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Impact of HMPV on the Human Body

Atmadeepa Srimany[1], Shruti Bagchi[2], Sujan Das[3], Debraj Paul[4]
[1]Department of Biotechnology, Maulana Abul Kalam Azad University of Technology (MAKAUT), West Bengal, India
[2]Department of Media Science, George College, Kolkata, West Bengal, India
[3,4]Department of Life Science, Guru Nanak Institute of Pharmaceutical Science and Technology, Kolkata, West Bengal, India

ABSTRACT: This study is conducted to identify the grievousness that can be caused by the Human Metapneumovirus (HMPV). The major purpose of conducting this study is to spread awareness about the virus. The means and mode of spreading and how it can be prevented from spreading. HMPV is highly contagious, and it is not easy to differentiate it from the common cold. With fast-moving technical advancement, the countries are getting more and more connected with each other. This is a boom in terms of learning and growing in mutual collaboration, but there is a dark side to it, too. Direct contact among a large number of individuals is taking place around the globe. If a person is infected by any contagious disease and not maintaining proper precautions can infect others coming in contact, the carelessness or the innocent unawareness will act like a never-ending chain of spreading the virus. The brief history of the virus and the pattern of the infection is pointed out in this study. Through this study, the major causes of contamination can be identified and how to prevent further spreading. The data used in the study are obtained from secondary data sources because of time limitations.

KEYWORDS: HMPV, virus, respiratory illness, epidemics, public health, ARDS, COPD, immunity, comorbidity

INTRODUCTION

***Research background*:** Human Metapneumovirus (HMPV) is a respiratory virus that predominantly infects infants, older adults, and immunocompromised persons. It produces a spectrum of diseases from mild upper respiratory illness to severe lower respiratory disease, such as bronchiolitis and pneumonia, which has a relevant impact on public health, particularly in seasonal epidemics and among risk groups. In the fast-moving global world, both good and bad things are getting transmitted from one to another.

Rationale: HMPV originated in the Netherlands. The cases registered in its initial phase were mostly infants. HMPV is a respiratory virus that significantly impacts human health, particularly affecting the lungs and airways. First identified in 2001, HMPV belongs to the Paramyxoviridae family, a group of viruses known for causing respiratory diseases. Its effects can range from mild, cold-like symptoms to severe respiratory conditions, with the intensity of its impact largely dependent on the host's age, immune status, and overall health (Bakkers et al. 2024).

Aim

This research aims to explore the various dimensions of HMPV's impact on the human body, encompassing its pathology, symptoms, complications, and broader implications for public health.

Objectives

- To identify the causes and symptoms of HMPV
- To explore the infection mechanisms and its impact on the immunity system on human body
- To understand the preventive measures for HMPV

LITERATURE REVIEW

Infection mechanism:

HMPV primarily infects epithelial cells lining the respiratory tract. After entering the body through respiratory droplets, it attaches to host cells via surface proteins, facilitating viral entry. The infection triggers an immune response characterized by inflammation and the release of cytokines. While this response is crucial for combating the virus, excessive inflammation can exacerbate symptoms and damage lung tissue. The virus's incubation period is typically 4-6 days. During this time, it replicates within the host's cells,

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causing cellular damage and initiating the release of pro-inflammatory mediators. These processes manifest as clinical symptoms and can lead to more severe complications in vulnerable individuals.

Impact on the Respiratory System

HMPV predominantly affects the respiratory system, causing a spectrum of illnesses ranging from mild upper respiratory tract infections to severe lower respiratory tract diseases. The extent of respiratory involvement varies based on individual susceptibility. In vulnerable populations, HMPV can cause severe respiratory diseases such as bronchiolitis and pneumonia. These conditions are characterized by wheezing and difficulty breathing, hypoxia (low blood oxygen levels), inflammation and mucus buildup in the airways (Bakkers et al. 2024). Bronchiolitis, a common outcome of HMPV in infants and young children, involves the inflammation of small airways, leading to respiratory distress. In older adults and immunocompromised individuals, pneumonia caused by HMPV can lead to life-threatening complications, including ARDS.

Mild Symptoms

For most healthy individuals, HMPV infections result in mild symptoms akin to the common cold. These include Cough, Runny or congested nose, Low-grade fever, and Sore throat. These symptoms are typically self-limiting, resolving within a week without medical intervention. However, even mild infections can disrupt daily activities and reduce productivity.

Immune System Response

The immune response to HMPV plays a pivotal role in determining the severity of the infection. Upon recognizing the virus, the immune system activates both innate and adaptive mechanisms. The innate immune system responds to HMPV by releasing interferons and other cytokines that inhibit viral replication. This response is typically effective in containing the infection in healthy individuals (Miller & Mousa, 2023).

However, excessive cytokine production can lead to a "cytokine storm," exacerbating lung inflammation and tissue damage. The adaptive immune response, involving T-cells and antibody production, helps clear the infection and provides short-term immunity (Guo et al. 2023). Unfortunately, immunity to HMPV is neither robust nor long-lasting, making reinfections common. This transient immunity poses a challenge in controlling the virus's spread and highlights the need for effective vaccines.

Complications of HMPV Infection

HMPV infections can lead to various complications, particularly in high-risk groups. These include Secondary Bacterial Infections. HMPV weakens the respiratory epithelium, making it more susceptible to bacterial colonization. Secondary bacterial infections, such as sinusitis, otitis media, or bacterial pneumonia, can prolong illness and increase the severity of symptoms. Chronic Respiratory Issues Severe HMPV infections can cause long-term respiratory problems (Roy et al. 2025). For example, children who experience recurrent HMPV infections may have an increased risk of developing asthma or other chronic lung conditions. Exacerbation of Pre-Existing Conditions Individuals with chronic respiratory diseases, such as asthma or chronic obstructive pulmonary disease (COPD), often experience exacerbations triggered by HMPV. These exacerbations can lead to hospitalization and further compromise lung function (Feng et al. 2024). Mortality, although rare, HMPV infections can be fatal, particularly in infants, elderly individuals, and those with weakened immune systems. The virus's ability to cause severe pneumonia and Acute Respiratory Distress Syndrome (ARDS) contributes to its mortality risk in these populations.

While HMPV primarily targets the respiratory system, its impact can extend to other parts of the body, particularly in severe cases (Feng et al. 2020). Systemic inflammation and hypoxia can affect the cardiovascular and central nervous systems. Severe HMPV infections can increase the risk of cardiovascular complications, such as myocarditis (inflammation of the heart muscle) and arrhythmias. These complications are often secondary to systemic inflammation and hypoxia. Although rare, HMPV infections have been associated with neurological symptoms, such as seizures or encephalopathy, particularly in young children (Sepúlveda-Alfaro et al. 2024). These symptoms are likely due to a combination of hypoxia and the systemic inflammatory response. Certain populations are at higher risk of severe HMPV infections, including infants and young children; their immature immune systems and smaller airways make them more susceptible to severe respiratory conditions. According to Jesse et al. (2022), age-related decline in immune function increases vulnerability to severe HMPV infections. Immunocompromised individuals who are undergoing chemotherapy, organ transplant recipients, or individuals with HIV are at heightened risk of prolonged and severe infections. According to Philippot et al. (2024), pre-existing respiratory or cardiovascular diseases increase the likelihood of

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complications. HMPV contributes significantly to the global burden of respiratory infections. During seasonal outbreaks, the virus leads to increased healthcare utilization, including Emergency room visits, Hospitalizations, and Intensive care admissions (Costa-Filho et al. 2025).

The associated costs include medical expenses, loss of productivity, and strain on healthcare systems. The lack of targeted antiviral therapies and vaccines exacerbates this burden, as management relies solely on supportive care.

METHODOLOGY

The research employs qualitative methods to analyze secondary data obtained from journal articles and medical records produced during 2019 up to 2025. The research only used English peer-reviewed sources because it needed both credible and relevant content. Derived knowledge about HMPV pathology and symptoms and public health aspects was extracted from a structured data review. Both HMPV-related materials and English publications within the specified time period formed the basis of this research because other materials would distort accuracy and reliability. The analysis focused on bringing together previous research while identifying common observations about disease transfer and immunity response as well as their associated complications.

Inclusion and exclusion criteria

The research methodology used peer-reviewed English language studies from 2019 to 2025 which investigated Human Metapneumovirus (HMPV) by studying its symptoms with an emphasis on transmission and complications along with their impact on public health. The study excluded papers from other languages and both research from before 2019 and all articles not concerning HMPV.

Research gap

Research on HMPV continues to expand but a complete integration of its medical effects and health concerns for the public remains insufficient during the period following 2019. Few studies examine the long-term medical consequences of repeated HMPV infections combined with their effects on respiratory health problems and immune systems as well as healthcare institutions.

DISCUSSION AND FINDINGS

Currently, there are no specific antiviral treatments or vaccines for HMPV. Preventive and supportive measures are essential for managing the virus's impact and further spreading. According to Sepúlveda-Alfaro et al. (2024), regular handwashing, avoiding close contact with sick individuals, and disinfecting surfaces can reduce transmission. Protective Measures include wearing masks and maintaining physical distance in highrisk settings, which can help prevent the spread of HMPV. Efforts to develop HMPV vaccines are ongoing and hold promise for reducing the virus's public health impact. Supportive treatment for HMPV infections focuses on relieving symptoms and preventing complications (Wang et al. 2021). This includes giving complete bed rest to the affected patient. The patient is given enough fluid so that the patient is hydrated. Fever antipyretics should be used to reduce the fever. If needed, emergency oxygen support is provided, but this is only in case of severe deterioration of condition (Carp, 2025). If the condition is highly severe, mechanical ventilation for life-threatening respiratory failure is needed.

Long-Term Implications

The long-term impact of HMPV extends beyond individual health. Recurrent infections and complications contribute to the global burden of respiratory diseases. Additionally, the overlap between HMPV symptoms and those of other respiratory viruses, such as influenza and RSV, complicates diagnosis and public health responses. Investing in research to develop effective vaccines and antiviral therapies is crucial for mitigating HMPV's long-term impact. Public health initiatives should also focus on raising awareness, improving diagnostic capabilities, and strengthening healthcare infrastructure to manage outbreaks effectively (RuizPozo et al. 2025). The HMPV is contagious; if people who are not affected by it can maintain some precautionary steps, the spreading can be controlled. These precautions are nothing difficult to follow; some basic hygiene is enough. HMPV may lead to some serious respiratory disorders if not treated. People who are already suffering from HIV, cancer, and other autoimmune disorders are too vulnerable to this virus (CostaFilho et al. 2025). Not only them, but patients who are consuming medicines to suppress their immunity are also at high risk of getting severely infected by the virus. The HMPV sometimes causes life-threatening issues like bronchitis, pneumonia, and severe asthma attacks can also cause ear infections.

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CONCLUSION

This study provides a clear picture of the effects and the population affected by HMPV. The HMPV can become a life-threatening health issue if it is not treated beforehand. The symptoms are not very outstanding; they can often be dismissed as a common cold or viral fever. In order to prevent oneself from suffering because of this, proper medical assistance should be taken as soon as anyone is suffering from one or all of the mentioned symptoms. With proper diagnosis and timely treatment, there are high chances of the patient recovering from the illness and getting back to usual life. The immunity of the patient is the key reason for the improvement or deterioration, as a person with stronger immunity can defeat the virus easily, sometimes even without medicine and a vaccine, but if the patient has a weak immune power, even medicine cannot be a lifesaver.

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