

What We've Learned So Far:

Identification, Management
and Impact of Covid-19 on
Chronic Lung Disease



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Disclosure Statements

Presenter Disclosures:

Non-financial : Presenter has no relevant non-financial relationships to disclose.

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Learning Objectives

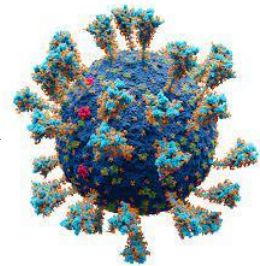


As a result of this course, participants will be able to:

- Recognize the difference between Covid-19 symptoms and typical chronic lung disease symptoms in asthma, allergies and COPD
- Identify how management strategies have evolved in the treatment of Covid-19 patients with chronic lung disease
- Describe the impact of Covid-19 on patients with chronic lung disease

Coronaviruses

- First identified a human coronavirus in 1965
- It caused a common cold
- Later that decade, a group of similar *human* and animal viruses were found and were named coronavirus after their “crown-like appearance”
- Primarily cause infections in birds and mammals but have shown to be capable of infecting humans



Severe Acute Respiratory Syndrome (SARS)

- China's Guangdong province
- Horseshoe bats-natural reservoir of SARS-CoV
- Spread by civets and other animals in wet markets
- 2003 SARS – atypical pneumonia
 - 1/3 fever, dyspnea, cough, watery diarrhea and needed mechanical ventilation
- Nov 2002-July 2003 -WHO reported 8,098 SARS cases from 29 countries,
- 774 SARS-related deaths (case-mortality rate: 9.6%)
- 29 cases in U.S. with “0” deaths



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Middle East Respiratory Syndrome (MERS-CoV)

- Demonstrated the lethality of CoV's when they cross the species barrier and infect humans
- First known cases appeared in Jordan in April 2012.
- Largest outbreak 2015 in the Republic of Korea
- WHO reported > 2400 cases linked to the Arabian Peninsula
- Transmitted by camels
- Similar symptoms to SARS but 50-89% required mechanical ventilation
- 35% Mortality



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Severe Acute Respiratory Syndrome SARS CoV-2

- Term COVID-19- **CoronaVirusDisease-19**
- SARS-CoV-2 due to similarity to SARS-CoV
- 1st case- December 12, 2019 in Wuhan, China
- Declared a pandemic (WHO) on March 11th 2020
- Variety of NEW symptoms dyspnea, neurological disturbances, nausea, headache, vomiting



SARS CoV-2 Mortality

- 65 years and \geq 80% of Covid deaths
- Residents in LTC < 1% of the population-35% of ALL deaths
- Fatalities 10-fold higher in US high population counties
- Racial and ethnic minority groups die at younger ages
- Highest % of increases in mortality among adults 25-44 years of age Hispanic or Latino
- Older adults and males higher mortality risk



COVID-19

Contributions to Worsening Outcomes

- Co-morbidities
 - Cardiovascular Disease
 - Diabetes
 - Chronic Pulmonary Disease
 - Kidney Disease
 - Liver Disease
 - Obesity
 - Genetics
 - Immune Disorders
- Racial and Socioeconomic disparities
- Population Density



Transmission SARS/MERS vs. SARS CoV-2

SARS-MERS

- Transmission from recognized disease (**symptomatic**)
- Grows on standard tissue epithelial cells in the **lower** lung

SARS CoV 2

- Transmission from **asymptomatic, mildly symptomatic and super spreading**
- Frequently transmitted 1-2 days prior to symptoms when most contagious
- Complicated the identification of cases and prevention of spread
- Grows better on epithelial cells of the primary or **upper** airway
- Upper airway continuously exposed to pathogens and pollutants



Angiotensin Converting Enzyme-2 (ACE-2)

SARS CoV-2- **10 x's higher** affinity to bind with ACE 2 than SARS

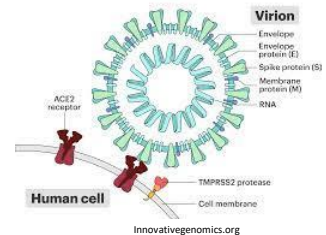
- Limiting factor in initial infection

ACE-2 expression varies and affected by chronic inflammatory diseases, Asthma & COPD

- ACE-2 increased in COPD and Tobaccos Smokers

Inhaled corticosteroids (ICS) used to treat AR, Chronic Rhinosinusitis, Asthma and COPD

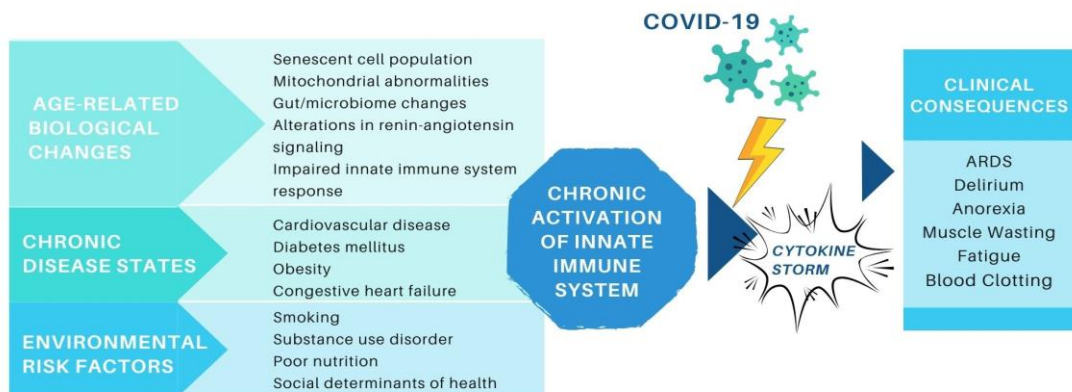
- ICS lowers expression of ACE-2
- Biologics upregulate ACE-2 and increase risk of SARS CoV-2
- ACE-2 Inhibiting agents can prevent the viral infection in vitro



The Aging Immune System

Covid Related Contributions to Cytokine Storm

And Observable Clinical Consequences



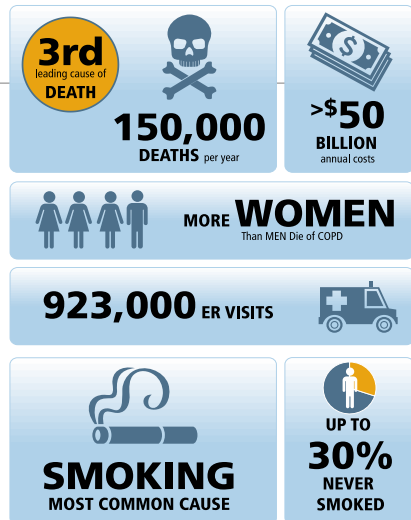
COPD

≈384 million people world wide

2nd most common cause of disability

What was the 3rd leading cause of death in 2020 and 2021?

COPD



COPD and COVID-19 - Risk & Severity

COPD patients **NOT** at increased risk of infection from Covid-19 Why?

- Fragile, more careful and utilized prevention measures
- Decreased air pollution due to the lockdown
- If ICS use- suppresses virus replication & cytokine production

Comorbid COPD and CLD In COVID-19

- Higher severity, complications & mortality
- Chronic inflammatory state and low respiratory capacity
- Poor lung function reserves, pnx, ARDS, Pulmonary Vascular Thrombolytic events lead to resp failure
- ACE-2 receptors are upregulated in the small airway epithelium and alveoli

COPD-Dx in COVID-19

Dx

- History, Symptoms and Risk factors, Spirometry
- Risk: Smoking, occupational exposure, air pollution, genetics, socioeconomic status, airway hyperreactivity.

Spirometry only if urgent or essential for Dx or assess lung function prior to surgery

RT-PCR test should be performed and results prior to test

- Home Peak Flow measurement

Validated Questionnaires

- Modified British Medical Research Council (mMRC) Scores 0-4
- COPD Assessment Test (CAT) 8 item Impairment scores 0-40
higher score larger impact



Challenges in Asthma & COPD Dx and Monitoring

Reductions in face to face consultations, rehab and exercise programs and home care

- Overlapping symptoms
- Access to care due to COVID patients
- Disruption of global supply chain
- Inability to afford medications with economic hardships
- Exacerbation events expose individual to increased risk
- Inability to assess inhaler technique
- Infection risks with certain meds
- Lack of telemedicine/Technology unavailable to the patient



Challenges in COPD Care in COVID-19

- Distinct difference in COPD Exacerbation w/COVID
 - Vascular injury
 - Pneumonitis
 - Coagulopathy
 - Systemic inflammation
 - Cytokine storm
 - Multiorgan involvement



COPD-Maintenance & Prevention in COVID-19 Pandemic

- If stable remain on ICS and OCS
- Ensure enough medication
- Remain on ACE inhibitors and Angiotensin Receptive Blockers
- Inhalers vs aerosols
- Vaccinations: Pneumococcal PPSV23, [Tdap](#) vaccine
- Prioritize for Covid Vaccination/Boosters
- General strategies, sheltering in place, hand washing, masking but [not lead to social isolation](#)
- Stay connected



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Symptoms: COPD Exacerbation vs. COVID-19

COPD Exacerbation: More **coughing** than usual,
↑SOB, fatigue >1 day, edema, trouble sleeping,
 changes in sputum

COPD & COVID-19 Overlap: **Cough and SOB**

COVID-19: ***Fever, loss of smell or taste***, headaches,
 lymphopenia, GI symptoms, profound fatigue, sore
 throat, congestion

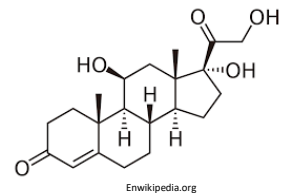
Treat aggressively with systemic corticosteroids and
 other meds to reduce morbidity and mortality



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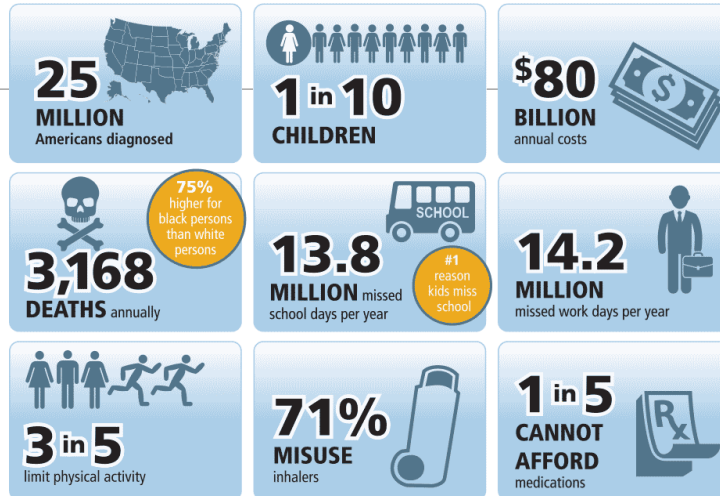
COPD w/COVID-19 Special Management Considerations

- Dexamethasone for up to 10 days reduced mortality in patients on Invasive Mechanical Ventilation (IMV) or oxygen alone
- Systemic Glucocorticoids reduce mortality in those **NOT** on IMV or vasopressors
- Aggressive EXTRA thromboprophylaxis 2 times daily
- Antibiotics with purulent sputum or (IMV)
- At risk for nutritional deficiency and skeletal muscle loss
 - Dietary support and early mobilization



En.wikipedia.org

Asthma



AllergyAsthmaNetwork.org



ASTHMA-Dx, Risk & Severity in COVID-19

Dx-

- Pulmonary Function Testing, History, Environment, Symptoms
- Spirometry if urgent or essential, Dx or assess lung function prior to surgery, RT-PCR test
- Home Peak Flow measurement, and validated questionnaires ie; Asthma Control Test



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Risk & Severity

Asthmatics-decreased risk of contracting Covid-19

- Decreased ACE-2 expression may lower the risk of Covid 19 severity and mortality
- T helper-2 (Th2) immune response
- ICS use may reduce the risk of infection or developing symptoms

Persons with Moderate to severe asthma are at increased risk of severe illness in COVID-19

Asthma Maintenance and Monitoring in COVID-19 Pandemic

Maintenance

- Continue therapy as usual including Biologics
- Continue ICS
- Little benefit of ICS in acute phases of virus if not already used
- Rescue pack of steroids at home
- Prednisone only for severe exacerbations

Monitoring

- Follow Asthma Action Plan
- Peak Flow Diaries
- Asthma Control Tests
- Avoid Triggers
- Review inhaler technique
- Telehealth found to significantly improve asthma control
- Most beneficial in severe disease vs. mild

Symptoms: ASTHMA vs. COVID-19

ASTHMA SYMPTOMS

- No fever
- **Audible Cough or wheeze**
- **Shortness of Breath**
- Chest Tightness and/or congestion
- You have to stop talking to catch breath
- Fatigue
- Not able to perform daily activities

SYMPTOMS COVID-19

- **Shortness of breath**
- **Coughing with or without wheeze**
- **Fever of over 100.4**
- **Loss of taste or smell**
- Headache
- Profound fatigue
- GI Symptoms
- Nasal congestion
- Sore throat

ALLERGIES Dx, Risk in COVID-19

DX:

Personal and Medical History

Physical Exam

Testing

- Skin Prick
- Blood tests
- Oral challenges
- Patch



RISK:

There is no evidence to suggest that people with allergies are at greater risk for COVID-19

Symptoms: ALLERGIES vs. COVID-19

SYMPTOMS: SEASONAL ALLERGIES

- Runny nose, usually with clear or pale-colored mucus
- Sneezing
- Coughing
- Red, watery eyes
- Itching around the nose, mouth, or eyes

Symptoms if left untreated

- Shortness of breath
- Nasal congestion, postnasal drip
- Headache
- Sore throat
- Decreased sense of smell
- Sinus, ear infections
- Puffiness or dark circles under the eyes
- Fatigue

SYMPTOMS: COVID 19

- Fever or chills
- Coughing
- Shortness of breath
- Fatigue
- Muscle, body aches, headache
- **NEW** loss of taste or smell
- Sore throat, congestion, runny nose
- Nausea or vomiting, diarrhea

ALLERGY Management & Prevention in COVID-19

- Continue prevention measures Intranasal same for AR, prevent sneezing
- GOLD guidelines-continue biologics
- Take allergy medication 2 weeks before symptoms occur
- General strategies, sheltering in place, hand washing, masking but **not lead to social isolation**
- Get the COVID-19 vaccine
- Pfizer/BioNTech and Moderna contain *polyethylene glycol (PEG)* or *polysorbate*, may cause allergic reactions in some people
 - Health professionals monitor patients for adverse symptoms for 30min
 - Facilities should be equipped to treat severe allergic reactions
 - Bring your own epinephrine auto-injector for extra protection



REMDESIVIR use in COVID-19

REMDESIVIR

Inhibits viral RNA dependent RNA polymerase which inhibits SARS CoV-2 in vitro

- Use** for 5 days or until discharge for patients with supplemental O₂ with **NO** need for HFNC, NIV, IMV or ECMO
- EARLIER** the administration the greater benefit
 - Decreased LOS reduced recovery time by 4 days most effective in those receiving supplemental oxygen
 - Reduced disease progression
 - Decrease use of respiratory assist devices and ECMO



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Monoclonal Antibodies

SARS CoV-2 enters the system through ACE-2 receptors in lungs and GI tract

Initially used on compassionate basis w/regulatory approval

In **Low** antibody titer or later in disease course or both:

- Lack of survival benefit
- Does not stop disease progression or help stabilize symptoms

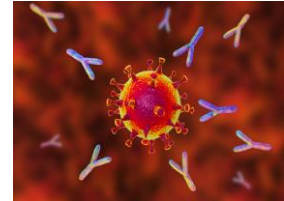
In **High** antibody titer/early w/ mild & mild to mod disease

- Slowed progression and better survival
- Decreased progression to hospital and death with IV route

Recommend for outpatients @ high risk of severe Covid-19

Challenges:

- Limited availability and delays in administration
- New Variants will render these ineffective
- Developing Sub Q, IM or inhalation and improving access will impact outpatient care



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Glutocorticoids

Dexamethasone

- RECOVERY TRIAL study showed a **GREATER mortality benefit** in patients with **SEVERE** illness with supplemental O₂ and IMV
- When used as a Standard of care
 - **LESS** beneficial in patients with supplemental O₂
 - **NO Benefit** with patients on Room Air
 - Immunosuppressive agents increase viral replication in early illness



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Medication Nebulization

- Inhalers vs aerosols
- Viral filters
- Mesh nebulizers separate meds from patient interface including circuits
- Proper hygiene and barrier precaution



Hypoxia/Hypoxemia

Hypoxia- reduced O₂ at the tissue level

- Anaerobic metabolism with Lactate production

Hypoxemia- Drop in the arterial pressure of O₂ below 80mmHg

Five causes of Hypoxemia

- Alveolar hypoventilation,
- RT to LT shunt
- Diffusion-perfusion abnormality
- Diffusion impairment
- Ventilation Perfusion mismatch

These result in SOB



“Silent” or “Happy” Hypoxemia

- * Well tolerated
- * Early stages on infection
- * No sensation of dyspnea, SOB or increased Work of Breathing

Non Vent Adults with Hypoxemic Respiratory Failure (HRF)



- Begin with Nasal Cannula
- High Flow Nasal Cannula (HFNC) preferred over NIPPV
- HFNC > ventilator free days than conventional O₂ or NIPPV
- 90 day mortality lower in HFNC than conventional O₂ and NIPPV
- HFNC reduced the rate of intubation and ICU mortality
- **HFNC and NIPPV use may avoid 20-25% of intubations decreasing use of critical resources during the pandemic**

Awake Prone Positioning –Non Intubated

- **TRIAL** of awake prone positioning in **Persistent** Hypoxemia despite O₂ and **NO** indication for Invasive Mechanical Ventilation(IMV):
- Awake patients that can adjust position and tolerate prone
- Acceptable in pregnant patients:
 - Lateral decubitus or fully prone
- **Contraindications:** patients in respiratory distress or require intubation and IMV, hemodynamically unstable, abdominal surgery and unstable spine
- Recommendation **AGAINST** prone positioning as **RESCUE** measure for refractory hypoxemia to avoid intubation

Invasive Mechanical Ventilation (IMV)

Previously intubated early

- When O₂ needs exceeded 5-6 lpm
- Fear of spreading the virus
- Closed ventilatory system



Early intubation placed a heavy burden on critical care resources

- Ventilator shortages

2020 studies from Italy and New York recognized a higher mortality with the intubated mechanically ventilated patient

Impact of Prolonged Mechanical Ventilation

- Delirium
- Hemodynamic instability
 - Secondary to decreased sympathetic drive and positive pressure ventilation
- Increased risk of infection
- Immobilization with increase risk of thromboembolism
- Neuromuscular paralysis
- Post ICU syndrome (PICS) physical and neurocognitive dysfunction



Patient Self Inflicted Lung Injury (P-SILI)

Patient Self-Inflicted Lung Injury (P-SILI) in the non-intubated patient with Acute HRF

- High Min. Ventilation, High RR, High Respiratory Drive
- Worsens any pre existing lung injury w/ increased vascular permeability with local and global lung over distension
- Compares to Ventilator-Induced Lung Injury (VILI) caused by high pleural and trans pulmonary pressure swings



Ventilation and Oxygenations in Mechanically Ventilated Adults

- Low Tidal Volume (4-8ml/kg of Predicted (Ideal) Body Weight)
- Targeted plateau pressures of <30 cm H₂O
- Conservative fluid strategy over liberal

Nitric Oxide: Inhaled Pulmonary Vasodilator

- **AGAINST** routine use
- **ONLY** if other options fail
- **NO** mortality benefit
- If no rapid improvement in oxygenation taper the treatment quickly



PEEP and Prone positioning in Mechanically Ventilated Adults with Moderate to Severe ARDS

PEEP **ONLY** based on oxygenation and lung compliance

Monitor for barotrauma and hypotension

Higher PEEP (>10 cm H₂O)

- Lower rates of ICU
- Mortality benefit



PRONE ventilation for 12-16 hrs/day over no prone
in COVID -19 and hypoxemia despite optimized ventilation

RESCUE Therapies in IMV, Severe Hypoxemia in COVID-19

Severe Hypoxemia despite optimal ventilation and other strategies

Use recruitment maneuvers , lung protective strategies

- Reduce mortality and improved oxygenation 24 hrs after the maneuver and decreased need for rescue therapy

IF decompensation occurs-DC

- Traditional PEEP strategies decrease mortality
- **AGAINST** incremental PEEP staircase



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Neuromuscular Blockade in COVID-19 IMV Adults w/Moderate to Severe ARDS

Neuromuscular Blocking Agents (NMBA)

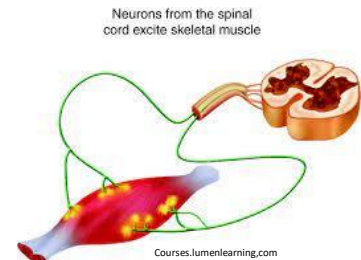
Intermittent boluses PRN or continuous

Continuous NMBA infusion 48 hours

- In patient ventilator desynchrony
- Ongoing deep sedation prone Ventilations
- Persistent high plateau pressures

Monitoring and controlling pain and anxiety

Succinylcholine can lead to hyperkalemia, malignant hypothermia, myalgia, increased gastric intraocular and cranial pressure, cardiac dysrhythmias, (bradycardia) and allergic reactions

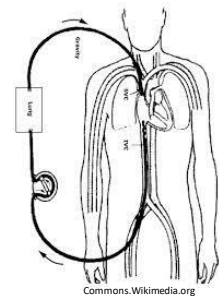


Extracorporeal Membrane Oxygenation (ECMO)

- Resource intense, nuanced and specialized
- Patient selection, maintenance and liberation
- Indications, Contraindications, Principles remain the same
- **Veno-Venous** most common for Respiratory Failure with better outcomes
- High Thrombus threat in COVID-19 - PTT values of **1.5-2.5** times normal

Extracorporeal Life Support Organization

- 40% 90 day mortality rate in 1000 carefully selected patients

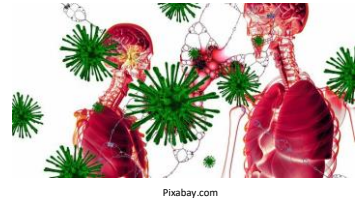


VENO-VENOUS

Impact on Chronic Lung Disease Patients in COVID-19

ASTHMA in normal times

- Anxiety & Depression
- Mood disorders greater in PWA leads to poor control medication adherence and health outcomes
- Lack of Social support

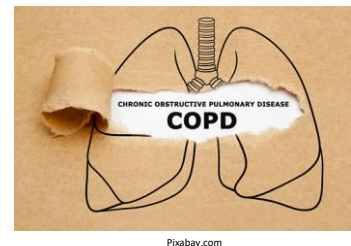


COPD In normal times:

- PTSD, anxiety
- Fear, depression suicidal ideation
- 40% depressive symptoms
- 36% anxiety symptoms

IMPACT on COPD Patients in COVID-19

- Pandemic may exacerbate worry and symptoms
- Financial stressors bad news, unemployment demoralizing and discouraging
- Social isolation lockdowns feeling trapped hopeless and suicidal ideation
- Bereavement over the loss of loved ones
- Adopt excessive drinking, substance misuse, smoking
- **Important to use Psychological screening tools
- **Depression Anxiety Stress Scale



BioPsychoSocial IMPACT in Older Adults

“The boundaries between health and disease, between well and sick are far from clear and never will be clear for they are diffused by cultural, social and psychological considerations

-George Engel,1977



Biological IMPACT

- Multi organ dysfunction in active and post infection
- **NEW** physical disability and health deterioration in COVID-19 survivors

Respiratory Manifestation

- ARDS

Neurological

- New disorder
- Or underlying condition



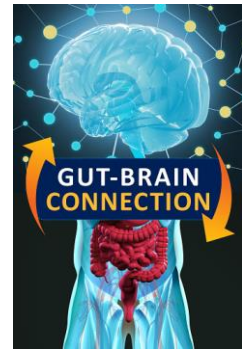
****Cytokine Storm and systemic inflammation responsible****

Molecular Mechanism IMPACT

Virus infected myeloid and lymphoid cells cause neuroinflammation that lingers beyond acute infection leading to neuropsychiatric disorders

Pharmacotherapy

- Immunomodulating corticosteroids
 - Disturbed sleep and cognition
- Gut-Brain Access
 - Alter the microbiome of the gut and brain resulting in psychiatric symptoms

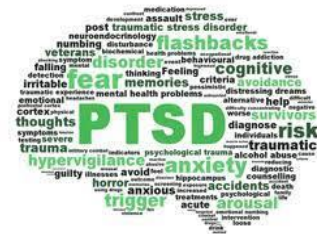


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Psychosocial IMPACT



Psychological IMPACT



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Post Intensive Care Syndrome (PICS)

- PTSD in 30% of ICU admission for ARDS
 - High rates of suicide related deaths
 - Thwarted belongingness and perceived burdensomeness
 - Isolated from family and reliant on care
 - Fear of illness, family member burden and disconnection from social contacts
- ***One study showed a heightened resiliency in those over 60 yrs in those who had strong interpersonal connections***

Social IMPACT

2017 Surgeon General call loneliness a “Global Pandemic” world wide

2018 The UK Appointed a Minister of Loneliness Tracy Crouch
First globally to publish a loneliness reduction strategy
and stated loneliness to be “the greatest public health threat of our time”

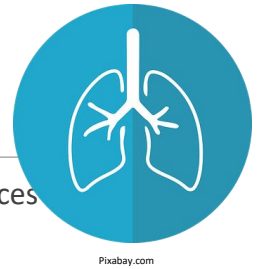
Social Isolation increased risk of:

- Heart disease
- Anxiety
- Depression
- Cognitive impairments
- Alzheimers
- Death



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LONG COVID-Post COVID



Symptoms: **Fatigue**, anxiety, myalgia, low mood and sleep disturbances

Risk: No relationship between the severity of the illness and risk of developing Long COVID

Findings: Absence of classic respiratory symptoms

- Biopsychosocial effects contribute to long lasting physical and mental symptoms
 - Patients with no previous disability are deficient in physical performance
- **Prioritization of rehab and psych support and NOT diagnostics and respiratory services**

Mental Health Impacts on Patient, Family and Healthcare Workers in COVID-19

Admission to the ICU is traumatic for the patient and family

Family involvement in normal circumstances is encouraged and has a positive effect

Families unable to be physically and emotionally there for their loved one

Patients will to live is diminished

WHO speculates this isolation will increase loneliness, harmful alcohol use and drug use, self harm and suicidal behavior

Healthcare workers continuously worked in stressful, fearful, resource depleted environments, along with the constant threat of exposure to the virus

Lack of mental health professionals, counselors and programs present an ongoing challenge

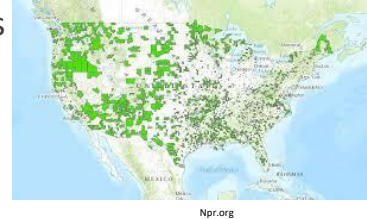
Socio-Economic IMPACT

Income/Job insecurity as a result of decreased global trade

Decreased financial security and reduced earnings

Some forced to retire early:

- Unsafe in workplace
- Unable to telework
- Ageism



BEFORE pandemic older adults suffered from food insecurity
income based and accessibility barriers

Pandemic created market shortages

Food deserts in rural areas

LONG COVID-Post COVID

UC Davis Post COVID 19 Clinic - Dr. Christian Sandrock

Common symptoms Sleep Disturbances, **Fatigue**, Lethargy

Treatment focused on better living and high quality of life

- Sleep through stress reduction, Meditation and Yoga

Adjust expectations:

- Difficult to progress a few steps forward and then steps back
- Fluctuating recoveries, Waxing and waning symptoms
- Requires patience
- NIH announced grants as part of it's Post Acute Sequelae of SARS-CoV-2 Infection (PASC)



LONG COVID-Post COVID



A retrospective cohort study reviewed 273,618 Covid -19 survivors

Symptoms: breathlessness, **fatigue**, chest throat pain , headache, abdominal symptoms myalgia, cognitive and anxiety depression

Findings: 1 in 3 had 1 or more features of Long COVID Between 3-6 months after diagnosis

2 in 5 patient recorded Long COVID symptoms in 3-6 month period but none in 1-3 month

Risk: Higher in patients with severe illness, females and young people
White and Non White equally affected

Chronic Fatigue in Post COVID-19

- A very large number of viruses can trigger ME/CFS
- Chronic Fatigue Syndrome or ME/CFS
- 17 – 24 million people worldwide
- United States est. 2.5 million
- All ages and races
- More common in women than men
- The Institute of Medicine reports that patients with ME/CFS are more functionally impaired than people with rheumatoid arthritis, diabetes, and hypertension
- Democratic Rep. Jamie Raskin of Maryland is co-sponsoring a bill, [HR 7057](#), the "Understanding Covid-19 Subsets and ME/CFS Act."



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Healthcare Workers and Post COVID

A study of persistent post COVID symptoms in HCW

- Covid-19 greater lethality in Males
- Females more to suffer from long term COVID
- After 4 months of the peak wave 45% had symptoms persisting and 32% indicated difficulty coping
- 39% Moderate to severe fatigue

Universal symptoms

- Mild to moderate SOB
- Anxiety
- Sleep disturbances

ONLY 16% consulted GP only 2% taking sick leave after initial recovery

Even with acknowledgement of severity and struggle to cope



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As of March 23, 2023

Globally

- 761 M Cases
- 6.8 M Deaths

United States

- 103 M cases
- 1.1 M Deaths

It's been tough...



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Healthcare workers were praised...



Healthcare workers weighed in...



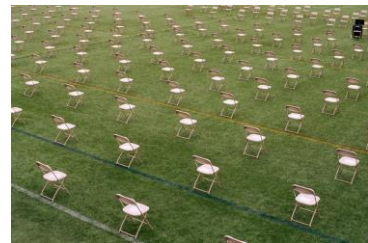
Things got political... :o(



HAND WASHING/ SANATIZING



MASKING

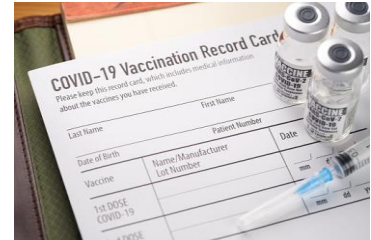


SOCIAL DISTANCING





VACCINES/BOOSTERS





[Long COVID SOS](#)

[Patient-Led Research Collaborative](#)

[HR 7057](#)

www.nih.gov

www.hopkinsmedicine.org

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www.fda.gov

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