# STUDY OF COVID RISK ESTIMATION

Akansha Chokse[1], Nikhil Patearia[2]

MTech.Scholar[1], Prof. [3]

Department of Computer Science Engineering[1,2,]

Jai Narain College of Technology, Bhopal, India

### *Abstract*

The COVID-19 pandemic, also known as the called the Covid pandemic, is a continuous worldwide pandemic of Covid sickness 2019 (COVID-19), which is brought about by extreme intense respiratory condition Covid 2 (SARS-CoV-2). The infection was first distinguished in December 2019 in Wuhan, China. The World Health Organization pronounced a Public Health Emergency of International Concern on 30 January 2020 and later announced a pandemic on 11 March 2020. Starting on 23 June 2021, in excess of 179 million cases have been affirmed, with more than 3.88 million affirmed passing ascribed to COVID-19, making it probably the deadliest pandemic ever.

The proposed system includes a set of algorithms for pre-processing the data to extract new features, handling missing values, eliminating redundant and useless data elements, and selecting the most informative features. After pre-processing the data, we use machine learning algorithms to develop a predictive model to classify the data, predict the medical condition, and calculate the probability and risk of mortality..

Keywords - *Handling missing values, Eliminating redundant useless, Data elements, Machine learning algorithms, Predict the medical condition*

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## I INTRODUCTION

The flow flare-up of the novel Covid SARSCoV-2 (Covid infection 2019; already 2019- nCoV), epi-focused in Hubei Province of the People's. The Republic of China has spread to numerous different nations. On 30. January 2020, the WHO Emergency Committee proclaimed a worldwide wellbeing crisis dependent on developing case notice rates in Chinese and global areas. The case discovery rate is changing every day and can be followed in practically ongoing on the site given by Johns Hopkins University [1] and different gatherings. As of the middle of February 2020, China bears the enormous weight of bleakness and mortality, though the occurrence in other Asian nations, in Europe and North America, remains low up until this point. Coronaviruses are a group of related RNA viruses that cause diseases in mammals and birds. In humans and birds, they cause respiratory tract infections that can range from mild to lethal. Mild illnesses in humans include some cases of the common cold (which is also caused by other viruses, predominantly rhinoviruses), while more lethal varieties can cause SARS, MERS, and COVID-19. In cows and pigs they cause diarrhea, while in mice they cause hepatitis and encephalomyelitis. Covids are wrapped, positive single-abandoned enormous RNA infections that taint people, yet additionally a wide scope of creatures. Covids were first portrayed in 1966 by Tyrell and Bynoe, who developed the infections from patients with basic colds [2] The Pandemic has a long history; however, the actual term is yet to be characterized by numerous clinical writings. There have been various critical pandemics recorded in mankind's set of experiences where pandemic-related emergencies contrarily affect wellbeing, economies, and surprisingly public safety around the world.

## II IMPACT OF COVID ON DIFFERENT SECTOR

**COVID and the construction sector**

The COVID-19 pandemic essentially affects the development area, which is touchy to monetary cycles. However, on the potential gain, development holds a lot of potential to animate recuperation, because of its capability to make occupations; and thus, recuperation measures can uphold the area's change towards maintainability and digitalization. Three-sided collaboration and social exchange, along with global work norms, are vital to advance a human-focused recuperation of the development area from the emergency.

**Coronavirus and Urban Passenger Transport Services**

This approach brief tries to sum up the issues identifying with COVID-19 and metropolitan traveler transport laborers. The brief talks about the mains effects of the pandemic in the area. It additionally remembers data for the three sided and sectoral measures that businesses, laborers and governments have taken to help the area and its laborers, and on the ILO's standards and instruments, including global work guidelines.

**Hand cleanliness at the work environment**

Work environments, especially those that utilize transient specialists and those in the casual economy, have become the overwhelming focus in the regulation of the COVID-19 infection. Since the ILO Centenary

Declaration for the Future of Work, embraced by the 108th Session of the International Labor Conference (Geneva, 2019), underscores that protected and solid working conditions are major to fair work, we devote this arrangement brief to hand cleanliness in work environments.

The principal message is that all laborers should have the offices to wash their hands securely and sufficiently grinding away to forestall or diminish the spread of COVID-19.

**Coronavirus and the media and culture area**

This concise feature the effect of COVID-19 on the media and culture area, hit hard by joblessness and shut creations. It investigations how the area's variety as far as agreement types and occupations makes difficulties in getting to social security, wellbeing and wellbeing, and financial alleviation programs. The brief additionally offers strategy choices, drawing from nations' models and drives from laborers' and businesses' associations, to relieve the monetary effect of the pandemic on the area.

**Coronavirus and the woodland area**

The COVID-19 pandemic is influencing general wellbeing and making remarkable disturbances economies and work markets, including for laborers and ventures in the woods area. It has exacerbated existing difficulties, with numerous undertakings and laborers enduring as a fallout. Accordingly, governments, managers' and laborers' associations, and other ranger service partners all throughout the planet, are working together to moderate the effect of the pandemic with the end goal of ensuring organizations and vocations, including through friendly discourse and the advancement of global work norms.

**Coronavirus and the Public Service**

Other than wellbeing and training laborers, all community workers assume a part in ending the spread and recuperating from the pandemic. This is genuine paying little mind to their occupation: regardless of whether in the organization of the state like duty authorities, police or prison guards; carrying out financial and social approaches like work controllers; offering types of assistance to the local area like waste gatherers; or supporting necessary government backed retirement frameworks like social specialists.

As caretakers of public merchandise, local officials are essential conductors for the recuperation. The COVID-19 pandemic shows the critical significance of catastrophe readiness and that private-area accomplices can't oversee alone the extent of mediations required at this point.

**Coronavirus and street transport**

The street transport area is vital for social and financial turn of events and ensures versatility across purviews and nations. Be that as it may, to control the spread of COVID-19, numerous nations all throughout the planet have set limitations on homegrown travel or potentially shut down line intersections for street cargo transport administrations. Pressing activity by governments, the social accomplices and gatherings to street transport production network parties – including transporters, recipients, transport purchasers and go-betweens – will be basic in addressing respectable work difficulties for these vital laborers to handle the emergency adequately.

**Coronavirus and Public Emergency Services**

This arrangement brief tends to issues identifying with public area laborers who perform cutting edge obligations in standing up to the COVID-19 emergency for the sake of the State, frequently portrayed in resolutions as fundamental administrations. The brief examines their job in managing the emergency, the actions that legislatures have taken to help their work and the ILO standards and devices, including global work guidelines, that secure them.

**Coronavirus and the auto business**

The auto business has been hit by a triple whammy: manufacturing plant terminations, store network interruption, and a breakdown popular. Without a moment to spare assembling measures have engendered the effect across the globe. Little and medium undertakings are among those hardest hits and a large number of occupations are in danger.

Automakers are critical to launching the worldwide economy. Not just by delivering life-saving ventilators and facemasks. Maintainable modern arrangements and focused on help and are critical to an enduring recuperation – to working back better – with respectable work for additional ladies and men.

**Coronavirus and food retail**

Food retail laborers have arisen as another class of forefront administrations during this pandemic. While fundamental to ensuring food security, they are themselves at high danger of openness to disease and assume a critical part in sanitation. To guarantee sufficient quantities of food laborers, they need admittance to and preparing on close to home defensive hardware and cleanliness conventions, just as working conditions that give satisfactory wages and admittance to social insurance, including paid wiped out leave.

**Coronavirus and the materials, dress, cowhide and footwear businesses**

The suitability of the materials, dress, calfskin and footwear enterprises is unwinding, as laborers are advised to remain at home, manufacturing plants close, and worldwide stock chains come to a standstill. The wiping out of requests has hit a large number of firms and a great many specialists especially hard. We direly need fortitude and joint activity across the ventures' stock chains. The ILO is focused on supporting governments in securing

the wellbeing and financial prosperity of laborers and organizations in the materials, dress, cowhide and footwear businesses.

**Coronavirus and common aeronautics**

To control the spread of COVID-19, a blend of flight abrogations and limitations have primarily ended global travel. The effect of the pandemic on work has been quick and critical. Cost-decrease procedures may incorporate a wide scope of strategies that will affect business and fair work in the common flying area. The ILO has gathered insight from past emergency circumstances to assist the area with recuperating this stun.

**Coronavirus and the wellbeing area**

The COVID-19 emergency is causing to notice the all-around overburdened general wellbeing frameworks in numerous nations, and to the difficulties looked in enrolling, conveying, holding and ensuring adequate very much prepared, upheld and roused wellbeing laborers. It features the solid requirement for supportable interest in wellbeing frameworks, remembering for the wellbeing labor force, and for nice working conditions, preparing and gear, particularly according to individual defensive hardware and word related security. Social discourse is crucial for building tough wellbeing frameworks, and thusly has a basic job both in emergency reaction and in building a future that is ready for wellbeing crises.

**Coronavirus and the schooling area**

Educators have needed to adjust to a universe of practically general distance training as almost 94% of all students have confronted school terminations. Most educators and their associations have accepted this test, albeit in many non-industrial nation's instructors come up short on the abilities and gear to give distance training viably. As governments consider resuming school as control measures are loose, the wellbeing of students and educators ought to be principal, and social separating of students, admittance to individual defensive hardware, and normal infection testing will be critical.

**Coronavirus and oceanic transportation and fishing**

Delivery conveys most world exchange, and fishing gives fundamental food. The pandemic effects the wellbeing and prosperity of sailors and fishers, their capacity to join their vessels and get back, and the fate of their positions. Sailors on voyage ships, which have frequently banished from entering port, are especially hard hit. The ILO is attempting to ensure these key oceanic laborers as the world looks to secure general wellbeing.

**Coronavirus and the travel industry area**

The travel industry is a significant driver of occupations and development. However, COVID-19 has significantly changed this. The effect on the travel industry undertakings and laborers, the greater part being young ladies, is extraordinary. Ideal, enormous scope and, specifically, planned approach endeavors both at global and public levels are required in discussion with governments, managers' and laborers' agents, contemplating important ILO worldwide work guidelines.

**Coronavirus and agribusiness and food security**

While attempting to take care of the world, numerous horticultural laborers can't lift themselves out of neediness and food weakness. As the pandemic spreads, the kept working of food supply chains is critical in forestalling a food emergency and diminishing the adverse consequence on the worldwide economy. Facilitated strategy reactions are expected to help agribusiness and the occupations and working states of millions of agrarian specialists in accordance with pertinent global work principles.

### III APPLICATION OF ARTIFICIAL INTELLIGENCE IN COVID-19 DISEASE MANAGEMENT

The exceptional speed of endeavors to address the COVID-19 pandemic circumstance is utilized by large information and man-made reasoning (AI). Different branches of AI have been utilized in a few infection flare-ups prior. Man-made intelligence can assume a crucial part in the battle against COVID-19.

Man-made intelligence is as a rule effectively utilized in the recognizable proof of illness bunches, checking of cases, the expectation of future episodes, mortality hazard, finding of COVID-19, sickness the executives by asset portion, working with preparing, record upkeep, and example acknowledgment for contemplating the infection pattern. A few uses of AI that are collecting a ton of interest and bringing trusts up in the battle against COVID-19 are as per the following:

**AI in prediction & tracking**

Computer-based intelligence can be tackled for gauging the spread of infection and growing early admonition frameworks by removing data from web-based media stages, calls, and news locales and give valuable data about the weak areas, and for foreseeing of dismalness and mortality. Bluedot distinguished a group of pneumonia cases and anticipated the flare-up and geological area of the COVID-19 flare-up dependent on accessible information utilizing AI. HealthMap gathers the openly accessible information on COVID-19 and makes it promptly accessible to work with the successful following of its spread. As of late, the part of AI in the recognizable proof and estimating of COVID-19 episodes by utilizing multitudinal and multimodal information was underscored [27].

**AI in contact tracing**

Man-made intelligence can increase portable heath applications where savvy gadgets like watches, cell phones, cameras, and the scope of the wearable gadget can be utilized for analysis, contact following, and proficient checking in COVID-19 [28]. Applications like AI4COVID-19 that depend on sound account tests of 2 shack can be utilized in telemedicine [29].

Computer-based intelligence in the observing of COVID-19 cases

Man-made intelligence methods are applied for observing patients in clinical settings and foreseeing the course of treatment. In view of the information got from essential measurements and clinical boundaries, AI may give basic data to asset assignment and dynamic by focusing on the requirement for ventilators and respiratory backings in the Intensive Care Unit [30]. Artificial intelligence can likewise be utilized for foreseeing the odds of recuperation or mortality in COVID-19 and to give every day updates, stockpiling, and pattern investigation, and diagramming the course of treatment.

### AI in early diagnosis

Artificial intelligence was utilized for the recognition and measurement of COVID-19 cases from chest x-beam and CT check pictures [31–33]. Specialists have fostered a profound learning model called COVID-19 discovery neural organization (COVNet), for separating between COVID-19 and local area procured pneumonia dependent on visual 2D and 3D highlights extricated from volumetric chest CT examine [34]. Singh et al. fostered a novel profound learning model utilizing Multi-Objective Differential Evolution and convolutional neural organizations for COVID-19 analysis utilizing a chest CT filter [35]. Coronavirus ResNet created utilizing programmed and discriminative learning rate and reformist picture resizing performed better compared to COVID-Net in diagnosing COVID-19 [36]. Alom et al. fostered a framework called COVID_MTNet by applying improved Inception Recurrent Residual Neural Network and NABLA-3 organization models for location and confinement of areas of interest from both x-beam pictures and chest CT check [37]. Another investigation utilized AI-based classifiers for anticipating the result of RT-PCR consequences of COVID-19 cases utilizing 16 straightforward boundaries got from complete blood profiles [38]. This may discover application in diminishing the quantity of RT-PCR tests in asset helpless settings.

### AI in reducing the burden from medical practitioners & healthcare staff

Computer based intelligence-based emergency frameworks can help in decreasing the work weight of clinical staff and medical services laborers via robotizing a few cycles like granting preparation to experts, assurance of the method of therapy and care by breaking down clinical information utilizing design acknowledgment draws near, digitalization of patient's reports, and furthermore by offering arrangements that limit their contact with the patients [39–41]. Simulated intelligence can be utilized for the order of patient's dependent on the seriousness of indications, hereditary demeanor, and clinical reports in various classes like gentle, moderate, and extreme so various methodologies can be embraced for taking care of the patients in the best way. Computer-based intelligence in telemedicine can likewise be utilized to take out the need of incessant and pointless medical clinic visits by inaccessible checking of cases and recording of patient's information in asymptomatic cases or patients with gentle manifestations. Man-made intelligence-based clinical chatbots can likewise be utilized for interviews, along these lines decreasing the actual swarming of clinics just as the spread of contamination and consequently forestall burdening of effective activity of basic consideration administrations [42,43]. Chatbots like Clara from the Center for Disease Control and Zini are offering genuinely necessary help to patients in far-off settings [44]. A prognostic expectation calculation anticipated the mortality hazard of patients by AI techniques utilizing extricated highlights got from the information of different patients as preparing datasets [45]. A comparable methodology was utilized to foresee the chance of creating intense respiratory trouble conditions [46]. Administration robots and human robots with AI centers can be utilized for the conveyance of fundamental administrations and routine assignments like cleaning, sanitizing, and observing in emergency clinic settings [47,48].

### AI in protein structure prediction

Computer-based intelligence can help in anticipating the design of significant proteins pivotal for infection passage and replication and give valuable knowledge that can clear routes for drug improvement in an exceptionally brief time frame. AlphaFold calculation of Google Deep psyche utilized profound lingering organizations (DRN) called ResNets for anticipating protein constructions of film protein, protein 3a, nsp2, nsp4, nsp6, and papain-like C-terminal space of SARS-CoV-2, which will give immense catalyst to tranquilize disclosure programs [49]. DeepTracer, a program dependent on a redid profound convolutional neural organization, was utilized to infer the protein complex construction of SARS-CoV-2 from high-goal cryoelectron microscopy thickness guides and amino corrosive succession [50].

### AI in development of therapeutics

Computer-based intelligence strategies can lift and supplement customary advancements by diminishing the time needed in carrying medication from seat to bed by accelerating lead disclosure, virtual screening, and approval measures by an immense edge. Man-made intelligence can likewise speed up the speed by inferring valuable information for drug repurposing or drug repositioning by screening properties of effectively endorsed and approved medications dependent on atomic descriptors and properties, which may not be feasible for a

human master. BenevolentAI utilized AI techniques to speed up its medication revelation program and recognized baricitinib as an expected medication against COVID-19 [51,52]. Insilico Medicine has recognized a few little particles against COVID-19 utilizing AI [53]. Another examination joined virtual screening and managed to figure out how to recognize expected medications against COVID-19 [54]. Zhou et al. received an integrative organization-based framework pharmacological philosophy for discovering likely medications for SARS-CoV-2 from the all-around existing collection of medication atoms and medication mixes [53]. A few other AI-based undertakings including inclProject IDentif.AI (recognizing irresistible sickness mix treatment with computerized reasoning) [55] and PolypharmDB [56] have been effective in distinguishing competitors against COVID-19. Many AI approaches and profound learning-based applications are additionally being utilized for facilitating the medication disclosure measure [57–60].

**AI in development of vaccines**
At no other time has humanity seen such a race for the improvement of an antibody against a microorganism. The speed of the revelation can be sped up complex by saddling the force of AI. Ong et al. anticipated conceivable immunization possibility for COVID-19 utilizing the Vaxign invert vaccinology-AI stage that depended on administered characterization models [61].

AI in curbing the spread of misinformation
Because of the torrential slide of data, this pandemic has transformed into an infodemic. Getting information, mindfulness, and practices toward COVID-19 by tapping data from web-based media stages like Twitter, Facebook, and so on can help in formulating the system to gather and disperse opportune and right data for alleviating the effect of COVID-19 [62,63]. AI procedures can be utilized to distinguish patterns and slant examination and give data with respect to the beginning of bogus data and help in abridging bits of hearsay and deception [64]. Simulated intelligence methods can additionally be utilized for introducing an unmistakable image of recuperation rates, openness, and accessibility to medical services, and recognizable proof of the holes. Man-made intelligence can give the most recent updates about the arising proof in determination, treatment, the range of manifestations, and restorative results in this profoundly unique circumstance, which will help clinicians in genuine situations and help the general population in beating apprehension and frenzy [65].

**Artificial intelligence in genomics**
Randhawa et al. concocted a strategy for quick and precise order of accessible SARS-CoV-2 genomes by applying AI on recognized genomic marks [51]. Wang et al. utilized a philosophy-based result forecast structure and Artificial Neural Network to assess the symptoms of Traditional Chinese Medicines for the treatment of SARS-CoV-2.

## IV CONCLUSION

*The traded instances of 2019 novel (COVID-19) contamination that were affirmed outside China give a chance to gauge the combined occurrence and affirmed case casualty hazard (cCFR) in terrain China.* Information on the cCFR is basic to portray the seriousness what's more, comprehend the pandemic capability of COVID-19 in the beginning phase of the scourge. Utilizing the remarkable development pace of the occurrence, the current examination genuinely assessed the cCFR and the fundamental proliferation number—the normal number of auxiliary cases created by a solitary essential case in a gullible populace. We demonstrated scourge development either from a solitary file case with sickness beginning on 8 December 2019 (Scenario 1), or utilizing the development rate fitted alongside different boundaries (Situation 2) in view of information from 20 sent out cases announced by 24 January 2020. The total frequency in China by 24 January was assessed at 6924 cases (95% certainty stretch [CI]: 4885, 9211) and 19,289 cases (95% CI: 10,901, 30,158), individually. The most recent assessed upsides of the cCFR were 5.3% (95% CI: 3.5%, 7.5%) for Scenario 1 and 8.4% (95% CI: 5.3%, 12.3%) for Scenario 2. The essential multiplication number was assessed to be 2.1 (95% CI: 2.0, 2.2) and 3.2 (95% CI: 2.7, 3.7) for Scenarios 1 and 2, separately. In view of these outcomes, we contended that the current COVID-19 scourge has a considerable potential for causing a pandemic. The proposed approach gives bits of knowledge in early danger appraisal utilizing openly accessible information.

### References

1. Coronavirus 2019-nCoV, CSSE. Coronavirus 2019-nCoV Global Cases by Johns Hopkins CSSE .https://gisanddata.maps.arcgis.com/apps/opsdashboard/index. html#/bda7594740fd40299423467b48e9ecf6)
2. Tyrrell DA, Bynoe ML. Cultivation of viruses from a high proportion of patients with colds. Lancet 1966: 1: 76–77.
3. Qiu, W., et al. "The pandemic and its impacts." Health, culture and society 9 (2017): 1-11.
4. CoopersmithCM,AntonelliM,BauerSR,DeutschmanCS,EvansLE,FerrerR,HellmanJ,JogS,KeseciogluJ, KissoonN,Martin-LoechesI,NunnallyME,PrescottHC,RhodesA,TalmorD,TissieresP,De Backer D, The

Surviving Sepsis Campaign: Research Priorities for Coronavirus Disease 2019 in Critical Illness. Critical care medicine. 2021 Apr 1     [PubMed PMID: 33591008]

5.  Huang C,WangY,LiX,RenL,ZhaoJ,HuY,ZhangL,FanG,XuJ,GuX,ChengZ,YuT,XiaJ,WeiY,WuW,XieX,YinW, LiH,LiuM,XiaoY,GaoH,GuoL,XieJ,WangG,JiangR,GaoZ,JinQ,WangJ,Cao B, Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet (London, England). 2020 Feb 15;     [PubMed PMID: 31986264]

6.  Liu H,WeiP,ZhangQ,ChenZ,AviszusK,DowningW,PetersonS,ReynosoL,DowneyGP,FrankelSK,KapplerJ, MarrackP,Zhang G, 501Y.V2 and 501Y.V3 variants of SARS-CoV-2 lose binding to Bamlanivimab {i}in vitro{/i}. bioRxiv : the preprint server for biology. 2021 Feb 16     [PubMed PMID: 33619479]

7.  HuaA,O'GallagherK,SadoD,Byrne J, Life-threatening cardiac tamponade complicating myo-pericarditis in COVID-19. European heart journal. 2020 Jun 7     [PubMed PMID: 32227076]

8.  GuoT,FanY,ChenM,WuX,ZhangL,HeT,WangH,WanJ,WangX,Lu Z, Cardiovascular Implications of Fatal Outcomes of Patients With Coronavirus Disease 2019 (COVID-19). JAMA cardiology. 2020 Jul 1     [PubMed PMID: 32219356]

9.  Libby P,LoscalzoJ,RidkerPM,FarkouhME,HsuePY,FusterV,HasanAA,Amar S, Inflammation, Immunity, and Infection in Atherothrombosis: JACC Review ANALYSIS OF MACHINE LEARNING BASED COVID RISK ESTIMATION of the Week. Journal of the American College of Cardiology. 2018 Oct 23    [PubMed PMID: 30336831]

10. Abou-Ismail MY,DiamondA,KapoorS,ArafahY,Nayak L, The hypercoagulable state in COVID-19: Incidence, pathophysiology, and management. Thrombosis research. 2020 Oct     [PubMed PMID: 32788101]

11. AmgalanA,Othman M, Exploring possible mechanisms for COVID-19 induced thrombocytopenia: Unanswered questions. Journal of thrombosis and haemostasis : JTH. 2020 Jun     [PubMed PMID: 32278338]

12. Ni W,YangX,YangD,BaoJ,LiR,XiaoY,HouC,WangH,LiuJ,YangD,XuY,CaoZ,Gao Z, Role of angiotensin-converting enzyme 2 (ACE2) in COVID-19. Critical care (London, England). 2020 Jul 13     [PubMed PMID: 32660650]

13. ZubairAS,McAlpineLS,GardinT,FarhadianS,KuruvillaDE,Spudich S, Neuropathogenesis and Neurologic Manifestations of the Coronaviruses in the Age of Coronavirus Disease 2019: A Review. JAMA neurology. 2020 Aug 1     [PubMed PMID: 32469387]

14. Patel KP,PatelPA,VunnamRR,HewlettAT,JainR,JingR,Vunnam SR, Gastrointestinal, hepatobiliary, and pancreatic manifestations of COVID-19. Journal of clinical virology : the official publication of the Pan American Society for Clinical Virology. 2020 Jul     [PubMed PMID: 32388469]

15. 1] GabarreP,DumasG,DupontT,DarmonM,AzoulayE,Zafrani L, Acute kidney injury in critically ill patients with COVID-19. Intensive care medicine. 2020 Jul     [PubMed PMID: 32533197]

16. BorczukAC,SalvatoreSP,SeshanSV,PatelSS,BusselJB,MostykaM,ElsoukkaryS,HeB,DelVecchioC,Fort arezzaF,PezzutoF,NavalesiP,CrisantiA,FowkesME,BryceCH,CalabreseF,Beasley MB, COVID-19 pulmonary