COVID-19 Science Update

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Intended for use by public health professionals responding to the COVID-19 pandemic.

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Collateral Impact of COVID-19 Pandemic

The COVID-19 pandemic has placed great stress on public health, health care infrastructure and personnel. Below, we summarize 4 studies assessing population behaviors, disruptions and decreases in services.

PEER-REVIEWED

A. **Trends in emergency department visits and hospital visits in health care systems in 5 states in the first months of the COVID-19 pandemic in the U.S.** Jeffery *et al*. JAMA Internal Medicine (August 3, 2020).

Key findings:

- During the national lockdown:
  - Visits *to* emergency departments (EDs) decreased while COVID-19 cases increased; New York (-63.5%), Massachusetts (-57.4%), Connecticut (-48.9%), North Carolina (-46.5%) and Colorado (-41.5%) (Figure 1).
  - Admissions into the hospital *from* EDs increased: New York (149.0%), Massachusetts (51.7%), Connecticut (36.2%), Colorado (29.4%), and North Carolina (22.0%) (Figure 2).

Methods: Cross-sectional assessment of 24 EDs in health care systems in 5 states, between January and April 2020. Trends were examined for ED visits and hospitalizations as a function of national COVID-19 case counts. Scatterplots were overlaid with nonparametric smoothed curves generated by LOWESS method. *Limitations*: Not representative of all US settings; cross-sectional data; purpose of ED visits unknown.

Figure 1

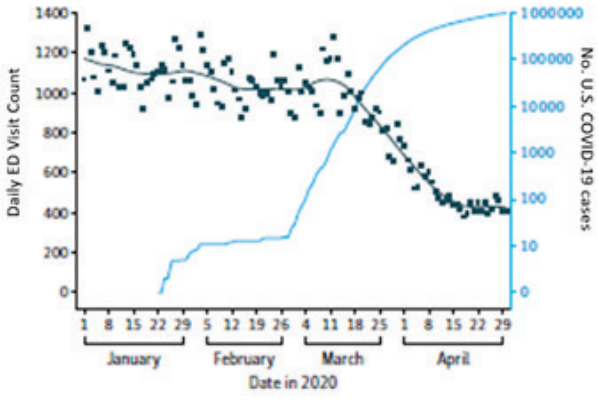
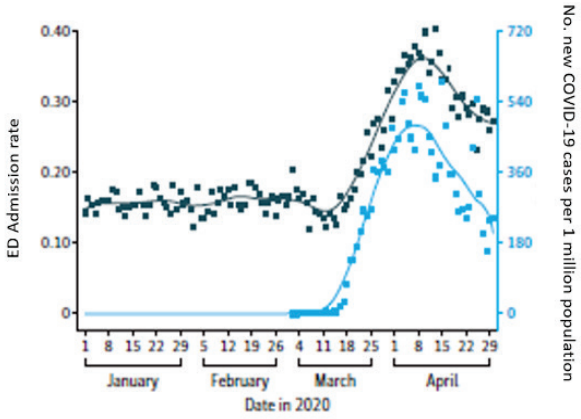


Figure 2



Note: Adapted from Jeffery *et al*. **Figure 1.** **Daily ED visit count** and number of reported US **COVID-19 cases**, January - April 2020. **Figure 2**. **ED admission rate** and number of reported US **COVID-19 cases per 1 million people**, January - April 2020. Licensed under CC-BY.

B. Effect of COVID-19 lockdown on alcohol consumption in patients with pre-existing alcohol use disorder. Kim *et al*. Lancet Gastroenterology & Hepatology (August 4, 2020).

Key findings:

- 43 of 182 participants (24%) increased alcohol consumption during lockdown, to an average of 82.5 units of alcohol per week (1 unit = 1 shot of spirits at 40% alcohol).
- 12 of 69 abstinent participants (17%) relapsed, consuming an average of 48.8 units per week.
- 14 of 113 participants (12%) who drank before lockdown became abstinent.

Methods: Telephone survey to assess alcohol use in 182 persons (73% male, 78% White, median age 57 years) with pre-existing alcohol disorders and registered in an alcohol clinic, London, UK, between May 21 and June 10, 2020. *Limitations*: Small sample size.

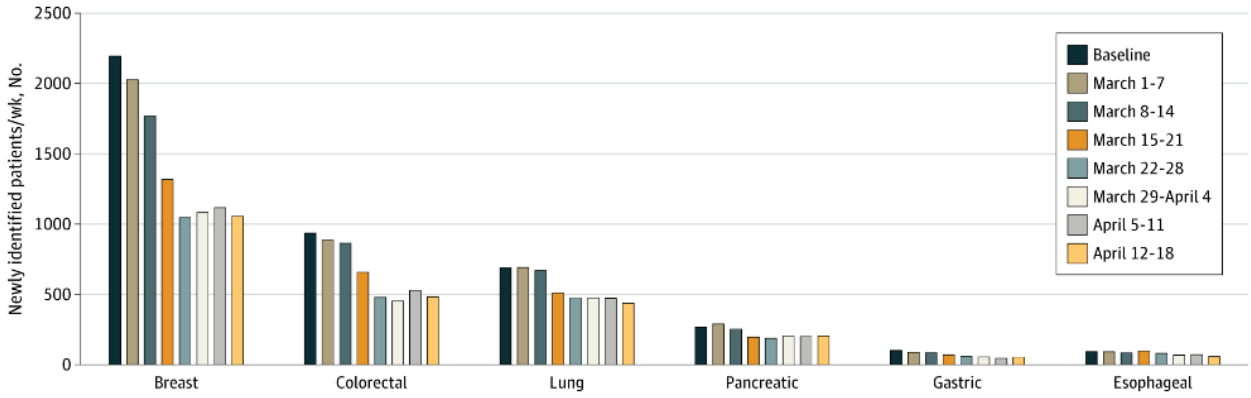
C. Changes in the number of US patients with newly identified cancer before and during the Coronavirus Disease 2019 (COVID-19) pandemic. Kaufman *et al*. JAMA Network Open (August 4, 2020; Correction on September 10, 2020).

Key findings:

- From March 1 to April 18, 2020, the weekly number of newly diagnosed patients declined 46.4% for 6 types of cancer (Figure).
    - Largest decrease was for breast cancer, 51.8%, p <0.001.
    - Smallest decrease was for pancreatic cancer, 24.7%, p = 0.01.

Methods: Cross-sectional study of 278,778 new diagnoses for any of 6 cancer types (breast, colorectal, lung, pancreatic, gastric, and esophageal). Weekly counts for diagnoses between January 6, 2018 and February 29, 2020 were compared with diagnoses between March 1 and April 18, 2020). *Limitations*: Impact of delayed diagnoses of cancer likely depends on the severity of disease at diagnosis relative to pre-pandemic levels.

Figure (corrected):



Note. Adapted from Kaufman *et al*. Newly-diagnosed cancers, January 6, 2019 - April 18, 2020. Dates represent weeks in 2020. Baseline - weekly average for January 6, 2019 - February 29, 2020. Licensed under CC-BY.

Correction issued by authors on September 10, 2020:

In the Figure, an additional column was added to represent data on esophageal cancer, and the dates of the weeks in the periods examined were adjusted by 1 day.

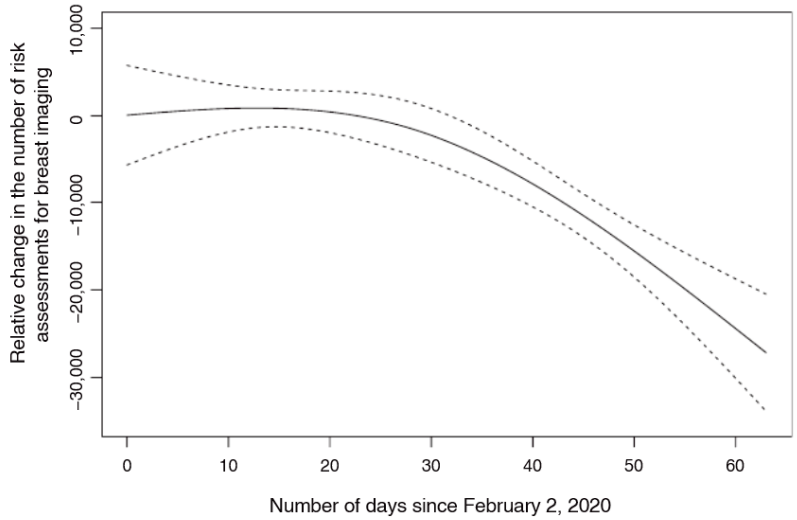
D. [Breast imaging, breast surgery, and cancer genetics in the age of COVID-19.](#) Yin *et al*. Cancer (August 4, 2020).

Key findings:

- The number of breast image assessments, breast surgeries, and genetics consultations dropped in the early months of the COVID-19 epidemic in the US.
    - For breast imaging, starting March 15, 2020 decrease by 61.7% per week, p = 0.001 (Figure 1).
    - For breast surgery consultations, starting March 8, 2020 decrease by 20.5% per week, p = 0.003, primarily due to reductions in consultations for benign breast disease (Figure 2).
    - For genetics consultations, starting March 15, 2020 decrease by 26.4% per week, p <0.001.

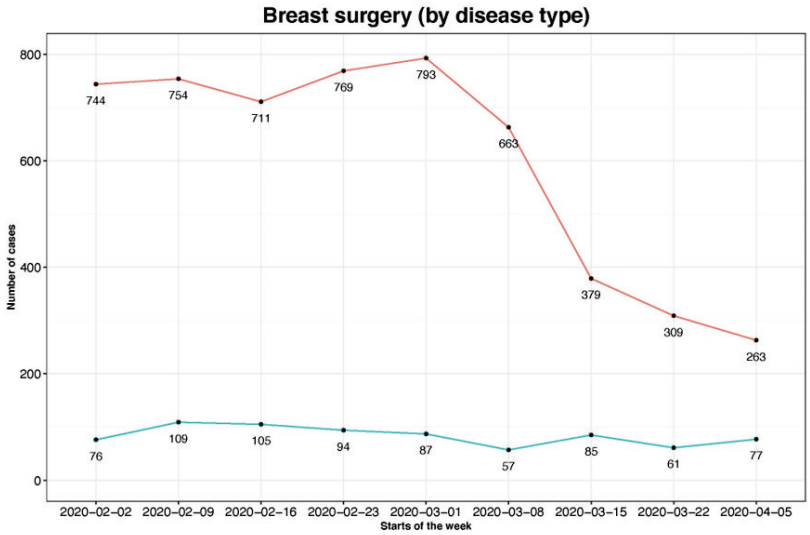
Methods: Cross-sectional analysis summarizing weekly volume of mammograms, breast surgery, and genetics consultations at 55 breast imaging clinics in 27 US states, between February 2 and April 11, 2020. *Limitations*: Breast imaging assessment analyses could not distinguish between cancer screening and breast diagnostic purposes.

Figure 1



Note. Adapted from Yin *et al*. Decrease in breast imaging assessments, February 2 - April 11, 2020. Solid line represents the estimate per day; dashed lines represent 95% CI around estimates. Used by permission of John Wiley & Sons, Inc. ©American Cancer Society.

Figure 2



Note. Adapted from Yin *et al*. Decline in breast surgery consultations by whether the consultation was for **benign** or **cancer** surgery. Used by permission of John Wiley & Sons, Inc. ©American Cancer Society.

Implications for 4 studies (Jeffery *et al.*, Kim *et al.*, Kaufman *et al.*, & Yin *et al.*): Impacts of the COVID-19 pandemic include disruptions to health service provision and potential indirect effects on population health. Delays in preventive care could lead to excess morbidity and mortality across numerous health conditions, as well as exacerbate racial and ethnic disparities (see Balogun *et al*. Disparities in cancer outcomes due to COVID-19 – A tale of two cities). Even with the stress COVID-19 places on global public health and health care, proactive outreach and prioritization of essential health services remains vital.

COVID-19 Impact on HIV Prevention

Given impacts of COVID-19 on clinical service availability and use, we take a closer look at the impact of COVID-19 on HIV prevention and treatment, including estimating the effects of service interruptions on HIV mortality and incidence and impacts for pregnant women needing PrEP.

PEER-REVIEWED

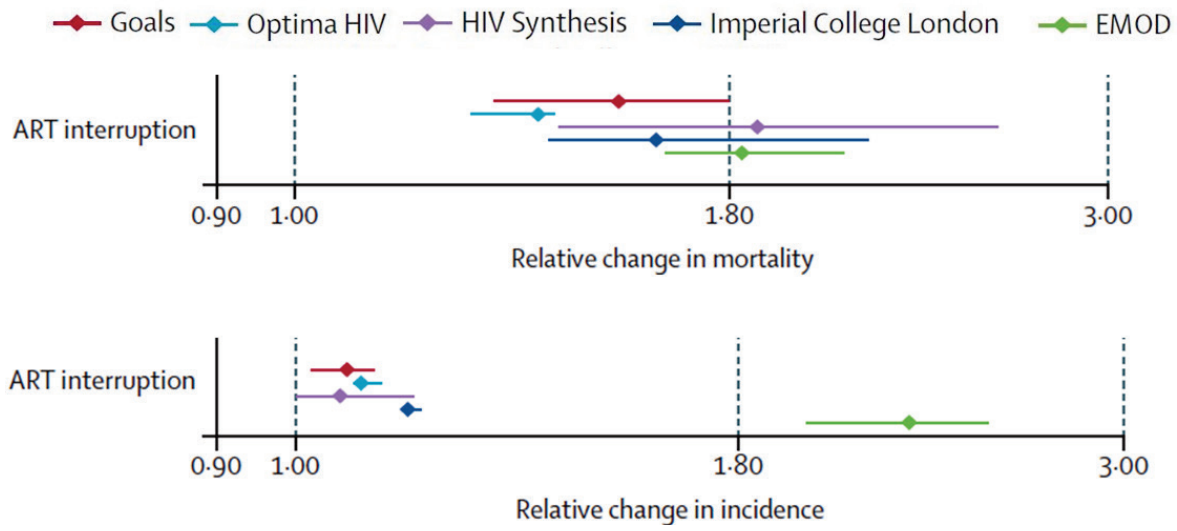
A. Potential effects of disruption to HIV programmes in sub-Saharan Africa caused by COVID-19: results from multiple mathematical models. Jewell *et al.* Lancet HIV (August 6, 2020).

Key findings:

- Interruption of antiretroviral therapy (ART) for 50% of people living with HIV increased predicted mortality by 63% and incidence by 9% across 5 models (Figure).
- All models predicted an increase in AIDS-related deaths.

Methods: Estimation of effect of potential disruptions to HIV services on HIV-related deaths and new HIV infections in sub-Saharan Africa over one year from April 1, 2020. Predictions were based on five mathematical models with disruptions affecting 20%, 50%, and 100% of the population for six months. *Limitations*: Different models were based on epidemics in different combinations of sub-Saharan countries; not all models incorporated estimates for all prevention methods; no stratification for subpopulations.

Figure:



Note: Adapted from Jewell *et al*. Predicted change in HIV mortality (top panel) and HIV incidence (bottom) in 1 year from April 1, 2020, as a function of a 6-month disruption of ART services for 50% of people living with HIV in sub-Saharan Africa, according to 5 mathematical models (named at top of figure). Point estimates represent predicted relative change in mortality with 95% CI indicated by bars. Licensed under CC-BY.

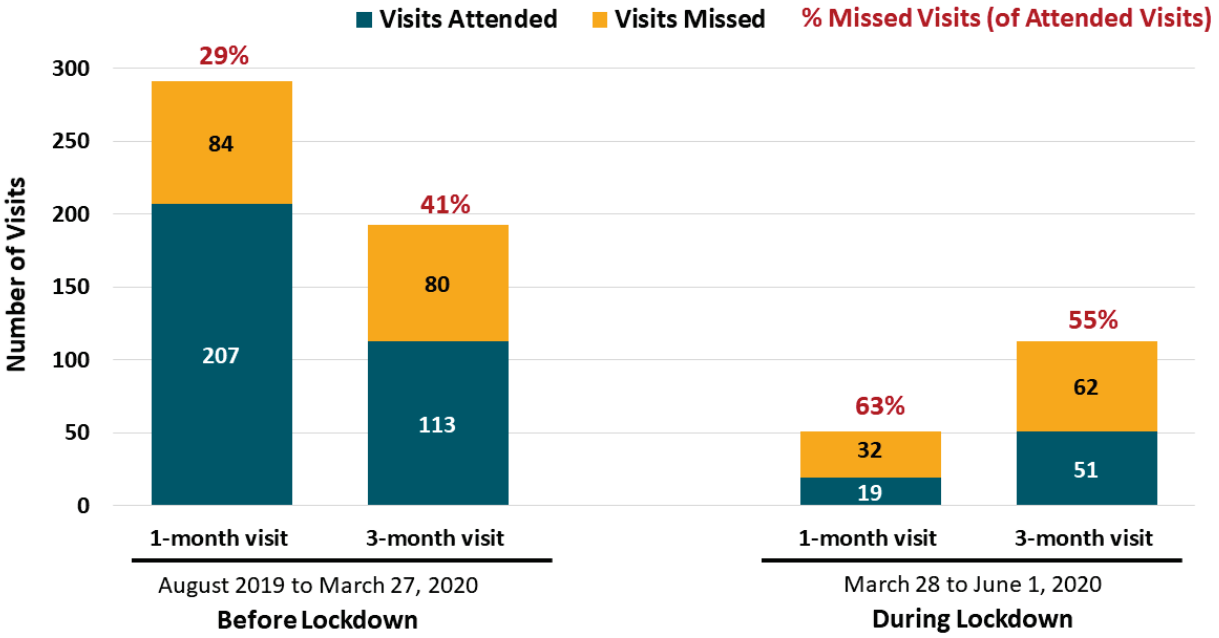
B. PrEP retention and prescriptions for pregnant women during COVID-19 lockdown in South Africa. Davey *et al.* Lancet HIV (August 3, 2020).

Key findings:

- Among HIV-negative women in prenatal and postpartum care, 57% missed pre-exposure prophylaxis (PrEP) study visits during the COVID-19 lockdown, compared to 34% during the pre-lockdown period, odds ratio (OR) 2.36 (95% CI 1.73-3.16).
    - For 1-month visits, 29% of women missed visits pre-lockdown, compared with 63% during lockdown, p <0.05 (Figure).
    - For 3-month visits, 41% of women missed visits pre-lockdown, compared with 55% during lockdown, p <0.05 (Figure).

Methods: Cohort of 414 HIV-negative pregnant women receiving PrEP, Cape Town, South Africa with scheduled visits 1 and 3 months after initial visit. Missed visits pre-lockdown (August 2019 - March 27, 2020) were compared with lockdown (March 28 - June 1, 2020). *Limitations*: Unadjusted analysis.

Figure:



Note: Adapted from Davey *et al*. **Visits Attended** and **Visits Missed** for PrEP before and during COVID-19 lockdown; 72 women did not have a 1-month visit scheduled during the evaluation window; 108 did not have a 3-month visit scheduled. This article was published in Lancet HIV, Vol 7, Davey *et al*., PrEP retention and prescriptions for pregnant women during COVID-19 lockdown in South Africa, Page e735, Copyright Elsevier 2020. This article is currently available at the Elsevier COVID-19 resource center: https://www.elsevier.com/connect/coronavirus-information-center.

Implications for 2 studies (Jewell *et al*. & Davey *et al*.): To minimize excess HIV-related deaths in severely affected countries, continuation of ART for people living with HIV needs to be assured. Prevention outreach for especially vulnerable populations should also be emphasized.

Epidemiology

PEER-REVIEWED

Assessing telemedicine unreadiness among older adults in the United States during the COVID-19 pandemic. Lam *et al.* JAMA Internal Medicine (August 3, 2020)

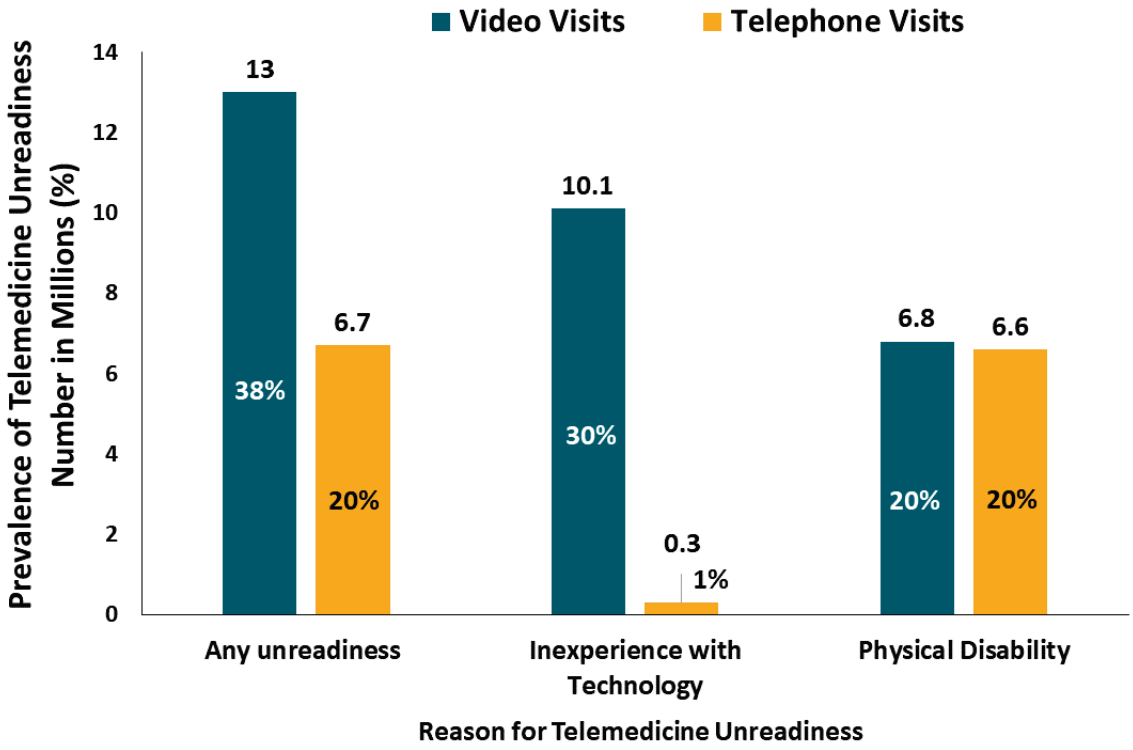
Key findings:

- An estimated 13 million older adults (38%) reported technological inexperience or physical disabilities that left them unready for video visits and 6.7 million (20%) were unready for telephone visits (Figure 1).
- The largest sociodemographic differences between those who were unready and those who were ready were age, racial or ethnic minority status, education, and income.
- Unreadiness was more prevalent as age increased and with worse self-reported health status (Figure 2).

Methods: Cross-sectional study with data from 4,525 adults age ≥65 years to assess physical disabilities and inexperience with technology that would inhibit capacity to use telemedicine (unreadiness). *Limitations*: Self-reported data; sample limited to Medicare beneficiaries; data drawn from 2018.

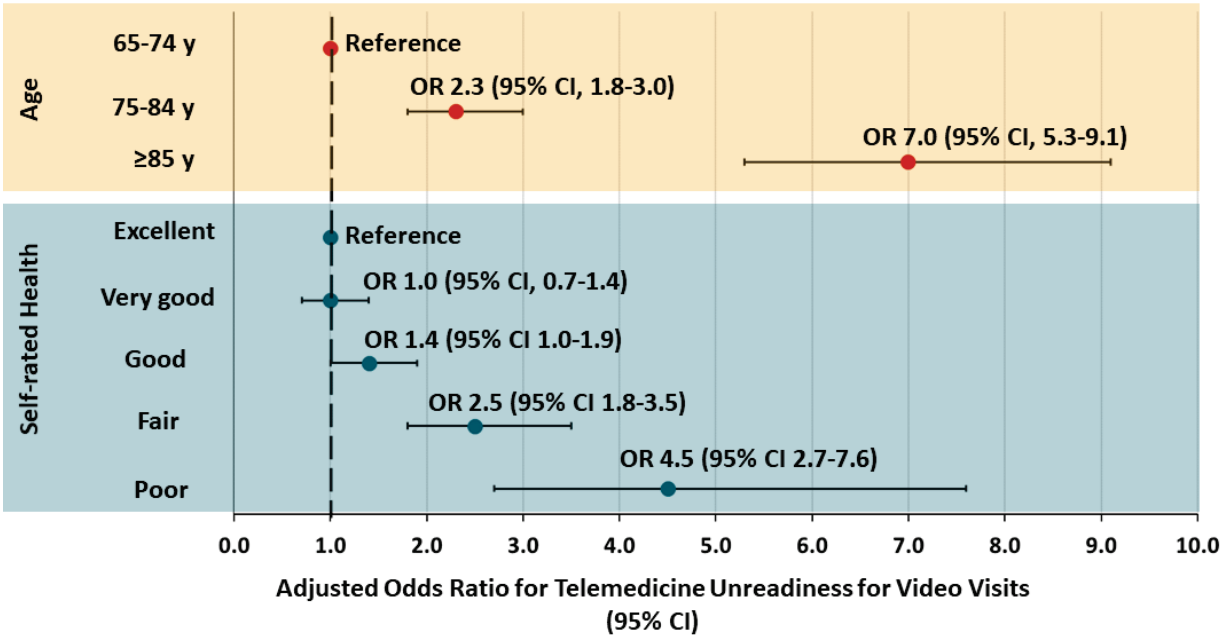
Implications: A substantial proportion of the US population that is vulnerable to COVID-19 based on age would have difficulty benefiting from telemedicine. Health policies and practices are needed to bridge this digital divide.

Figure 1



Note: Adapted from Lam *et al*. Estimated number of US adults ≥65 years with indicators of unreadiness for **Video Visits** and **Telephone Visits.** Numbers are in millions; numbers inside bars indicate percentages of the entire ≥65 years population of Medicare beneficiaries. Reproduced with permission from JAMA Intern Med. doi:10.1001/jamainternmed.2020.2671.

Figure 2



Note. Adapted from Lam *et al*. Association of age and self-reported health status with unreadiness for telemedicine services among US adults age ≥65 years. Dots indicate odds ratio (OR); bars indicate 95% CI. Reproduced with permission from JAMA Intern Med. doi:10.1001/jamainternmed.2020.2671. Copyright©2020 American Medical Association. All rights reserved.

PREPRINTS (NOT PEER-REVIEWED)

Risk of hospitalisation with coronavirus disease 2019 in healthcare workers and their households: a nationwide linkage cohort study. Shah *et al.* medRxiv (August 3, 2020). Published in BMJ (October 28, 2020).

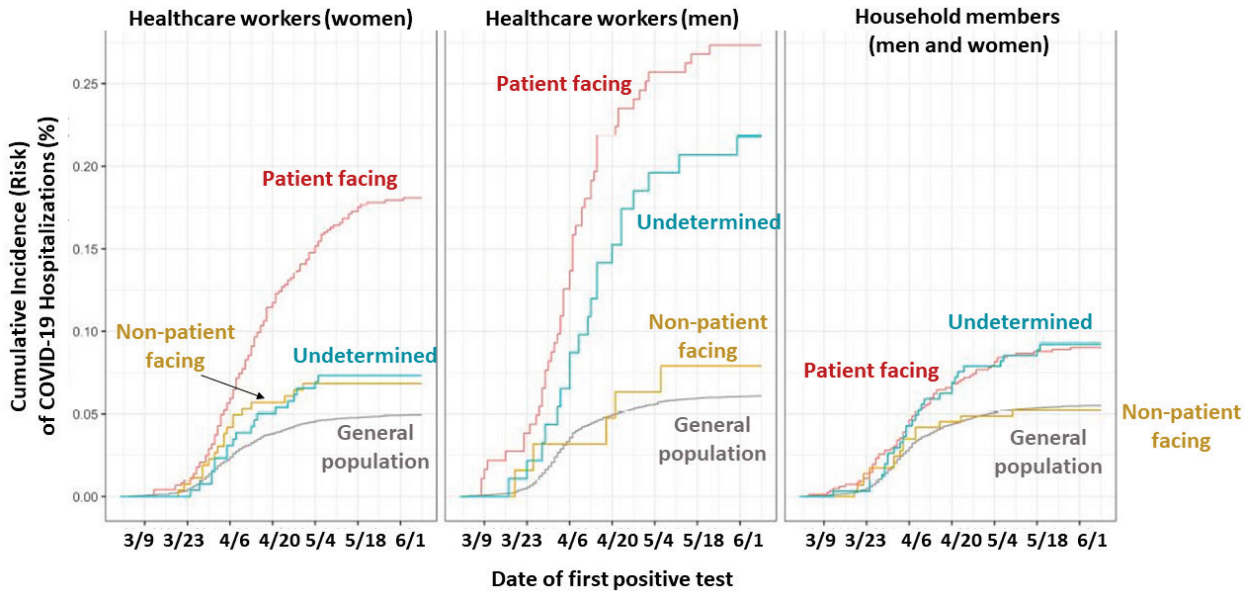
Key findings:

- Healthcare workers (HCW) and members of their households comprised 1 in 6 hospitalized COVID-19 cases in Scotland (Figure).
- HCW *with* direct patient contact, compared with non-patient-facing HCW, were at higher risk of hospitalization for COVID-19: adjusted hazard ratio (HR) 3.30 (95% CI 2.13-5.13).
    - Household members of patient-facing HCW were at higher risk of hospitalization than household members of non-patient-facing HCW: HR 1.79 (95% CI 1.10-2.91).
- HCW *without* direct patient contact and their household members had similar hospitalization rates as the general population.

Methods: National study to compare the risk of COVID-19 hospitalization in 158,445 HCW, 229,905 of their household members and the general population in Scotland, between March 1 and June 6, 2020. *Limitations*: HCW might have been more likely to be hospitalized than other COVID-19 cases; lack of power to examine race or ethnic minority groups, assessment of worker PPE and PPE use (e.g., proper donning/doffing, correct usage) not assessed.

Implications: Higher hospitalization rates among HCW with direct patient contact suggest nosocomial transmission and highlights that consistent testing and infection control practices are needed to protect HCW and their families.

Figure:



Note: Adapted from Shah *et al*. Cumulative incidence (risk) of COVID-19 hospitalizations in **patient facing HCW**, **non-patient facing HCW**, **HCW of undetermined status**, members of their households and the general **population of Scotland** (working age for HCW, all ages for household members). Licensed under CC-BY 4.0.

Vertical Transmission

PEER-REVIEWED

Early-onset symptomatic neonatal COVID-19 infection with high probability of vertical transmission. Kulkarni *et al.* Infection (August 2, 2020).

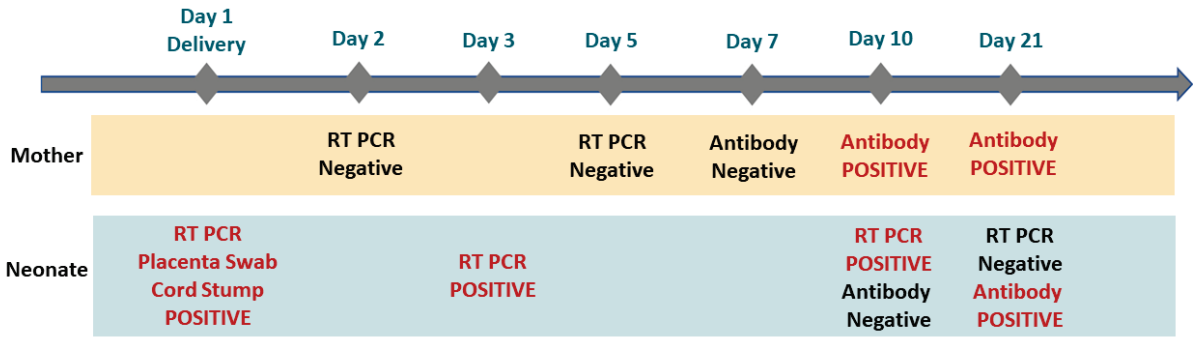
Key findings:

- Although viral cultures were negative, SARS-CoV-2 infection in the neonate suggested by:
  - Positive RT-PCR from umbilical stump, placenta, NP at birth and days 3 and 10 and positive serology at day 21.
  - Clinical and lab features of COVID-19 on day 2, (fever, poor feeding, hyperbilirubinemia, elevated inflammatory markers) (Figure).

Methods: Case study of a 24-year-old pregnant woman (38 weeks) with COVID-19-compatible symptoms, negative RT-PCR and positive serology who delivered at term using procedures to isolate neonate from infection. *Limitations*: Single case; no placental histological examination was performed.

Implications: Transplacental infection is rare and most births to infected mothers do not lead to neonate infection. Vertical transmission may need to be considered in clinical procedures and practice guidelines during COVID-19 pandemic.

Figure:



Note: Adapted from Kulkarni *et al*. Timeline depicting RT-PCR and serology results across time in mother and neonate. Available via Nature Public Health Emergency Collection through PubMed Central.

Clinical Treatment & Management

PEER-REVIEWED

Cerebral micro-structural changes in COVID-19 patients — An MRI-based 3-month follow-up study. Lu *et al. EClinical Medicine* (August 1, 2020).

Key findings:

- Among persons recovered from COVID-19, neurological symptoms were reported by 68% during acute disease and 55% at follow-up about 3 months later.
- Compared to controls, persons recovered from COVID-19 had multiple and diffuse structural differences in selected areas of the brain.
- Specific changes in the brains of patients compared with healthy controls were associated with a significantly greater risk of memory loss.

Methods: Case-control study of 60 persons recovered from COVID-19 (78% with mild disease) and 39 age-and sex-matched controls, Anhui province, China, May 2020. Data were collected from patient records and self-report. MRI was performed a mean of 97 days after onset to quantify brain regional volumes. *Limitations*: Controls were not asked about neurological symptoms; single center.

Implications: Structural brain changes and associated functional neurological changes 3 months after COVID-19 illness onset followed by recovery may portend long-term deleterious consequence of SARS-CoV-2 infection.

Loss of smell and taste among healthcare personnel screened for Coronavirus 2019. Kempker *et al.* Clinical Infectious Diseases (June 28, 2020).

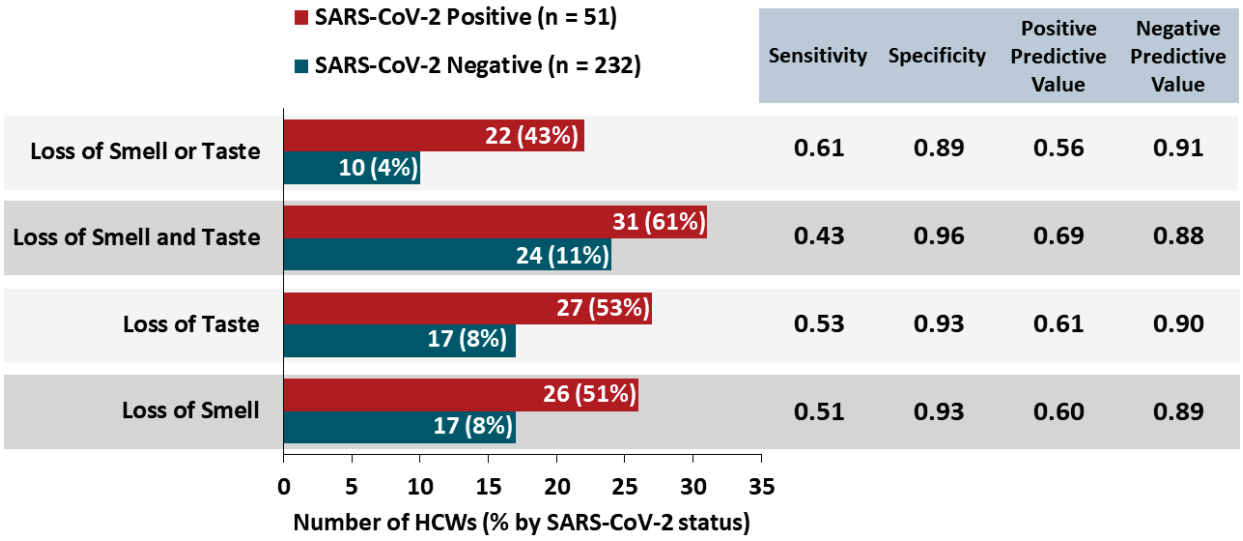
Key findings:

- Of 283 healthcare workers (HCW) tested for SARS-CoV-2, 51 (18%) tested positive.
- Chills or myalgia, both $p = 0.01$, and fever, loss of taste, loss of smell or both, all $p < 0.01$, were associated with positive test results, $p < 0.01$.
- Among all symptoms, loss of taste, smell, or both had the highest specificity (≥ 89%) and positive predictive values (≥56%) (Table).

Methods: Convenience sample of 549 HCW reporting symptoms consistent with COVID-19. After undergoing symptom screening, including for loss of smell or taste, 283 were referred for SARS-CoV-2 RT-PCR testing. *Limitations*: Not all HCW received testing; criteria for testing were not reported.

Implications: Loss of taste and smell should be included in screening algorithms for HCW.

Figure:



	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Loss of Smell or Taste	0.61	0.89	0.56	0.91
Loss of Smell and Taste	0.43	0.96	0.69	0.88
Loss of Taste	0.53	0.93	0.61	0.90
Loss of Smell	0.51	0.93	0.60	0.89

Note: Adapted from Kempker *et al*. Prevalence of loss of taste and smell in HCW infected with SARS-CoV-2 (n = 51) compared with uninfected HCW (n = 232) and performance as a predictor of COVID-19. All comparisons significant at p <0.01. Available via Oxford University Press Public Health Emergency Collection through PubMed Central.

Laboratory Science

PEER-REVIEWED

SARS-CoV-2-reactive T cells in healthy donors and patients with COVID-19. Braun *et al.* Nature (July 29, 2020).

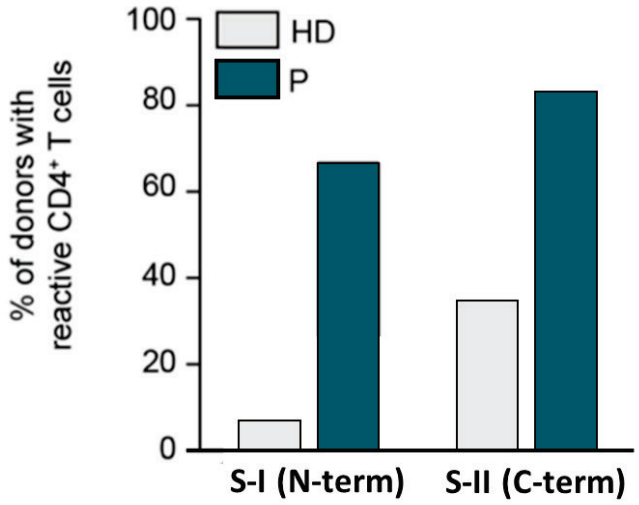
Key findings:

- CD4 T lymphocytes from 67% of SARS-CoV-2-infected patients and 5.8% of healthy blood donors responded to spike glycoprotein I (S-I) (Figure).
- CD4 T lymphocytes from 83% of patients and 35% of healthy donors responded to spike glycoprotein II (S-II) (Figure).
    - Of 18 healthy donors who were tested, all had IgG antibodies to all 4 of the endemic human coronaviruses, irrespective of the CD4+ cell response to S-II.

Methods: 68 healthy blood donors and 18 patients with SARS-CoV-2 diagnosed by RT-PCR, between March 1 and April 2, 2020 were examined to assess CD4+ T cell response to SARS-CoV-2 spike glycoproteins S-I and S-II (note: SARS-CoV-2 S-II resembles the spike glycoprotein from the 4 endemic human coronaviruses). All 68 healthy donors had serology measured on day 0, and 65 donors at day 28 after enrollment. *Limitations*: Small number of patients with SARS-CoV-2; findings might not be generalizable to other settings.

Implications Response to S-II by CD4 T lymphocytes from healthy donors suggests potential cross-reactivity as a result of prior infection with endemic human coronaviruses that are best known as a cause of the common cold. Cell-mediated response might contribute to SARS-CoV-2 immunity independent of antibodies.

Figure:



Note: Adapted from Braun *et al*. CD4+ T cell response to SARS-CoV-2 S-II and S-I in **HD** (healthy donors) and **P** (patients). Used by permission of Springer Nature.

In Brief

Novel Surveillance Approaches

- Arora *et al*. **SeroTracker: A global SARS-CoV-2 seroprevalence dashboard.** Lancet Infectious Diseases. Sero Tracker, is a custom-built dashboard that systematically monitors and summarizes findings from SARS-CoV-2 serological studies and presents a visualization of seroprevalence estimates on a world map.
- Sayers *et al.* **Notes from the field: Use of emergency medical service data to augment COVID-19 public health surveillance in Montgomery County, Maryland, from March to June 2020.** Journal of Medical Internet Research Public Health and Surveillance. Measurements of oxygen saturation by pulse oximetry obtained by the emergency medical service enhanced epidemiologic and syndromic surveillance metrics.

Risk Factors and Vulnerabilities

- Reddy *et al*. **The effect of smoking on COVID-19 severity: A systematic review and meta-analysis.** Journal of Medical Virology. Largest metanalysis of peer reviewed literature finds that past and current smokers are at significantly increased risk of severe COPVID-19 outcomes, including mortality.
- Wu *et al*. **Characterization of clinical, laboratory and imaging factors related to mild vs. severe COVID-19 infection: A systematic review and meta-analysis.** Annals of Medicine. Severe COVID-19 is significantly associated with older age, male gender, a combination of chronic diseases and laboratory and pulmonary CT abnormalities.
- Droesch *et al*. **Livedoid and purpuric skin eruptions associated with coagulopathy in severe COVID-19.** JAMA Dermatology. Describes 4 patients with severe COVID-19 and acute respiratory distress syndrome requiring intubation; patients had skin findings of acral fixed livedo racemosa and retiform purpura.

School Openings

- Wise *et al*. **Covid-19: NHS Test and Trace must improve for schools to reopen safely, say researchers.** BMJ. Emphasizes needed improvements in scale up and effectiveness of testing and contact tracing in the context of planned school openings in England.
- Betz, C. **COVID-19 and school return: The need and necessity.** Journal of Pediatric Nursing. Roles of pediatric nurses in providing evidence-based guidance and support to parents and children for safe return to school.

Other Topics

- Woloshin *et al*. **False negative tests for SARS-CoV-2 infection — Challenges and implications.** NEJM. Reviews the impact of pretest probability and test performance indicators on the proportion of false negative results and highlights the need for highly sensitive and well-validated tests.
- Inagaki *et al*. **Rapid inactivation of SARS-CoV-2 with deep UV-LED irradiation.** Emerging Microbes and Infections. *In vitro* irradiation via 280 ± 5 nm ultraviolet light rapidly inactivates SARS-CoV-2 from a patient.
- Lurie *et al*. **The development of COVID-19 vaccines: Safeguards needed.** JAMA. Describes four needed safeguards in COVID-19 vaccine development: 1) strong evidence of effectiveness; 2) strong evidence of safety; 3) clear informed consent prior to approval; and 4) comprehensive adverse event monitoring systems.
- Balogun *et al*. **Disparities in cancer outcomes due to COVID-19 – A tale of two cities.** JAMA Oncology. Discusses the potential impact of COVID-19 on well-established racial and ethnic disparities in cancer-related outcomes.

cdc.gov/coronavirus