

## Review Paper:

# The Pathogenicity of MERS-CoV, SARS-CoV and SARS-CoV-2: A Comparative Overview

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## Abstract

*The ongoing detrimental consequences of SARS-CoV-2 or COVID-19 are attributable to its remarkable pathogenesis and modes of transmission. Originating from a common ancestor of the previous coronavirus outbreaks, MERS-CoV and SARS-CoV-1, the former has been evolved in terms of its pathogenic mechanisms, routes of transmission and the extent of infection. The comprehensive evaluation of these modifications at the molecular level would reveal astonishing details about the extensive lethality of the current SARS-CoV-2 outbreak.*

*Further, these details can be utilized for the development of effective and specific treatment methods. This review elaborates the comparative assessment of the viral characteristics of coronaviruses: MERS-CoV, SARS-CoV-1 and SARS-CoV-2. With the comparative account, the study endeavours to leave a clear picture explaining the reason behind the extensive lethality of the current SARS-CoV-2 pandemic.*

**Keywords:** SARS-CoV, MERS-CoV, Pathogenesis, Transmission, Infection.

## Introduction

The past two decades of the 21<sup>st</sup> century have witnessed several malicious biological hazards that took the entire globe into an appalling situation including Ebola, Zika and Nipah viral outbreaks to name a few. However, they stood no match for the disastrous outbreak of severe acute respiratory syndrome-2 (SARS-CoV-2) or COVID-19 and its consequences.<sup>34</sup> Since its emergence in December 2019, the latter has resulted in a steep escalation in mortality rates. Expanding to the different parts of the world, it gained a status of the pandemic within no time due to its profound pathogenicity, transmission and resistance to the available therapeutic options.<sup>54,65</sup>

Though there were reports of outbreaks of other viruses from the same family, they were not as infectious as of the SARS-CoV-2. For example, four endemic human coronaviruses HCoV-229E, -NL63, -HKU1 and -OC43 were known to circulate in human blood yet causing no major casualties. It was reported that HCoV-229E and -OC43 accounted for 15–

29% of respiratory pathogens with relatively reduced viral load which serves as a rough approximation.<sup>15,76</sup> The other two viruses HCoV-NL63 and -HKU1 were discovered only in 2004 and 2005 respectively, leaving negligible chances of a major outbreak due to their endemic nature.<sup>15</sup> But the health crisis began in 2003 when China reported the first of their epidemic kind, the SARS-CoV-1 or severe acute respiratory syndrome-1. This epidemic was responsible for the death of 919 people and 8422 cases, with the fatality rate of 11.0%.<sup>76</sup>

The zoonotic transmission of SARS-CoV-1 from December 2003 to January 2004 became a pavement for researches into the origin of this epidemic. Though it was declared as over in 2004 with no further cases detected, demonstration of SARS-CoV-like viruses found in bats revealed the chance of re-emergence of SARS in future.<sup>44</sup>

In support of this prediction, another epidemic coronavirus known as MERS-CoV (Middle East Respiratory Syndrome Coronavirus) was detected in the sputum of a deceased pneumonia male patient with renal failure in Saudi Arabia. The epidemic caused 858 deaths and 2494 cases with a fatality rate of 34.4% from 27 different countries.<sup>76</sup> The increased fatality rate was attributed to nosocomial infections and international travels that made it a global threat. In May 2015, South Korea reported the outbreak of MERS-CoV due to a returned individual from Middle East.<sup>19</sup> Besides a tremendous progression is made towards deciphering the biological features of SARS-CoV-1 and MERS-CoV at an unprecedented speed, a shocking and detrimental outbreak of COVID-19 has resulted in 387,155 deaths and 6,535,354 confirmed cases from 213 countries across the globe with an increasing death rate as of 6<sup>th</sup> June 2020.<sup>71</sup>

Although MERS-CoV and SARS-CoV-1 share several common and important features that are responsible for nosocomial transmission, preferential viral replication and viral immunopathology, SARS-CoV-2 stands with few uncommon characteristics that make it more malicious.<sup>57</sup> Though it has been isolated and the mechanisms of its pathogenicity and infectivity are deciphered, there is much room to know and highlight the viral mode of action, life cycle and pathogenicity.<sup>17</sup> This review focuses on the effective life cycle, severity, transmission modes, therapeutic options of SARS-CoV-2 to highlight its pathogenicity over the other two epidemic coronaviruses.