
Received: 2024-09-09 Revised: 2025-08-19 Accepted: 2025-11-01 Published: 2026-02-15

Impact of Human Metapneumovirus (HMPV) Infection on the Human Physiology

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ABSTRACT

This study aims to assess the severity of human metapneumovirus (HMPV). The principal objective of this research is to enhance awareness of the virus, the mechanisms of its transmission, the methods of dissemination, and strategies to impede its proliferation. HMPV is challenging to differentiate from the common cold due to its high contagion rate. The nations are becoming progressively integrated due to swift technology advancement. This presents an opportunity for learning and fostering reciprocal cooperation, although it also has a disadvantage. Globally, numerous individuals are establishing direct communication with each other. If an individual possesses a hazardous illness and neglects to implement the requisite precautions, they may transmit the virus to others in proximity. This negligence or naive unawareness would initiate an interminable chain reaction. This study emphasizes the virus's concise history and the pattern of infection. This analysis can identify the primary sources of contamination and methods to prevent its dissemination. Owing to temporal limitations, the study utilized secondary data sources.

Keywords: Comorbidity, Public Health, Respiratory Illness, HMPV, and Virus

INTRODUCTION

Vegetables and fruits provide a substantial component of the human diet, serving as primary sources of carbohydrates, lipids, vitamins (A, B complex, C, and E), minerals, antioxidants, dietary fibers, and other essential nutrients. Healthcare practitioners aim to diminish the probability of severe non-communicable diseases, such as the respiratory virus known as human metapneumovirus (HMPV), which predominantly impacts immunocompromised individuals, the elderly, and neonates. It induces a spectrum of ailments, ranging from mild upper respiratory disorders to severe lower respiratory diseases such as pneumonia and bronchiolitis, significantly impacting public health, particularly during seasonal epidemics and among vulnerable populations (Lim et al., 2020). Both positive and bad influences are being transmitted between individuals in the swiftly evolving global landscape.

HMPV originally emerged in the Netherlands. Infants were the predominant portion of the cases documented in the initial phases. Human health is significantly influenced by HMPV, a respiratory virus that predominantly targets the lungs and airways. HMPV was initially identified in 2001 and belongs to the Paramyxoviridae family of viruses, recognized for inducing respiratory ailments (Baños-Lara et al., 2015). The severity of its effects ranges from mild, cold-like symptoms to severe respiratory diseases, mostly influenced by the host's age, immunological system, and overall health. This study aims to examine the various aspects of HMPV's impact on the human body, encompassing its pathophysiology, symptoms, repercussions, and broader public health implications.

RESEARCH ELABORATIONS

HMPV causes a variety of problems, ranging from mild upper respiratory tract infections to severe lower respiratory tract diseases, primarily impacting the respiratory system. The extent of respiratory involvement varies based on individual susceptibility. HMPV can induce severe respiratory diseases, such as pneumonia and bronchiolitis, in vulnerable populations. characterize these illnesses by inflammation, mucus accumulation in the airways, hypoxia,

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wheezing, and respiratory difficulties. A prevalent outcome of HMPV in infants and young children is bronchiolitis, marked by inflammation of the small airways, resulting in respiratory distress (Kan-o et al., 2017). ARDS is a potentially lethal outcome of pneumonia induced by HMPV in elderly and immunocompromised individuals.

The extent of infection is mostly influenced by the immune system's response to HMPV. The immune system activates both innate and adaptive responses upon pathogen detection. The innate immune system releases interferons and other cytokines that inhibit viral replication in response to HMPV. In healthy individuals, this response typically functions effectively to manage the condition. However, an excess of cytokines can induce a "cytokine storm," which aggravates tissue damage and pulmonary inflammation. The adaptive immune response, comprising T-cells and antibody production, facilitates short-term immunity and infection resolution (Vidaur et al., 2019). Reinfections are common due to the unfortunately weak and temporary immunity to HMPV. This provisional protection hinders the cessation of the virus's spread and underscores the imperative for effective vaccines.

HMPV infections can lead to various complications, particularly in high-risk groups. Secondary bacterial infections are included among them. The respiratory epithelium is compromised by HMPV, heightening its susceptibility to bacterial colonization. Otitis media, sinusitis, and bacterial pneumonia exemplify subsequent bacterial infections that can exacerbate symptoms and prolong illness. Chronic Respiratory Disorders Severe HMPV infections may lead to chronic respiratory complications. Children who frequently catch HMPV may have increased susceptibility to asthma or other chronic respiratory conditions. HMPV often exacerbates pre-existing illnesses, particularly in individuals with chronic respiratory ailments like asthma or chronic obstructive pulmonary disease (COPD) (Papenburg & Boivin, 2010). These exacerbations may lead to hospitalization and additional deterioration of lung function. Mortality: While rare, HMPV infections can be fatal, particularly in small children, the elderly, and individuals with weakened immune systems. The virus elevates the mortality risk in these populations due to its ability to provoke acute respiratory distress syndrome (ARDS) and severe pneumonia.

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Peer-reviewed papers in English, completed from 2019 to 2025, that investigated the symptoms of Human Metapneumovirus (HMPV) with an emphasis on transmission, complications, and public health consequences were utilized in the study methodology. Papers authored in languages other than English, studies undertaken before 2019, and articles unrelated to HMPV were excluded from the study. Despite the ongoing research on HMPV, a comprehensive grasp of its medical implications and public health concerns remains insufficient for the years following 2019. Limited research examines the long-term health consequences of recurring HMPV infections, including their impact on immune systems, respiratory health, and healthcare systems.

RESULTS AND DISCUSSION

Currently, there are no specific antiviral drugs or vaccines for HMPV. Supportive and preventive measures are essential to mitigate the virus's impacts and curtail its further transmission. Consistent handwashing, refraining from direct interaction with ill individuals, and disinfecting surfaces can all contribute to reducing transmission. Preventive strategies to mitigate the transmission of HMPV encompass the utilization of masks and maintaining physical distance in high-risk scenarios. The ongoing advancement of HMPV vaccinations demonstrates potential in alleviating the virus's effects on public health. The primary objectives of supportive treatment for HMPV infections are symptom alleviation and complication prevention.

This requires administering complete bed rest to the affected patient. The patient is administered sufficient fluids to maintain hydration. Antipyretics should be administered to reduce the fever. Emergency oxygen support is administered only if the patient's condition markedly deteriorates. Mechanical ventilation is necessary for life-threatening respiratory failure when the situation is critically severe. HMPV has enduring consequences that extend beyond individual health. The global burden of respiratory diseases is intensified by repeated infections and their repercussions. Moreover, the overlap in symptoms between HMPV and other respiratory viruses, such as influenza and RSV, complicates identification and public

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health measures. Research on effective vaccinations and antiviral treatments is necessary to mitigate the long-term impact of HMPV.

To effectively manage outbreaks, public health initiatives must focus on raising awareness, improving diagnostic capabilities, and strengthening hospital infrastructure. Human metapneumovirus (HMPV) is transmissible; however, its dissemination can be controlled if uninfected individuals adopt specific preventive strategies. Adhering to these safeguards is straightforward; maintaining fundamental hygiene is adequate. If untreated, HMPV can lead to serious respiratory diseases. This virus poses significant risks to those with HIV, cancer, or other autoimmune disorders. Patients utilizing immunosuppressive drugs are at an elevated risk of viral infection and severe complications. Besides ear infections, HMPV can intermittently lead to critical illnesses such as pneumonia, bronchitis, and acute asthma exacerbations.

CONCLUSION

This study clearly illustrates the implications of the population affected by HMPV. If HMPV is not treated promptly, it may progress into a potentially lethal medical condition. The symptoms are often subtle and are commonly dismissed as a viral infection or a typical cold. Upon experiencing any or all of the aforementioned symptoms, individuals should promptly seek appropriate medical assistance to prevent further suffering. The patient has a high likelihood of recovery and returning to normalcy if provided with an accurate diagnosis and timely therapy. The patient's immunological response is the principal determinant of their condition's progression, since individuals with a robust immune system may frequently combat the virus without pharmacological intervention or vaccination, whilst those with a compromised immune system may not be salvaged even with medication.

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