

Review Article

Overview of JN.1 the variant of interest: strengths, weaknesses, opportunities, and threats analysis

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ABSTRACT

Amidst the ongoing global battle against the COVID-19 pandemic, the World Health Organization (WHO) emphasizes monitoring variants of interest (VOIs) of the SARS-CoV-2 virus. The JN.1 variant, initially considered within the framework of BA.2.86, has rapidly gained global prevalence, prompting its reclassification as an independent VOI. This study assesses the strengths, weaknesses, opportunities, and threats (SWOT) analysis of the JN.1 variant. A literature review from PubMed, and expert opinions from newspaper articles were utilized for information collection. The study incorporates a comprehensive SWOT analysis, associated with the JN.1 variant. The JN.1 variant's global dominance is marked by exponential increases in COVID-19 cases, impacting healthcare systems. While strengths include global guidance, vaccine effectiveness, and a robust surveillance system, weaknesses encompass wastewater analysis, seasonal impacts, and immune escape capabilities. Opportunities lie in continuous vaccination campaigns, monitoring, research, vaccine adaptation, and adaptive strategies. Threats include co-circulation with respiratory diseases, lower antibody responses, and potential global spread. The study underscores the importance of clear public communication, continuous surveillance, and research efforts in addressing the challenges posed by the JN.1 variant. Recommendations include assessing vaccine effectiveness, updating strategies and fostering global collaboration for a more effective response.

Keywords: JN.1 variant, VOI, COVID-19, COVID-19 nucleic acid testing, Pandemic preparedness, COVID-19 vaccines

INTRODUCTION

In the relentless battle against the COVID-19 pandemic, the World Health Organization (WHO) underscores the significance of monitoring variants of interest (VOIs) of the severe-acute-respiratory-syndrome-related coronavirus -2 (SARS-CoV-2) virus. The JN.1 variant has been classified as a VOI, indicating genetic alterations and distinctive characteristics that warrant monitoring by health agencies and governments. Initially, JN.1 was monitored within the framework of BA.2.86, the ancestral lineage categorized as a VOI. However, over recent times,

JN.1 has been consistently reported in numerous countries, and its global prevalence has escalated swiftly.

Currently, it constitutes the predominant portion of BA.2.86 descendant lineages documented on global initiative on sharing all influenza data (GISAID).

Because of its rapid and widespread dissemination, the WHO has decided to classify JN.1 as an independent VOI distinct from the parent lineage BA.2.8. Notably, JN.1 is not a new virus but rather a sub-variant of BA.2.86, itself a sub-variant of the Omicron variant.¹

On 06 September 2023, the media briefing by the WHO Director-General highlighted concerning trends for COVID-19. The BA.2.86 variant has been detected in small numbers in 11 countries, prompting close monitoring by WHO to assess its transmissibility and potential impact.²

VOIs are characterized by specific genetic changes known to influence the virus's behaviour and potential impact on human health. This can encompass its transmissibility, severity of disease, detectability, and treatability. Identifying a VOI is crucial as it may signal an increased ability to spread, posing a potential emerging risk to global public health.

Global scenario

The JN.1 variant was first identified in the United States in September 2023. By mid-December of the same year, it had already accounted for 44 percent of nationwide COVID-19 cases, indicating a rapid surge in its prevalence. The global initiative on sharing avian influenza data (GISAID) had received 7,344 JN.1 sequences from 41 countries, which represented 27% of the globally available sequences during epidemiological week 48 (27 November to 03 December 2023). Among these countries, France had the highest proportion of JN.1 sequences, with 1,552 sequences accounting for 20.1% of the total, followed by the United States of America (1,072 sequences, 14.2%), Singapore (934 sequences, 12.4%), Canada (512 sequences, 6.8%), the United Kingdom (422 sequences, 5.6%), and Sweden (381 sequences, 5.0%). These findings highlight the global spread and significance of the JN.1 variant in the ongoing COVID-19 pandemic.³

Indian scenario

The first case of the JN.1 subvariant of COVID-19 in India was identified in a 79-year-old woman from Kerala.⁴ India has reported 760 new COVID-19 infections, with the total number of JN.1 variant cases surpassing the 500 mark in January 2024.⁵ The Union Health Ministry reported a continued increase in COVID-19 cases in India, with 760 new infections recorded in the last 24 hours. This marked an increase of 158 cases compared to the previous day. Despite the rise in overall cases, the number of active cases decreased to 4,423. Additionally, two deaths were registered, one each in Karnataka and Kerala, according to the provided data.⁶ The state wise JN.1 Variant cases in India as of January 2024 details are shown in Figure 1.⁷

The state health system announced continuous surveillance of the latest COVID-19 variant, JN.1, in Tamil Nadu a southern state of India. The variant is causing mild infections, with no clustering of cases reported in the state. The Tamil Nadu state health system emphasized ongoing monitoring, especially due to the rapid spread of JN.1 in South Asia. Collaborations with international health experts, including those from Singapore with the

Government of Tamil Nadu in this regard, are to be highlighted.

The advisory encourages individuals with COVID-19 symptoms to stay home for at least three to four days. While no family clustering was reported, the state health system reassured the public, emphasizing the availability of 1.25 lakh beds in the state.⁸

Need for the SWOT analysis

A VOI can become a variant of concern when it is identified as having characteristics that include increased transmissibility, the potential to cause more severe disease, evasion of the body's immune response, alteration of virus symptoms, or a reduction in the effectiveness of established tools, such as public health measures, diagnostics, treatments, and vaccines.⁹

Given this, it is essential to conduct a strengths, weaknesses, opportunities, and threats (SWOT) analysis of the JN.1 variant to gain a nuanced understanding of India's response to this variant of SARS-CoV-2. This analysis aims to inform public health strategies, support targeted interventions, and contribute to a more comprehensive global and regional response to the evolving dynamics of the COVID-19 pandemic. The objective of this study was a SWOT analysis of the JN.1 variant of SARS-CoV-2.

METHODS

A review of literature was undertaken to collect information from PubMed pertaining to the JN.1 variant of SARS-CoV-2. The search strategy was done with the keyword "JN.1". The detailed identification, screening, eligibility and included studies is shown in the PRISMA flowchart Figure 2.¹⁰ Additionally, expert opinions were extracted from newspaper articles for SWOT analysis.

SWOT ANALYSIS

Strengths

Scientific understanding and experience

The acknowledgment of the expected emergence of new variants aligns with scientific understanding, emphasizing the need for ongoing tracking of SARS-CoV-2 and its genetic changes.¹¹ The protocols and vaccines discovered prior with the 2020 COVID-19 are a strength to control the JN.1 variant

Global guidance and global surveillance system

The WHO provides global guidance on monitoring and responding to VOIs, offering a unified approach to combatting evolving threat.¹² The continuous monitoring and reporting of new variants, like JN.1, demonstrate an effective global surveillance system capable of detecting and identifying emerging threats promptly.¹³

Vaccines considered to be effective

The WHO urges individuals, especially those at high risk, to ensure they stay updated with their vaccinations. The

genetic similarity between JN.1 and BA.2.86, particularly in the spike protein targeted by vaccines, suggests that current vaccines are likely effective against JN.1.¹³

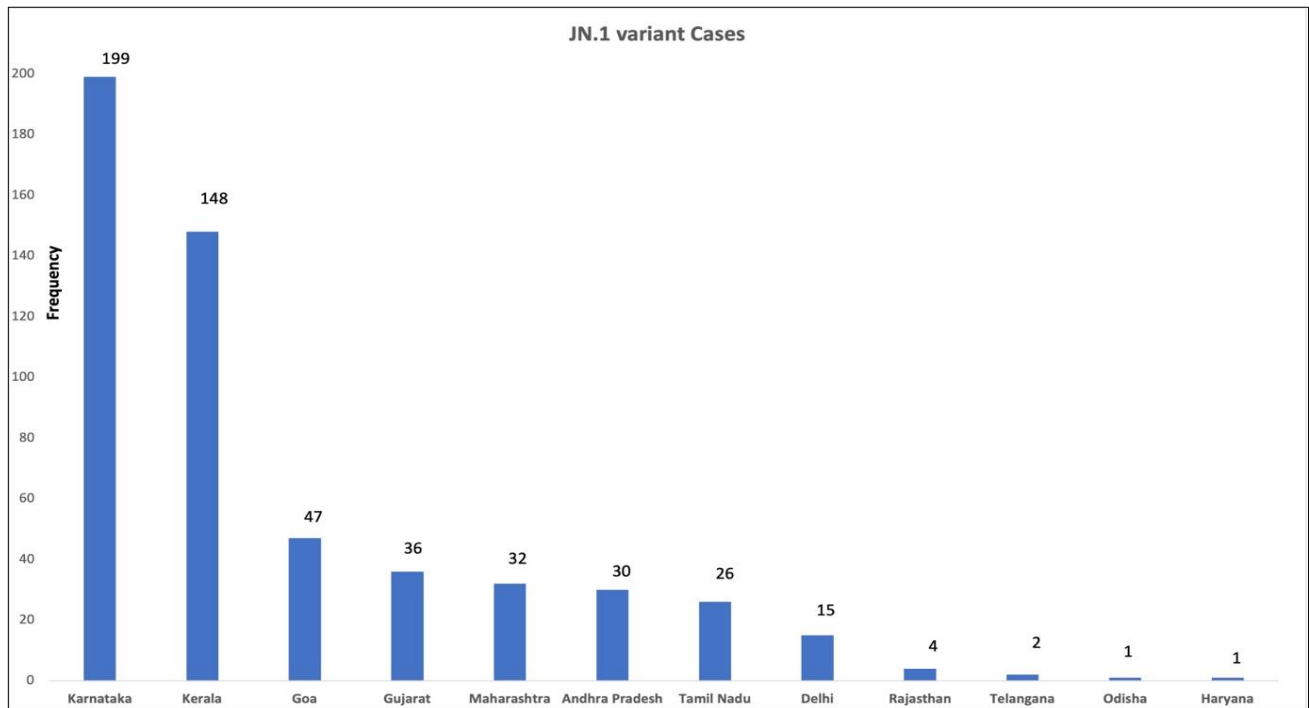


Figure 1: State-wise JN.1 variant cases in India as of 03 January 2024.

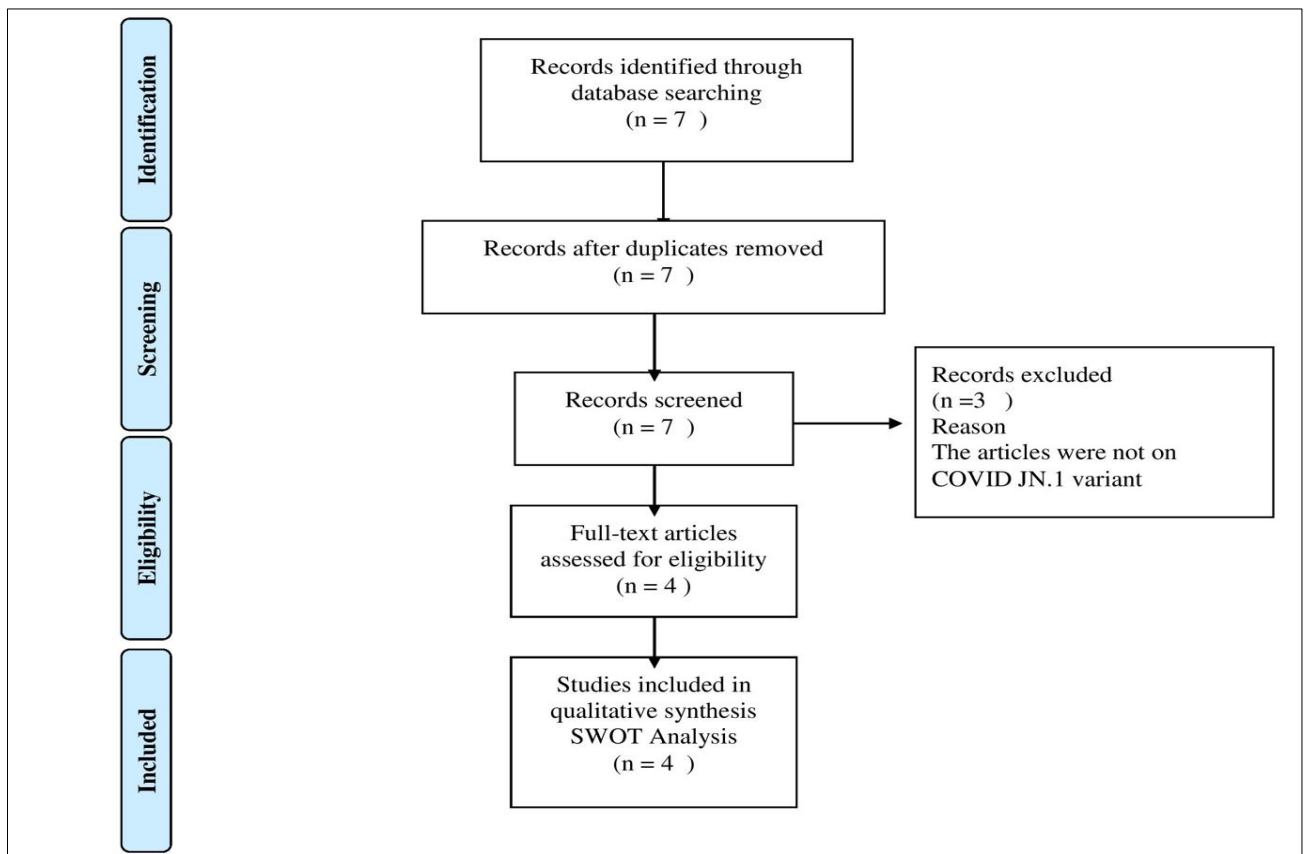


Figure 2 : PRISMA flowchart.¹²

Preventive measures

Despite the focus on COVID-19, the UN agency warns that other respiratory diseases, including influenza, respiratory syncytial virus (RSV), and common childhood pneumonia, are on the rise. It advises the public to adhere to preventive measures such as wearing masks, practicing regular hand hygiene, covering coughs and sneezes, and staying at home if feeling unwell.¹³ The recommended preventive measures, such as mask-wearing, hand hygiene, and vaccination, serve as robust measures against the virus and its variants. Continuous COVID tests should be done for elderly individuals above 60 years of age, pregnant women, travel history to states reporting high COVID cases and for individuals with co-morbid conditions like hypertension, diabetes. Elderly people over 60 are advised to take third booster dose of vaccination.

Existing genomic testing protocols

Encouraging testing for symptomatic individuals or those exposed to SARS-CoV-2 or reporting COVID RT PCR positive to further investigate with genomic test for detection of JN.1 variant.

Collaboration of state and non-state act

To educate government and private doctors on the mitigation strategies to control JN.1 variant along with the support of government and non-government organisations.

Weaknesses

Exponential increase in wastewater

Wastewater analysis indicates an exponential increase in the JN.1 strain, suggesting widespread community transmission. This weakness poses challenges for containment and control measures.¹⁴

Winter season impact

The World Health Organization warns that the winter season may increase the burden of respiratory infections, potentially exacerbating the spread of JN.1 and other respiratory diseases.¹⁴

Enhanced immune escape

The variant's enhanced immune escape capabilities may contribute to increased survival and transmission by evading host immune responses.¹⁵

Decreased neutralization titres

Individuals re-infected with XBB post-BA.5 or BF.7 infection showed decreased neutralization titres for JN.1 which may hinder the ability of the immune system to neutralize the virus upon reinfection.¹⁵

Lower ACE2 affinity

JN.1 displays lower affinity to ACE2, which might affect its efficiency in host cell entry, potentially influencing transmission dynamics.^{14,16}

Public perception

The regular reporting of new variants may contribute to public concern and worry, even when the variants are not necessarily more threatening than previous ones.¹¹

Potential for misinterpretation

There is a risk of misinterpretation or misunderstanding of the significance of new variants, leading to unnecessary panic or inappropriate public health responses.¹¹

Limited availability of testing kits

Limited availability of testing kits such as medical equipment, personal protective equipment (PPE), masks, and ventilators poses a challenge.¹⁷

Insufficient emergency healthcare infrastructure

Insufficient emergency healthcare infrastructure and professionals pose challenges, with ratios indicating a shortage: doctor to patient ratio: 1:1445, hospital beds to people ratio: 0.7:1000, and ventilators to population ratio: 40000:1.3 billion.¹⁷

Opportunities

Continuous vaccination campaigns

There is an opportunity to encourage and conduct continuous vaccination campaigns to ensure that individuals stay up to date with their vaccinations, particularly those at high risk of disease.¹³

Monitoring

Continuous monitoring and surveillance of the JN.1 variant and its impact on hospitalizations, especially in areas with low vaccination rates.¹³

Research

Surveillance is needed for better understanding the transmission dynamics and characteristics of the JN.1 variant.¹⁵

Vaccine adaptation

Insights gained from studying JN.1's immune escape mechanisms could guide the adaptation of vaccines to enhance protection against this variant and potentially future variants.¹⁵

Adaptation of antivirals

The active response to antivirals offers an opportunity for the development and adaptation of antiviral medications to combat the JN.1 variant.¹⁶ Experts add that the peak and subsequent decline of a strain are influenced by the speed at which it spreads—the faster it spreads, the quicker both its peak and decline will occur.¹¹

Threats

Global dominance

The rapid spread and competitive nature of JN.1 make it a potential threat to become the globally dominant group of variants, potentially causing increased cases and placing strain on healthcare systems.¹³

Co-circulation with other respiratory diseases

The co-circulation of JN.1 with other respiratory diseases like flu, RSV, and pneumonia poses a threat to public health.¹³ The JN.1 virus, along with other variants, demonstrates potent infection of nasal epithelial cells, suggesting a high fitness for transmission within the respiratory system.¹⁵

Public health impact

The rapid transmission and enhanced immune escape capabilities of JN.1 potentially may lead to increased cases, breakthrough infections, and challenges in controlling the spread.¹⁵

High immune evasion properties

JN.1 exhibits higher immune evasion properties compared to BA.2.86.1, potentially hindering the effectiveness of natural immune responses and vaccines.¹⁵

Continuous emergence of novel variants

The unceasing circulation of SARS-CoV-2 and the emergence of novel variants pose a threat to public health, potentially complicating mitigation efforts and vaccine effectiveness.

Antibody responses markedly lower

The marked decrease in neutralizing antibody responses from vaccines and previously infected individuals against BA.1/BA.2, and the higher immune evasion properties of JN.1, may pose challenges to existing vaccination strategies.¹⁶

Possibility of highly transmissible variants

While JN.1 may not currently pose a significant threat, the continuous emergence of new variants raises the possibility of a highly transmissible or more severe variant in the future.¹¹

Overburdened healthcare systems

Frequent reporting of new variants could strain healthcare systems and resources, particularly if each variant is perceived as a cause for significant concern.¹¹

Elevated risk of heart issues

Health professionals caution that individuals contracting the disease face an elevated risk of potential heart complications. The recent surge in COVID-19 cases in various countries, such as the US, UK, China, and India, is attributed to the emergence of the new strain, JN.1.¹⁸

High transmission rate

JN.1 is rapidly becoming the dominant strain, responsible for a significant percentage of new COVID-19 infections globally. Its fast growth indicates a high transmission rate.¹³

The information was condensed using a framework matrix, and strategic planning was defined based on the interconnections within the data framework Table 1.

Limitations

The analysis limitations include limited data sources, time sensitivity, geographical variability in depth, and a lack of primary research.

Table 1: Literature review and expert opinion from newspaper articles: SWOT analysis.

Factor	Content			
Strengths	WHO guides global response to evolving VOIs	Vaccines likely effective against JN.1, WHO emphasizes	Scientific understanding emphasizes ongoing tracking of SARS-CoV-2 and its changes	Preventive measures and continuous COVID testing along with genomic testing
Weaknesses	Limited testing kits and essential materials challenge healthcare systems	JN.1's lower ACE2 affinity affects host entry, influencing transmission	Enhanced immune escape in JN.1 may boost survival and transmission	Reinfection weakens neutralization titres, hindering immune response to JN.1

Continued.

Factor	Content			
Opportunities	Encourage continuous vaccinations for high-risk individuals	Conduct extensive research on JN.1 for better understanding	Adapt vaccines based on JN.1 immune escape insights	Employ adaptive strategies for evolving SARS-CoV-2 variants
Threats	Co-circulation with respiratory diseases poses a health resource threat	Lower antibody responses may challenge vaccination strategies	N.1 raises risk of heart complications in COVID-19 cases	Potential risk of becoming a “variant of concern”

CONCLUSION

The SWOT analysis emphasizes the need for robust public communication on preventive measures and vaccination. Ongoing surveillance, genomic sequencing, and research are crucial for understanding and responding to new virus variants. Evaluating vaccine effectiveness against recent variants is recommended, with potential updates or booster shots.

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