



Causes of death in COVID-19 patients: A literature review

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ABSTRACT

Currently, we are facing a very dangerous outburst of the epidemic all over the world called COVID-19, i.e. Coronavirus disease-2019 which were found in Wuhan city of China in December 2019. It is becoming pandemic throughout the world day by day, hence knowing the different causes of death in COVID-19 patient. Since the outbreak of COVID-19 in china, in which most of the deaths occurs due to severe acute respiratory syndrome (SARS-CO-2-2019), there is progress in the total number of positive cases and corresponding deaths occur worldwide. The main cause of death is respiratory distress and failure; other complications include multiple organ failure, kidney injury, sepsis and also include providence of other medical resources to COVID-19 patient. To know the causes of death in COVID-19 patient. Various research articles were studied from various websites related to causes of death in COVID19. Many literatures were studied, such as *Morbidity and Mortality Weekly Report*, *European Heart Journal*, etc. The literature of causes of death in COVID-19 patient explores the idea regarding deaths- like respiratory distress, sepsis, and related kidney disorder, underlying diseases such as hypertensive disorders, diabetic conditions, shock, and multiple organ failure, etc. patients who are not able to survive in this pandemic even not after hospitalization are likely to be older by age, some patients have some secondary underlying diseases in the body or elevated D-dimer. Some peoples do not have sufficient ventilation, which also one of the causes of death of the patients due to novel COVID-19.

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INTRODUCTION

Since first cases of coronavirus disease caused by SARS-Co-2 found in Wuhan city of China on 31st Dec

2019. Evident that there is an increase in the numbers of positive infectious cases and associated deaths worldwide. Nearly more than 100,000 people all over the world died because of COVID-19 or nCoV. (Novel coronavirus) (Phua *et al.*, 2020; Parwe *et al.*, 2020).

Most of these deaths, which occur due to COVID-19 and the positive infectious cases, have occurred in seven European countries and one Asian country among the ten most affected countries. The United States of America replaces China, where the actual outbreak occurs, currently a top country of confirming positive cases and deaths due to coronavirus disease. France, Spain and the United States, New York City, Germany, Iran, Switzerland, Turkey are the top countries where most confirmed cases are

found. While COVID-19 becomes a pandemic across the globe, it is important to understand the transmission and the effect of the virus, which has made it a pandemic. COVID-19 belongs to the coronavirus family, which also include the SARS virus and MERS. The family of coronavirus includes virus strained that cause the common cold and flu ([Anker et al., 2020](#)).

According to sources, it is found that most diseases are caused by the failure of the respiratory system. Today, for which patients needed supportive invasive mechanical ventilation for lungs recovery. If the health condition of the patient gets worse, then the extracorporeal life support (ECLS) technique is provided for several weeks. Corona positive patient get complexes with sepsis and some underlying diseases, but the actual cause of death and disease is not known yet. Even the role of secondary bacterial infection is also not well described. Mainly, organ failure is the real contributor to the death of the patient: its type and severity, which includes respiratory failure, cardiovascular failure, and the patient died with respiratory distress syndrome, shock, kidney failure/injury or multiple organ failure. Other factors included in the actual process of death are limitations at the level of hospitals and life support systems, e.g. lack of facilities, bed, personnel or equipment, and the other naturally contributing factors like age, comorbidities (underlying diseases) or environmental factors ([Wang et al., 2020](#)).

RESULTS

Causes of death due to underlying health conditions in COVID-19 patient (Figure 1).

Statistical data shows that nearly about 10.5% of deaths occur due to cardiovascular diseases. The second major cause of death in diabetic patients is about 7.3%, followed by chronic respiratory diseases, about 6.3%. Hypertension plays an individual role in causing death due to COVID, which is barely 6% of total and cancer is about 5.6% responsible for death due to COVID-19, and very few, i.e. 0.9% of death occurs with having any underlying health condition.

Statistical data shows that the rate of hospitalization, ICU admissions, and Deaths are more in elderly aged person > 65 of age. Death of a patient due to age factor and availability of hospitals and life sustaining medical resources (Figure 2).

DISCUSSION

Early symptoms include

1. High grade temperature
2. dry cough
3. fatigue

Other symptoms include

1. body Aches and pains
2. pharyngitis
3. loose stool
4. red eye with inflammation
5. Anorexia
6. Skin rashes

Serious symptoms include

1. Shortness of breath
2. Chest Pain and pressure
3. Unable to speak and for movement
4. New confusion
5. Bluish lips or face

The virus creates pneumonia like condition, which further leads to respiratory failure, septic shock occurs if having any sepsis and death, difficulty in breathing. Suppose one gets exposed to the infected person, their symptoms of COVID-19 started showing just within 2 days or up to 12 days. Duration varies from person to person, depending on one's immunity. On the basis of information gathered from researches done in China over the coronavirus, these are the common symptoms found in people who get hospitalised due to coronavirus ([James, 2020](#)).

1. Fever 99%
2. Fatigue 70%
3. Dry cough 59%
4. Loss of appetite 40%
5. Body aches 35%
6. Shortness of breath 31%
7. Mucus of phlegm 27%

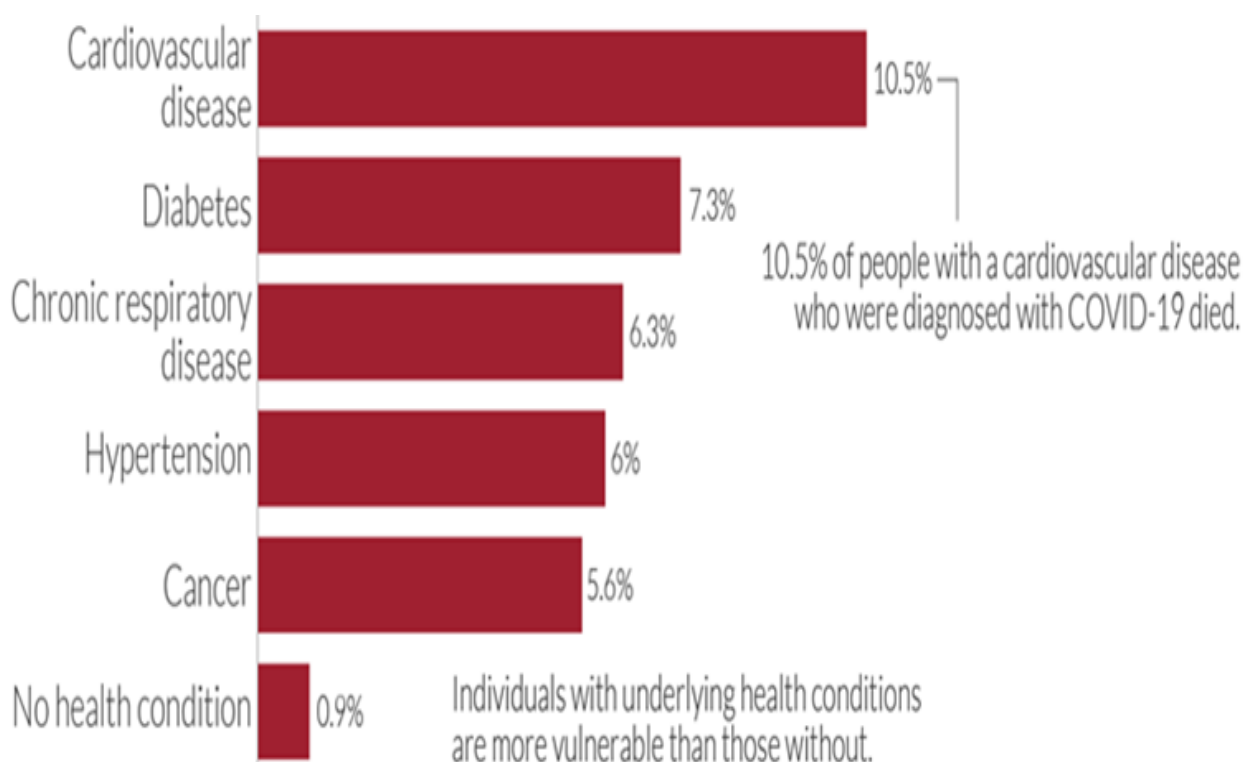


Figure 1: Causes of death due to underlying health conditions in COVID-19 patient

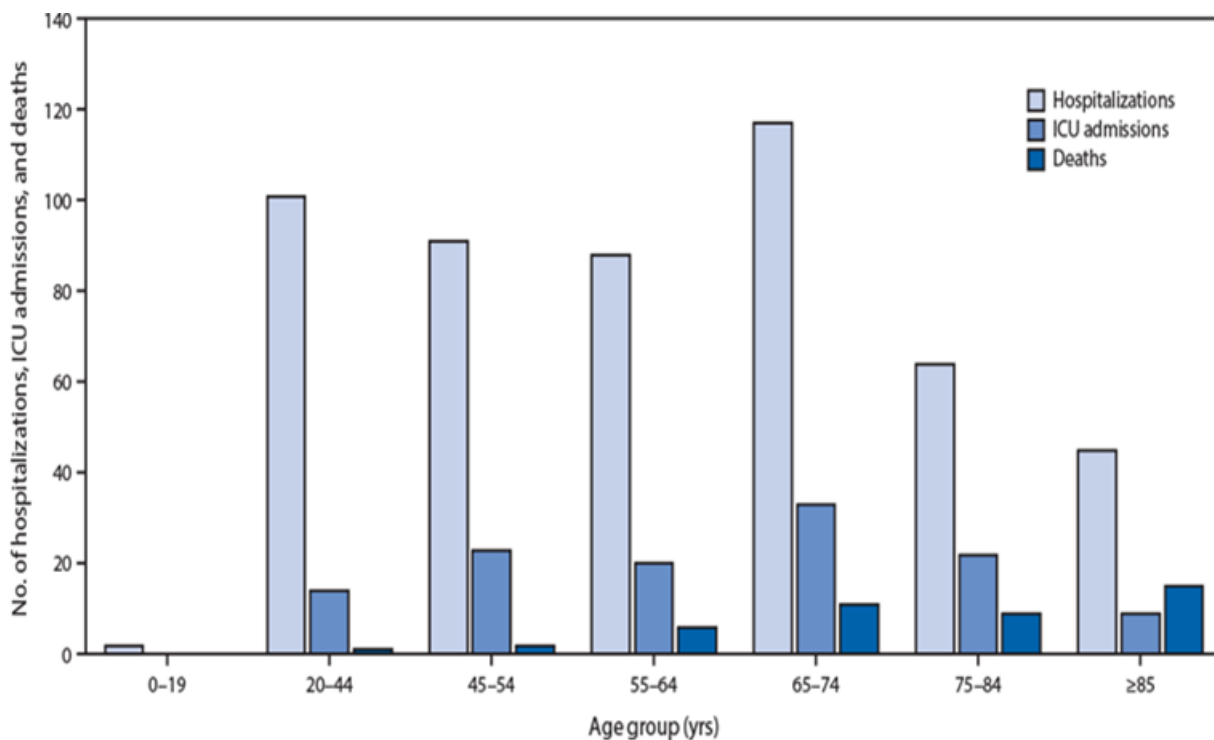


Figure 2: Death of a patient due to age factor and availability of hospitals and life sustaining medical resources

Spread of coronavirus disease or COVID-19

Spread of coronavirus occurs mainly by droplets infection, which is produced when the infected person shows coughing or sneezing; this will happen in both ways i.e,

Direct close contact; if any healthy person comes in contact with the patient infected with coronavirus just within 1 meter, especially if that healthy person or even infected person is not covering his mouth and nose, then by droplet transmission, the disease gets exchanged.

Indirect contact; the droplets released while coughing or sneezing can survive for many days on the surfaces and the cloths of a person. Therefore, by touching such surfaces and then with the same hand touching one's face, mouth nose can transmit the virus and the disease ([Winget, 2014](#)).

Three possible characteristics of the dying process in COVID-19

Organ failure and life support systems to restore the life

1. Respiratory failure: Artificial ventilations and ECLZ/ECMO used as required
2. Respiratory Distress: use of artificial ventilation depending on its necessity and availability
3. Distributive shock due to sepsis
4. Multiple organ dysfunction syndromes.
5. Shock due to cardiac arrest as there is myocardial injury occurs.

Related probability of care in restoring the life

1. Providence of life support systems
2. Removal of life support system
3. Whole life restoring care is given, but no CPR is provided.
4. Complete life restoring care is given, including CPR
5. Providence of Life support care to one who has had a long life expectancy or healthy to defeat the disease.
6. Death of a person due to some natural causes, including the age of a person (old age), weakness, underlying disease and coronavirus disease, is a secondary infection of the body.

Death of a person having COVID-19 with lower life anticipation

It is not possible to admit every patient to ICU because of fewer chances of survival some are not giving that expected life support care and to such patient ventilation and some vasoconstrictor support is provided called middle care unit, but if the further condition gets worsen death will occur due to severe hypoxia as withdrawal of ventilation is done .

In some cases, there are limitations of the life support systems and care for hospitalised and ICU patients and also the poor outcomes due to old age, comorbidities, frailty and also limitations to the associates such as beds, personals, or hospital materials.

In some cases, patients are not admitted for COVID infection and even their death is not related to the COVID-19, e.g. brain injury, accidents.

The need to study the various pathways of death due to COVID-19 is to understand the different consequences we are facing while dealing with this pandemic. To evaluate the health status of the older patients with COVID-19, to assess the risk of poor health outcomes during hospitalization or ICU admission, to assess the need for more medical equipment, ventilators etc. to increase the immune response of the body to fight against the infections to avoid secondary comorbidities and sepsis which generally occur in COVID-19 and also one of the causes of death in COVID-19. These limitations in hospitals, hospital equipment, ventilations, beds etc., indicates the necessity of improving the same things to fight powerfully in this pandemic. We have to standardize the terminology to report cardiovascular complications and to standardize the diagnosis of COVID patients all over the world. We have to specify the underlying path physiology in the dying process, including respiratory failure, or cardiogenic shock or sepsis ([Vincent and Taccone, 2020](#)).

Causes of Death

Coronavirus is the leading cause of death all over the world, killing more people per day. There are many reasons and causes of death due to the novel coronavirus; the main leading cause is respiratory failure ([Butt et al., 2020](#)). Patient other causes include the following causes such as,

Acute respiratory failure/ acute respiratory distress

The leading principal cause of death of a patient infected with the coronavirus (COVID-19) is acute respiratory failure/ respiratory distress.

The major organ of the respiratory system is the lung, when fluid gets filled into your lungs, your lungs are not able to release the oxygen into your blood which is very necessary to provide oxygen rich blood to the normal functioning of your organs. As a result, your organs can't get the required oxygen for their normal function.

Pneumonia

On the basis of researches done on COVID-19 and WHO, pneumonia is the basic cause of deaths and commonly found diagnosis in corona infected person. Individuals having COVID-19 infection showing the basic signs as- inflammation of the lungs and alveolar cells, which may destroy the alveolar cells causing accumulation of the fluids in the alveolar cells or lungs, which makes the gaseous exchange difficult as a result, blood can't get enough oxygen, and it makes hard to expel the carbon dioxide. Fluid gets leaked into the lungs out from blood vessels.

Researchers studied the images of the lungs of corona infected individuals; they observe the lungs, which are filled with fluids, discharges, and exudates.

Acute hepatic failure

Typical laboratory findings in COVID-19 infected individuals are Elevated-C-reactive protein and ferritin. Also, lactate dehydrogenase, aspartate amino transferase (AST), and alanine amino transferase (ALT) are often elevated in COVID-19 patients, indicating liver damage ([Nisargandha and DadaraoParwe, 2020](#)).

According to the data, a very ill person infected with COVID-19 shows a high risk of hepatic injury, but the scientist is not so sure about the main cause of damage as it happens due to coronavirus or any other cause.

Acute cardiac injury

COVID-19 can have fatal consequences for people with underlying cardiovascular diseases and causes cardiac injury even inpatient without underlying heart conditions; it is likely that even in the absence of previous heart disease, the heart muscles can be affected by coronavirus disease ([Zhou et al., 2020](#)).

Studies of some individuals admitted in health centres for COVID-19 had found some cardiac difficulties and arrhythmia like states.

Super infection

A super infection is a consequential result of infection, which is completely irrelevant with the primary infection. That means you get infected with bacteria or viruses, with some primarily present health problem. It means you get an infection with

some other organisms along with primarily present COVID-19 infection.

Comparatively, secondary infection evident high mortality rate and incidences of severe infections along with COVID-19. The chances of this secondary infection are all because of the body's weak immune system, which allows growing in the body and causing infection in the body.

Acute renal failure

It is found that acute renal failure is not seems to be a regular conflict, but it is found in patients with COVID-19 infection and it is consequential. If kidneys stop working regularly, it will damage the body as the body cannot remove the waste from the body.

As a result, doctors started managing the restoration of the body's damage with the help of dialysis of blood, until kidneys started working properly, but in some cases, kidneys get deteriorate further and lands into chronic kidney damage, which is very difficult to manage and need long term treatment.

Septic shock

Sepsis is the life-threatening condition of the body in which the body releases the chemicals to defeat the infection, which creates inflammation all over the body hence, sepsis occurs when the body's system is misused against its own body cells. This released chemical causes damage in the own body cells resulting in multiple organ damage, failure, and sometimes death. If sepsis does not get controlled, it will further lead to shock, which is lethal, named as septic shock.

This septic shock was also found in some of the patients infected with COVID-19.

Diffused intravascular coagulopathy

Researchers found that abnormal blood clotting occurs in coronavirus patient with severe covid-19 infection leads to micro clots within the lungs that contribute to the death of some patients.

Cancer

Immune system of the body protects the body against any illness and infections caused by viruses or any micro-organism like the coronavirus. However, some people having cancer condition have a weak immune system due to chemotherapy or radiotherapy or the body's improper functioning, which reduces their ability to fight against this infection.

How Death Occurs

Epidemiological infections such as coronavirus infection is a type of acute respiratory syndrome which mainly starts from nose and mouth as this

two are the primary route of entry of infections, which further transmit the infection up to the lungs, as this spread occurs through droplet infection by direct close contact and by indirect contact by touching infected surfaces and that infected hands to the nose and mouth. The COVID-19 mainly affects the respiratory system and this is a respiratory virus. Coronavirus gets to invade the respiratory tract and infect the respiratory system, it infects the whole upper as well as lower respiratory system and causes disorder (Arentz *et al.*, 2020).

When viruses infect the upper respiratory tract, commonly found symptoms are high grade fever, dry cough, sore throat, and fatigue. When the virus reaches the lower respiratory tract, i.e. lungs, it results in the infection of the lungs and as a result, inflammation of the lungs occurs, resulting into the destruction of the alveolar cells and accumulation of the fluids into the lungs, which further leads to difficulty in exchanging gaseous like oxygen and carbon dioxide between blood and alveoli called pneumonia. As the alveoli are mainly responsible for gas exchange in the breathing process by inhaling oxygen and releasing carbon dioxide. The condition of pneumonia further deteriorates, causing acute respiratory distress syndrome. The virus COVID-19 causes disruption of the lung cells is the main reason this infection or illness causes a severe respiratory pathology, which is the main leading behaviour and characteristics of this disease (Xiong *et al.*, 2020).

Gas exchange is a main leading function for life and exactly this is the function that gets disrupted by the virus in COVID-19 infection. When the coronavirus enters the lower respiratory tract, lungs and air sacs, it comes in contact with the alveolar cells called pneumocytes which found in the alveolar sacs called type-II cells. The horny projections appearance of the COVID-19 is able to interconnect with a molecule on the type II alveolar cells and then invade those cells and replicate. Once the virus enters into this type-II cells of air sacs, its stars replicate and start multiplying and create a number of many viruses, as our cells get infected, it gets burst and releases many new viruses. Immediately after cells get burst, new multiple stands of viruses spread into the body and infect many more cells of the body (Wang *et al.*, 2020).

Fatality is all depending on the immunity of a person. Individuals having a strong immune system can defeat the infection, but the ones who are having a compromised immune system or any other underlying health condition or old age persons are having more difficulty in facing the infection of COVID-

19. As a result of infection of the virus, one's immune system started fighting against infection-causing raised temperature, inflammation like condition which further cause sore throat and cough, which causes impairment in the breathing process. Further infection of the lungs leads to pneumonia like condition progresses into acute respiratory distress syndrome, where the individual needed a supplementary life support system and ventilations. When this immune system causes sepsis, it leads to extreme damage to the body, causing multiple organ failure, whereas a weak immune system fails to fight against the infection (Mcmichael *et al.*, 2020).

CONCLUSION

The study of the review article we come to know as the COVID-19 outbreak is becoming pandemic now a day and many deaths occur worldwide. The main cause of death is respiratory distress and failure, other complications include multiple organ failure, cardiovascular diseases, kidney injury, abnormal blood clotting, acute liver disorder, sepsis and also include providence of other medical resources to COVID-19 patient such as ventilations, use of extracorporeal membrane oxygenation (ECMO) systems, ICU admission, hospitalization, availability of beds, age factor etc.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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