

## THE IMPACT OF AMBIENT AIR POLLUTION TOWARD CORONAVIRUS DISEASE 2019 (COVID19): A LITERATURE REVIEW

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### Abstract

**Introduction:** WHO has announced coronavirus Disease 2019 (Covid19) as a global pandemic at the immune decline, one of which is due to chronic exposure to ambient air pollution. This literature review aims to describe the impact of ambient air pollution toward the risk of being infected by Covid19. **Discussion:** Covid19 can be found in a bat (host primer), and can be contagious through a person, also possible from pets. The symptoms that sufferers will perceive are fever, cough, diarrhea, myalgia, fatigue, headache, nausea, vomit, abdominal pain, loss of appetite, and some asymptomatic people. The body's immunity affects a person's susceptibility to Covid19 infection. The body's immunity can be affected by ambient air pollution (with PM10, PM2.5, and O3 are the most pollutant in the air in various countries) for an extended period could be the reason for chronic illness (especially, respiratory tract) could reduce immune resistance. Furthermore, it might be happened on increasing at ACE2 activity and can cause increasing infected by Covid19. Prevention action can be done by contributing from all of the sectors at an observance in guarding, physical distancing, quarantine, and maintaining the ambient air quality in the future. **Conclusion:** Ambient air pollution must be considered as one effort to prevent chronic illness that can reduce immunity, which can increase the risk of being infected with Covid19. Furthermore, future studies will be carried out on ACE2 activity in people infected with Covid19 in order to get more valid results and following current conditions.

## INTRODUCTION

Coronaviruses (CoVs) is a disease that is transmitted from animals to humans (1). In December 2019, there was pneumonia syndrome which started in Wuhan City, China (2). WHO mentioned this new syndrome as a Covid19 or Corona Virus Disease 2019 (3). Covid19 has been widespread and caused quarantine from January 23, 2020 in Wuhan City and surrounding areas to reduce Covid19 transmission and to prevent the spread of outbreaks (2). On 10 July 2020, WHO provided information that the number of positive confirmed cases of Covid19 was 12.015.193 with 549.247 deaths and it occurred in 216 countries (4).

Covid19 sufferers will get the flu, but in worse conditions it will need a treatment in hospital and could become Acute Respiratory Distress Syndrome (ARDS) or even death with exacerbated by ambient air pollution (5). Ambient air pollution is experienced by developed countries or developing countries (6). The ambient air pollution is ozone ( $O_3$ ), particulate matter ( $PM_{2.5}$  and  $PM_{10}$ ), carbon monoxide (CO), and sulfur dioxide ( $SO_2$ ) have a relationship with Covid19. Ambient air pollution can cause microorganisms that come into body and decrease body immunity (7). The Environmental Protection Agency (EPA) pays attention to the Air Quality Index (AQI) on  $O_3$ ,  $PM_{2.5}$ ,  $PM_{10}$ , CO, and  $SO_2$  which are categorized as good, moderate, unhealthy for sensitive group, unhealthy, very unhealthy, and hazardous (8). In addition, the rising temperatures in the air could lead to a decrease in new confirmed cases of Covid19 in the Southern City of China (9). Therefore, it is necessary to conduct a review with a literature review. The articles for reference is limited to explaining the effect of ambient air pollution and Covid19 case with the publication time of the article in the 2019 until 2020. The purpose of writing this literature review is to describe the factual explanation regarding ambient air pollution which give an impact on health and increases the risk of being infected by Covid19.

## DISCUSSION

Coronavirus-19 also called as Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (3,10-11). SARS-CoV-2 or Covid19 has a nucleotide similarity of 89,1% with a coronavirus group alike with SARS that could be found in bats as a primary host that originated from China and could also be found in other hosts such as pets (11–13). The transmission of animals to humans in SARS-CoV-2 has not established, but based on the consideration of previous studies, it could be happened (11). The first place where SARS-CoV-2 was found is at Huanan Seafood Market, Wuhan, China

(12). The Covid19 breakout that has occurred in China to be a pandemic (14).

The main route of transmission of coronavirus in Beijing comes from person to person (15). The transmission could happen by having close contact with confirmed positive cases with a percentage of 60.4% and without a contact with percentage of 10.9% (15). Coronavirus can be transmitted from human to human through close contact by splashes of droplets when coughing and sneezing of an infected person (10,12,16–18) especially at close distances (19), and can spread through aerosols (16). In addition, it was also mentioned that SARS-CoV-2 can spread through the air especially in the air of rooms that have limited ventilation (19). However, coronaviruses cannot spread through fecal-oral, because there has been no evidence with research (20).

The factors that can increase the risk of an individual infected from Covid19 are old age, male sex, and obesity (21). The majority of people, who are infected with Covid19, are men (22-23). This is supported with research that explained about the majority of people infected with Covid19 occurred in men rather than women at the percentage of 67% (24).

Covid19 can infect humans at any age (25). However, the age of the most infected is between 35-55 years (10). In addition, many virus infections occur at an average age of 59 years with a prevalence that still tends to be high and can result a death (26). Different studies mentioned that the majority of patients over the age of 60 years have a higher risk of dying because the infection of Covid19 (6,22). All of these studies explain that respondents with older age have a high risk to be infected by Covid19.

Someone who has cancer will be more easily infected by Covid19 (22). Patients with cardiovascular disease have a mortality rate of 10.5%; diabetes the mortality rate is 7.3%; chronic respiratory diseases (such as asthma and chronic obstructive pulmonary disease) are 6.3%; hypertension is 60% and cancer mortality rate is 5.6% (27). Characteristics of individuals with chronic diseases can also increase the risk of being infected with Covid19.

The most accurate investigation on individuals who are infected by Covid19, is using molecular methods such as Reverse-Transcriptase Polymerase Chain Reaction (RT-PCR) and digital PCR droplets (ddPCR) (28) and Real Time Polymerase Chain Reactions (real-time PCR) (29-30). RT-PCR has sensitive results, but ddPCR also has good potential for detecting blood samples (28). Clinical specimens that used are nasal secretions, blood, sputum, and *bronchoalveolar lavage*

(BAL) in individuals who are suspected of being infected with Covid19 (14).

Coronavirus is very easy to come into the body, especially at the Angiotensin Converting Enzyme (ACE2) receptor as in SARS-CoV (31-32). SARS-CoV-2 is easy to be disease in certain organs, especially the respiratory tract. Another organs that have an impact are the heart, kidneys, lungs, digestive tract (31). In addition, Coronavirus can cause liver disorders and neurological symptoms, because those are the part of *Coronaviridae* family (33). Most of Covid19 positive sufferers got fever or respiratory problems (33–36). Other symptoms and indication of Covid19 sufferers are cough, diarrhea, myalgia or fatigue, and headaches (35-36). In addition, Covid19 sufferers can also get diarrhea (34,37), nausea, vomiting, abdominal pain, loss of appetite (34).

The general symptoms of Covid19 disease were fever (82.1%), cough (45.8%), fatigue (26.3%), dyspnea (6.9%) and headache (6.5%) (15). Covid19 symptoms are divided into general symptoms (headache, severe flu, dry cough, sore throat, fatigue) and complications (body temperature more than 38°C, shortness of breath, severe acute pneumonia, haemoptysis, acute diarrhea) (11). Asymptomatic cases can be caused by close contact with a Covid19 sufferer even though the person has not yet experienced the clinical indications (17). ACE2 which is located on the surface area of heart, arteries, intestines, and kidneys, could become the reason for damaging to several organs in patients with extreme cases (12). Patients with Covid19 have disorders on blood glucose, and disorders of the kidneys that can be found in patients who are being treated in hospital (37). In addition, there were also patients with Covid19 who had lung lesions in 61% of cases, with 7 deaths due to progressive respiratory failure and 176 others recovered (33).

Ambient air pollution is pollution that exists in the environment, which can come from human activities, or takes place, naturally, in nature (38). Air pollution can be caused by human activities in the aspect of industrial activities, motor vehicles (39), households, energy generation, agriculture, and the shipping sector (40). It is the population that living in Greater London and surrounding area until the M25 highway in England, because there is high ambient air pollution (41). An increasing of air pollution can be influenced by an increase of population density (42). In addition, the presence of industrial movement from cities to villages will cause an increasing of air pollution (43).

Air quality in the environment according to the European Environment Agency (EEA) can be measured by the Air Quality Index (AQI), namely Particulate

Matter (PM) in the form of PM<sub>10</sub> and PM<sub>2.5</sub>, and Sulfur Dioxide (SO<sub>2</sub>), Nitrogen Dioxide (NO<sub>2</sub>), and Ozone (O<sub>3</sub>) (5). Regulations in Indonesia, Regulation of Minister of Environment No. 12 of 2010 concerning about Implementation of Air Pollution Control in Regions which is a substitute regulation for Government Regulation No. 41 of 1999, also imposes AQI restrictions, namely on parameters SO<sub>2</sub>, CO, NO<sub>2</sub>, O<sub>3</sub>, HC, PM<sub>10</sub>, PM<sub>2.5</sub>, dust, lead, dustfall, and specifically for the basic chemical industry (total fluorides, fluor index, chlorine and chlorine dioxide, and sulphate index) (44). Air pollutants that give the biggest pollution in various countries are PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, and O<sub>3</sub> (45). O<sub>3</sub> is a powerful oxidant, while NO<sub>2</sub> is included in free radicals (40). The populations that often be exposed by SO<sub>2</sub> air pollution are in productive age and elderly people (41). PM<sub>2.5</sub> air pollutants have a very strong connection with Myocardial Infarction (MI) in the study with individuals in the age about 65 years (46).

Air pollution can have an impact on the body, those are diseases that related to nerves, respiratory disorders, heart problems, and cancer, with the highest risk belongs to nerves and breathing (40). There is possibility on 30 incidents of death and 22.000 incidents of acute respiratory symptoms (47). Ambient air pollution has a significant impact on health in the form of Disability-Adjusted Life Years (DALYs), premature death, and the impact on economic development (48). There is a relationship between ambient air pollution and other factors namely noise with cognitive decline and dementia (49). NO<sub>2</sub> ambient air pollution is able to influence student education assessment in schools on the short term (50), and in chronic exposure that NO<sub>2</sub> pollutants cause inflammation in the lungs (51). Exposure to ambient air pollution in the long term can lead to premature death and increase the morbidity in the worldwide (38).

Air pollution has health problems effects such as asthma, and Seasonal Allergic Rhinitis (SAR), which is, the majority, hay fever (50). Pollution located in the atmosphere can affect the respiratory system and heart health (16). Chronic diseases can be influenced by air pollution, especially in urban areas (1,6,52). Air pollution in Beijing can cause individuals to be attacked by Chronic Obstructive Pulmonary Disease (COPD) (42). However, there is not enough evidence to state that air pollution can cause fundamental indications of chronic disease in general, such as the presence of various responses through oxidative stress and inflammation (38). In addition, air pollution (NO<sub>2</sub>, NO<sub>x</sub>, PM<sub>2.5</sub>, and PM<sub>10</sub>) can has an impact on fetal growth in utero (41). The level of noise in the environment give an effect on the pregnant women resulting in low weight of baby (41). Ambient air pollution can be reduced by paying special

attention to industry, transportation, households, energy generation, agriculture, and the shipping sector (40). It can be done by cooperation between companies, public authorities, and the community (40). Ambient air pollution can be controlled by conducting more stringent supervision of energy structures and industrial structures (53-54). However, it has a possibility not successful and is exacerbated by unfavorable meteorological conditions (54).

The spread of Covid19 can be through the droplets of patient (10,12,16–18). However, the spread of the virus through the air still has no case reports, so it has not been able to be verified that the spread of the virus through the air (20). Researchers have proven that the aerosol and surface stability of SARS-CoV-1 are lower than SARS-CoV-2 by remaining actively transmitted in aerosols for hours and SARS-CoV air transmission can occur aside from close contact (55). SARS-CoV-2 has a possibility to spread through certain aerosol producers that was found in health care facilities (20). Research conducted at Wuhan Hospital showed SARS-COV-2-RNA from air samples collected at the hospital and its surroundings has a conclusion that air routes should be considered as an important in the process of spreading the virus (55).

Based on table 1, there is a relation between air pollution and the prevalence of Covid19 in California (1). A similar matter, in Lombardy and Emilia there was a relation between the prevalence of Covid19 in the population and air pollution. (5). The condition of the population is exacerbated by the presence of low immunity, because the majority of the population are elderly (5). There is a relation between high prevalence and the presence of air pollution in the environment, such as  $PM_{2.5}$ ,  $PM_{10}$ , CO,  $NO_2$ , and  $O_3$  (7). Chronic air pollution can chronically affect an individual's health so that it influences immunity, and can result in an increased risk of being infected with Covid19 (45). People who live with high  $NO_2$  contamination have a high prevalence of Covid19 (51). Overall from the study is the relation between ambient air pollution and the number of cases of Covid19.

The high Covid19 mortality rate in Lombardy and Emilia is influenced by the presence of people at risk, namely having chronic diseases (one of which is in the respiratory tract) so that the body's immunity is low (5). In cases that occur in California, CO and  $SO_2$  have a significant correlation (1). The same thing also happened in Wuhan China, where patients with chronic diseases and those over 60 years have a higher risk of experiencing critical condition or even death (6). Chronic exposure to  $NO_2$  pollutants causes inflammation in the

lungs, resulting in a decrease in body immunity (51). Italy, Spain, France and Germany have a relation with high  $NO_2$  air pollution, besides the countries have a high Covid19 mortality rate (51). Air pollution cannot be attributed to Covid19 because of the need for long-term and chronic perspective, and make conclusions in a short time will only be limited evidence (45).

Air quality can affect the body immunity of an individual, so that it can boost Covid19 infection and increase the number of deaths (5,16). Chemicals and drugs consumed will affect immunotoxicity (such as allergies and autoimmune diseases) (56). Covid19 transmission can be influenced by air elements, such as humidity and temperature (57), also black carbon, and  $NO_x$ , weather conditions and  $PM_{10}$  air pollution (16). Air pollution is one of the risk factors underlying the pathophysiology associated with the Renin-Angiotensin System (RAS) in SARS-CoV-2 infections (23). Chemical exposure from the environment to individuals in a long period of time can affect the prevalence of allergies as well as an increase or decrease in immune response, depending on the route of exposure, dosage, and time (56). Diseases related to the environment (such as cancer, metabolic syndrome, type 2 diabetes and obesity), and infectious diseases (such as parasitic, influenza and Covid19) have similarities in their pathogenic mechanisms (56).

Other factors that can affect the increased risk of being infected with Covid19 are obesity, air pollution, and smoking behavior (23). The risk of being infected with Covid19 will increase in the population of smokers and patients with chronic obstructive pulmonary disease (COPD) (56). The condition is probably due to an increase in the ACE2 receptor which is the entry receptor for SARS-CoV-2 (56). It should be noted that ACE2 is a component of RAS whose expression is able to dominate the alveolar epithelium of lung cells (58). The underlying diseases of Covid19 such as hypertension, respiratory system diseases and cardiovascular disease are likely to be risk factors for patients with Covid19 becoming more severe (59). Overall, the increase in ACE2 activity in male is greater than in female, so the risk of being infected with Covid19 is predominantly male.

The pandemic condition caused Malaysia to lockdown various educational institutions, tourism, and others, so that it could indirectly have an impact on reducing air pollution by offset by local meteorological factors and anthropogenic emissions (60). In addition, in the YRD Region there was also a decrease in air pollution in  $SO_2$ ,  $NO_x$ ,  $PM_{2.5}$  pollutants and Volatile Organic Compounds (VOCs) due to activity restrictions during the Covid19 pandemic (53). The same thing also happened in India which experienced a decrease

Table 1. Summary of Previous Researches

Authors	Research Title	Population	Method	Results	Conclusion
Muhammad Farhan Bashir, Ben Jiang MA, Bilal, Bushra Komal, Muhammad Adnan Bashir, Taimoor Hassan Farooq, Najaf Iqbal, Madiha Bashir	Correlation Between Environmental Pollution Indicators and Covid19 Pandemic: A Brief Study in California Context (1)	Secondary data consisting of: (a) Cases and Deaths Data for Covid19 in California sourced from the California Department of Public Health (CDPH), and (b) Data related to pollution indicators in the environment: PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> , VOC, CO, and Pb in California sourced from the Environmental Pollution Agency (EPA)	Data analysis using the Spearman and Kendall correlation test	Pollutants that have a strong relation between the number of cases and deaths of Covid19 and ambient air pollution in California are PM <sub>10</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , NO <sub>2</sub> , and CO.	Pollutants in the environment have a correlation between the number of Covid19 cases and the death rate in California.
Edoardo Conticini, Bruno Frediani, Dario Caro	Can Atmospheric Pollution be Considered a Co-Factor in Extremely High Level of SARS-CoV-2 Lethality in Northern Italy (14)	Secondary data consisting of: (a) Cases and deaths of Covid19 in Lombardy and Emilia, and (b) Measurement of air quality (NO <sub>2</sub> , PM <sub>2.5</sub> , SO <sub>2</sub> , PM <sub>10</sub> , and O <sub>3</sub> )	Article Review	Environments with high levels of ambient air pollution, such as Lombardy and Emilia, will increase an individual's risk of developing chronic respiratory diseases and are easily infected with various infective agents. This has an influence on the high prevalence and mortality of Covid19. Lombardy and Emilia also have a population with an average elderly population. However, it is also necessary to consider other <i>confounding factors</i> that can influence the high mortality rates of Covid19 in Lombardy and Emilia (Northern Italy).	An environment with high ambient air pollution will provide more risk for chronic diseases, thereby reducing the body's immunity and can be easily infected with various infective agents.
Yongjian Zhu, JinguiXie, Fengming Huang, Liqing Cao	Association Between Short-Term Exposure to Air Pollution and Covid19 Infection: Evidence from China (16)	Secondary data for the period between January 23, 2020 and February 29, 2020 consisting of: (a) Daily Covid19 prevalence data that were sourced from the official local health website; (b) Daily Air pollution data consisting of PM <sub>2.5</sub> , PM <sub>10</sub> , SO <sub>2</sub> , CO, NO <sub>2</sub> , and O <sub>3</sub> that were sourced from online platform ( <a href="https://www.aqistudy.cn">https://www.aqistudy.cn</a> ); and (c) Daily meteorological data consisting of temperature, relative humidity, barometric pressure and air velocity that were sourced from the National Meteorological Information Center ( <a href="http://data.cma.cn">http://data.cma.cn</a> )	The analytical method used is the Generalized Additive Model (GAM) with the Gaussian distribution family	Results of this research is: (a) All air pollution variables (PM <sub>2.5</sub> , PM <sub>10</sub> , SO <sub>2</sub> , CO, NO <sub>2</sub> , and O <sub>3</sub> ) have a significant correlation with temperature and humidity; (b) SO <sub>2</sub> , CO, and O <sub>3</sub> have a negative correlation with air pressure, while PM <sub>2.5</sub> and NO <sub>2</sub> have a positive correlation with air pressure; (c) All pollutants have a significant correlation with wind speed except SO <sub>2</sub> ; and (d) Air pollutants (PM <sub>2.5</sub> , PM <sub>10</sub> , CO, NO <sub>2</sub> , and O <sub>3</sub> ) have a positive relation with Covid19 cases. Whereas SO <sub>2</sub> has a negative relationship with Covid19 confirmed cases	There is a significant relation between air pollution and cases of Covid19 infection. High concentrations of PM <sub>2.5</sub> , PM <sub>10</sub> , CO, NO <sub>2</sub> , and O <sub>3</sub> will result in a higher risk of being infected with Covid19. Whereas on short exposure to high concentrations of SO <sub>2</sub> will result in a reduced risk of being infected with Covid19.
Daniele Fattorini, Francesco Regoli	Role of the Chronic Air Pollution Levels in the Covid19 Outbreak Risk in Italy (49)	Secondary data consisting of: (a) Cases and deaths of Covid19 in Italy, and (b) Measurement of air quality (NO <sub>2</sub> , PM <sub>2.5</sub> , PM <sub>10</sub> , and O <sub>3</sub> )	Analysis of secondary data from EEA, ICPD, and Legambiente. Data were analyzed using Pearson Correlation.	Air pollution in Italy has a relation with the increase in Covid19 cases, as evidenced by the significant values of all parameters less than 0,05. Therefore, attention needs to be paid to air quality to maintain health and prevent epidemics.	Air quality can increase the risk of an individual to be infected with Covid19.
Yaron Ogen	Assessing Nitrogen Dioxide (NO <sub>2</sub> ) Levels as A Contributing Factor to Coronavirus (Covid19) Fatality (56)	Secondary data for the period January - February 2020 from 66 regions in Italy, Spain, France, and Germany consisting of: (a) Covid19 cases data sourced from the Ministry of Health (Italy), The National Agency of Public Health (France), Social Service and Equality (Spain), The Robert-Koch-Institute, and The State Health Offices (Germany); (b) NO <sub>2</sub> related data that were collected using the Google Earth Engine API; (c) Atmosphere's condition sourced from NOAA/ OAR/ ESRL PSD, Boulder, Colorado, USA ( <a href="https://www.esrl.noaa.gov/psd/">https://www.esrl.noaa.gov/psd/</a> )	The analysis is done by combining NO <sub>2</sub> with the death rate due to Covid19.	Chronic exposure to NO <sub>2</sub> pollutants causes inflammation of the lungs. This condition will result in a decrease in body immunity. The high death rate of Covid19 in this region has a relationship with high NO <sub>2</sub> air pollution.	Environmental conditions (such as NO <sub>2</sub> pollutants) can affect the body's immunity from exposure to infectious diseases (Covid19).

in PM<sub>2.5</sub> emissions in the air (61). In addition, there was a significant decrease in NO<sub>2</sub> based on the results of satellite monitoring of the European Space Agency and the National Aeronautics and Space Administration

(NASA) precisely in Delhi, Mumbai, and various states of Gujarat which were observed during the period January 2020 to April 2020 (62). In addition to each region, there is a decrease in air pollution, namely NO<sub>2</sub> in all regions,

especially in locations where Covid19 distribution centers (Wuhan, USA, Spain, Italy, etc.) decreased by 30% (63). A decrease in PM<sub>2.5</sub> concentration in ambient air by 10-20% is due to a reduction in emissions from industry and transportation that occurred in China due to the outbreak (43). The concentrations of SO<sub>2</sub>, NO<sub>2</sub>, PM<sub>2.5</sub> and PM<sub>10</sub> in China which were classified as low were the effects of lockdown (64). However, the concentration of CO in the air is less affected and tends to increase as in previous years (64). The decrease in air pollution occurred during the Covid19 pandemic, but besides that it can increase the build-up of waste in the form of medical waste (masks, gloves, and hand sanitizers) in the environment (65).

The condition of the pandemic shows that there is a need for quick and effective health care to reduce the level of morbidity and death. Air pollutants can be controlled by joint actions and long-term policies as a preventive measure (49). Control of emissions needs to be balanced with an understanding of the role of chemistry and meteorology in its arrangement (43). That is because a person will have a high risk of experiencing chronic pain, so that it will reduce the person's immune system (43). Decreased immunity will affect the decline in health, resulting in a person susceptible to disease and this can increase the risk of being infected with Covid19. Therefore, it is necessary to implement strict quarantine protocols to prevent further spread of Covid19 (14). In addition, medics or other personnel working in health services need to use Personal Protective Equipment (PPE) to prevent Covid19 transmission from patients (16). All efforts to reduce the spread of Covid19 must be made, while waiting for the vaccine (16).

Further research is needed to provide sufficient evidence related to individual exposure to pollutants in the air and Covid19 cases at said locations. In addition, this study only focuses on environmental health factors and has a very short span of time, so it cannot yet represent the pollutants that most influence the risk of being infected with Covid19. Future studies are expected to provide a clearer picture through the recording and ongoing research related to air pollution of individuals who have been chronically infected with the risk of being infected with Covid19, so that it can be detected in detail and over a longer period of time that may occur in individuals. In addition, it is necessary to review from other factors that might be influential to the increased risk of being infected with Covid19, such as personal hygiene behavior, community consumption patterns, other chronic diseases (such as Diabetes Mellitus, hypertension, coronary heart disease, etc.), social aspects, cultural aspects, and economic aspects.

## CONCLUSION

Air pollution can be caused naturally or by human behavior. Exposure to chronic ambient air pollution, resulting in less detectable if analyzed in a short time. Individuals who have chronic exposure to air pollution have a high level of risk for being infected with Covid19. The body's immunity can be affected by the presence of ambient air pollution (with PM<sub>10</sub>, PM<sub>2.5</sub>, and O<sub>3</sub> are the most pollutant in the air in various countries) for a long period might be happened on increasing at ACE2 activity and can cause increasing infected by Covid19. Individuals who are exposed have a high mortality rate in individuals of male sex, old age, and have a history of chronic illness. Prevention that can be done is to apply disciplines of physical distancing and personal hygiene on an individual scale, as well as the implementation of lockdown on a broader scale.

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