COVID-19 UPDATE:
PUBLIC HEALTH IMPACT OF COVID-19
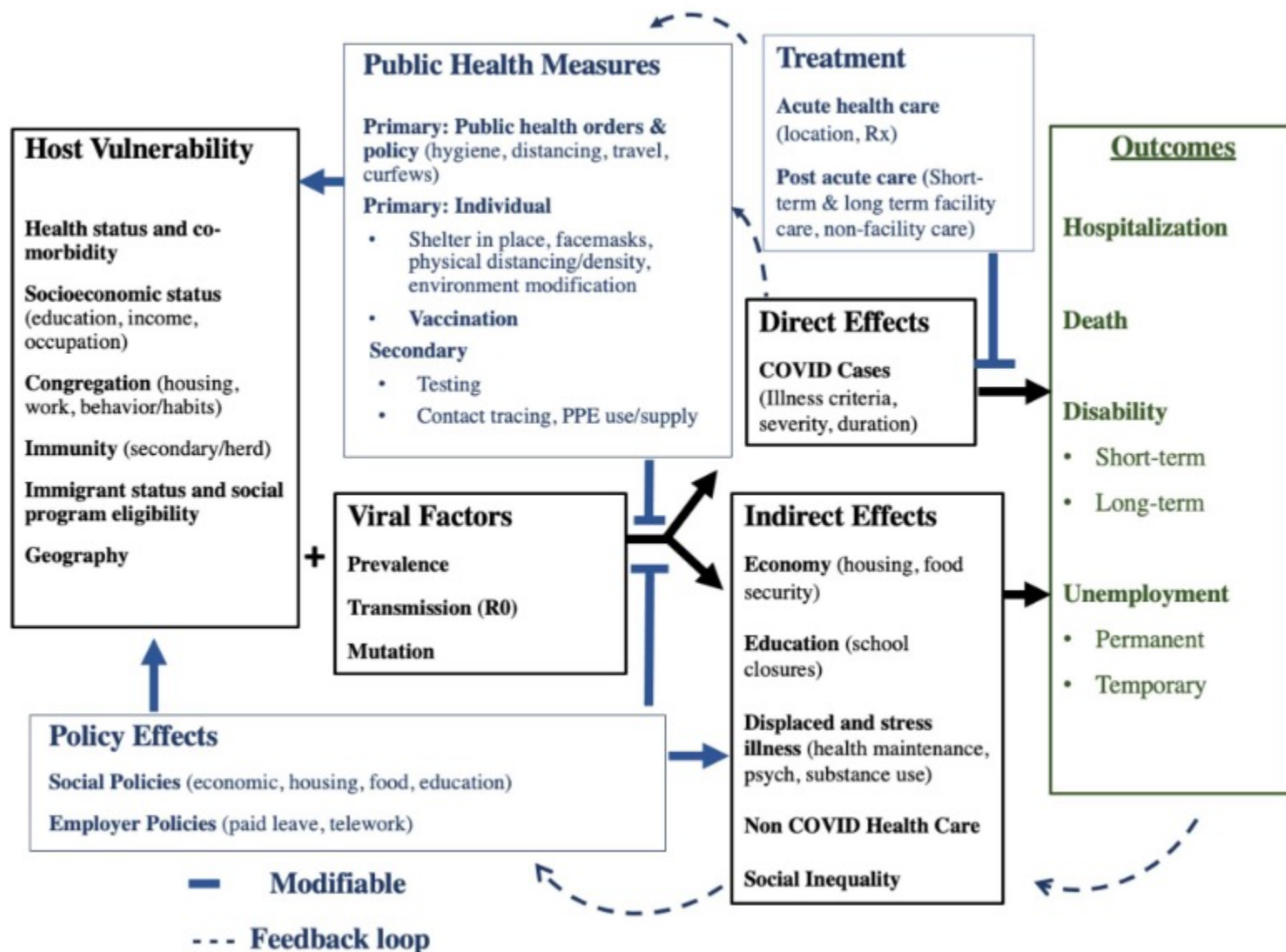
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Disclosures: Consultancy; Pfizer, Sanofi, PDI, Germitec, Uvinnovators, Merck
All drugs/vaccines issues discussed consistent with FDA approvals or authorizations

Figure 1: Conceptual Framework of Factors Affecting the Pandemic's Trajectory

Public Health Measures

Primary: Public health orders & policy (hygiene, distancing, travel, curfews)

Primary: Individual

- Shelter in place, facemasks, physical distancing/density, environment modification
- **Vaccination**

Secondary

- Testing
- Contact tracing, PPE use/supply

Treatment

Acute health care (location, Rx)

Post acute care (Short-term & long term facility care, non-facility care)

Outcomes

Hospitalization

Death

Disability
- Short-term
- Long-term

Unemployment
- Permanent
- Temporary

Host Vulnerability

Health status and co-morbidity

Socioeconomic status (education, income, occupation)

Congregation (housing, work, behavior/habits)

Immunity (secondary/herd)

Immigrant status and social program eligibility

Geography

+

Viral Factors

Prevalence

Transmission (R0)

Mutation

Direct Effects

COVID Cases (Illness criteria, severity, duration)

Indirect Effects

Economy (housing, food security)

Education (school closures)

Displaced and stress illness (health maintenance, psych, substance use)

Non COVID Health Care

Social Inequality

Policy Effects

Social Policies (economic, housing, food, education)

Employer Policies (paid leave, telework)

— **Modifiable**

- - - **Feedback loop**

Credit: COVID-19 Task Force Epidemiology Working Group, National Academy of Social Insurance

COVID-19 AROUND THE WORLD

Coronavirus around the world

Total deaths	Total confirmed cases
4.8 million	**239.6 million**

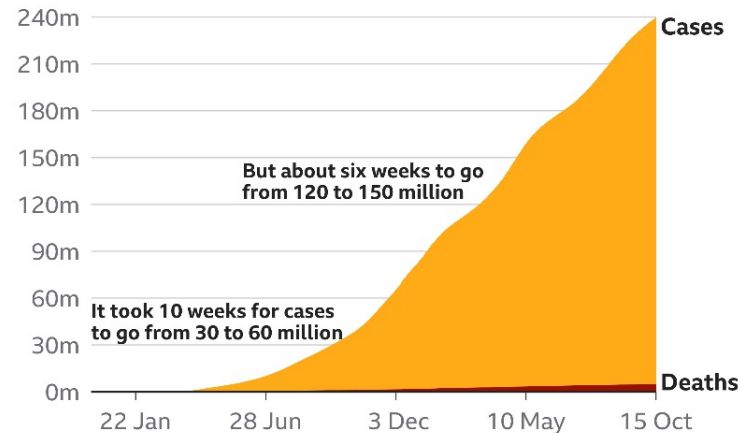| Latest daily figure	56-day trend	Latest daily figure	56-day trend
7,684 new deaths		**438,446** new cases	

Source: Johns Hopkins University, national public health agencies, 15 Oct **BBC NEWS**

More than 239m coronavirus cases worldwide

But about six weeks to go from 120 to 150 million

It took 10 weeks for cases to go from 30 to 60 million

Cases

Deaths

22 Jan   28 Jun   3 Dec   10 May   15 Oct

Source: Johns Hopkins University, data to 15 Oct **BBC**

CORONAVIRUS mapped

Zoom to   The world

Show   **239,630,162** cases   **4,882,363** deaths

44,600,000
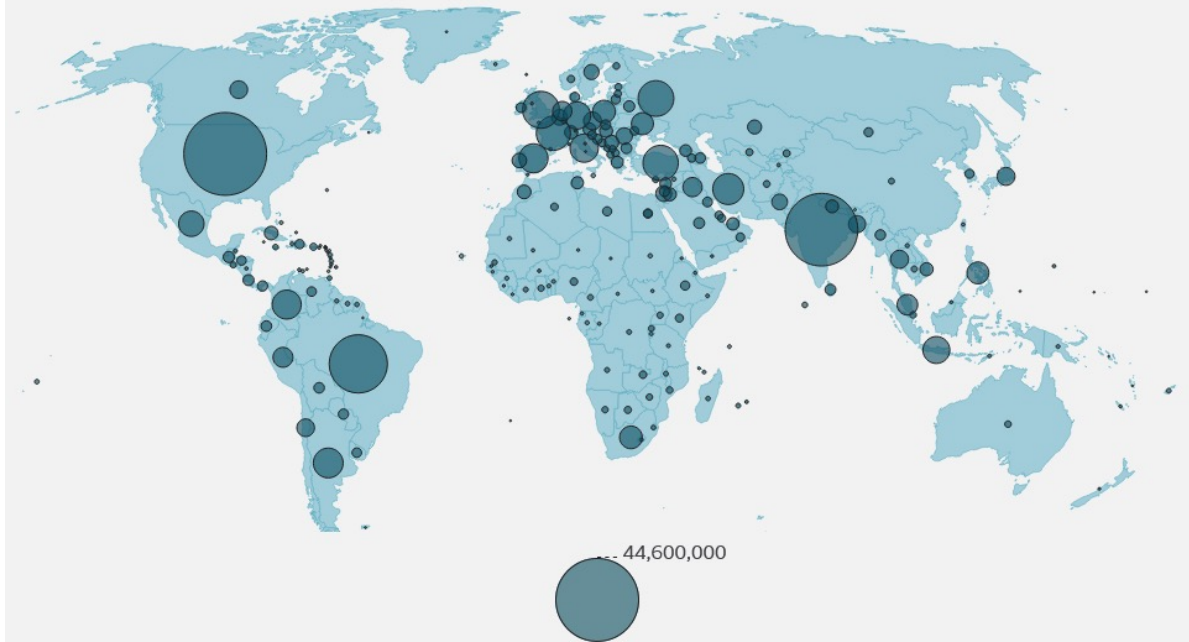
Circles show number of confirmed coronavirus cases per country.

Deaths from COVID-19 and Other Pandemics and Wars, US

Deaths from Wars and Pandemics

Category	Deaths
COVID-19, est. 1/1/22	787,834
COVID-19, 10/6/21	705,383
HIV/AIDS, till 2018	700,000
1918 "Spanish" Flu	675,000
World War ll	405,399
World War l	116,516
1968 Flu pandemic	100,000
Vietnam conflict	58220
Korean war	36574
Operation Iraqi Freedom	4418
9/11 attack	2977
Persian Gulf War	2586

Deaths from Wars and Pandemics
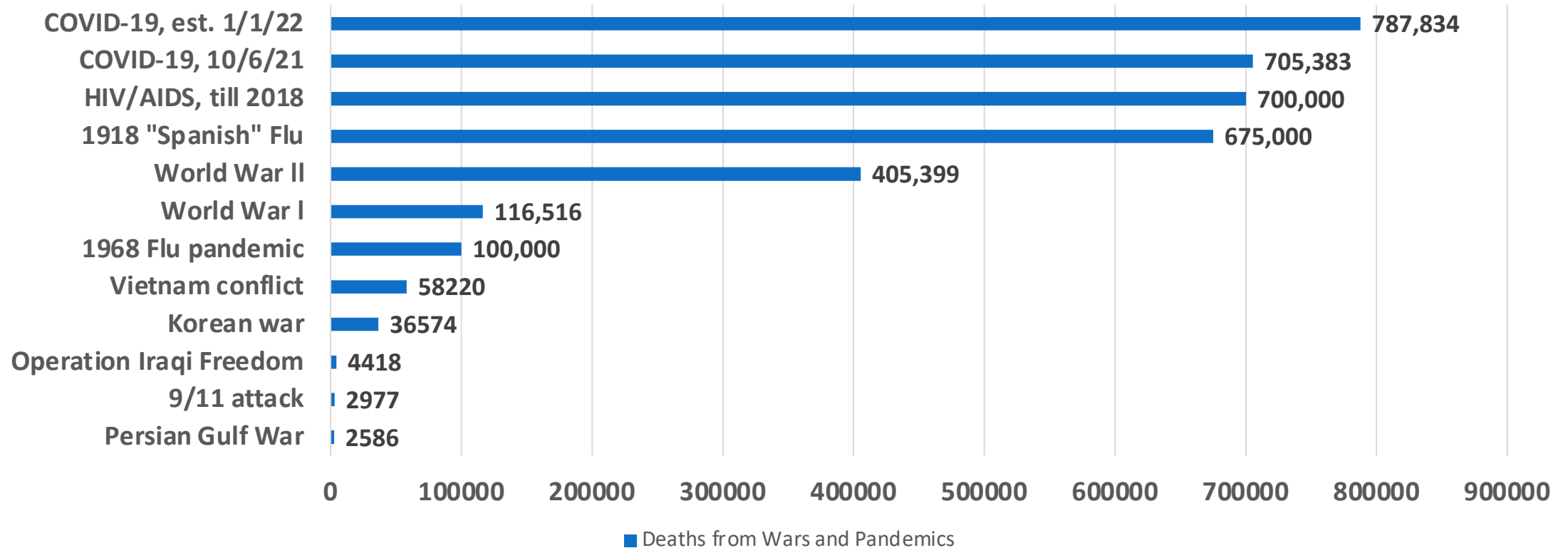
Leading Causes of Death, US, 2015-2020

Cause of death	No. of deaths by year					
	2015	2016	2017	2018	2019	2020
Total deaths	2 712 630	2 744 248	2 813 503	2 839 205	2 854 838	3 358 814
Heart disease	633 842	635 260	647 457	655 381	659 041	690 882
Cancer	595 930	598 038	599 108	599 274	599 601	598 932
COVID-19[b]						345 323
Unintentional injuries	146 571	161 374	169 936	167 127	173 040	192 176
Stroke	140 323	142 142	146 383	147 810	150 005	159 050
Chronic lower respiratory diseases	155 041	154 596	160 201	159 486	156 979	151 637
Alzheimer disease	110 561	116 103	121 404	122 019	121 499	133 382
Diabetes	79 535	80 058	83 564	84 946	87 647	101 106
Influenza and pneumonia	57 062	51 537	55 672	59 120	49 783	53 495
Kidney disease	49 959	50 046	50 633	51 386	51 565	52 260
Suicide	44 193	44 965	47 173	48 344	47 511	44 834

[a] Leading causes are classified according to underlying cause and presented according to the number of deaths among US residents. For more information, see the article by Heron.[4] Source: National Center for Health Statistics. National Vital Statistics System: mortality statistics (http://www.cdc.gov/nchs/deaths.htm). Data for 2015-2019 are final; data for 2020 are provisional.

[b] Deaths with confirmed or presumed COVID-19, coded to *International Statistical Classification of Diseases and Related Health Problems, Tenth Revision* code U07.1 as the underlying cause of death.

TOTAL DEATHS
US, ~723,000
World, ~4,890,000

COVID-19 was the 2nd leading cause of death in the U.S. in September 2021

Average daily deaths in the United States from COVID-19 (September 2021) and other leading causes (2021)

Disease	Daily Death Average
1. Heart disease	2,078
2. COVID-19	1,899
3. Cancer	1,636
4. Accidents	553
5. Stroke	444
6. Chronic lower respiratory disease	377
7. Alzheimer disease	327
8. Diabetes	280
9. Other diseases of the respiratory system	182
10. Renal failure	145
11. Suicide	126

Notes: The COVID-19 daily death average is for September 1 - September 30, 2021 and is based on KFF COVID-19 tracker data. Accidents and suicide daily death averages are for 2020. The Alzheimer disease death average is calculated from the first day of January 2021 to the last day of June 2021. Average daily deaths for all other leading causes are from the CDC and are from the beginning of 2021 to the last MMWR week of June 2021.

Source: KFF analysis of CDC mortality and KFF COVID-19 tracker data • Get the data • PNG

Peterson-KFF **Health System Tracker**

Number dying each day: Heart disease, 2,000; cancer 1,600; COVID-19 Sept, 1,899

Ahmad FB, Anderson RN. JAMA ;325:1829-30;
https://www.healthsystemtracker.org/brief/covid19-and-other-leading-causes-of-death-in-the-us/

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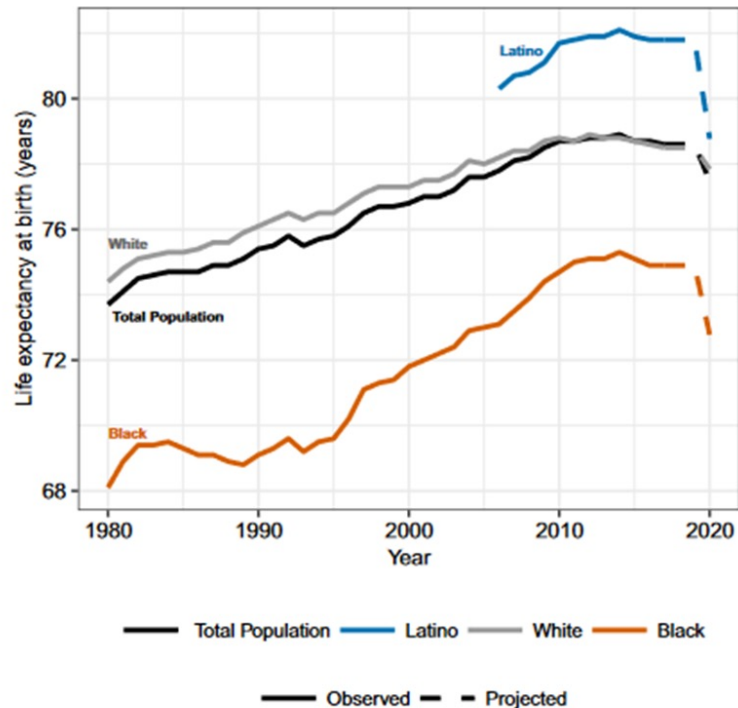# IMPACT OF COVID-19 ON LIFE EXPECTANCY, US AND UK

Fig. 2. Trends in life expectancy at birth by race and ethnicity: 1980–2020. Note that the data for the Black and White populations prior to 2006 include Latinos; data for these groups from 2006 onward are for the non-Latino Black and non-Latino White populations. The projections for 2020 are based on the IHME current projection scenario (October 9, 2020 update).
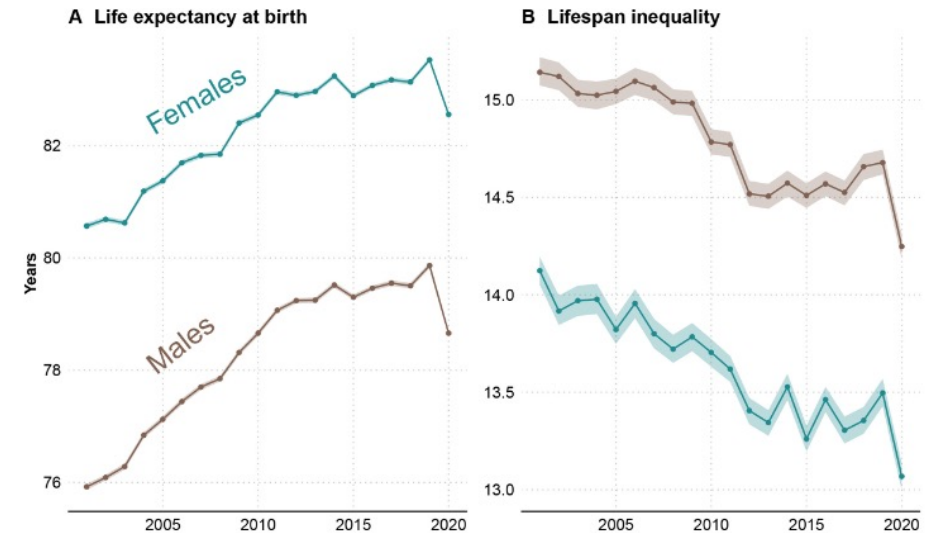
Figure 3 Life expectancy and lifespan inequality (SD of ages at death) estimates for the periods 2001–2019, and for 2020 considering the first 47 weeks of the year by sex. Shaded areas represent 95% prediction intervals.

Andrasfay T, Goldman N. PNAS 2021;118:No. 5 e2014746118; Abuto JM, et al. BMJ 2021;75:735-740

The Impact of Coronavirus on Households Across America, Robert Wood Johnson Foundation, SEPTEMBER 2020

- At least half of households in the four largest U.S. cities—New York City (53%), Los Angeles (56%), Chicago (50%), and Houston (63%)—report serious financial problems including depleted savings, and trouble paying bills or affording medical care.

- Many of these experiences are concentrated among Black and Latino households; households with annual incomes below $100,000; and households experiencing job or wage losses since the start of the outbreak.

- At least four in ten Latino, Black, and Native American households report using up all or most of their household savings during this time.

- One in five households in the United States (20%) report household members unable to get medical care for serious problems. A majority unable to get care when needed (57%) report negative health consequences as a result.

- More than 1 in 3 households that include anyone with a disability report facing serious financial problems, many experiencing difficulty affording utilities and food.

- More than one in three (36%) households with children face serious problems keeping their children's education going, and among working households, nearly one in five (18%) report serious problems getting childcare when adults need to work.

- About one in three households with children (34%) either do not have a high-speed internet connection at home or report serious problems with their connection while doing schoolwork or their jobs during the pandemic.

https://www.rwjf.org/en/library/research/2020/09/the-impact-of-coronavirus-on-households-across-america.html

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IMPACT OF COVID, WORLDWIDE AND US

https://www.brookings.edu/research/social-and-economic-impact-of-covid-19
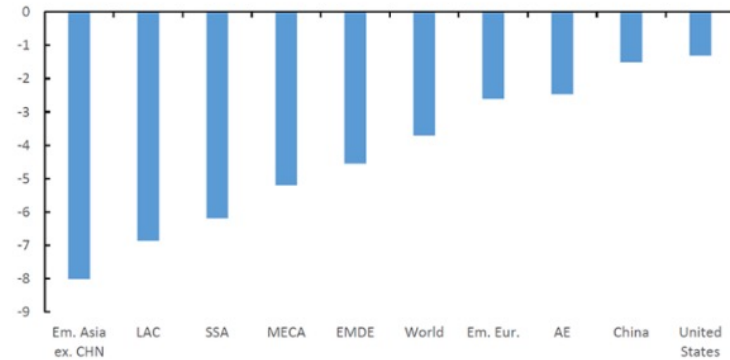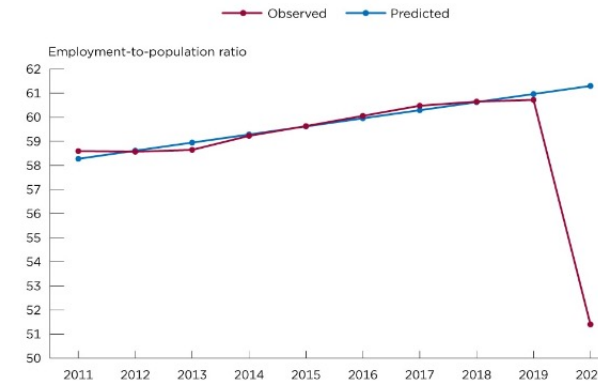

Figure 2. Global GDP growth 2020

Figure 1.
U.S. Share of Population Working Full-time or Part-time: April 2011-2020

https://www.census.gov/library/stories/2021/03/initial-impact-covid-19-on-united-states-economy-more-widespread-than-on-mortality.html
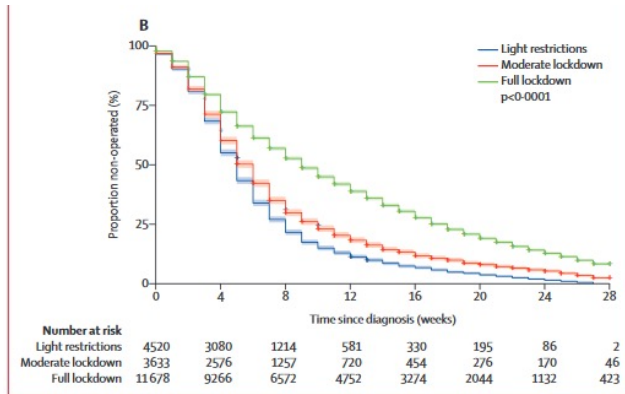

Figure 2: Effects of lockdowns on surgical capacity

COVID-19 related	All patients
Multidisciplinary team decision to delay surgery due to patient risk during COVID-19	1456 (72·8%)
Change to alternative treatment modality because of COVID-19	533 (26·6%)
Patient choice to avoid surgery during COVID-19 pandemic	460 (23·0%)
Ongoing neoadjuvant therapy (COVID decision)	378 (18·9%)
No bed, critical care bed, or operating room space available due to COVID-19	299 (14·9%)
Change of recommendations in society guidelines related to COVID-19	220 (11·0%)
Patient unable to travel to hospital related to COVID-19	140 (7·0%)
Collateral impact on supporting services causing delay	24 (1·2%)
Patient delayed due to SARS-CoV-2 infection	23 (1·1%)
Died of COVID-19 while waiting for surgery	14 (0·6%)
Total	2001 (100·0%)

Due to the COVID-19 pandemic, extreme poverty is likely to increase sharply
Number of people in extreme poverty

https://blogs.worldbank.org/voices/2020-year-review-impact-covid-19-12-charts
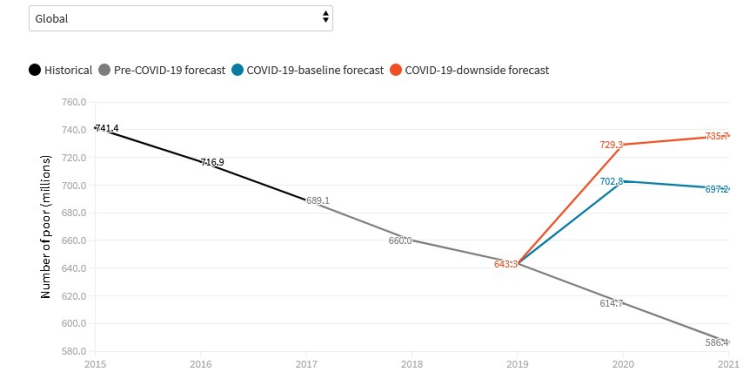
Effect of COVID-19 pandemic lockdowns on planned cancer surgery for 15 tumor types in 61 countries: an international, prospective, cohort study, Lancet Oncology 2021
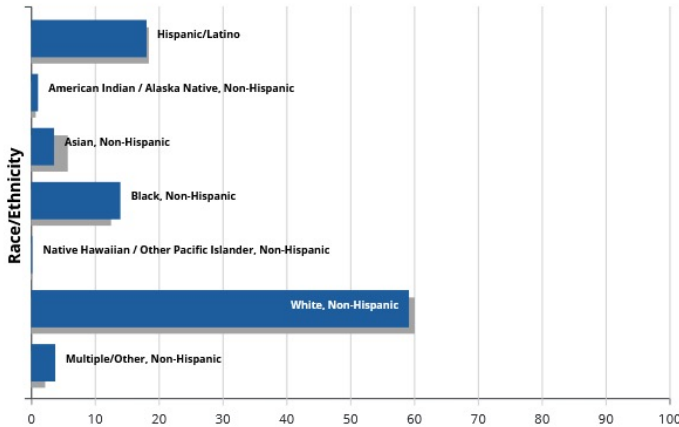
COVID-19 CASES/DEATHS, DISPARITIES, US

Deaths by Race/Ethnicity:

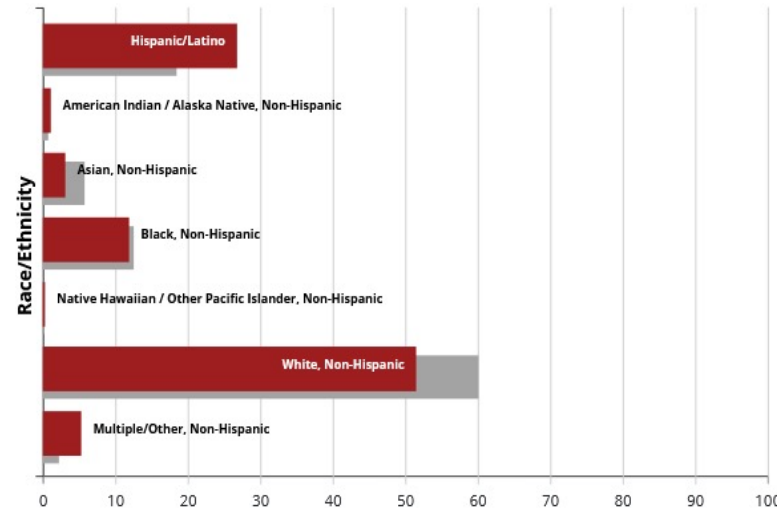Data from 570,178 deaths. Race/Ethnicity was available for 480,586 (84%) deaths.

- Percentage of Deaths, All Age Groups
- Percentage of the US Population, All Age Groups

Cases by Race/Ethnicity:

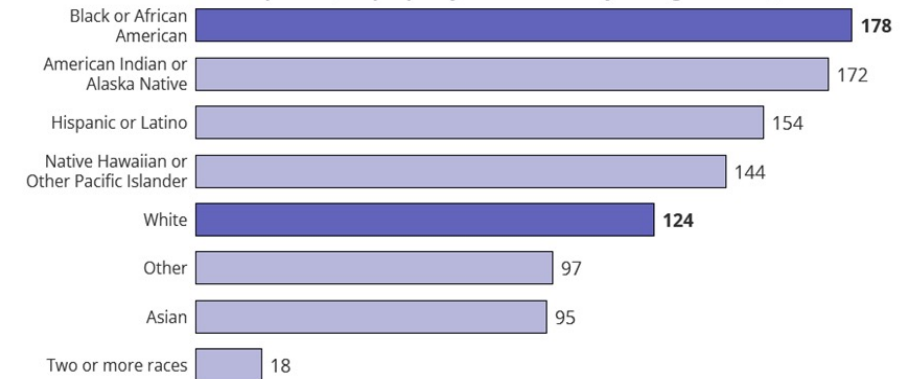Data from 34,525,119 cases. Race/Ethnicity was available for 22,424,493 (64%) cases.

- Percentage of Cases, All Age Groups
- Percentage of the US Population, All Age Groups

Nationwide, Black people have died at 1.4 times the rate of white people.

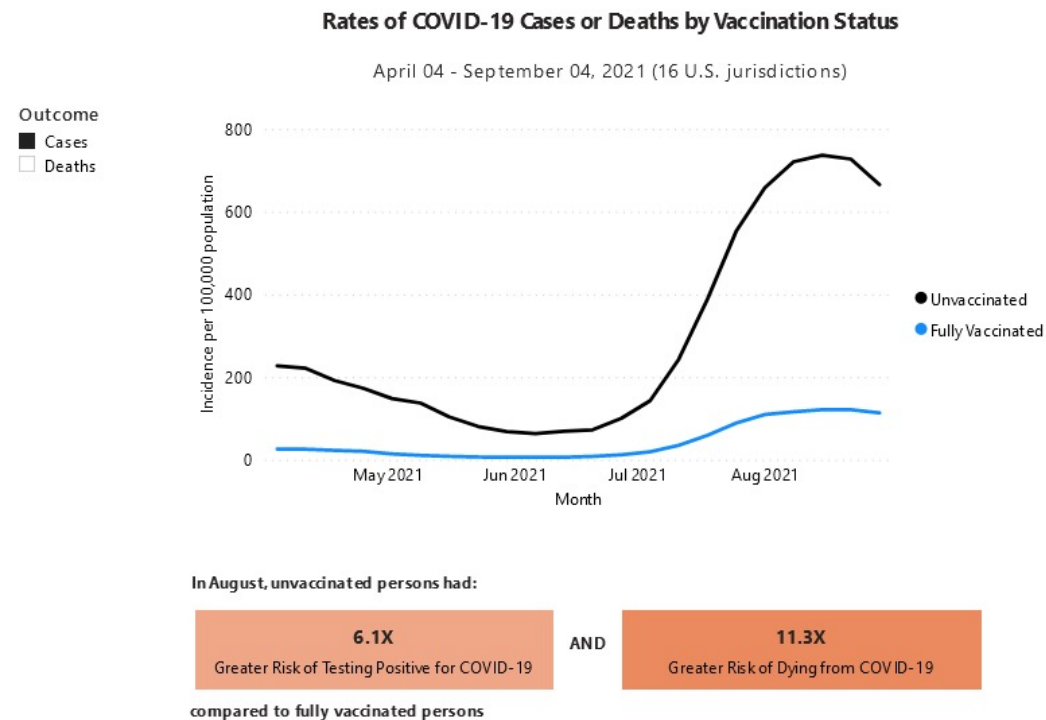Deaths per 100,000 people by race or ethnicity through March 7, 2021

Black or African American	178
American Indian or Alaska Native	172
Hispanic or Latino	154
Native Hawaiian or Other Pacific Islander	144
White	124
Other	97
Asian	95
Two or more races	18

Notes ↓

We've lost at least 73,462 Black lives to COVID-19 to date. Black people account for 15% of COVID-19 deaths where race is known.
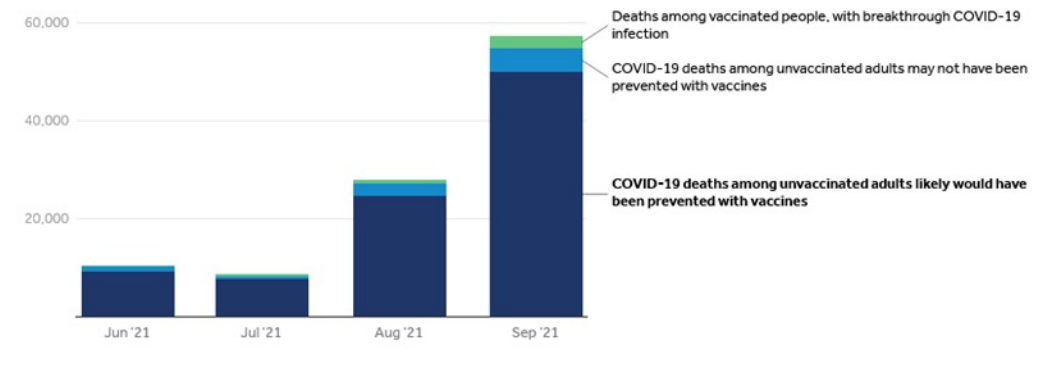
https://covid.cdc.gov/covid-data-tracker/#demographics

https://covidtracking.com/race

IMPACT OF COVID-19 VACCINES ON DEATHS, US

https://covid.cdc.gov/covid-data-tracker/#rates-by-vaccine-status

https://www.healthsystemtracker.org/brief/covid19-and-other-leading-causes-of-death-in-the-us/

MENTAL HEALTH ISSUES

- Methods: To evaluate mental health conditions among these workers, a nonprobability–based online survey was conducted during 3/29-4/6/21, among UA public health workers

- Results: Among 26,174 respondents, 53.0% reported symptoms of at least one mental health condition in the preceding 2 weeks, including depression (32.0%), anxiety (30.3%), PTSD (36.8%), or suicidal ideation (8.4%). Severity of symptoms increased with increasing weekly work hours and percentage of work time edicated to COVID-19 response activities.

- Conclusion: Implementing prevention and control practices that eliminate, reduce, and manage factors that cause or contribute to public health workers' poor mental health might improve mental health outcomes during emergencies.

Bryant-Genevier J, et al. MMWR 2021;70:947

TABLE 2. Traumatic events or stressors reported by 26,174 state, tribal, local, and territorial public health workers and comparisons* of symptoms of post-traumatic stress disorder[†] — United States, March–April 2021

Traumatic event or stressor/Response	No.[§]	PTSD prevalence, %	PTSD PR (95% CI)
Personal-related			
Had COVID-19			
Yes[¶]	2,834	36.7	1.03 (0.98–1.09)
Maybe**	3,310	42.4	1.19 (1.14–1.25)
No	16,266	35.6	Ref
Got divorced or separated			
Yes	747	49.6	1.36 (1.27–1.47)
No	22,084	36.3	Ref
Experienced death of a loved one			
Yes	7,580	42.3	1.24 (1.20–1.29)
No	15,403	34.0	Ref
Worried about the health of family and loved ones			
Yes	20,857	39.4	3.11 (2.77–3.48)
No	2,203	12.7	Ref
Felt isolated and alone			
Yes	12,944	49.8	2.49 (2.38–2.60)
No	10,080	20.0	Ref
Work-related			
Felt overwhelmed by workload or family/work balance			
Yes	16,563	45.4	3.10 (2.91–3.30)
No	6,451	14.7	Ref
Felt disconnected from family and friends because of workload			
Yes	14,051	49.0	2.77 (2.64–2.91)
No	8,964	17.7	Ref
Felt inadequately compensated for work			
Yes	13,703	45.2	1.85 (1.78–1.93)
No	9,101	24.4	Ref
Felt unappreciated at work			
Yes	12,362	46.5	1.82 (1.76–1.90)
No	10,551	25.5	Ref
Experienced stigma or discrimination because of work			
Yes	5,962	56.2	1.88 (1.82–1.94)
No	16,944	29.9	Ref
Received job-related threats because of work			
Yes	2,699	61.8	1.85 (1.78–1.92)
No	20,262	33.4	Ref
Felt bullied, threatened, or harassed because of work			
Yes	5,376	59.0	1.97 (1.91–2.03)
No	17,594	30.0	Ref
Interacted often with the public			
Yes	11,143	41.1	1.23 (1.19–1.28)
No	13,318	33.3	Ref
Worried about workplace exposure to COVID-19			
Yes	11,197	42.6	1.36 (1.31–1.41)
No	11,805	31.3	Ref

Abbreviations: IES-6 = 6-item Impact of Event Scale; PR = prevalence ratio; PTSD = post-traumatic stress disorder; Ref = referent group.
* Referent group for all prevalence ratio calculations was not experiencing the traumatic event/stressor (i.e., "No" category).
[†] Experienced symptoms of post-traumatic stress disorder in the 2 weeks preceding survey, defined as having an IES-6 score ≥1.75 out of 4.
[§] Some categories might not sum to 26,174; only those respondents who completed IES-6 questions (N = 22,248) are included in analysis.
[¶] Positive COVID-19 test or diagnosis by medical professional.
** Had symptoms compatible with COVID-19 but not tested or test inconclusive.

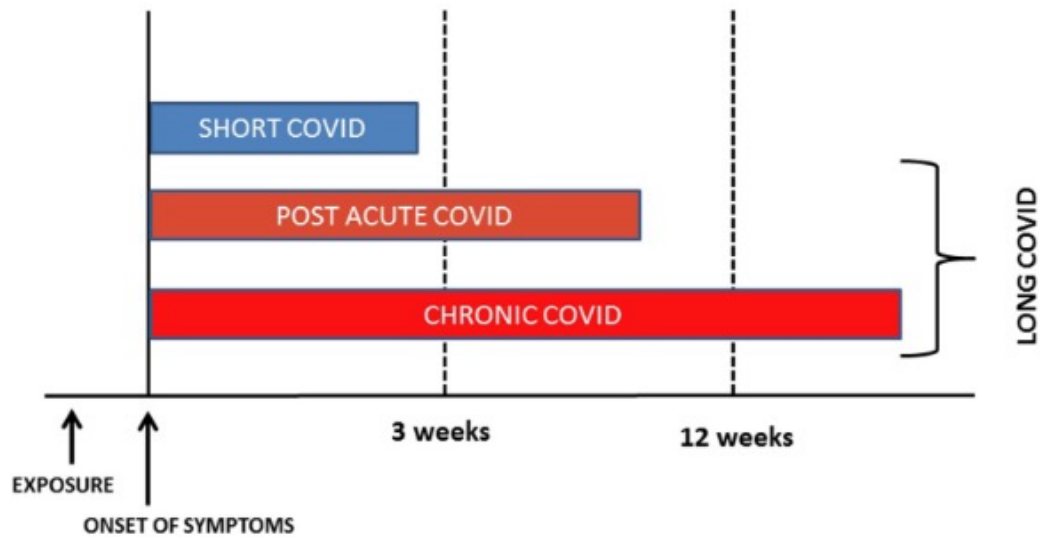# LONG-COVID-19 SYNDROME

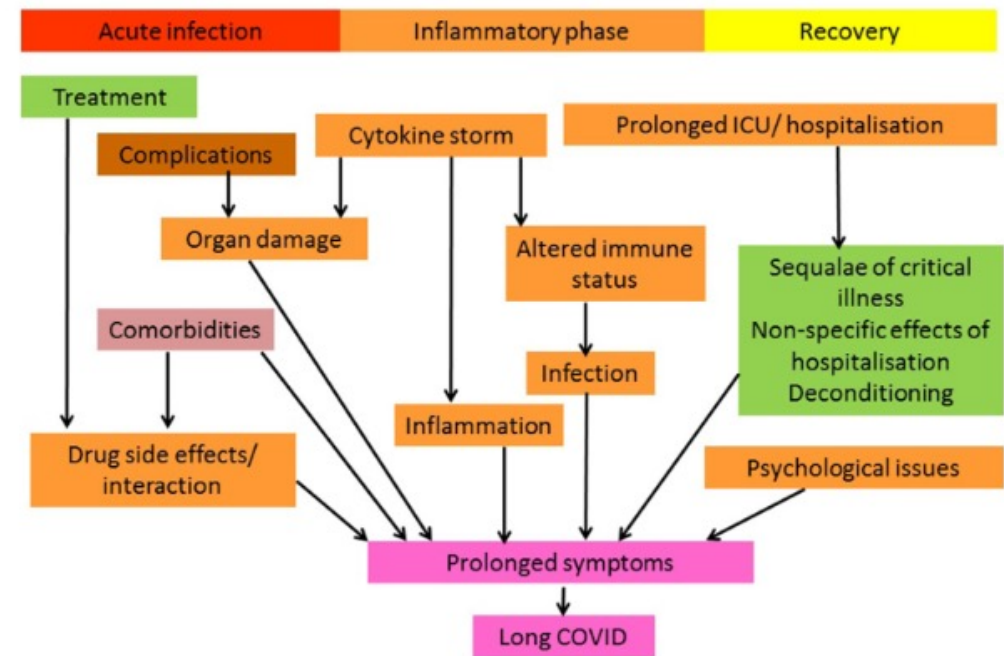Fig. 1. Classification of long COVID.

Fig. 2. Various pathophysiological mechanism of "Long COVID".
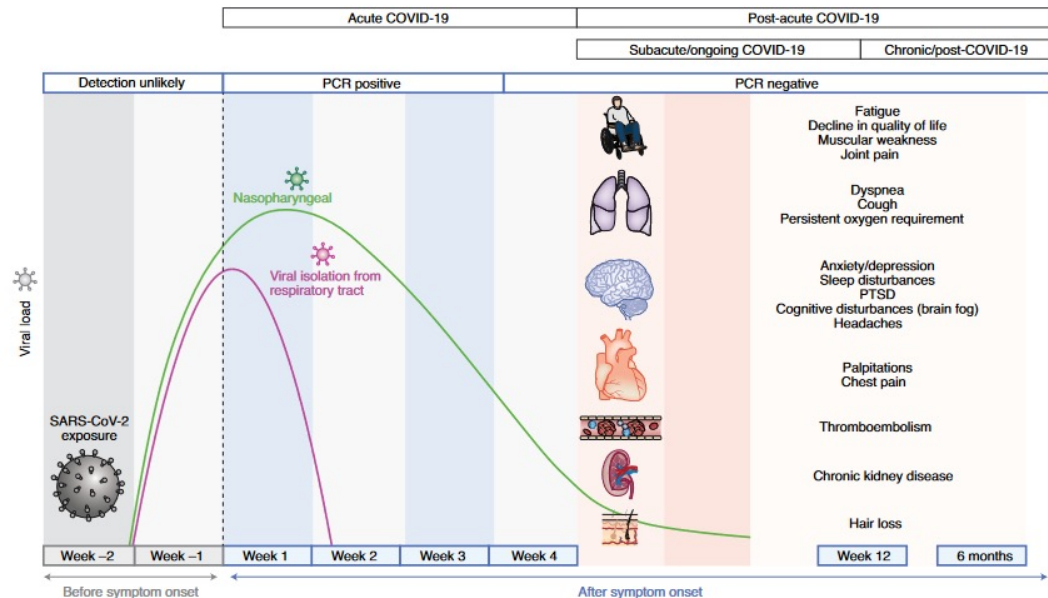
FREQUENCY AND SYMPTOMS OF LONG-COVID-19

Fig. 1 | **Timeline of long-COVID.** Nalbandian et al. define long-COVID as persistent symptoms and/or delayed or long-term complications beyond four weeks from the onset of symptoms. Credit: Adapted with permission from A. Nalbandian et al. *Nat. Med.* 27, 601–615 (2021), Springer Nature

Schmidt C. Nature Biotechnology 2021;39:908-913

- Goal: Assess long-COVID-19 in large EMR database

- Methods: Retrospective cohort study using EMR data from 81 million patients, 273,618 COVID-19 survivors; incidence within 6 months and 3-6 months after diagnosis

- Results: Among COVID-19 survivors (mean [SD] age: 46.3 [19.8], 55.6% female), 57.00% had one or more long-COVID feature recorded during the whole 6-month period (i.e., including the acute phase), and 36.55% between 3 and 6 months.

  - 1 in 3 patients had one or more features of long-COVID recorded between 3 and 6 months after a diagnosis of COVID-19. This was significantly higher than after influenza.

  - 2 in 5 of the patients who had long-COVID features in the 3- to 6-month period, had no record of any such feature in the previous 3 months.

  - The risk of long-COVID features was higher in patients who had more severe COVID-19 illness, and slightly higher among females and young adults. White and non-white patients were equally affected.

Taquet M, et al. PLOS Medicine 2021;28 September

THE COVID-19 PANDEMIC: LOOKING BACK AND LOOKING FORWARD, US RESPONSE

Missteps and Misinformation in US Pandemic Response

- Lack of a centralized, coordinated Federal response

- Executive Branch consistently minimized and trivialized risk of COVID-19

- US Public Health infrastructure woefully inadequate

- Slow development and scale-up of rapid, accurate, and widely available testing

- Inaccurate initial assumptions about transmission: Failure to focus on aerosol transmission; failure to recognize the importance of asymptomatic and pre-symptomatic spread

- Inadequate stockpiles of PPE and failure to rapidly ramp up production

- Initial failure to recommend masking by the public as a mitigation strategy

- Failure to initially focus on transmission in nursing homes

Major Remaining Pandemic Concerns

- Science denialism

- Politicization of pandemic response

- Vaccine hesitancy and resistance

- Vaccinations for children

- Evolution and spread of more highly transmissible and/or virulent variants

- Post-COVID-19 clinical issues

- Lack of public support for public health interventions (e.g., mask mandates) if /when another wave or new agent arrives

- Need for recurring boosters

- Unanticipated challenges

- Pandemic fatigue