTRA SLIDES for Ref and Q&A

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Biological Sciences - Article

SARS-CoV-2 infection and persistence throughout the human body and brain

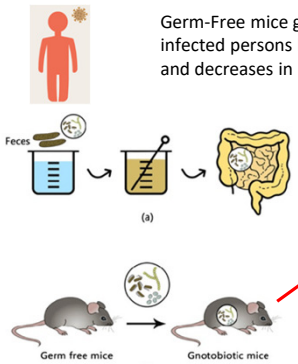
nature portfolio

Daniel Chertow, Sydney Stein, Sabrina Ramelli, Alison Grazioli, and 29 more

- NIH study of 44 autopsies after COVID-19
- Asx to severe dz; acute infxn - 7 mos
- Findings:
  - SARS CoV2 RNA widely distributed throughout body, including brain
  - RNA persists up to 230 days fr onset
  - Paucity of inflammation or cytopathology outside of lungs
  - Viral replication outside lung suggested as late as day 99 from onset

59

Germ-Free mice given fecal microbiota from past COVID infected persons led to inflammatory changes in the brain and decreases in memory and cognitive performance



Viviani M. 22 June 2022, PREPRINT (Version 1) available at Research Square [https://doi.org/10.21203/rs.3.rs-

60

National Center for Health Statistics Household Pulse Survey

Ever experienced long COVID, as a percentage of all adults

Phase	Phase 3.8			
Time Period	Mar 29 - Apr 10, 2023			
Group	Percent	95% CI		
National Estimate				
United States	15.5	14.9 - 16.1		
By Age				
18 - 29 years	17.8	16.0 - 19.7		
30 - 39 years	18.3	16.9 - 19.7		
40 - 49 years	17.4	16.0 - 18.8		
50 - 59 years	16.6	15.7 - 17.6		
60 - 69 years	12.5	11.6 - 13.4		
70 - 79 years	9.3	8.1 - 10.5		
80 years and above	8.8	6.1 - 12.1		
By Sex				
Female	19.0	18.2 - 19.9		
Male	11.9	11.1 - 12.7		
			By Race/Hispanic ethnicity	
			Hispanic or Latino	18.6
			Non-Hispanic Asian, single race	10.1
			Non-Hispanic Black, single race	12.6
			Non-Hispanic White, single race	15.4
			Non-Hispanic, other races and multiple races	20.1
			By Disability status	
			With disability	24.7
			Without disability	13.8

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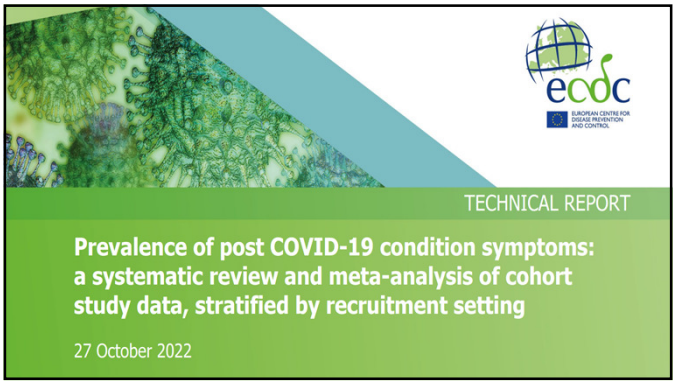

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Table 1. Estimated prevalence of post COVID-19 condition symptoms reported among patients recruited in both the community and hospital setting

Post COVID-19 condition symptom	Community setting prevalence	Hospital setting prevalence
Fatigue	**30.8%** 95% CI: 21.0–41.6	**46.1%** 95% CI: 37.5–54.9
Shortness of breath	**20.9%** 95% CI: 12.1–31.3	**45.4%** 95% CI: 31.9–59.2
Depression	**17.3%** 95% CI: 9.0–27.5	**23.3%** 95% CI: 15.0–32.8
Headache	**14.4%** 95% CI: 7.9–22.4	**16.5%** 95% CI: 9.2–25.3
Dizziness	**10.2%** 95% CI: 4.7–17.4	**18.3%** 95% CI: 6.1–35.0

Considering only prevalence estimates supported by evidence scored as moderate or high certainty (See Figures 2 and 3).

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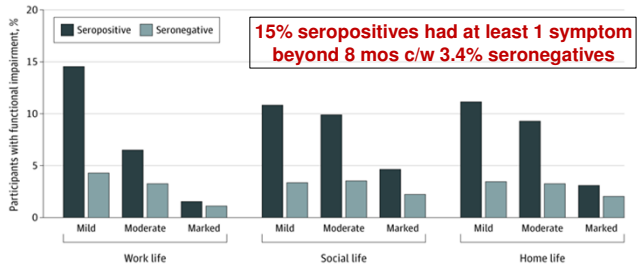
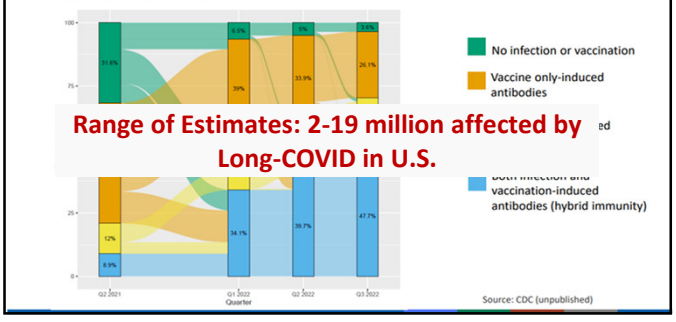
Functional Impairment in Healthy Swedish HCWs at Least 2 mos Out from Mild COVID-19



Havervall S et al. JAMA Network Open, Apr 2021

64

Shifts in vaccine-induced, infection-induced, and hybrid immunity against SARS-CoV-2 among people aged ≥16 years — United States, Quarter 2 2021– Quarter 3 2022

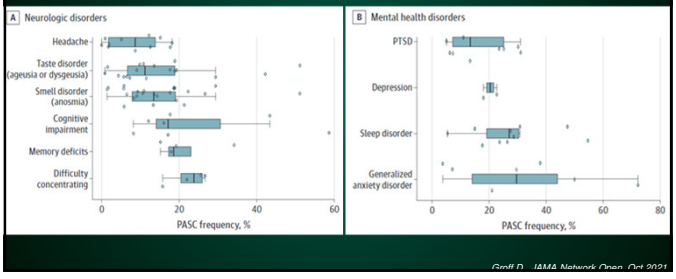


Range of Estimates: 2-19 million affected by Long-COVID in U.S.

65

Systematic Review of "Long-COVID"

- 57 eligible studies out of 2100; 250,351 patients – majority were inpatient, at least 60 days of follow up.

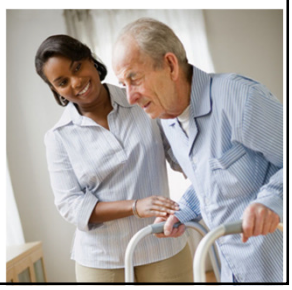


Groff D. JAMA Network Open, Oct 2021

66

Disability Persisting after Discharge to Home

- Retrospective study of 1300 hospitalized patients d/c to home
  - Only 40% independent in all ADLs at 30 days[1]
- Another study, almost 40% unable to return to normal activity at 60 days[2]



1. Bowles KH. *Ann Intern Med*, Nov 2021
2. Chopra V. *Ann Intern Med*, Nov 2021

67

Mayo CARP Pop'n

"COVID Activity Rehab Program"

- Fatigue 80%
- Respiratory 59%
- Neurologic 59%
- Cognitive impairment 45%
- Sleep disturbance 30%
- Mental health sx 26%

Vanichkachorn G, Vanichkachorn.greg@mayo.edu, Newcomb R, et al. Post COVID-19 Syndrome (Long Haul Syndrome): Description of a Multidisciplinary Clinic at the Mayo Clinic and Characteristics of the Initial Patient Cohort. *Mayo Clinic Proceedings*. 2021;(00)doi:10.1016/j.mayocp.2021.04.02

68

CARP POPULATION UNIQUE SX

- Tinnitus
- Prolonged loss of taste and smell
- Hair shedding (telogen effluvium)
- Syncope
- Sinus discomfort
- Eye changes

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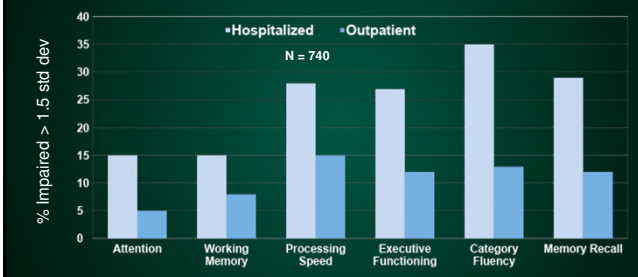
Neuropsychiatric Testing After COVID-19 Recovery



Becker JH. *JAMA Open Network*, Oct 2021

70

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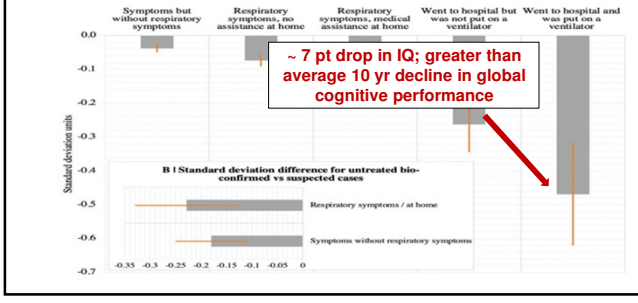
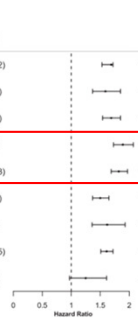
The Great British Intelligence Test



72

Comparison of 360-day risk for new diagnosis Alzheimer's disease (matched COVID-19 vs non-COVID-19 cohorts)

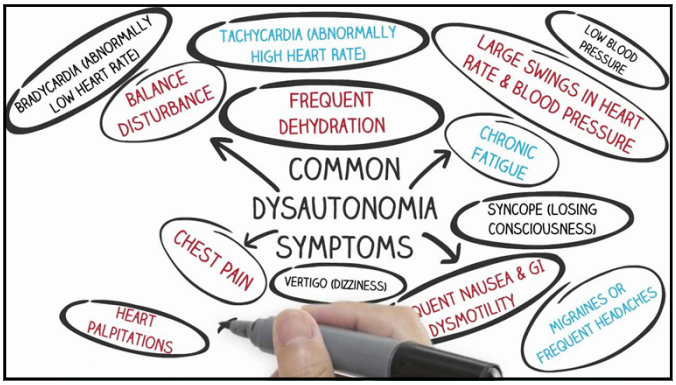
Population	Matched Cohort (COVID-19)	Matched Cohort (non-COVID-19)	HR (95% CI)
Overall (>=65)	0.68% (2,716/399,916)	0.47% (1,910/403,672)	1.69 (1.53-1.72)
65-74	0.20% (416/213,508)	0.13% (359/213,814)	1.59 (1.37-1.85)
75-84	0.87% (1,111/127,298)	0.59% (752/128,534)	1.69 (1.54-1.85)
>=85	2.01% (1,189/59,110)	1.33% (812/61,032)	1.89 (1.73-2.07)
Women	0.80% (1,696/213,138)	0.48% (1,042/215,383)	1.82 (1.69-1.97)
Men	0.55% (1,020/186,698)	0.42% (785/188,026)	1.50 (1.37-1.65)
Black	0.77% (306/39,925)	0.53% (212/40,206)	1.62 (1.36-1.93)
White	0.70% (2,094/301,366)	0.49% (1,475/303,865)	1.61 (1.51-1.72)
Hispanic	0.47% (128/27,229)	0.41% (112/27,265)	1.25 (0.97-1.61)



COVID ass'd with increased risk of Alzheimer's dz, especially in very elderly, and women

Wang L. *J of Alzheimer's Dis*, 2022

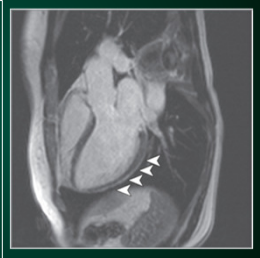
73



74

Persistent Cardiac Inflammation After COVID-19 Recovery

- German study of 100 patients 64-92 days after dx with cardiac MRI and hsTroponin
- 2/3 recovered at home with 18 asymptomatic, and 49 mild to moderate
- **78% had cardiac involvement, 60% had ongoing inflammation**
- Independent of pre-existing conditions or severity of illness



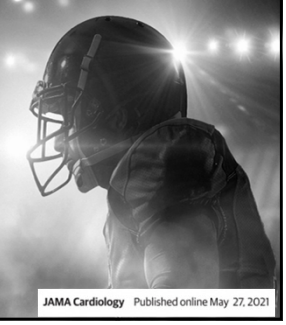
- Abnormalities persisted beyond 3 mos

75

Myocarditis in Big 10 Athletes After Recent SARS CoV2

Cardiac MRI scans on 1597 athletes after recovering from recent SARS CoV-2 infection

2.3% of athletes diagnosed with COVID-19 myocarditis



JAMA Cardiology Published online May 27, 2021

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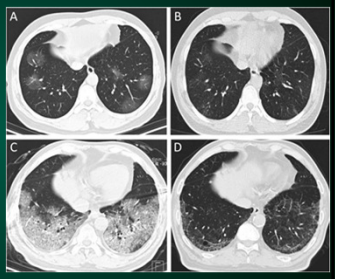
Persistent Lung Abnormalities

- 55 Chinese pts followed in prospective cohort study[1]
  - 4 mild, 51 pneumonia (4 severe)
- At 3 mos
  - 64% had persistent symptoms
  - 71% had interstitial thickening or fibrosis on chest CT
  - 25% had decreased CO diffusion capacity
- Similar study of 57 pts 30d after discharge – 53% with decreased CO diffusion capacity[2]



1. Zhao Y. EClinMed Aug 2020
2. Huang Y. Resp Research, 21; Jun 2020

77

Does Asymptomatic Mean Harmless?

- 76 asymptomatic cases – CT scan of chest
- 41 (54%) had ground glass infiltrates

Inui S et al. Radiology, Mar 2020

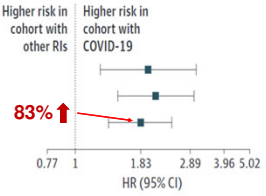
78

Increased Risk of T1DM in Children under 18

A Patients aged 0-18 y at diagnosis of infection

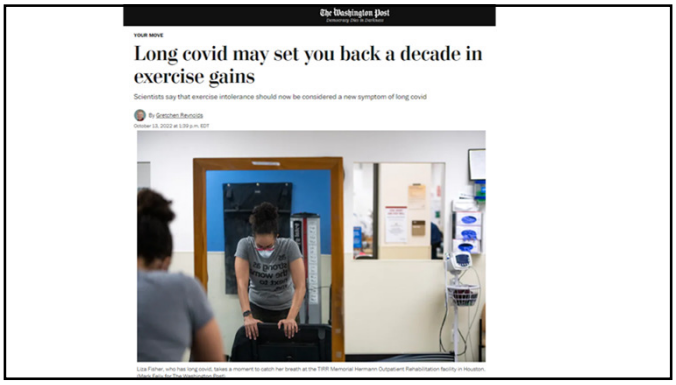
Time since infection, mo	Patients with type 1 diabetes, No. (%) Cohort with COVID-19	Cohort with other RIs	HR (95% CI)
1	56 (0.02)	30 (0.01)	1.96 (1.26-3.06)
3	91 (0.03)	46 (0.02)	2.10 (1.48-3.00)
6	123 (0.04)	72 (0.03)	1.83 (1.36-2.44)

1:2500



Kendall E. JAMA Sept 2022

79



80

Could mild COVID-19 Affect Athletic Performance?

Study in elite soccer players

Fischer, DICE Discussion Paper, No. 368, ISBN 978-3-86304-367-4

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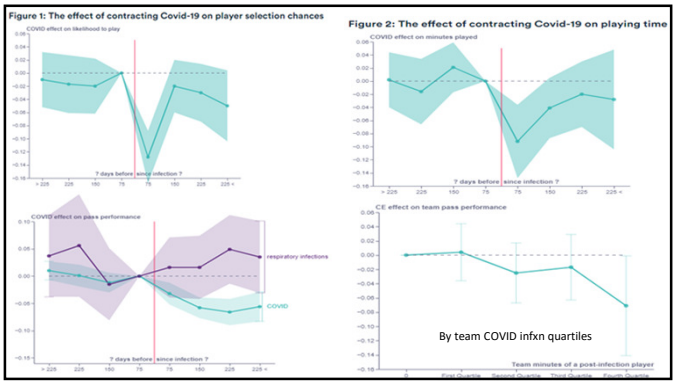
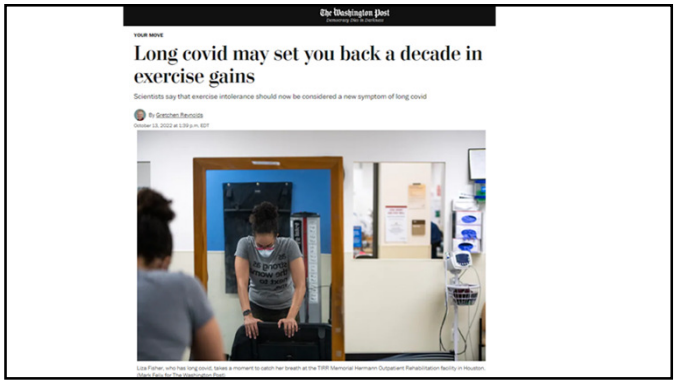


82



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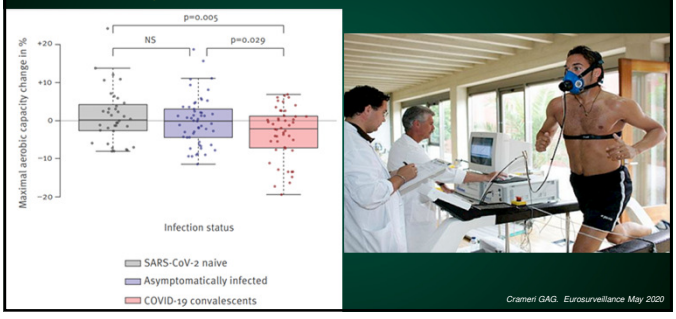
Cardiorespiratory Fitness Declined in Swiss Military Recruits 1-2 mos After COVID-19

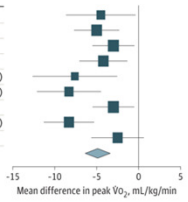


Crameri GAG. Eurosurveillance May 2020

84

Studies Showing Lowered VO2 Max in Patients with Long-COVID

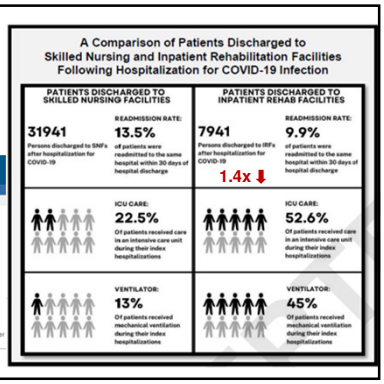
Source	No. of participants/mean (SD) LC symptoms	No LC symptoms	Mean difference (95% CI)	Weight, %
Schaeffer et al,[58] 2022	34/19.9 (7.1)	15/24.4 (6.7)	-4.5 (-8.6 to -0.4)	8.22
Aparisi et al,[47] 2021	41/17.8 (4)	29/22.8 (6.6)	-5.0 (-7.7 to -2.3)	13.04
Barbagelata et al,[38] 2022	112/25.8 (8.1)	88/28.8 (9.6)	-3.0 (-5.5 to -0.5)	13.85
Brown et al,[44] 2022	20/14.9 (2.3)	20/19.1 (6.1)	-4.2 (-7.1 to -1.3)	12.38
Durstenfeld et al,[26] 2022	23/21.2 (8.2)	16/28.8 (7.7)	-7.6 (-12.6 to -2.6)	6.28
Ladlow et al,[31,69] 2022	61/32.4 (6.7)	26/40.7 (8.9)	-8.3 (-12.1 to -4.5)	9.12
Margalit et al,[37] 2022	66/27.7 (7.5)	75/30.7 (7.5)	-3.0 (-5.5 to -0.5)	13.96
Skjørten et al,[33] 2021	59/23.6 (7.9)	67/31.9 (9.3)	-8.3 (-11.3 to -5.3)	11.81
Szekely et al,[29] 2021	48/18.8 (6.3)	23/21.3 (6.3)	-2.5 (-5.6 to 0.6)	11.34
Heterogeneity: $\tau^2 = 2.51$; $I^2 = 50.28\%$			-4.9 (-6.4 to -3.4)	



JAMA Network Open. 2022;5(10):e2236057. doi:10.1001/jamanetworkopen.2022.36057 October 12, 2022

85

Does it matter where your inpatients with COVID go after hospital discharge?



American Journal of Physical Medicine & Rehabilitation

RESEARCH ARTICLE

A Comparison of Patients Discharged to Skilled Nursing and Inpatient Rehabilitation Facilities Following Hospitalization for COVID-19: A Retrospective Study

Author Information

American Journal of Physical Medicine & Rehabilitation (10.1097/PHM.0000000000002162, December 6, 2022. | DOI: 10.1097/PHM.0000000000002162

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Elements of Rehab Program

- Thorough medical evaluation
  - Cardiac, Pulmonary, Psych, Neuro, Dysautonomia
- Autonomic reconditioning
  - Breathing exercises: increase vagal tone
  - Salt intake, mineralocorticoids, beta-blockers
- Avoid post-exertional fatigue
  - Slow and graded exercise program, PT, OT
- Sleep hygiene, sleep referral

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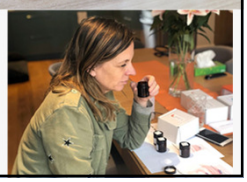
Treatment of Post-Viral Olfactory Dysfunction

- Trial of nasal steroids
- PT for the nose
  - Smell familiar essential oils or herbs for 20 sec while focusing on memories of that scent. 2x daily for 4-6 mos.
  - Commonly used: rose, lemon, clove, eucalyptus
  - Review showed improvement in a



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Clinical management of COVID-19

LIVING GUIDELINE

13 JANUARY 2023

World Health Organization

https://www.who.int/publications/i/item/WHO-2019-nCoV-clinical-2021-2

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LONG COVID PHYSIO

Our website is for everybody living with Long COVID and anyone wanting to learn more

https://longcovid.physio/

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Summary

- PASC (i.e. “Long-COVID”) appears to be common, even among outpatients and young adults
  - True incidence needs better defining with more controlled studies
  - Long-term effects on CNS/Kidney/Heart/Lung/Brain are yet to be realized
- Given the enormous attack rate from COVID-19, we should expect major impacts on clinical practice
- Patients will benefit most from multi-disciplinary approach with a graded rehabilitation program
- Antiviral treatment, immune modulation, post-acute COVID vaccination warrant

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