COVID-19 Pandemic and Environmental Health: Effects and the Immediate Need for a Concise Risk Analysis

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COVID-19 Pandemic and Environmental Health: Effects and the Immediate Need for a Concise Risk Analysis

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ABSTRACT: COVID-19 pandemic, as another disease emerging in the interface between animals and humans, has revealed the importance of interdisciplinary collaborations such as the One Health initiative. Environmental Health, whose role in the One Health concept is well established, has been associated with COVID-19 pandemic via various direct and indirect pathways. Modern lifestyle, climate change, environmental degradation, exposure to chemicals such as endocrine disruptors, and exposure to psychological stress factors impact human health negatively. As a result, many people are in the disadvantageous position to face the pandemic with an already impaired immune system due to their exposure to environmental health hazards. Moreover, the ongoing pandemic has been associated with outdoor and indoor air pollution, water and noise pollution, food security, and plastic pollution issues. Also, the inadequate infrastructure, the lack of proper waste and wastewater management, and the unequal social vulnerability reveal more linkages between Environmental Health and COVID-19 pandemic. The significant emerging ecological risk and its subsequent health implications require immediate risk analysis and risk communication strategies.

KEYWORDS: COVID-19, pandemic, Environmental Health, One Health, risk analysis, risk communication

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Introduction

Four months after the first confirmed case of COVID-19 in Wuhan, China, on November 17, 2019, the World Health Organization acknowledged this new coronavirus disease as a global pandemic.[1] Since then, due to international commercial connections and traveling, the disease has rapidly spread all over the world, with 96 906 712 confirmed cases and 2 075 902 deaths (January 21, 2021, UTC 08:46).[2]

COVID-19 constitutes another fatal disease emerging in the interface between animals and humans; scientific community should, therefore, reconsider the importance of the One Health concept, which embraces interdisciplinary initiatives aiming at simultaneously protecting animals, humans, and the natural environment.[3-6] The role of the Environmental Health—defined as the branch of public health dealing with all the environmental factors with a potential impact on health, such as physical, chemical, biological, social, and psychological factors—in the One Health concept initiative is well established.[4,7,8]

How Environmental Health is Associated with COVID-19

Modern lifestyle may negatively affect our health.[9] As a result, many people may be in the disadvantageous position to face the pandemic with an already impaired immune system due to their exposure to environmental health hazards. Starting from the intrauterine life period, humans are in a constant exposure—willingly or not—to various endocrine-disrupting chemicals, mutagens, carcinogens, hazardous radiation, and psychological stress factors that interact with their immune system.[10-16] Moreover, food and water security issues, climate change, as well as water, soil, and air pollution are only a few environmental factors with known detrimental effects on human and animal health.[17-20]

A very important factor with a well-studied detrimental effect in the respiratory system and overall physical state is the low quality of urban air.[21,22] It is well known that aerosols carry pathogens attached to their surface; moreover, particulate matter contributes to the pathogenesis of pulmonary and cardiovascular diseases, and various types of cancer.[23-29] Indeed, an association between urban air quality and COVID-19 morbidity and mortality has already been reported, increasing the concern about the potential aerosol transmission of COVID-19.[30-33] This negative association may also be determined by other environmental factors, such as meteorological conditions including temperature, wind speed, and air relative humidity.[34,35]

Of note, during the pandemic, in addition to the reduction in noise pollution levels, a reduction in the emission of urban air pollutants was documented; this was attributed mainly to the

reduction of circulating vehicles due to lockdown measures, thus temporarily improving air quality.[36-39] On the contrary, indoor air quality has been negatively affected, as a result of the intensification of common domestic activities.[40,41] Moreover, due to the wide use of disinfectants, masks, and gloves, both the release of many chemical agents in the aquatic environment and plastic pollution are expected to increase greatly.[42,43] The environmental footprint of the pandemic needs to be thoroughly assessed concurrently with its evolution, and appropriate interventions should be applied. For instance, biomonitoring of many chemical disinfectant agents in aquatic organisms may reveal new environmental health hazards and food security issues.

Furthermore, another challenge to be met is the proper management of medical waste. This could amount to a significant emerging ecological risk to natural ecosystems, especially in areas with no reliable waste management planning or with inadequate relevant infrastructure.[44] Moreover, the potential transmission of COVID-19 through wastewater requires special attention.[45] Close monitoring of household waste management should also continue.

The social determinants of Environmental Health, such as low income, poor housing, lack of access to safe drinking water and food, poor hygienic conditions, and inadequate infrastructure significantly interact with the ongoing pandemic as evident by the significant spread in low-income areas not only in Latin America and Asia but in the developed world as well.[46-49] These conditions also determine the gravity of the pandemic impact. There are many challenges to be met, such as in the case of living conditions in the developing countries and in areas with clustering of vulnerable populations, for example, refugee camps.[50,51]

The Immediate Need for Risk Analysis and Risk Communication

Nobody is able to predict the precise outcome of the ongoing health crisis. However, its multidimensional impacts can be mitigated through effective strategies; an inter-disciplinary approach is essential. The One Health concept, aiming at protecting the Environmental Health, may offer a necessary interdisciplinary arsenal for sustainable management of this and future health crises.

Already-fragile healthcare systems, such as in the case of sub-Saharan countries, find it harder to cope with current pandemic.[52] Decision-makers should never forget that these countries are obliged to simultaneously deal with other serious health threats such as malaria outbreaks.[53]

Moreover, the importance of the non-pharmaceutical intervention has been clearly outlined in recent guidance.[54,55] The prospect of adverse environmental effects of similar and novel interventions should be further discussed within the context of One Health and the prospect of inevitable future pandemics. Both improvement of the health status of the general population, and protection of the aggregate of the environmental factors that affect both directly and indirectly human health are of paramount importance against the ongoing and future health crises.

Conclusion

In conclusion, the ongoing pandemic may be associated with significant environmental health hazards that need continuous risk analysis and management via the collaboration of all relevant stakeholders. Risk communication strategies will enhance the understanding of the importance of such interventions by lay people and policy makers. Diseases of zoonotic origin, such as Ebola Virus Disease and COVID-19, are constantly revealing the significance of the One Health concept.

Humanity should stand united in the fight against this and future pandemics realizing that this is a multi-faceted effort at many fronts demanding interdisciplinary collaboration. Environmental Health is one of the most important ones.

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REFERENCES

1. Adil MT, Rahman R, Whitelaw D, et al. SARS-CoV-2 and the pandemic of COVID-19. *Postgrad Med J*. 2020;0:1-7.
2. Dong E, Du H, Gardner L. An interactive web-based dashboard to track COVID-19 in real time. *Lancet Infect Dis*. 2020;20:533-534.
3. Murdoch DR, French NP. COVID-19: another infectious disease emerging at the animal-human interface. *N Z Med J*. 2020;133:12-15.
4. Musoke D, Ndejjo R, Atusingwize E, Halage AA. The role of environmental health in One Health: a Uganda perspective. *One Health*. 2016;2:157-160.
5. Essack SY. Environment: the neglected component of the one health triad. *Lancet Planet Health*. 2018;2:e238-e239.
6. Decaro N, Martella V, Saif LJ, Buonavoglia C. COVID-19 from veterinary medicine and one health perspectives: what animal coronaviruses have taught us. *Res Vet Sci*. 2020;131:21.
7. McSwane D, French J, Klein R. Environmental health and safety. In: Bradsher J, Wojtala G, Kaml C, Weiss C, Read D, eds. *Regulatory Foundations for the Food Protection Professional*. Springer; 2015:125-141 (ISBN: 978-1-4939-0650-5).
8. Frumkin H. *Environmental Health: From Global to Local*. John Wiley & Sons; 2016:3-26. Accessed November 6, 2020. https://media.wiley.com/product_data/excerpt/65/11189847/1118984765-15.pdf
9. Trivedi GY, Saboo B. The risk factors for immune system impairment and the need for lifestyle changes. *J Soc Health Diabetes*. 2020;8(01):025-028.
10. Norval M, Cullen AP, De Gruijl FR, et al. The effects on human health from stratospheric ozone depletion and its interactions with climate change. *Photochem Photobiol Sci*. 2007;6:232-251.
11. Anand P, Kunnumakara AB, Sundaram C, et al. Cancer is a preventable disease that requires major lifestyle changes. *Pharm Res*. 2008;25:2097-2116.
12. Bennasroune A, Rojas L, Foucaud L, et al. Effects of 4-nonylphenol and/or diisononylphthalate on THP-1 cells: impact of endocrine disruptors on human immune system parameters. *Int J Immunopathol Pharmacol*. 2012;25:365-376.
13. Ünüvar T, Büyükgebiz A. Fetal and neonatal endocrine disruptors. *J Clin Res Pediatr Endocrinol*. 2012;4:51.
14. Rogers JA, Metz L, Yong VW. Review: endocrine disrupting chemicals and immune responses: a focus on bisphenol-A and its potential mechanisms. *Mol Immunol*. 2013;53:421-430.
15. Morey JN, Boggero IA, Scott AB, Segerstrom SC. Current directions in stress and human immune function. *Curr Opin Psychol*. 2015;5:13-17.
16. Soerjomataram I, Shield K, Marant-Micallef C, et al. Cancers related to lifestyle and environmental factors in France in 2015. *Eur J Cancer*. 2018;105:103-113.
17. Willis HH, MacDonald Gibson J, Shih RA, et al. Prioritizing environmental health risks in the UAE. *Risk Anal*. 2010;30:1842-1856.
18. Zhang J, Mauzerall DL, Zhu T, Liang S, Ezzati M, Remais JV. Environmental health in China: progress towards clean air and safe water. *Lancet*. 2010;375:1110-1119.
19. Smith KR, Woodward A, Campbell-Lendrum D, et al. Human health: impacts, adaptation, and co-benefits. In: Field CB, Barros VR, Dokken DJ, et al., eds.

Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press; 2014:709-754. Accessed November 6, 2020. https://www.ipcc.ch/site/assets/uploads/2018/02/WGIIAR5-Chap11_FINAL.pdf
20. Losacco C, Perillo A. Particulate matter air pollution and respiratory impact on humans and animals. *Environ Sci Pollut Res*. 2018;25:33901-33910.
21. D'Amato G. Environmental urban factors (air pollution and allergens) and the rising trends in allergic respiratory diseases. *Allergy*. 2002;57:30-33.
22. Zora JE, Sarnat SE, Raysoni AU, et al. Associations between urban air pollution and pediatric asthma control in El Paso, Texas. *Sci Total Environ*. 2013;448:56-65.
23. Chen X, Kumari D, Achal V. A review on airborne microbes: the characteristics of sources, pathogenicity and geography. *Atmosphere*. 2020;11:919.
24. Wei M, Li M, Xu C, Xu P, Liu H. Pollution characteristics of bioaerosols in $PM_{2.5}$ during the winter heating season in a coastal city of northern China. *Environ Sci Pollut Res Int*. 2020;27:27750-27761.
25. Pope CA, III, Burnett RT, Thun MJ, et al. Lung cancer, cardiopulmonary mortality, and long-term exposure to fine particulate air pollution. *JAMA*. 2002;287:1132-1141.
26. Zhang F, Li L, Krafft T, Lv J, Wang W, Pei D. Study on the association between ambient air pollution and daily cardiovascular and respiratory mortality in an urban district of Beijing. *Int J Environ Res Public Health*. 2011;8:2109-2123.
27. Kim HB, Shim JY, Park B, Lee YJ. Long-term exposure to air pollutants and cancer mortality: a meta-analysis of cohort studies. *Int J Environ Res Public Health*. 2018;15:2608.
28. Jariyasopit N, Tung P, Su K, et al. Polycyclic aromatic compounds in urban air and associated inhalation cancer risks: a case study targeting distinct source sectors. *Environ Pollut*. 2019;252:1882-1891.
29. Liu X, Zhu H, Hu Y, et al. Public's health risk awareness on urban air pollution in Chinese megacities: the cases of Shanghai, Wuhan and Nanchang. *Int J Environ Res Public Health*. 2016;13:845.
30. Comunian S, Dongo D, Milani C, Palestini P. Air pollution and Covid-19: the role of particulate matter in the spread and increase of Covid-19's morbidity and mortality. *Int J Environ Res Public Health*. 2020;17:4487.
31. Magazzino C, Mele M, Schneider N. The relationship between air pollution and COVID-19-related deaths: an application to three French cities. *Appl Energy*. 2020;279:115835.
32. Mele M, Magazzino C. Pollution, economic growth, and COVID-19 deaths in India: a machine learning evidence. *Environ Sci Pollut Res*. 2021;28(3):2669-2677.
33. Tang S, Mao Y, Jones RM, et al. Aerosol transmission of SARS-CoV-2? Evidence, prevention and control. *Environ Int*. 2020;144:106039.
34. Zhang Z, Xue T, Jin X. Effects of meteorological conditions and air pollution on COVID-19 transmission: evidence from 219 Chinese cities. *Sci Total Environ*. 2020;741:140244.
35. Zoran MA, Savastru RS, Savastru DM, Tautan MN. Assessing the relationship between surface levels of PM2.5 and PM10 particulate matter impact on COVID-19 in Milan, Italy. *Sci Total Environ*. 2020;738:139825.
36. Bar H. COVID-19 lockdown: animal life, ecosystem and atmospheric environment. *Environ Dev Sustain*. Published online October 1, 2020. doi:10.1007/s10668-020-01002-7
37. Bera B, Bhattacharjee S, Shit PK, Sengupta N, Saha S. Significant impacts of COVID-19 lockdown on urban air pollution in Kolkata (India) and amelioration of environmental health. *Environ Dev Sustain*. Published online July 28, 2020. doi:10.1007/s10668-020-00898-5
38. Dutheil F, Baker JS, Navel V. COVID-19 as a factor influencing air pollution? *Environ Pollut*. 2020;263:114466.
39. Zhang Z, Arshad A, Zhang C, Hussain S, Li W. Unprecedented temporary reduction in global air pollution associated with COVID-19 forced confinement: a continental and city scale analysis. *Remote Sens*. 2020;12:2420.
40. Du W, Wang G. Indoor air pollution was nonnegligible during COVID-19 lockdown. *Aerosol Air Qual Res*. 2020;20:1851-1855.
41. Nwanaji-Enwerem JC, Allen JG, Beamer PI. Another invisible enemy indoors: COVID-19, human health, the home, and United States indoor air policy. *J Expo Sci Environ Epidemiol*. 2020;30:773-775.
42. Zhang H, Tang W, Chen Y, Yin W. Disinfection threatens aquatic ecosystems. *Science*. 2020;368:146-147.
43. Silva ALP, Prata JC, Walker TR, et al. Increased plastic pollution due to COVID-19 pandemic: challenges and recommendations. *Chem Eng J*. 2021;405:126683.
44. Rahman MM, Bodrud-Doza M, Griffiths MD, Mamun MA. Biomedical waste amid COVID-19: perspectives from Bangladesh. *Lancet Glob Health*. 2020;8:e1262.
45. Adelodun B, Ajibade FO, Ibrahim RG, Bakare HO, Choi KS. Snowballing transmission of COVID-19 (SARS-CoV-2) through wastewater: any sustainable preventive measures to curtail the scourge in low-income countries? *Sci Total Environ*. 2020;742:140680.
46. Laborde D, Martin W, Swinnen J, Vos R. COVID-19 risks to global food security. *Science*. 2020;369:500-502.
47. Martins-Filho PR, de Souza Araújo AA, Quintans-Júnior LJ, Santana Santos V. COVID-19 fatality rates related to social inequality in Northeast Brazil: a neighbourhood-level analysis. *J Travel Med*. 2020;27(7):taaa128.
48. Mishra SV, Gayen A, Haque SM. COVID-19 and urban vulnerability in India. *Habitat Int*. 2020;103:102230.
49. Zar HJ, Dawa J, Fischer GB, Castro-Rodriguez JA. Challenges of COVID-19 in children in low-and middle-income countries. *Paediatr Respir Rev*. 2020;35:70-74.
50. Accornero G, Harb M, Magalhães AF, et al. 'Stay home without a home': report from a webinar on the right to housing in Covid-19 lockdown times. *Radic Hous J*. 2020;2:197-201.
51. Kluge HHP, Jakab Z, Bartovic J, D'Anna V, Severoni S. Refugee and migrant health in the COVID-19 response. *Lancet*. 2020;395:1237-1239.
52. Paintsil E. COVID-19 threatens health systems in sub-Saharan Africa: the eye of the crocodile. *J Clin Invest*. 2020;130:2741-2744.
53. Sherrard-Smith E, Hogan AB, Hamlet A, et al. The potential public health consequences of COVID-19 on malaria in Africa. *Nat Med*. 2020;26:1411-1416.
54. Flaxman S, Mishra S, Gandy A, et al. Estimating the effects of non-pharmaceutical interventions on COVID-19 in Europe. *Nature*. 2020;584:257-261.
55. Lytras T, Tsiodras S. Lockdowns and the COVID-19 pandemic: what is the endgame? *Scand J Public Health*. 2021;49(1):37-40.