Air Pollution & COVID-19: Examining the Correlation

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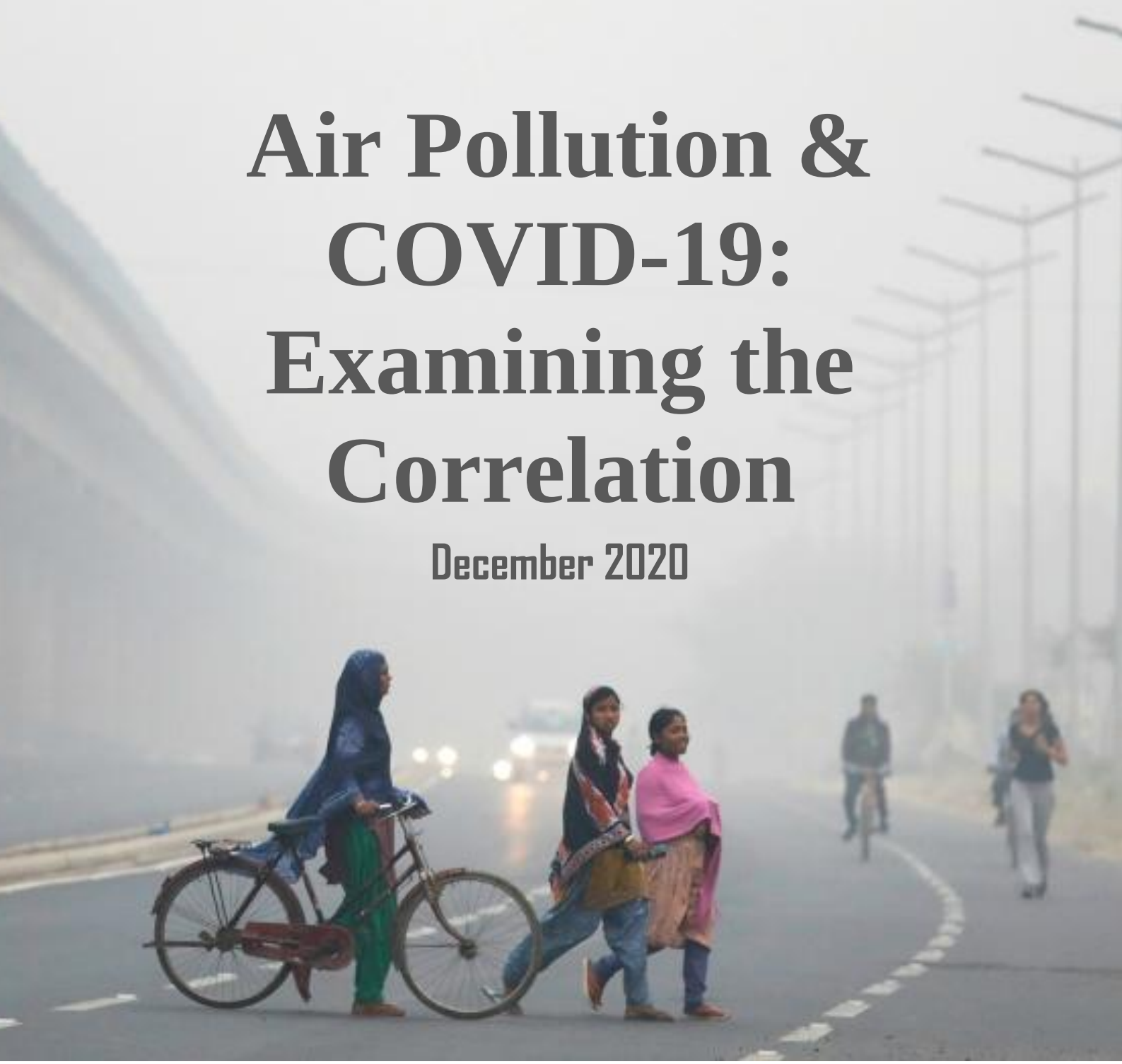

Research Brief

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Purpose: The objective of this report is to establish if air pollution is a co-factor in health impacts of COVID-19 through analysis and review of global studies.

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Preface

This report attempts to examine the correlation between COVID-19, air pollution, and their combined impact.

A growing body of research evidence establishes a positive correlation between air pollution and COVID-19 contraction and mortality. A general pattern that is emerging is that both short-term and long-term exposure to air pollution has had an impact on the severity of COVID infected patients, and a positive correlation between the two has been established. Areas with high pollution levels are at greater risk of COVID spread and populations exposed to air pollution are regarded more vulnerable to contracting infection. While the pattern is more salient in some countries, growing body of research points towards similar patterns being observed around the world.

The report further attempts to outline the mechanisms through which air pollution impacts COVID spread, assess its impacts and enlist recommendations to deal with the urgent crisis. As research in this area evolves, a clearer pattern is likely to emerge in the future, however, given the current statistical estimates, the role of air pollution in exacerbating the COVID crisis can't be undermined.

We hope to draw further research attention towards this crisis and spread awareness among masses about its impacts to help them prepare and equip themselves for meeting the challenges of the crisis. Investing in measures to combat air pollution and minimizing exposure are potential ways to mitigate the associated health impacts. Further research would generate more insights to help mitigate the crisis.

Executive Summary

This report delves into the impacts of air pollution and the COVID crisis, and correlation between the two. It reviews how the pandemic combined with high pollution levels has contributed to a health crisis in India. Air pollution, as a co-factor, has been observed to have a significant impact on spread of the pandemic and the associated mortality rate. The report consolidates some key findings published in this area and highlights its health and economic impacts. It further outlines few recommendations for dealing with the emerging crisis by raising awareness and taking proactive steps to meet its challenges.

The scale and magnitude of challenges posed by the COVID crisis in India has been unprecedented. Eight months into the pandemic, the mayhem caused by the crisis is still unsettled and the economy is yet to recover from its aftermath.

As winter months are approaching and pollution levels are increasing in the city, the pandemic combined with the air pollution crisis poses a unique challenge. A distinct pattern has been observed in areas with high pollution levels and increasing COVID cases around the world. In India, as AQI levels are increasing, worsening health impacts of the pandemic are being reported. Air pollution is seen to be a key contributor to COVID spread and delayed recovery of infected patients. Virus molecules have been observed to travel from infected to healthy patients via droplets suspended in air called aerosols (released when someone coughs or sneezes). Pollutant particles like PM 2.5, PM 10 and others provide additional pathways for the virus to travel, thereby increasing transmission and mortality risk. It also has a direct impact on health of patients as they inhale polluted air which delays recovery. Both long-term and short-term exposure to air pollution have been linked to increased vulnerability to COVID-19. (Silvia Comunian, 2020)

This report outlines key insights on the twin impact of air pollution and COVID-19 and ways to address the crisis. With monumental challenges of the COVID crisis, high pollution levels have added to the woes of public and increased burden on healthcare systems and the economy. While COVID-19 is perceived to be the most immediate threat, these co-factors could play a crucial role in determining the trajectory of the spread of the disease.

The crisis demands immediate policy attention to mitigate its detrimental impacts as the government looks at a challenging road ahead.

Introduction

High Stakes of Air Pollution

The World Health Organization estimates that polluted air kills 7 million people a year globally, with even short-term exposure causing or aggravating diseases like reduced lung function, cardiac health, asthma and other respiratory infections. In the year 2018, nearly 4.5 million deaths were attributed to air pollution. (Aidan Farrow, 2020)

India, China and US are among countries bearing the highest economic cost of air pollution. India's economic burden from rising pollution levels is estimated at $150 billion a year. (Mint, 2020) Among key pollutants, PM 2.5 is known to have the greatest health and economic cost due to increased work absences. Other pollutants like ozone and NO2 are estimated to cost around $350 billion and $380 billion in damages to the global economy annually. (Mint, 2020)

Over the years, Indian cities have been constantly ranking among some of the worst polluted cities in the world. Vehicular and industrial emissions contribute year-round to India's poor air, combining with dust from road construction and millions of domestic fires or forest fires. Additionally, as winter season approaches, farmers burn thousands of acres of crop stubble resulting in an exponential increase in pollution levels. This translates into high health and economic costs that increase burden on the economy.

Is There a Link between Rising COVID cases & Air Pollution?

Despite the alarming estimates mentioned earlier, air pollution is not recognized as an urgent crisis in India and its health and economic impacts are largely undermined.

With the onset of COVID-19 in 2020, air pollution has posed a unique challenge for health and healthcare systems in India- Air Pollution and COVID-19 are perceived to be a dangerous combination as severe pollution levels have been linked to increasing number of COVID-19 cases and increased risk of mortality associated with the infection.

Several studies citing a positive correlation between exposure to high pollution levels and vulnerability to COVID-19 have been published. Spread of the disease has been observed to increase in areas with high pollution levels as pollutants like PM 2.5, PM 10, NO2 and others provide a pathway for the virus to travel from infected persons and the virus can also remain in air for longer periods of time. (Silvia Comunian, 2020) This study identifies key transmission routes - 21% by aerosol (long distance), 29% by close contact between individuals (droplets), and 50% by contact with surfaces (fomite route).

Pollution particles are, therefore, regarded as a co-factor in aggravating COVID-19 spread and symptoms. Notably, in countries with heavy pollution, daily cases of covid-19 have spiked up to nearly 40% and deaths rose even by 25%.

Profiling the Two Crises

Air Pollution: The Silent Epidemic

Air Pollution is one world's largest health and environmental problems, which develops in two contexts: indoors and outdoors. While high AQI levels have been making headlines over last few years, the crisis still remains largely unnoticed by the public and is often called the 'silent killer'.

Air pollution refers to release of harmful pollutant particles into the atmosphere at rates that exceed the natural capacity of the environment to absorb them. Major pollutants in urban settings include sulfur dioxide, nitrogen dioxide, carbon monoxide etc. These are emitted directly into the air from industrial and domestic sources. Air pollution primarily develops in two contexts: indoor and outdoor pollution. Sources of outdoor pollution include vehicular emissions, smoke from factories, burning fossil fuels, stubble burning etc. Indoor air pollution can be attributed to sources like chimneys, incense sticks, paint and solvents, wood fires etc. (Mackenzie, 2016)

With an estimated 7 million deaths worldwide being attributed to air pollution each year, it is rightly regarded as a silent epidemic with far reaching economic, health and environmental impacts.

COVID-19: The Global Pandemic

COVID-19 is defined as a respiratory and vascular disease caused by SARS-COV-2 (Severe Acute Respiratory Syndrome Coronavirus). Coronaviruses are a family of viruses that can cause illnesses such as the common cold, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). These are identified as zoonotic pathogens that are transmitted from animals to humans with significant human-to-human transmission. The disease outbreak started in China in 2019 where the novel coronavirus was first identified. In March 2020, the World Health Organization (WHO) declared the COVID-19 outbreak a pandemic. (Tesini, 2020)

With nearly 55 million cases reported globally, the pandemic is regarded as one of the largest outbreaks witnessed in hundreds of years. The massive toll that the crisis has taken over the entire world population is unprecedented, and is likely to impact all aspects of business and economy for years to come.

The virus is known to spread primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes, via large respiratory droplets which can spread to upto 6 feet distance from an infected person, Other small respiratory particles called aerosols, which can linger in air for several hours, are responsible for airborne transmission of the virus and can spread up to 20 ft. However, research evidence for airborne transmission is limited at present. (Tesini, 2020)

Review

Overview

COVID-19 primarily spreads through direct contact or via air borne transmission. There is still uncertainty about the exact mode of transmission as the behavior of SARS-COV-2, the virus causing COVID, is highly variable. Air pollution is found to be one of the co-factors contributing to its spread. Significant research attention is being paid to study the relationship between pollution levels and its impact on COVID-19 infected patients, and how long-term and short-term exposure to air pollution has proved to be detrimental in the fight against COVID.

What we know so far

There have been multiple studies citing the impact of air pollution on COVID-19 spread and recovery. A direct correlation has been observed in countries around the world between high air pollution levels and rising COVID cases. Clusters of COVID cases have been identified in areas with high air pollution levels and worsening of symptoms has been observed in COVID patients exposed to air pollution or suffering from any respiratory ailments due to pre-exposure.

Review in Countries around the World

In Italy, for instance, northern and southern regions reported significant differences in COVID-19 cases and death rate, which are attributed to different levels of pollution across regions. A positive correlation was observed between PM 2.5 concentration and SARS-COV-2 transmission in provinces of Milan and Italy. (Simone Lolli, 2020). Other parameters like population density and climatic conditions were also co-factors in spread of disease but not as significant as air pollution.

In USA, a statistically significant relationship was found between high pollution levels and COVID-19 transmission. An increase of 1 μg/m3 in PM2.5 was found to be associated with an 8% increase in the COVID-19 death rate. Another study concluded that 1μ/m3 increase in PM2.5 concentrations is associated with 9.4 additional units of Covid-19 cases, 3.0 more units of hospital admissions, and 2.3 more units of deaths recorded. (Cole, 2020).

The Netherlands, a relatively small, densely populated nation with an ethnically diverse, aging population, faces a number of potential Covid-19 risk factors. The country additionally experience hotspots of local air pollution both within urban areas and also, in the case of PM2.5, in more rural areas, due in part to intensive livestock farming. By early June 2020, the Netherlands had experienced over 6,000 deaths as a result of Covid-19, resulting in the 7th highest number of Covid-19 deaths per capita. These statistics provide compelling evidence of a statistically significant positive relationship between air pollution and Covid-19 cases, hospital admissions and deaths. More specifically, an increase of 1 μ/m3 of PM 2.5 was found to be associated with an increase of 9.4-15.1 units in COVID cases, 2.9-4.4 units increase in hospital admissions and 2.2-3.6 units increase in number of deaths recorded. (Matt Cole, 2020)

In China, Covid-19 was first reported in Wuhan, in December 2019. A study conducted to analyze the relation between air pollution levels and COVID-19 in the region concluded that Covid-19 infection rate is related to air pollution concentration, and is strongly dependent on inter- and intra-city movements. To reduce the infection rate, the international community suggested effective air pollution reduction plans and social distancing policies.

In India, there has been a significant impact of rising air pollution levels. For instance, nearly 13% of COVID-19 cases in Delhi have been linked to increasing air pollution levels. Patients especially sensitive to respiratory diseases are at greater risk of vulnerability to COVID-19 if their surroundings are highly polluted. A study by European institutes concluded that 17 per cent of India's Covid-related deaths could be linked to exposure to air pollution, as compared to the 15% global average.

There is thus growing evidence that SARS-CoV-2 virus that causes COVID-19, can cling to air pollutants. It can survive for significant part of time and travel to some distance without losing its viability and virulence.

Tables below shows estimate of COVID-19 mortality rate linked to Air Pollution:

Table 1: Regional and Global Contribution of Air Pollution to COVID mortality rate ***(Andrea Pozzer, 2020)***

Region	COVID-19 Mortality Rate Linked to Air Pollution
Worldwide	15%
East Asia	27%
Europe	19%
North America	17%

Table 2: COVID mortality rate linked to Air Pollution across Countries **(Pozzer, 2020)**

Country	COVID-19 Mortality Rate Linked to Air Pollution
USA	8%
Netherlands	16%
India	17%
Germany	26%
Italy	14%
China	26%

Combined Impacts of Air Pollution & COVID-19

Economic Impact

Rising pollution levels have drastically increased burden of disease in India, health and welfare of people and also have an impact on income and savings.

India has been reeling under pressure from limited resource capacity and rising number of cases, and the air pollution crisis. The pandemic led to disruptions in several sectors of the economy impacting growth, employment and overall welfare.

As per estimates, US $4.3 billion would be needed for mass procurement of COVID-19 vaccines, tests and treatments. India has currently pitched around Rs 80,000 crore for the vaccine. (Jyothi, 2020)

Impact on Health

There have been multiple studies citing impact of air pollution on spread of COVID 19. Air pollution is directly responsible for several co-morbidities that increase risk of contracting COVID-19 like respiratory diseases, cardiac health, lung function, weak immunity etc.

As per 'State of Delhi's Air 2020' report, 94% of survey respondents were found to have suffered from ailments directly attributable to air pollution. Further, several participants were unaware of the impact of long-term exposure to air pollution and felt that it only poses a problem during October-December period. Around 20% respondents felt that air pollution crisis is overhyped and not urgent enough. (Alok Raj Gupta, 2020)

As per IMA, 1 in 8 COVID cases in Delhi could be attributed to air pollution (13% of total recorded cases). High AQI levels causing breathing difficulties are responsible for the worsening impact of COVID-19, making treatment and

recovery even tougher. (Delhi seeing third COVID-19 spike, cold and air pollution aiding virus spread: ICMR, 2020)

Impact on Children

Children are known to be carriers of SARS-COV-2 virus and research suggests that they may play a larger role in the spread of infection. Due to weaker immunity and developing lung function, their bodies are more likely to carry higher viral load making them more vulnerable to the infection.

As per the survey report 'State of Delhi's Air 2020', among respondents who had children below 10 years of age, nearly 45% of them were found to be suffering from throat/chest congestion due to high air pollution levels. 16% new-borns faced breathing difficulties, making them vulnerable to viral loads and other respiratory illnesses. (Alok Raj Gupta, 2020)

Studies conducted in areas with large-scale school closures found a correlation between shutdown of schools and reduction in spread of infection. Studies containing analysis of past epidemic outbreaks also found evidence supporting the fact that school closures reduced cumulative infection rate by about 25% and delayed the peak of epidemic (Neil M. Ferguson, 2006), suggesting that children can be extremely vulnerable to infections. COVID cases among children were also found to be mostly asymptomatic thereby making them harder to notice, further increasing risk of spread. (Katherine A Auger, 2020)

Environmental Impact

Reduced activity (economic and otherwise) during the pandemic led to a fall in emissions and improved air quality during initial phases. These improvements contributed to reduction in mortality rates linked to high pollution. They also highlighted the contribution of vehicular and industrial emissions to pollution levels and the need to invest in renewable energy sources. Primarily, NO2 levels (one of key pollutants in India) were noticed to have reduced drastically. CO2 levels are estimated to have decreased by 5.5 % in India despite a reduction in overall activity. However, this change was not sustained for long, and as economies opened up, pollution levels increased again.

The pandemic has also increased strain on resources like water as demand for it has increased to maintain recommended hygiene levels during the pandemic.

Many regions have reported an influence of weather patterns on viral behavior, however there is still a lot of ambiguity surrounding the nature of impact. For e.g. in parts of California where wildfires occur frequently, frontline workers are at increased risk of contracting respiratory illnesses due to exposure to smoke and thus are more vulnerable to COVID-19. (Montrose, 2020).

Key Findings

- A positive correlation has been established between air pollution and COVID-19 spread and mortality rate, as supported by growing research evidence. It provides additional pathways for the virus to travel thereby increasing risk of spread.

- Other co-factors aggravating COVID spread include climatic conditions, indoor pollution levels, underlying health conditions, etc.

- Both short-term and long-term exposure to air pollution are found to have an impact on increasing vulnerability to COVID-19.

- While short-term exposure delays recovery of infected patients, long-term exposure has been found to be a contributory factor in developing underlying conditions like respiratory diseases, poor cardiac health, diabetes etc., which increase vulnerability to COVID.

- Areas with higher pollution levels have been found to record higher number of COVID cases.

- SDG 3 focuses on good health and well being for all age groups. The pandemic has reversed several gains made in this area and compromised on many health and well-being goals. Some of these impacts include:
  - → Childhood immunization interrupted in over 70 countries. Illnesses and deaths due to other communicable diseases expected to increase.
  - → Greater health and financial burden on people and aggravation of underlying health conditions. Less than half of global population is covered by essential health coverage and the pandemic has had a direct impact on out of pocket expenditure and welfare of people.
  - → Diversion of funds and resources towards handling the pandemic, compromising on critical health care for other diseases.

Conclusion

There is growing research evidence supporting the hypothesis that there is a statistically significant positive correlation between Air Pollution and Covid-19. Both short-term and long-term exposure to Covid-19 increase vulnerability to COVID and a worsening of symptoms among infected patients.

This 'twindemic' is emerging as a critical threat in cities around the world. Globally, 15% of total Covid-19 deaths have been attributed to air pollution and the recorded average for India is 17%. Worsening health impacts are an increased burden on healthcare systems and add on to mounting human, health and economic costs.

This paper comprehensively reviews the role of Air Pollution as a co-factor in Covid-19 spread and mortality rate. Rising cases and deaths worldwide underscore the need for further research attention to be given to studying impacts of this 'twindemic', especially in India, ranked among most polluted countries. The outcome of this research would also have a bearing on how the Air pollution crisis is addressed in the short and medium term, while pressing for urgent policy reforms.

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Notes

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