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Household pollution and COVID-19: irrelevant association?

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Abstract

Evidence supports the link between air pollution and coronavirus disease 2019 (COVID-19). Therefore, exposure to indoor pollution (IDP) is likely to be associated with the disease. The poor, refugees, and migrant workers who live in feeble conditions are the most vulnerable. The pandemic has caused many people to remain indoors, especially at-risk individuals (e.g., the elderly, diabetics, obese, cardiac, and chronic lung disease patients). Home isolation may be an underlying factor to other health problems among these populations if the place where they are socially isolating is not adequately ventilated. Therefore, understanding the consequences of the relationship between IDP and the COVID-19 pandemic is essential.

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Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the pathogen of coronavirus disease 2019 (COVID-19), a disease first reported in a small cluster in Wuhan, Hubei province, China, in December 2019, and subsequently spread throughout the world.^{1,2}

The sudden and overall character of this pandemic raised urgent questions that required pinpointed and accredited information to delay its devastation. Due to its high contagiousness and aggressive course, the World Health Organization (WHO) declared a Public Health Emergency of International Concern.

Despite the growing number of reports on COVID-19, there has only been limited epidemiological investigation, and little is known about the probability of transmission and infectivity of SARS-CoV-2. One of the critically important public health objectives is to identify the main modifiable environmental factors that can increase the severity of health outcomes.³

Household pollution and SARS-CoV-2 infection

Recent evidence suggests a positive association between long-term exposure to household pollution and the severity of SARS-CoV-2 infection.⁴ Conticini et al. suggested that the higher prevalence and mortality from COVID-19 observed in northern Italy could be partially explained by the exposure to a higher level of air pollution.⁵ Researchers in the USA⁶ observed a significant association between air pollution and deaths from COVID-19, a fact also observed in other areas of the world.^{7,8}

Air pollution is a significant yet manageable threat to people's health, well-being, and sustainable development. Air pollution is considered the main preventable health risk that affects everyone, although the most vulnerable people - lower socioeconomic status, the sick, elderly, women, and children - face disproportionate risks.⁹

Home isolation is known to be the most effective prevention implemented in many countries for healthy and infected individuals with mild symptoms to combat COVID-19.¹⁰ However, some factors should be considered in social isolation as they could increase the risk of contagion with the new coronavirus¹¹: (i) population density, that is, close contact between people; (ii) family size: a large family will have a greater chance of someone taking the virus home; (iii) level of social distancing: various groups may show different levels of social distancing; and (iv) rules for staying at home can be a challenge for those who live in smaller houses.

The living conditions of ethnic and racial minorities can contribute to underlying health problems, which would make it difficult to implement measures to avoid falling ill with COVID-19.¹² Li et al. recently showed that the contagion rate among members of the same household is 16.3% (mainly among adults over 18 years and spouses).³ These rates are higher when compared to those observed in other pandemics, such as severe acute respiratory syndrome (SARS),¹³ Middle East respiratory syndrome (MERS), and influenza A in 2009, with 13%.¹⁴

Social-economic level and SARS-CoV-2 infection

Social inequalities in healthcare have different impacts on the morbidity and mortality of COVID-19.¹⁵ Approximately 13 million Brazilians live in impoverished areas, generally with more than three people per room and limited access to drinking water. It is almost impossible to meet the recommendations for physical distancing and hygiene in these environments.¹⁶

One dramatic contributing factor to such a large number of infected individuals is that neither residents of conflict zones and refugee camps nor immigrants can physically distance or isolate themselves. They lack adequate facilities for their own hygiene and laundry¹⁷ and generally share bathrooms, a fact that should be taken into account since people with COVID-19, symptomatic or asymptomatic, can spread viruses through their stools.¹⁸

Home isolation could be an underlying factor to other health problems among these populations if the place where they are socially isolating was not adequately ventilated. The pandemic has caused many people to remain indoors for almost the entire time, especially at-risk individuals (e.g., the elderly, diabetics, obese, cardiac, and chronic lung disease patients). By not opening windows and doors, their rooms are not adequately ventilated, and they expose themselves more intensely to low-quality air.^{19,20}

Therefore, alerting health professionals and the general population about the consequences of exposure to IDP during home isolation and its relationship with COVID-19 is of utmost importance.³ IDP is a global environmental health problem that affects approximately 2.45 billion people in low- and middle-income countries, causing between 2.8 and 4.3 million premature deaths each year, which is equivalent to 7.7% of the global mortality rate, significantly higher than that determined by malaria, tuberculosis, and HIV/AIDS combined.²¹

Of these deaths, 3.8 million are caused by noncommunicable diseases (NCDs). IDP is estimated to cause 25% of all deaths from stroke, 15% from ischemic heart disease, 17% from lung cancer, and more than 33% from all chronic obstructive pulmonary diseases (COPD).²¹ Considering that the most impoverished populations are more likely to have chronic diseases, this puts them at a greater risk of COVID-19 mortality.²²

Although smoking is the leading cause of COPD in the developed world, exposure to IDP is likely to be an essential factor to be prevented in low- and middle-income countries, especially for women.²³ Pepe et al. documented chronic respiratory problems and deficient lung function in young, nonsmoking women exposed to biomass burning.²⁴

During the pandemic, children are not able to go to school, daycare centers, or play outdoors with their peers. Kids spend more time at home, usually, in congested and polluted environments, where they are often exposed to concentrations of pollutants at levels above those recommended by the WHO.²² This exposure increases the risk of premature deaths among children of low-income households and makes them more susceptible to developing diseases associated with this contamination, such as pneumonia, the second leading cause of worldwide mortality for children under 5 years of age.²⁵

The mechanisms between IDP and pneumonia are poorly understood. Still, studies suggest that IDP may increase the likelihood of bacterial pneumonia, rather than viral pneumonia.²⁶ The timing of IDP exposure is also emerging as an important variable, as many studies indicate that the risk variable changes throughout a lifetime.²⁷ This can have substantial ramifications if the prenatal period really includes a window of susceptibility. Policies reducing exposure to pregnant women can be highly relevant.

Approximately 3 billion people worldwide are known to still use biomass fuels for their cooking and heating needs, including wood, manure, and coal.²⁸ The current economic slowdown caused by the pandemic may mean that it will even be necessary for families that have transitioned to cleaner fuels such as electricity, liquefied petroleum gas, or ethanol to return to the use of firewood or other polluting methods for cooking.²⁹

One needs to keep in mind that it is common to use multiple fuels in the same home during periods of economic instability. Such usage provides a sense of energy security for low-income families as they do not have complete dependence on a single type of fuel.²⁹

As a result, in developed countries, the level of exposure to particulate matter (PM) in these homes is usually higher than the concentrations that occur in ambient air,²⁵ especially if we take into account indoor exposure to other common household pollutants such as candles, incense, mosquito coils, and mainly tobacco smoke.^{19,28}

Emerging evidence indicates that people with lung problems may be at an elevated risk of complications or death from COVID-19.³⁰ Recent studies have warned that smokers would be more exposed, because the nicotine would directly affect the virus receptor (ACE2), leading to a harmful signal to lung cells, promoting epigenetic changes underlying lung damage from inflammation and proteases.³¹

The systematic review warns that smokers would be 1.4 times more likely to have severe symptoms of COVID-19, and 2.4 times more likely to need mechanical ventilation or even die as compared to nonsmoking COVID-19 patients.³²

Active smokers with COPD who contract COVID-19 have an increased risk of more severe conditions and higher mortality. Smoking patients hospitalized for COVID-19 would be 14 times more likely to die as compared to nonsmokers.³³

The period of self-isolation and blocking restrictions during this pandemic may be used by some as an opportunity to stop smoking, but, realistically, only a minority of people will achieve complete cessation. For most smokers, the increased stress of having a potentially fatal disease, the possibility of job loss, feelings of insecurity, confinement, and boredom may work in reverse to increase the desire to smoke.³⁴

Health professionals should include warnings aimed explicitly at managing indoor air quality when providing guidance on home isolation. This information is more critical for the elderly, women, children, and immunocompromised individuals living in cold regions and rural areas where a wood-burning stove is the main source of cooking and heating.²⁰

As the global economy deepens into an economic crisis of unprecedented proportions, government rescue

programs continue to prioritize industry, scarce resource decisions, and allocation of financing. They should aim to reduce inequalities rather than exacerbate them.²² What we do today to minimize and mitigate the impact on the climate - developing, investing, and deploying renewable energy technologies - can and will make a difference in the years or decades to come.³⁵

In conclusion, our ability to prevent and manage future health crises and deal with the negative impacts of the ongoing crisis - the lack of clean and efficient energy services for cooking and climate change - depends on how we care for our most vulnerable and disadvantaged populations during and after COVID-19.

However, to be successful and sustainable in the long-term, governments need to be willing and able to prioritize COVID-19 recovery programs that progress alongside a climate agenda. The fact that simultaneous progression allows access to clean and affordable kitchen energy services, setting ambitious policies that reflect the scale of the challenge and introducing significant socioeconomic reforms in order to generate sustainable opportunities and skills for everyone are of utmost importance.

Declarations of interest

The authors declare no conflicts of interest.

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