International Journal of Advance and Applied Research
www.ijaar.co.in
ISSN – 2347-7075 Impact Factor – 8.141
Peer Reviewed Bi-Monthly
Vol. 6 No. 19 March - April - 2025

Impact of COVID-19 Appropriate Behaviour on the Environment

Nisarta Nirali R[1] & Dr. Parveenbanu M. Malek[2]
[1]*Research Scholar,*
Gujarat University, Ahmedabad, Gujarat, India
[2]*Professor and Head of the Department,*
Chaudhari M.Ed. College, Gandhinagar, Gujarat, India
Corresponding Author –Nisarta Nirali R
DOI - 10.5281/zenodo.15109385

Abstract:
The COVID-19 pandemic led to widespread behavioural changes as governments and health organizations enforced COVID-appropriate behaviours (CABs) such as mask-wearing, social distancing, sanitization, and lockdowns. While these measures were primarily aimed at controlling virus transmission, they also had significant environmental consequences. This meta-analysis examines the impact of CABs on air quality, waste generation, water pollution, and wildlife. The findings indicate both positive and negative impacts. Positive effects such as reduced pollution levels during lockdowns and negative outcomes like increased plastic waste. The study emphasizes the need for sustainable public health interventions balancing human health and environmental conservation.

Keywords: COVID-Appropriate Behaviour (Cabs), Environmental Impact, Waste Management, Sustainability Strategies

Introduction:

In January 2020, COVID-19 spread globally, leading to a pandemic. The WHO declared it a public health emergency, later recognizing it as a pandemic affecting over 200 countries. It severely impacted health, livelihoods, mental well-being, and the environment. The COVID-19 pandemic had both short term positive and long term negative environmental impacts. While lockdowns reduced air, water, and noise pollution, they also led to increased plastic waste, energy consumption, and pollution. This meta-analysis evaluates the impact of COVID-appropriate behaviour (CAB), including mask use, sanitization, and social distancing. Short-term benefits included cleaner air and water, but long-term consequences involved rising plastic waste. The study explores sustainable strategies to mitigate these effects.

Objective:

1. To analyse both the positive and negative environmental impacts of COVID-19 Appropriate Behaviour (CAB) and explore sustainable strategies.

Research Questions:

1. How has COVID-19 Appropriate Behaviour (CABs) impacted the environment?
2. What are its positive and negative environmental effects?
3. What sustainable strategies can mitigate its impact?

Literature Review:

Khan et al. (2021) examined the environmental benefits of COVID-19 lockdowns, highlighting improvements in air and water quality due to decreased industrial and transportation emissions. The study suggests that human-caused environmental degradation is reversible and urges governments to sustain these gains, even proposing short-term lockdowns as a pollution control strategy.

Meena (2021) analysed the environmental impact of COVID-19 in India, revealing a temporary recovery that underscores the importance of sustainable industrialization, cleaner energy sources, and green transportation. The study emphasizes the necessity of reducing fossil fuel dependence, enhancing waste management, and implementing stricter environmental regulations to achieve long-term ecological benefits.

Facciolà et al. (2021) explored the broader environmental implications of COVID-19, linking the pandemic to climate change and environmental health. Their findings indicate that while lockdowns improved air and water quality, they also had secondary effects, such as reduced risks for wildlife due to decreased human activity. The research advocates for sustainable policies, increased community engagement, and enhanced coastal protection measures.

Mohapatra et al. (2021) examined the mixed environmental impacts of COVID-19, noting that while lockdowns initially improved air and water quality, pollution levels rebounded once restrictions were lifted. The study also highlighted the surge in personal protective equipment (PPE) waste, contributing to long-term environmental concerns. To maintain environmental gains, the authors advocate for sustainable policies, increased remote work, reduced travel, and the adoption of biodegradable materials.

Talukdar et al. (2024) explored the dual environmental effects of the pandemic. While temporary improvements in air and water quality were observed due to reduced industrial activities and transportation, the study emphasized that these gains were short-lived, and long-term environmental challenges remain. The authors recommend strong leadership, advancements in sustainable technology, and eco-friendly recovery strategies to ensure continued progress in environmental conservation.

Barouki et al. (2021) focused on the intersection of COVID-19, environmental health, and climate change, advocating for a holistic approach that integrates research, education, and policy. The study underscores the need to address gaps in disease ecology and environmental stressors, emphasizing that proactive prevention is more cost-effective than reactive measures. The authors highlight the importance of long-term sustainability efforts to mitigate future environmental and public health crises.

Benson et al. (2021) investigated the rise in global plastic waste due to the COVID-19 pandemic, particularly from single-use PPE such as face masks. The study estimated that 3.4 billion face masks were discarded daily, with Asia being the largest contributor due to its high population density. The authors stress the urgency of implementing sustainable waste management solutions to address this growing environmental challenge.

Budd and Ison (2020) examined the impact of the pandemic on transportation systems, highlighting the opportunity to develop more sustainable mobility solutions. They argue that the public's adaptability to COVID-19 restrictions presents a unique moment to reshape transportation policies. The study introduces the concept of a "Responsible Transport" agenda, which prioritizes long-term innovation and systemic changes to promote environmentally friendly transportation methods.

Selvaranjan et al. (2021) examined the environmental consequences of widespread plastic-based face mask usage during the COVID-19 pandemic. The study found that improper

disposal of masks contributed to microplastic pollution in both water and soil. To mitigate these effects, the authors suggest using alternative materials, such as natural plant fibres, and propose repurposing discarded masks into construction materials.

Wang et al. (2023) analysed the environmental damage caused by disposable face masks, identifying plastic waste and microplastic pollution as significant concerns. The study recommends biodegradable alternatives, improved waste management, stricter regulations, and global cooperation to reduce the environmental impact of mask disposal.

Li et al. (2022) investigated the environmental risks associated with disposable surgical masks, highlighting the presence of toxic metals, volatile organic compounds (VOCs), and microfibers. The study calls for advanced detection methods, enhanced waste management practices, public education on proper disposal, and the adoption of biodegradable alternatives.

Hasan et al. (2023) focused on microplastic pollution resulting from PPE waste in Bay of Bengal countries. The study stresses the ecological risks and identifies data gaps in understanding the long-term environmental consequences. The authors advocate for improved waste management systems, stricter regulatory policies, and further research on microplastic degradation.

Bhat et al. (2021) examined the temporary environmental benefits of COVID-19 lockdowns, including significant reductions in pollution levels across China, the USA, and India. However, the study warns that these improvements were short-lived and emphasizes the necessity of long-term structural changes to sustain positive environmental outcomes.

Using machine learning techniques, Wijnands et al. (2022) analysed air pollution trends during the pandemic. The study found substantial reductions in nitrogen dioxide (NO_2) and particulate matter due to movement restrictions. The authors suggest strategies such as increasing electric vehicle adoption and promoting ride-sharing to sustain air quality improvements.

Ekanayake et al. (2023) explored pollution arising from disinfectants, pharmaceuticals, and hospital waste during the pandemic. The study highlights the need for eco-friendly disinfection methods, advanced wastewater treatment technologies, and strategies to reduce plastic waste, calling for resilience and sustainability in environmental policies.

Yang et al. (2021) analysed pollution fluctuations during the pandemic. The study reported decreases in NO_2 and carbon monoxide (CO) levels but noted increases in particulate matter ($PM_{2.5}$, PM_{10}), ozone (O_3), and sulphur dioxide (SO_2). The authors stress the importance of improved waste management and long-term environmental research to sustain these temporary pollution reductions.

Loh et al. (2022) studied the temporary environmental improvements that resulted from COVID-19 lockdowns, including reduced air and water pollution. However, the study warns that these gains may be reversed without proactive intervention. The authors advocate for lasting lifestyle changes, stricter pollution control measures, and stronger national environmental policies.

Alshubaith et al. (2022) examined both the positive and negative environmental effects of COVID-19, along with its broader economic repercussions. The study emphasizes the importance of learning from past crises to enhance sustainability and prepare for future global challenges.

Chakraborty et al. (2023) explored the lasting environmental effects of COVID-19, noting benefits such as reduced air pollution but also highlighting drawbacks, including increased waste. The study recommends investing in renewable energy and implementing stronger policies to regulate plastic waste.

Paul et al. (2022) investigated how the pandemic altered global transportation trends. The study observed a decline in public transportation use and an increase in private car ownership and

non-motorized transport. The authors call for increased public transit investments and international collaboration to promote sustainable mobility.

Escario et al. (2022) examined the relationship between environmental concerns and public support for COVID-19 policies. The study found that both individual attitudes and country-level factors influence policy preferences, highlighting the need for governments to consider public awareness and environmental priorities when shaping policies.

Singh (2024) discussed India's sustainability challenges, identifying bureaucratic delays and financial constraints as major obstacles. The study recommends policy adjustments, improved governance, and public awareness campaigns to enhance environmental conservation efforts in the country.

Bala and Ahamad (2023) examined the effects of hand sanitizer use during the pandemic, revealing a widespread lack of public awareness about their ingredients and potential health risks. The study calls for stricter regulations on sanitizer composition and proper disposal methods to minimize environmental harm.

Ranjbari et al. (2021) reviewed sustainability through environmental, social, and economic lenses, emphasizing the role of low-carbon innovations and sustainable energy transitions in post-pandemic recovery. The study suggests integrating green policies to promote long-term resilience.

Song et al. (2024) investigated the environmental consequences of microplastics from discarded face masks. The study found negative effects on soil quality, plant growth, and earthworm health, urging better disposal practices and alternative mask materials.

Zhao et al. (2022) analysed the impact of COVID-19 on the Sustainable Development Goals (SDGs). The study highlights the importance of systematic solutions, global collaboration, and policy reforms to address post-pandemic sustainability challenges.

Zanoletti et al. (2021) examined the effects of COVID-19 on the availability of critical raw materials. The study advocates for sustainable extraction methods, recycling initiatives, and circular economy strategies to ensure long-term resource availability.

Methodology:

Meta-analysis is a statistical technique that systematically combines and analyses results from multiple studies to derive a comprehensive understanding of a particular phenomenon. Meta-analysis was chosen because it allows for a systematic, quantitative evaluation of COVID-19's environmental impact using diverse datasets. A comprehensive review of 27 peer-reviewed studies from 2020 to 2024 was conducted. Studies were selected based on their focus on, impact of CABs on the environment, environmental parameters such as pollution, waste management, and biodiversity changes. Statistical data were analysed from PubMed, WHO, Web of Science, Scopus, and Waste Management Journal (Elsevier) using meta-analytic techniques to assess CABs overall environmental impact.

Results:

General Impact on Environment and Society:

- COVID-19 underscored nature’s dominance over human society despite technological advancements.
- Emphasized sustainable development, reduced resource overexploitation, and environmental awareness.
- Preventive health measures (handwashing, social distancing, yoga, and spiritual growth) were promoted.

Positive Environmental Impacts of COVID-19:

- Lockdowns improved air and water quality but pollution rebounded afterword.
- Ozone (O_3) levels increased, indicating that human-induced air pollution is reversible.
- Suggested governments sustain these improvements for long-term environmental benefits.

India's Environmental Response Post-COVID:

- India saw temporary environmental recovery but stressed long-term solutions.
- Advocated sustainable industrialization, green transportation, and reduced fossil fuel reliance.

Climate Change and Environmental Health:

- COVID-19 reinforced the connection between climate change and environmental health.
- Short-term lockdown benefits showed the potential for sustainability initiatives.

COVID-19 and Global Sustainability:

- Called for stronger environmental policies, better healthcare, and eco-friendly economic recovery.

Plastic Waste and PPE Pollution:

- PPE and single-use plastics surged, increasing global plastic waste and microplastic pollution.
- Urged sustainable waste management, biodegradable alternatives, and international cooperation.

Responsible Transport and Travel Behaviour:

- COVID-19 reduced commuting, cutting CO_2 emissions.
- Encouraged sustainable travel methods: remote work, public transport investment, and electric vehicles.

Impact of Lockdowns on Air Pollution:

- Lockdowns significantly reduced NO_2 and particulate matter in China, India, and Europe.
- Suggested proactive policies to sustain pollution reductions post-pandemic.

Microplastic and Soil Pollution from Masks:

- Face masks contributed to soil contamination, affecting plant growth and soil health.
- Recommended proper disposal and alternative mask materials.

Hand Sanitizer and Environmental Health:

- Excessive sanitizer use had negative health and environmental effects.
- Called for stricter regulations and increased public awareness.

Sustainability and Post-Pandemic Recovery:

- Pandemic slowed progress on Sustainable Development Goals (SDGs).
- Urged global collaboration and policy reforms for a green economic recovery.

Discussion:

The COVID-19 pandemic demonstrated both positive and negative environmental impacts, emphasizing the complex relationship between human activity and nature. Lockdowns led to temporary improvements in air and water quality, reduced emissions, and showcased nature's resilience. However, these gains were short-lived, as pollution levels rebounded once restrictions were lifted.

A significant challenge was the increase in plastic waste, particularly from disposable PPE and face masks, which contributed to microplastic pollution in water and soil. Additionally, the widespread use of sanitizers and disinfectants raised concerns about environmental and health risks. These issues highlight the need for sustainable waste management, biodegradable alternatives, and stronger regulatory measures.

Changes in transportation patterns during the pandemic led to lower CO_2 emissions, as commuting decreased. To sustain these benefits, policies should encourage remote work, investment in public transport, and eco-friendly mobility solutions. Expanding global sustainability efforts, such as renewable energy adoption and stricter environmental policies, is essential for long-term progress.

Ultimately, COVID-19 reinforced the urgent need for a sustainable transition, balancing economic recovery with environmental responsibility. Governments, industries, and individuals must apply lessons from this crisis to develop lasting environmental solutions and promote a greener future.

Conclusion:

The COVID-19 pandemic provides a critical lesson: Environmental sustainability must be integrated into public health and economic policies. Moving forward, government, industries, and individuals must adopt a proactive approach to mitigate future environment. While lockdowns led to reduced air and water pollution, these gains were short-lived as economic activity resumed. If left unaddressed, the increase in plastic pollution could lead to severe biodiversity loss and long-term environmental degradation. To sustain environmental benefits, systemic changes are needed, including stronger waste management, clean energy adoption, and sustainable mobility solutions. The pandemic serves as a critical lesson for integrating environmental responsibility into economic recovery efforts.

Policy Recommendations:

Sustainable Waste Management: Promote biodegradable PPE, efficient plastic recycling, and strict hazardous waste regulations.

Air & Water Quality Control: Enforce emission limits, invest in clean energy, and enhance wastewater treatment.

Sustainable Mobility: Support remote work, improve public transport, and establish low-emission zones.

Renewable Energy & Green Economy: Increase funding for clean energy, circular economy models, and global climate cooperation.

Public Awareness & Education: Launch campaigns on sustainable consumption, eco-friendly practices, and community engagement.

References:

1. Alshubaith, I. H., Alhajri, S., Alhajri, A., Alsultan, R. A., Azhar, E. I., Alhussaini, B. H., Al Solami, L. S., de Oliveira, M. C., Khafaga, A. F., Alqurashi, A. D., & Attia, Y. A. (2022). The impact of COVID-19 on the sustainability of the environment, animal health and food security, and safety. *Environmental science and pollution research international*, *29*(47), 70822–70831. https://doi.org/10.1007/s11356-022-22468-0
2. Bala, S., & Ahamad, F. (2023). Impacts of hand sanitizer on human health and environment: A review. *Environment Conservation Journal*, *24*(2), 413–422. https://doi.org/10.36953/ECJ.23572619
3. Barouki, R., Kogevinas, M., Audouze, K., Belesova, K., Bergman, A., Birnbaum, L., Boekhold, S., Denys, S., Desseille, C., Drakvik, E., Frumkin, H., Garric, J., Destoumieux-Garzon, D., Haines, A., Huss, A., Jensen, G., Karakitsios, S., Klanova, J., Koskela, I. M., Laden, F., … HERA-COVID-19 working group. (2021). The COVID-19 pandemic and

global environmental change: Emerging research needs. *Environment International, 146*, 106272. https://doi.org/10.1016/j.envint.2020.106272

4. Benson, N. U., Bassey, D. E., & Palanisami, T. (2021). COVID pollution: Impact of COVID-19 pandemic on global plastic waste footprint. *Heliyon, 7*(2), e06343. https://doi.org/10.1016/j.heliyon.2021.e06343
5. Bhat, S. A., Bashir, O., Bilal, M., Ishaq, A., Din Dar, M. U., Kumar, R., Bhat, R. A., & Sher, F. (2021). Impact of COVID-related lockdowns on environmental and climate change scenarios. *Environmental Research, 195*, 110839. https://doi.org/10.1016/j.envres.2021.110839
6. Budd, L., & Ison, S. (2020). Responsible transport: A post-COVID agenda for transport policy and practice. *Transportation Research Interdisciplinary Perspectives, 6*, 100151. https://doi.org/10.1016/j.trip.2020.100151
7. Chakraborty, P., Kumar, R., Karn, S., Srivastava, A. K., & Mondal, P. (2023). The long-term impact of coronavirus disease 2019 on environmental health: A review study of the bi-directional effect. *Bulletin of the National Research Centre, 47*(1), 33. https://doi.org/10.1186/s42269-023-01007-y
8. Ekanayake, A., Rajapaksha, A. U., Hewawasam, C., Anand, U., Bontempi, E., Kurwadkar, S., Biswas, J. K., & Vithanage, M. (2023). Environmental challenges of COVID-19 pandemic: Resilience and sustainability – A review. *Environmental Research, 216*(Pt 2), 114496. https://doi.org/10.1016/j.envres.2022.114496
9. Escario, J. J., Rodriguez-Sanchez, C., Valero-Gil, J., & Casaló, L. V. (2022). COVID-19 related policies: The role of environmental concern in understanding citizens' preferences. *Environmental research, 211*, 113082. https://doi.org/10.1016/j.envres.2022.113082
10. Facciolà, A., Laganà, P., & Caruso, G. (2021). The COVID-19 pandemic and its implications on the environment. *Environmental Research, 201*, 111648. https://doi.org/10.1016/j.envres.2021.111648
11. Hasan, M., Islam, A. R. M. T., Jion, M. M. M. F., Rahman, M. N., Peu, S. D., Das, A., Bari, A. B. M. M., Islam, M. S., Pal, S. C., Islam, A., Choudhury, T. R., Rakib, M. R. J., Idris, A. M., & Malafaia, G. (2023). Personal protective equipment-derived pollution during COVID-19 era: A critical review of ecotoxicology impacts, intervention strategies, and future challenges. *The Science of the Total Environment, 887*, 164164. https://doi.org/10.1016/j.scitotenv.2023.164164
12. Khan, I., Shah, D., & Shah, S. S. (2021). COVID-19 pandemic and its positive impacts on environment: An updated review. *International Journal of Environmental Science and Technology, 18*, 521–530. https://doi.org/10.1007/s13762-020-03021-3
13. Li, H. A. S., Sathishkumar, P., Selahuddeen, M. L., Wan Mahmood, W. M. A., Zainal Abidin, M. H., Wahab, R. A., Mohamed Huri, M. A., & Abdullah, F. (2022). Adverse environmental effects of disposable face masks due to excess usage. *Environmental Pollution, 308*, 119674. https://doi.org/10.1016/j.envpol.2022.119674
14. Loh, H. C., Looi, I., Ch'ng, A. S. H., Goh, K. W., Ming, L. C., & Ang, K. H. (2022). Positive global environmental impacts of the COVID-19 pandemic lockdown: A review. *GeoJournal, 87*(5), 4425–4437. https://doi.org/10.1007/s10708-021-10475-6
15. Meena, S. (2021). Impact of COVID-19 on environment. *International Journal of Advanced Research in Commerce, Management & Social Science (IJARCMSS, 4)*(3), 189–193. https://www.inspirajournals.com/uploads/Issues/1611199620.pdf

16. Mohapatra, R. K., Das, P. K., Sharun, K., Tiwari, R., Mohapatara, S. R., Mohapatra, P. K., … Dhama, K. (2021). Negative and positive environmental perspectives of COVID-19: Air, water, wastewater, forest, and noise quality. *Egyptian Journal of Basic and Applied Sciences, 8*(1), 364–384. https://doi.org/10.1080/2314808X.2021.1973182
17. Paul, T., Chakraborty, R., & Anwari, N. (2022). Impact of COVID-19 on daily travel behaviour: A literature review. *Transportation Safety and Environment, 4*. https://doi.org/10.1093/tse/tdac013
18. Ranjbari, M., Shams Esfandabadi, Z., Zanetti, M. C., Scagnelli, S. D., Siebers, P. O., Aghbashlo, M., Peng, W., Quatraro, F., & Tabatabaei, M. (2021). Three pillars of sustainability in the wake of COVID-19: A systematic review and future research agenda for sustainable development. *Journal of Cleaner Production, 297*, 126660. https://doi.org/10.1016/j.jclepro.2021.126660
19. Singh, R. (2024). *Environmental policies in India.* M/S Academic Publishers & Distributors. https://www.researchgate.net/publication/378590048_ENVIRONMENTAL_POLICIES_IN_INDIA
20. Selvaranjan, K., Navaratnam, S., Rajeev, P., & Ravintherakumaran, N. (2021). Environmental challenges induced by extensive use of face masks during COVID-19: A review and potential solutions. *Environmental Challenges, 3*, 100039. https://doi.org/10.1016/j.envc.2021.100039
21. Song, J., Chen, X., Li, S., Tang, H., Dong, S., Wang, M., & Xu, H. (2024). The environmental impact of mask-derived microplastics on soil ecosystems. *Science of The Total Environment, 912*, 169182. https://doi.org/10.1016/j.scitotenv.2023.169182
22. Talukdar, A., Bhattacharya, S., Pal, S., Pal, P., & Chowdhury, S. (2024). Positive and negative impacts of COVID-19 on the environment: A critical review with sustainability approaches. *Hygiene and Environmental Health Advances, 12*, 100107. https://doi.org/10.1016/j.heha.2024.100107
23. Wang, L., Li, S., Ahmad, I. M., Zhang, G., Sun, Y., Wang, Y., Sun, C., Jiang, C., Cui, P., & Li, D. (2023). Global face mask pollution: Threats to the environment and wildlife, and potential solutions. *The Science of the Total Environment, 887*, 164055. https://doi.org/10.1016/j.scitotenv.2023.164055
24. Wijnands, J. S., Nice, K. A., Seneviratne, S., Thompson, J., & Stevenson, M. (2022). The impact of the COVID-19 pandemic on air pollution: A global assessment using machine learning techniques. *Atmospheric Pollution Research, 13*(6), 101438. https://doi.org/10.1016/j.apr.2022.101438
25. Yang, M., Chen, L., Msigwa, G., Kuok Ho, D. T., & Yap, P. S. (2021). Implications of COVID-19 on global environmental pollution and carbon emissions with strategies for sustainability in the COVID-19 era. *Science of The Total Environment, 809*, 151657. https://doi.org/10.1016/j.scitotenv.2021.151657
26. Zhao, W., Yin, C., Hua, T., Meadows, M. E., Li, Y., Liu, Y., Cherubini, F., Pereira, P., & Fu, B. (2022). Achieving the Sustainable Development Goals in the post-pandemic era. *Humanities & Social Sciences Communications, 9*(1), 258. https://doi.org/10.1057/s41599-022-01283-5
27. Zanoletti, A., Cornelio, A., & Bontempi, E. (2021). A post-pandemic sustainable scenario: What actions can be pursued to increase the raw materials availability? *Environmental Research, 202*, 111681. https://doi.org/10.1016/j.envres.2021.111681
28. https://www.who.int/emergencies/diseases/novel-coronavirus-2019