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Review Article

Assessing the Need for Continuity of Preventive Environmental Health Recommendations to Avoid Contamination With COVID-19: A Systematic Review Study

Mohammad Ali Zazouli[1], **Zabihollah Yousefi**[2], **Hadi Niknejad**[3], **Alireza Ala**[4*]

[1]Department of Environmental Health Engineering, School of Health, Health Sciences Research Center, Mazandaran University of Medical Sciences, Sari, Iran
[2]Department of Environmental Health Engineering, School of Health, Mazandaran University of Medical Sciences, Sari, Iran
[3]Environmental Health Engineering, Faculty of Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Iran
[4]Department of Environmental Health Engineering, School of Health, Health Sciences Research Center, Student Research Committee, Mazandaran University of Medical Sciences, Sari, Iran

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***Corresponding author:**
Alireza Ala,
Email: ala_alireza@yahoo.com

Abstract

The coronavirus may persist for an extended period, underscoring the importance of maintaining preventive environmental health recommendations and sustainable environmental health management to curb viral infections and prevent the resurgence of COVID-19. This systematic review of existing literature aimed to assess the role of environmental health in COVID-19 prevention. The systematic review involved searching scientific articles across databases including PubMed, Scopus, Embase, Web of Science, and Google Scholar, using keywords such as Environmental Health, SARS-CoV-2, COVID-19, Coronavirus, and Preventive. Articles were included based on their provision of full-text research focusing on the role of environmental health in COVID-19 prevention. Quality assessment and validation using the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist were conducted independently by two authors. Ultimately, 20 articles comprising descriptive observational studies, systematic reviews, and analytical articles were selected from the total number of articles identified. Public participation in health protocols, environmental factors control, preventive recommendations, promotion of protective behaviors, immunization, and implementation of management measures emerged as critical strategies for effective risk communication and notification of preventive recommendations in addressing COVID-19. Fostering mutual understanding and sustaining public engagement are vital components in the ongoing battle against COVID-19. Given the significance of preventive measures and adherence to health protocols, ensuring the continuity of essential health services, implementing a combination of strategies to contain viral spread within society, and providing systematic information to stakeholders are underscored as crucial elements.

Keywords: COVID-19, Prevention, Coronavirus, Environmental health, Immunization

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Introduction

The emergence of COVID-19 has posed significant threats to public health worldwide.[1] Key concerns regarding COVID-19 include its global transmission, frequent outbreaks, substantial number of deaths and infections, and its impact on healthcare providers and vulnerable populations. The World Health Organization (WHO) declared COVID-19 a pandemic on March 11, 2020.[2] Within just five months, the disease spread to over 210 countries, becoming a global epidemic with profound consequences for public health.[3] The WHO)has reported over 640 million confirmed cases and nearly 6.6 million deaths.[4,5] he WHO has recommended preventative measures and a healthy lifestyle with a strong immune system as essential strategies to combat and safeguard against COVID-19.[6] The primary approach to reducing infection involves avoiding direct contact with the virus and disrupting its transmission chain.[7] This is achieved through a combination of public health interventions and infection prevention and control (IPC) measures in healthcare settings, including practicing hand and respiratory hygiene, employing personal protective equipment (PPE) rationally and appropriately, and implementing thorough cleansing and disinfection protocols, as well as safe waste management practices.[8,9] Public health authorities must develop comprehensive environmental health management plans to combat COVID-19. Factors such as air quality, water sanitation, sewage management, waste disposal, and disinfection policies play significant roles in the transmission of COVID-19 in the environment.[9] Furthermore, environmental factors such as migration, poverty, marginalization, limited access to healthcare facilities, and inadequate water supply influence the control of COVID-19.[10] Controlling environmental factors plays a crucial role in preventing the spread of COVID-19 and reducing infection rates and mortality caused by the disease.[11] Enhancing environmental standards worldwide stands out as one of the most effective ways to prevent disease epidemics, particularly in the current context of COVID-19.[12] Health measures such as patient quarantine, self-care practices including personal hygiene, hand and face washing, avoiding facial contact, maintaining physical distance, and limiting travel have been identified as highly effective methods for disease control.[12,13] Providing appropriate PPE for healthcare workers involved in the care of COVID-19 patients has been shown to significantly reduce transmission rates to zero.[14] Measures such as reducing high-risk aerosol transmission in healthcare settings through the use of medical-grade PPE like filtering facepiece respirators (FFRs) and ensuring proper use of face coverings by the general public have been emphasized for COVID-19 prevention.[15] Proper management of PPE waste during infectious disease outbreaks is critical and should be treated as an emergency.[16] Poor indoor air quality has been linked to increased COVID-19 transmission, highlighting the importance of improving indoor ventilation.[17] Simple actions like opening windows for ventilation can significantly reduce the concentration of viral particles indoors.[18] Social distancing and ventilation are strongly recommended to control the COVID-19 pandemic in enclosed spaces.[19] Implementing educational, communication, and behavioral intervention strategies based on recommendations can enhance the effectiveness of COVID-19 prevention programs.[20] Campaigns addressing behavioral aspects of COVID-19 targeting both healthcare providers and the general public have proven to be successful. [21-23] Ensuring global improvement in environmental standards is essential for countries to protect their populations from COVID-19 and other public health risks.[11] This study systematically examined the most important environmental health measures and recommendations during the COVID-19 outbreak, emphasizing the necessity of sustainable environmental management and the continuation of essential prevention measures against COVID-19.

Materials and Methods

The review was conducted according to the criteria outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

Search Strategy

Electronic databases were searched for research articles on COVID-19 and environmental health measures and recommendations from inception to September 2022, including full articles, editorials, commentaries, and studies related to healthcare in the field of environmental health. The authors conducted a comprehensive search for measures and recommendations proposed by various researchers worldwide regarding environmental health management and care during the COVID-19 outbreak. The systematic review involved searching databases such as PubMed, Scopus, Embase, Web of Science, and Google Scholar using keywords including "Environmental Health," "SARS-CoV-2," "COVID-19," "Coronavirus," and "Preventive." Search combinations included terms such as 'COVID-19' OR 'Coronavirus' OR 'SARS-CoV-2' AND 'Environmental Health' AND 'Preventive'. Articles were included if they provided full-text coverage of at least one environmental health recommendation or preventive measure. Exclusions comprised ambiguous results, duplicate entries, and non-scientific publications. The study had a limitation of not including articles in languages other than English and Persian.

Quality assessment and validation of selected articles were performed independently by two authors using the STROBE checklist. Out of 1307 articles initially searched, 20 were included in the final research. Duplicate and overlapping articles (759) were removed, as were articles based on title (192), abstract (276), and full text (60) (see Figure 1). The reviewed articles encompassed descriptive observational (cross-sectional), systematic, and analytical

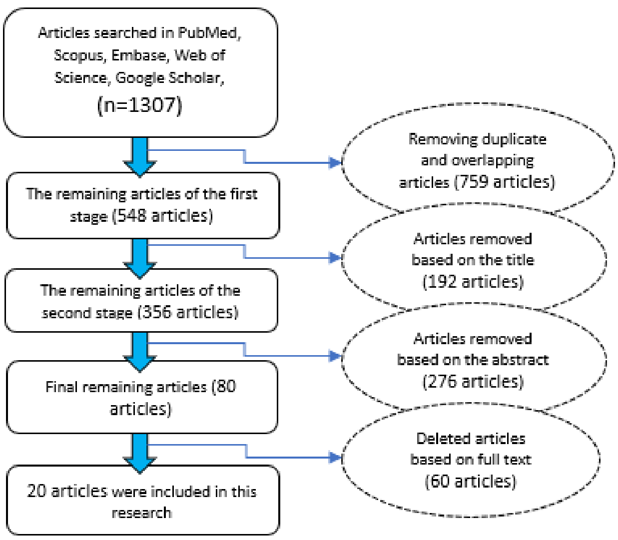

Figure 1. Flowchart of the Steps of Entering Studies Into the Process

review articles.

Results and Discussion

Overview

The primary objective of this study was to conduct a comprehensive analysis of the necessity to uphold preventive environmental health recommendations and sustainable environmental management in order to mitigate viral infections and thwart the resurgence of COVID-19. Throughout the systematic literature review, various preventive environmental health recommendations and strategies to prevent the resurgence of COVID-19 were identified and categorized. A total of 1307 articles were screened, and 20 full-text articles were meticulously reviewed. The studies underscored the importance of preventive environmental health recommendations in curbing the spread of COVID-19. This study delineated recommendations and diverse preventive environmental health methods aimed at preventing the recurrence of COVID-19 across seven distinct domains. These domains encompassed immunization and waste management, PPE, ventilation, disinfection and sterilization, social and physical distancing, and environmental factors such as air pollution, temperature, humidity, water, and sewage. The findings were summarized and analyzed to underscore the imperative nature of continuing preventive environmental health recommendations to avert COVID-19 infections.

Immunization and Waste Management

Vaccination and immunization help to control the disease.[24] Today, achieving full vaccination coverage for the majority of the global population is widely recognized as the most crucial strategy for overcoming the COVID-19 pandemic.[25] Vaccination stands as an effective measure to prevent the transmission of diseases, including COVID-19.[26] However, the proper collection and management of vaccination-related waste are of paramount importance.[27] The rapid spread of the COVID-19 disease has heightened the utilization of PPE such as masks. Inadequate management of PPE used in medical facilities to mitigate the spread of COVID-19 can potentially result in indirect infections.[28] Improper management of sanitary waste contributes to the transmission of the COVID-19 virus. Implementing proper management practices helps mitigate landfill issues and prevents the further spread of the virus.[29] Masks, gowns, and shields utilized to protect the public and medical personnel from the virus contribute to the waste generated by disposable PPE.[30] Additionally, the production, transportation, and disposal of vaccines consume resources and contribute to environmental pollution.[31] The waste generated during the management of this pandemic necessitates special attention. A critical aspect of COVID-19 waste management involves segregating medical waste from general solid waste. Since waste generated during COVID-19 vaccination and care qualifies as infectious waste, raising public awareness about the hazards of COVID-19 waste and implementing source segregation are crucial recommendations. Guidelines formulated for managing waste generated during the diagnosis, treatment, and vaccination of suspected or confirmed COVID-19 patients must be adhered to. Managing medical waste generated during the prevention and treatment of COVID-19, including vaccination, is not only a concern for public health but also a legal and social responsibility for all stakeholders.[31,32] In addition to waste generated during vaccine production, primary waste associated with vaccination includes vials, syringes, needle heads, expired vaccines, and disposable plastic packaging.[31] (Table 1).

Personal Protective Equipment

PPE is widely debated and considered a sensitive issue for frontline healthcare workers caring for patients with COVID-19. Studies have shown that 40% of healthcare professionals make mistakes when removing and disposing of their PPE, leading to contamination of their skin and clothing.[32,33] In 2020, the University of North Carolina Medical Center (UNC-MC) implemented PPE monitors as part of its comprehensive preventive strategy to observe employees and the use of PPE in areas treating or suspected patients with COVID-19 to reduce employee risk. in the face of covid-19.[14] The evaluation demonstrated that personal protection monitors play a crucial role in a comprehensive COVID-19 prevention strategy.[14,34] The most effective approach to addressing the COVID-19 disease is to prevent contamination and curb its transmission by adhering to protective measures and practicing personal hygiene.[35]

Masks

Given that saliva droplets containing aerosols are expelled during breathing or coughing and serve as the primary mode of SARS-CoV-2 transmission, masks can offer protective benefits against the coronavirus in various occupations. Therefore, the use of masks is strongly recommended as an effective measure to prevent the worldwide spread of the COVID-19 pandemic.[36,37] Among the various physical distancing measures implemented by the government, mandates requiring the use of masks are considered one of the most critical measures.[38] Surgical masks and N95 filter face masks (FFRs) are effective in preventing the transmission of SARS-CoV-2 infection and provide protection for medical personnel. The demand for surgical masks and N95 FFRs surged during the 2019 coronavirus disease pandemic.[39] Masking, particularly when paired with social distancing, avoiding gatherings, and frequent hand and face washing, is likely to be at least as effective as widespread vaccination in conferring immunity and preventing premature death. Globally, masking stands as the oldest and most straightforward method of controlling the transmission of respiratory pathogens. For over a century, masking has been the fundamental pillar of infection control in hospitals, operating rooms, and clinics.[40] Despite widespread

Table 1. Disposal of Vials, Syringes, Applicators and Sprays

Garbage Items	Waste Type	Garbage Collection and Disposal Containers
Empty vials* of inactivated vaccine and empty vaccine syringe without needle	Non-hazardous/non-infectious waste	They are placed safely in a normal trash or in a container and then disposed as a medical/biological waste.
Vaccines without preservatives (Usually, disposable vials and some prefilled syringes without needles)	Non-hazardous/non-infectious waste	They are placed safely in a normal trash or in a container and then disposed as a medical/biological waste.
Empty the syringe with needles	Hazardous/medical waste	They are placed in safe containers (safety box).
Live vaccine (applicator, vial and spray)	Hazardous/medical waste	They are placed in special medical waste bins and safe containers (the needle tip should not be separated from the syringe).
Vaccines containing mercury or cresol-based preservatives or multi-dose vials containing vaccines or pre-filled syringes	Hazardous waste	It is placed in Safe containers for hazardous waste and sharps (clearly marked and disposed of by licensed companies).

*When 3% or less of the original vaccine remains, and all vaccines that can be removed by normal methods (syringe) have been extracted, the vial is considered empty.

vaccination campaigns in many regions, ongoing efforts to maintain social distancing and utilize face masks remain crucial in mitigating the spread of COVID-19. The adoption of face masks, even in communities with limited social distancing measures, has led to a 62% reduction in the risk of contracting the COVID-19 disease. These findings underscore the effectiveness of mask-wearing in diminishing the transmission of COVID-19, particularly in settings with inadequate social distancing measures.[41-43]

Gloves

The utilization of PPE, particularly gloves and masks, holds significant importance in managing the COVID-19 pandemic. Healthcare workers, as well as members of the community, rely on PPE to reduce the risk of infection. Moreover, PPE may enhance psychological well-being by instilling a sense of comfort and greater protection among its wearers.[44] In a study conducted in Poland, less than half of the respondents reported using disposable gloves (e.g., for cleaning or work) before the pandemic. At that time, it was estimated that the use of a pair of gloves equated to 0.58 people per week. However, estimates revealed that after 2 months of the pandemic, the utilization of disposable gloves increased approximately tenfold, representing a 936% surge.[45] The primary rubber utilized in the manufacturing of gloves, particularly for medical purposes, is natural rubber, commonly known as latex.[46] The heightened utilization of disposable protective gloves (DPGs) has led to substantial amounts of glove waste accumulating in landfills and various other locations.[47] DPGs, such as heavy metals and organic chemicals, have the potential to be readily released from the gloves and contaminate water and soil.[48] The release potential of metals from DPGs was assessed by Garçon and co-workers in 2017. In this evaluation, metals from 15 different types of gloves sourced from various manufacturers, varying in color and material (vinyl, nitrile, latex, and neoprene), were washed and their concentrations were measured. The measurements revealed the presence of over 60 elements in the extracts. Zinc was found to be the most prevalent, with concentrations ranging from 0.6 to 863.8 mg/L.[45,48] Therefore, despite the protective role that gloves serve in preventing the transmission of various diseases, improper disposal and discarding of gloves over the long term may pose a genuine threat to both current and future generations.

Ventilation

The potential threat of the virus spreading through airborne transmission via ventilation systems in buildings and enclosed spaces is acknowledged as a significant concern. In order to mitigate this threat, researchers have explored various technologies and methods aimed at eliminating or reducing the concentration of the virus in ventilation systems and enclosed spaces. A recent study even suggests that airborne transmission may be the predominant mode of COVID-19 transmission.[49,50] Various technologies and methods have been employed to combat airborne viruses, such as COVID-19. These include increased ventilation, high-efficiency air filtration, air ionization, environmental condition control, ultraviolet germicidal radiation, non-thermal plasma, and various activated oxygen species, filter coatings, chemical disinfectants, and thermal inactivation. Developing technologies include thermal, nanoparticle, chemical, and plasma methods.[50] A specific quantity of virus must be introduced into an uninfected individual to elevate the viral load and initiate a new infection. Traditionally, the number of infectious particles in the air required for the infection of 63% of individuals in a confined space is defined in epidemiology as a “quantum.”[51] Ventilating a confined space effectively decreases the concentration of airborne particles carrying the COVID-19 virus. This can be achieved by simply opening a window or by utilizing systems such as HVAC (Heating, ventilation, and air conditioning) to introduce a fresh air source.[52] Small droplets are of particular significance due to their association with aerosol transmission of SARS-CoV-2.[43,52] In a study, the removal rate of droplets with a diameter of 5 microns was investigated under various ventilation conditions in three different rooms. In the room with the most effective ventilation, the number of droplets halved after 30 seconds. In the room with no ventilation, this process took 5 minutes, while in the room with poor ventilation, the number of droplets halved after 1.4 minutes.[43] The findings from these studies underscore the critical importance and necessity of ventilation in indoor spaces to mitigate the spread of respiratory droplets. Based on various research studies, an approach incorporating multiple methods is recommended for air ventilation, as no single method can entirely eliminate suspended particles. The optimal approach may vary for each specific situation, aiming to ensure the most effective removal of airborne particles containing COVID-19.[50,53]

Decontamination and Disinfection

Given that the exhaled air of infected individuals is a primary source of environmental contamination by pathogenic microorganisms, biological risk control in healthcare environments and medical clinics becomes a critical concern regarding the spread of COVID-19 infection and a public health emergency.[43,54] The spread of SARS-CoV-2 primarily occurs through the transmission of respiratory droplets from infected individuals. Research has demonstrated that coughing releases viral particles, which can remain viable and infectious for up to 3 hours when suspended in particles.[55] Cleaning and disinfection protocols for healthcare surfaces and clinics are essential components of infection prevention programs, particularly during the SARS-CoV-2 pandemic. In terms of hospital disinfection, various non-contact methods are employed against highly resistant organisms. These include aerosolized hydrogen peroxide, H_2O_2 vapor, ultraviolet C light, pulsed xenon, and gaseous ozone.[56] The utilization of disinfectants and sanitizers should be carried out with careful consideration for the safety of both the patient and their caregiver.[57] Disinfectants employed to safeguard against COVID-19 and manage urban environments must possess potent antiviral activity. It is crucial to carefully select and apply these disinfectants to minimize unnecessary environmental pollution.[9] Another approach utilized for disinfection against coronaviruses involves radiation methods,[58,59] gamma-ray ionization, non-ionization of ultraviolet rays, using temperature modulation methods[60], acidity and alkalinity,[61,62] peroxides,[63,64] halogens,[62,65] aldehydes and solvents,[66,67] alcohols,[68,69] detergents and surfactants, detergents/surfactants,[68,70,71] phenolics,[63,67,72,73] and other combined disinfectants such as quaternary ammonium compounds, chlorhexidine and alcohol.[57,73,74] In the future, it is imperative to investigate the direct impact of disinfectants within the patient's living environment, particularly concerning COVID-19, through an examination of relevant disinfection protocols.

Social and Physical Distance

Physical distancing may indeed be the most effective measure to control the transmission of COVID-19.[75] Considering that particles ranging in diameter from sub-micron to 10 microns are produced during conversation, coughing, and sneezing, and it has been determined that coughs contain viral particles,[76] which can remain viable and infectious in suspended particles for up to 3 hours[55] underscores the significance of maintaining physical and social distance. Individuals residing in communities with the strictest adherence to social distancing measures are 31% less susceptible to COVID-19 infection compared to those living in communities with less stringent social distancing practices.[41] One of the primary objectives of the community health system is to mitigate the transmission of COVID-19 by restricting large gatherings. Given that COVID-19 spreads from person to person through direct contact, the primary preventive measure is to limit large gatherings.[13] The specific growth rate (SGR) of COVID-19 decreased by over 66% following the implementation of quarantine measures. This rate steadily declined with the proper enforcement of quarantine protocols.[77] In an observational study conducted in the United States, the impact of implementing physical distancing measures and ambient temperature on controlling COVID-19 was examined. The study found that the implementation of physical distancing was associated with a 12% reduction in the risk of contracting COVID-19 (relative risk [RR]: 0.88, 95% confidence interval [CI]: 0.86–0.89), while every 5 °C increase in temperature was associated with a 2% decrease in cases (RR: 0.98, 95% CI: 0.97–0.98). These findings suggest that higher temperatures and the implementation of physical distancing measures both contributed to a decrease in COVID-19 cases, with physical distancing interventions being significantly more effective. Additionally, the study revealed a statistically significant interaction between temperature and the implementation of physical distancing, underscoring the importance of physical distancing measures in controlling the spread of COVID-19.[78] Physical distance interventions should be consistently implemented, even in hot seasons or areas, to achieve effective containment of COVID-19.[78-80] It was found that, on average, the implementation of any physical distance intervention was associated with an overall reduction in the prevalence of COVID-19 by approximately 13% .[81]

Environmental Factors

Air pollution

several studies have indicated that chronic exposure to air pollution increases respiratory and cardiovascular toxicity.[82] As a result, it has been hypothesized that air pollution may also contribute to the severity of COVID-19 illness.[83,84] Particulate matter less than 2.5 µm in diameter ($PM_{2.5}$) was identified as one of the primary contributors to COVID-19 cases in the UK. Specifically, a 1 m^3 increase in long-term average $PM_{2.5}$ was associated with a 12% increase in COVID-19 cases.[85] Additionally, a preliminary study conducted in the United States of America has indicated that $PM_{2.5}$ is associated with COVID-19 mortality.[86] A minor escalation in air pollution resulted in a substantial surge in both infections and fatalities from COVID-19 in the UK. Furthermore, lifetime exposure to air pollution influences the severity of COVID-19 illness.[87,88] Ozone, nitrogen oxide, and nitrogen dioxide levels are significantly associated with death due to COVID-19 along with population density.[85] A study conducted in England revealed that a mere increase of 1 cubic meter of ozone in the long-term average is correlated with a 4.5% rise in COVID-19 cases, while the same increase in nitrogen oxides is linked to nearly a 2% increase in COVID-19 cases[85,89] PM_{10}, $PM_{2.5}$, and NO_2 are among the variables that have a direct relationship with mortality caused by corona disease.[90] Short-term and long-term exposure to SO_2 is associated with an elevated risk of COVID-19. While the dose-response relationship of SARS-CoV-2 infection, particularly concerning aerosol transmission, remains uncertain, aerosols containing a low concentration of the virus in inadequately ventilated spaces, characterized by low humidity and high temperature, may result in an infectious dose over time.[91] Exposure to air pollution has a notable impact on the COVID-19 pandemic, necessitating further research to delve deeper into this matter.[92] Environmental factors, including air pollution, coupled with social and behavioral factors, can either augment or mitigate the spread of COVID-19.[93] Enhancing physical distancing and decreasing population density can diminish air pollution in enclosed spaces.[94] Adhering to proper health behaviors within society can mitigate environmental pollution and positively impact disease transmission prevention.[95,96]

Temperature and Humidity

Environmental conditions such as temperature, pH, and humidity serve as primary factors influencing the activity of microorganisms. In climates undergoing change, the mutation of microorganisms poses an additional threat.[97] A study conducted in Brazil revealed a negative linear correlation between temperature and the number of confirmed cases across 27 Brazilian state capital cities from February 27, 2020, to April 1, 2020, characterized by tropical temperatures. Similar research suggests that ambient temperature may influence the transmission of the coronavirus. Furthermore, investigations into the stability of coronaviruses in various environments indicate that these viruses survive longer in colder temperatures and lower relative humidity.[35] However, the effect of ambient temperature on COVID-19 is still controversial.[98] The seasonal prevalence of influenza during cold months also underscores, to some extent, the correlation between meteorological factors and infectious diseases.[91] While COVID-19 may not exhibit clear seasonality, research indicates that certain temperatures and humidity levels create conditions conducive to its transmission.[99,100] Chen et al reported that remains highly stable at 4 °C but exhibits significant sensitivity to heat.[101] Given the potential variability of this coronavirus disease, along with factors such as weather and other environmental conditions, its prevention and control should be promptly and thoroughly investigated.[102]

Water and Wastewater

The wastewater in hospitals and treatment centers for SARS-CoV-2 patients, as well as domestic wastewater from contaminated areas, may contain high concentrations of the virus and require special attention. However, a recent study confirmed that the risk of contamination is low when wastewater is properly managed.[103] China has already enhanced the disinfection process, primarily by increasing the use of chlorine, to prevent the spread of the SARS-CoV-2 virus through sewage. However, excessive use of chlorine in water can lead to the formation of harmful byproducts.[104] Moreover, widespread use of disinfectants may destroy non-target beneficial species, potentially causing ecological imbalances.[81] Laboratory-scale studies have shown the efficacy of purification systems in removing viruses. In one study, water was coagulated using various coagulants, resulting in a significant reduction (99.9%) in viral pathogens and the MS2 model virus.[105] Wastewater-based epidemiology (WBE) monitoring offers advantages in terms of cost-effectiveness and speed compared to clinical screening. However, it is important to note that WBE cannot entirely substitute clinical screening methods. Given that SARS-CoV-2 virus RNA can be detected in stool samples, monitoring wastewater has emerged as a valuable complementary tool for understanding the circulation of the virus within human populations.[106]

Ensuring the provision of safe and sanitary water is crucial for preventing the transmission of various infectious diseases, including COVID-19. Particularly in areas with inadequate sanitation, there is a risk of faecal-oral transmission of SARS-CoV-2. This underscores the potential for the virus to spread through contact with sewage-contaminated water or via the faecal-oral route. Consequently, monitoring wastewater can play a vital role in controlling the spread of COVID-19 and mitigating its impact on public health.[107] Monitoring sewage is an essential complement to clinical surveillance for assessing the presence and prevalence of emerging infectious diseases like SARS-CoV-2. This innovative approach provides valuable data that can enhance the accuracy of epidemiological models, thereby aiding in the understanding of how SARS-CoV-2 spreads, particularly in vulnerable communities.[108,109] Furthermore, wastewater monitoring can detect mild and asymptomatic cases of SARS-CoV-2 infection. This underscores the significance of environmental factors in public health, emphasizing the importance of effective water and wastewater management in preventing and controlling pandemics like COVID-19. Table 2 provides a summary of environmental health cares in the prevention of COVID-19.

Conclusion

Existing risk communication strategies aimed at preventing the transmission of COVID-19 exhibit gaps in information and sometimes convey incorrect messages, resulting in

Table 2. Summary of Environmental Health Cares in the Prevention of COVID-19

Agents and Equipment	Authors/Year	Targets	Conclusion	Reference
Waste Management	Capoor et al, 2021	Management of biomedical waste in the context of COVID-19	Raising public awareness about the hazards of COVID-19 waste and implementing segregation at its source are essential recommendations.	110
Waste Management	Das et al, 2021	COVID-19 pandemic and healthcare solid waste management strategy	Mismanagement of sanitary waste contributes to the transmission of the COVID-19 virus.	111
PPE	Cook 2020	PPE during the 2019 coronavirus pandemic	Proper use of PPE significantly reduces the risk of virus transmission.	112
PPE	Hirschmann et al, 2020	PPE for the prevention of occupational covid-19	Adequate PPE must be available and used to prevent occupational transmission of COVID-19.	113
Ventilation	Berry et al, 2021	Reducing the possibility of air spread of COVID-19 in ventilation systems and closed spaces	For air conditioning, an approach based on different methods is recommended.	114
Ventilation	Fadaei et al, 2021	Ventilation Systems and COVID-19 Spread	ventilation is crucial in preventing COVID-19 expansion in indoor air environments.	115
Disinfection and disinfection	Mousazadeh, 2021	Management of environmental health during the outbreak of the disease COVID-19	Disinfectants should be chosen and applied in a manner that minimizes unnecessary environmental contamination.	9
Disinfection and disinfection	Ilyas et al., 2020	Disinfection strategies for managing COVID-19 waste	Covid wastes must be disinfected to control the spread of the epidemic.	116
Social and physical distance	Mofijur et al, 2021	Review of global preventive measures taken to reduce the transmission of COVID-19	The main method of prevention is to limit large gatherings.	117
Social and physical distance	Sun et al, 2020	The effectiveness of social distancing in preventing the transmission of COVID-19	Increasing social distance can significantly reduce the infection of the COVID-19 virus (20-40%).	19
Air pollution	Dutheil et al, 2020	Is air pollution an effective factor in covid-91 disease?	Reducing air pollution directly or indirectly helps to reduce the severity of covid-19.	118
Air pollution	Khan et al, 2021	Mortality risk from covid-91 and air pollution in Pakistan	There is a connection between the possibility of death due to covid-19 and air pollution.	119
Air pollution	Ho et al, 2021	The effects of exposure to air pollution on the incidence and mortality of covid-19	Exposure to air pollution has a significant impact on the covid-19 pandemic.	92
Air quality improvement	Agarwal et al, 2021	Indoor air quality improvement in the COVID-19 pandemic	Implementing a modified ventilation system will help maintain indoor air quality.	17
Temperature and humidity	Kumar, V et al., 2021	Environmental studies of COVID-19	In changing weather conditions, the mutation of microorganisms is another threat	97
Temperature and humidity	Shao et al,2020	The relationship between human mobility and temperature with the spread of COVID-19	Temperature can affect the spread of covid-19 by affecting human mobility.	98
Temperature and humidity	Haque et al.,2020	Investigating the relationship between temperature, humidity and the prevalence of covid-19 in Bangladesh	High temperature and high humidity, respectively, dramatically reduce the spread of COVID-19.	120
Water and Wastewater	Lodder et al, 2021	Investigating the potential health risks of SARS-CoV-2 in wastewater	Providing safe and sanitary water can protect against any infectious disease (including covid-19).	107
Water and Wastewater	Kataki et al, 2021	Wastewater treatment during the COVID-19	Complete purification of drinking water and sewage is necessary to prevent covid-19.	121
Water and Wastewater	Wu et al, 2020	Sampling from a Massachusetts sewage treatment plant	Viral titers in wastewater correlate with new clinically diagnosed cases of COVID-19.	122

local responses to global risks. Therefore, there is a pressing need for more inclusive and engaging risk communication efforts that involve communities as stakeholders, fostering their willingness to remain resilient during disasters and crises. Basic strategies for controlling COVID-19 include hand hygiene, social distancing, screening and case identification, isolation, vaccination, disinfection, and proper ventilation. Mismanagement of sanitary waste and failure to handle PPE in healthcare settings can indirectly contribute to COVID-19 transmission. It is crucial to raise public awareness about the hazards of COVID-19 waste and promote segregation at its source. Among various physical distancing measures, adherence to social distancing and mask-wearing are paramount. Masks are recommended as effective tools in combating the global COVID-19 pandemic. The potential spread of the virus through airborne transmission via ventilation systems is a significant concern, necessitating a multifaceted approach to air conditioning methods. Implementing thorough cleaning and disinfection protocols for healthcare facilities and clinics is vital for infection prevention, particularly during the SARS-CoV-2 pandemic. Disinfectants should be carefully chosen and used to minimize environmental pollution. Limiting large gatherings remains a crucial method for preventing and controlling COVID-19 transmission. Consistent implementation of physical distancing measures, even in hot climates or regions, is essential for effectively containing COVID-19. Exposure to air pollution significantly impacts the pandemic, highlighting the importance of environmental control measures and monitoring sewage and sanitary water supplies in preventing COVID-19 transmission. It is advisable to employ a combination of strategies to contain virus spread within the general community (e.g., social distancing, ventilation) and implement specific measures in healthcare settings to minimize transmission from known individuals to healthcare staff (e.g., PPE, waste management).

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Authors' Contribution

Conceptualization: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala, Hadi Niknejad.
Data curation: Mohammad Ali Zazouli, Alireza Ala, Zabihollah Yousefi.
Formal analysis: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala.
Funding acquisition: Mohammad Ali Zazouli and Alireza Ala.
Investigation: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala.
Methodology: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala.
Project administration: Mohammad Ali Zazouli and Alireza Ala.
Resources: Mohammad Ali Zazouli and Alireza Ala.
Software: Mohammad Ali Zazouli, Alireza Ala, Hadi Niknejad.
Supervision: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala.
Validation: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala, Hadi Niknejad.
Visualization: Mohammad Ali Zazouli and Alireza Ala.
Writing–original draft: Mohammad Ali Zazouli and Alireza Ala.
Writing–review and editing: Mohammad Ali Zazouli, Zabihollah Yousefi, Alireza Ala, Hadi Niknejad.

Competing Interests

The authors of this manuscript declare that there is no conflict of interest.

Ethical Approval

This study was approved by the Ethics Committee of the Mazandaran University of Medical Sciences (Ethical code: IR.MAZUMS.REC.1401.043). The authors certify that this study has not been published separately elsewhere, nor will it be in the future.

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