

# Awareness on Covid-19 and Covid Associated Mucormycosis During Second Wave in India

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## ABSTRACT

### BACKGROUND

COVID-19 is a viral pandemic disease reported from 222 different countries in the world. Although government agencies of various countries are responding to the suggestions of medical experts, public understanding of the nature of the disease is necessary to control the disease. Moreover, Covid associated mucormycosis (CAM) is found to emanate as a secondary infection in countries such as India. Therefore, this study was done to evaluate the awareness of COVID-19 and Covid associated mucormycosis.

### METHODS

A questionnaire designed using google form was used to assess the public's awareness about the airborne nature of the virus, Covid associated mucormycosis, and the government's efforts in combating the disease.

### RESULTS

About 690 people responded to the questions and among them 78 % were females and 21 % males. The age of the respondents ranged from 17 to 70 yrs. Nearly 69.5 % of the respondents believed that the virus was airborne. Although 89 % of respondents correctly stated that India was experiencing the second wave of COVID-19, yet majority of them could not make the same statement about other countries like the UK and the USA. Naming the mucormycosis as the black fungus had reached 88 % of the respondents. Nearly 60 % of the general public were satisfied with the government's initiatives in providing medical facilities.

### CONCLUSIONS

The study provides the public's understanding of Covid-19 after the second wave of Covid-19 and Covid associated mucormycosis in India. The research provides inputs to the Indian government and the governments of Indian states to further raise public awareness on controlling the disease.

### KEY WORDS

COVID -19; Airborne virus; Covid Associated Mucormycosis; Black fungus, India.

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## BACKGROUND

Covid-19 caused by a virus SARS-CoV-2 is a pandemic disease affecting more than 222 countries worldwide. The disease affected around 190 million (as of 18<sup>th</sup> July 2021) and caused mortality in about 4.1 million population worldwide.<sup>1</sup> The disease was first reported on 30 January 2020 in India and the disease is still spreading. The daily infection of the disease when plotted on the graph results in a wave-like pattern, which is designated as the second wave in India. In India alone, nearly 31.1 million population are affected by the disease and the mortality is around 0.41 million. Apart from regular symptoms like fever, cough, and sneeze, the symptoms widely reported during the second wave included dyspnoea – tightness in the chest, gasping of air, shortage of oxygen (SpO<sub>2</sub> level),<sup>2</sup> hearing loss, conjunctivitis, dryness in the mouth and fatigue when compared with that of the first wave caused by Covid-19.<sup>3</sup> Sudden emergence of mucormycosis in the second wave of Covid-19 is of high concern in India. Nearly 40,845 instances of Covid associated mucormycosis (CAM) are recorded in the country.<sup>4</sup> It is difficult for medicos and scientists to understand the disease due to its complexity. Understanding the disease is still confusing for the general public.

The first wave of Covid-19 started in India with only 3 cases recorded on 1<sup>st</sup> March 2020 and the number increased to 11.1 million cases by 28<sup>th</sup> of February 2021<sup>1</sup> contributing only 36.39 % of infected people among the total cases recorded. The remaining 63.6 % of cases were recorded during the second wave in India. The demand for hospital beds, ventilators, oxygen, medicine and other infrastructure has increased alarmingly. The Government of India and different state governments worked on war footing mode to control the disease. The Indian government has prioritized the development of the vaccine. Different state governments imposed a lockdown to contain the pandemic. The emergence of mucormycosis and the post-treatment to Covid-19 added a burden to the government as well as the general public. The Indian government advised the state governments to declare the Covid associated mucormycosis (CAM) as an epidemic. Although more than a year has passed, public awareness on understanding Covid-19 at a global level, understanding the disease CAM, its symptoms, the medicines available, and responses by the Government of India and other state governments to the disease were evaluated in this study using a questionnaire.

## METHODS

The questionnaire consisted of major headings as follows:

1. Personal Details: Data on age, sex, and education.
2. Understanding Covid-19: The nature of airborne transmission, its spread at the international level, the implementation of lockdown and vaccinations to control the disease.
3. Covid associated mucormycosis: Causal agent, route of infection, symptoms, cause of infection.
4. Government response to Covid-19: Providing beds, supplying oxygen and medicine. Was designed using a

google form and circulated to the general public through social media like Facebook and WhatsApp from May 2021 to June 2021. The collected data is presented in detail.

## RESULTS

### Personal Details

A total of 690 responses were received for the survey. Among the respondents, 78.1 % were females and 20 % were males. The age of the respondents ranged from 17 to 70 years. The majority of responders were between the age of 17 and 20, followed by those between the ages of 21 and 25. Between the age of 46 and 50, about 53 persons expressed their interest in responding to the survey. The number of respondents according to their age group is presented in Fig. 1a. With regard to the educational status, 50 % of respondents were pursuing undergraduate studies, 25.9 % were postgraduates and 21.4 % were engaged in research as a scholar or as a faculty member. The rest of the respondents were either school-educated or held a diploma.

### Understanding COVID-19

The respondents were asked about the airborne nature of the Covid-19 virus, its spread at the international level, the implementation of lockdowns and vaccination to control the disease.

Amongst 684 respondents, 69.7 % believed that the virus was airborne, 9.8 % said that they had no idea about it while the remaining responded that the virus did not spread through the air (Fig. 2a). The same was reciprocated when the question was posed related to the acceptance of the World Health Organization (WHO) regarding the airborne nature of the virus. However, 12.6 % said that they had no idea about the acceptance of WHO. 676 respondents answered the question regarding the acceptance of the Centre for Disease Control (CDC). Amongst the respondents, nearly 18.6 % had no idea about the acceptance of CDC as the virus was airborne and 15.4 % said no as their response (Fig. 2a).

By posing questions about the number of waves seen in India, the United Kingdom, the United States, and countries affected by Covid-19 in the world, knowledge about the spread of the disease at the international level was assessed. A maximum number of people (89.4 %) stated that the second wave was seen in India. However, several of them were unable to provide an answer about the number of waves witnessed across the world, in the United States, and in the United Kingdom (Fig. 2b) Maximum respondents said that only a second wave was seen in the world.

The largest number of respondents (88.1 %) supported the implementation of lockdown to control Covid-19. Related to the vaccine in controlling the disease, 67.3 % believed in vaccines while 20.6 % did not (Fig. 2d). Maximum respondents preferred Covishield (36.2 %), followed by Covaxin (33.8 %) and Sputnik (10.6 %). Nearly 19.4 % of respondents had no idea about the vaccines (Fig. 2e). Amongst the respondents, 52.5 % supported exporting

vaccines whereas 26 % were against it. 21 % of them did not want to respond to the question.

**Knowledge on Covid Associated Mucormycosis (CAM)**

Regarding Covid associated mucormycosis (CAM), the vast majority (86.4 %) of respondents knew that a fungus caused the disease. Among the respondents, 88.9 % identified the disease as ‘Black fungus’. Forty percent of the respondents said that the route of entry for CAM was through the nasal system. Thirty-four percent of respondents stated that the eye was the route of entry for CAM and 16.5 % as lungs.

Most respondents said that the mortality rate for CAM was 2 %. A quarter of the respondents said that they had no idea about the mortality rate of CAM. Ten percent of them said more than 70 % as mortality rate. Around 32 % of respondents believed the use of mask as the reason for CAM, 20.8 % as cylinders, and 10 % of respondents believed that vaporizers were the reason for CAM infection. Most respondents believed that there were other reasons for the infection of CAM (Table 1).

A maximum number of people stated that the reason for CAM was due to a diabetic condition, use of steroids, and immunocompromised status of the individuals. Around 55 % identified that swollen eyes, the formation of black spots, and infection of the brain as the symptoms of CAM. Only 2.2 % of respondents said that CAM affected the brain. Nearly 44.8 % of respondents believed that amphotericin B was an antibiotic used in controlling CAM, and many (32.7 %) indicated that they had no idea on antibiotics in control of CAM (Table 2).

Question	Response Received			
Causal organism of Mucormycosis	Fungi 86.4%	Virus 7.3%	Bacteria 2.5%	No idea 3.8%
Mucormycosis is also called as	Black fungus 88.9%	Yellow fungus 2.5%	White fungus 2.5%	No idea 6.1%
Route of Infection of CAM	Nasal 40.3%	Lung 16.5%	Eye 34 %	Skin 9.2%
Fatality recorded for CAM	2 percent 38%	30 percent 30%	More than 70 percent 10.7%	No idea 25.8%
The reason for infection	Mask 31.9%	Vaporizers 10%	Oxygen cylinders 20.8%	Other factors 37.3%

**Table 1. Response Pertaining to Covid Associated Mucormycosis**

Question	Response Received				
Covid Associated Mucormycosis is caused in subjects	Steroid usage 14.5%	Diabetes 7%	Immunocompromised 11.4%	No idea 13.3%	All the above 53.8%
Symptoms of CAM include	Swollen Eyes 20.4%	Black spot 13.9%	Affects Brain 1.2%	No idea 8.3%	All the above 56.2%
CAM can be controlled using	Penicillin 9.1%	Streptomycin 6%	Amphotericin B 44.7%	Ketoconazole 7.5%	No Idea 32.7%

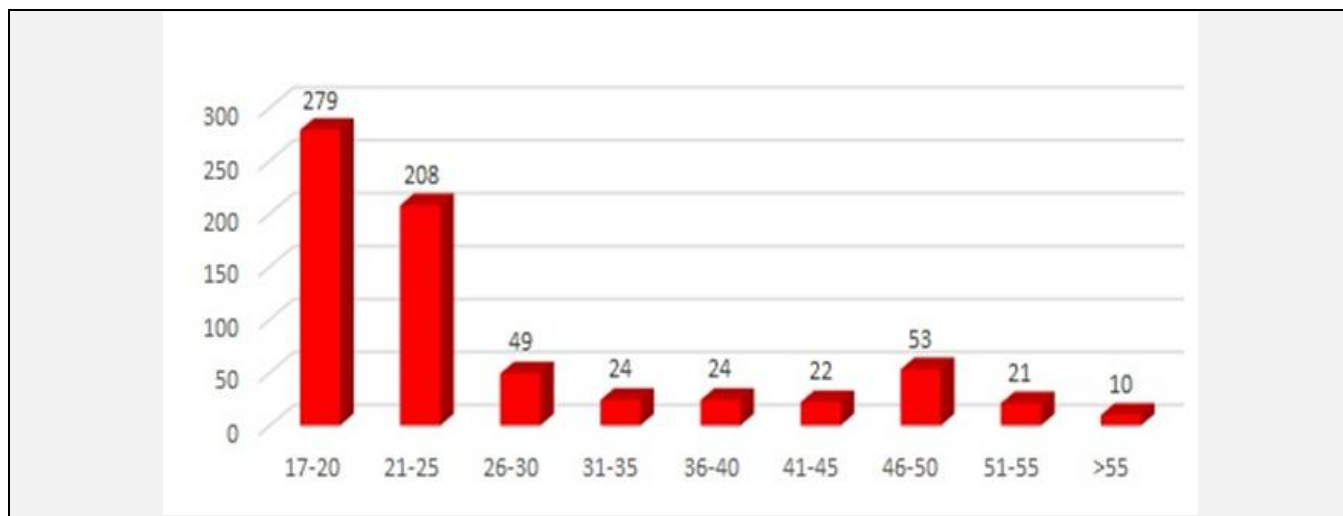
**Table 2. Cause, Symptoms and Control of Covid Associated Mucormycosis**

**The Public's Satisfaction with the Government's Role**

Owing to the sudden peak in COVID spread, the number of hospital beds, the demand for the drug remdesivir, and the supply of oxygen, people’s satisfaction with government responsibilities is highly desirable. As a result, respondents were asked questions on the importance of oxygen and remdesivir. In addition, the actions of the central government and the states were assessed.

Most people (33.2 %) responded that they needed oxygen when the SpO<sub>2</sub> level was below 85 % and 30.2 % said they needed oxygen when the SpO<sub>2</sub> level was below 90 % (Figure 3a). Nearly 41 % of the respondents believed that remdesivir controlled the disease. Around 24.4 % of people stated that they had no idea about the usage of remdesivir (Fig. 3b).

More than 57 % of the respondents said that the central government met their needs, and more than 71.7 % of the respondents said they were satisfied with the hospital beds provided by the state government. Nearly 62 % of respondents said that they were satisfied with the central government’s action in supplying oxygen and 75.7 % said that they were satisfied with the state government in supplying oxygen. Amongst the respondents, 61.7 % stated that they were satisfied with the central government in supplying remdesivir and 66.5 % stated that they were satisfied with the state government in supplying remdesivir. A comparative graph on government response towards providing hospital beds, supplying oxygen and remdesivir is presented in figure 3c.



**Figure 1. Age Group of Responders**

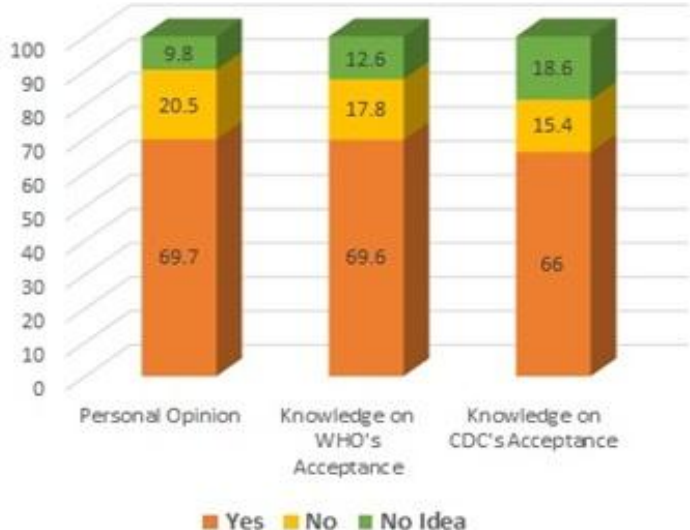


Fig. 2a. Knowledge on Airborne nature of Virus

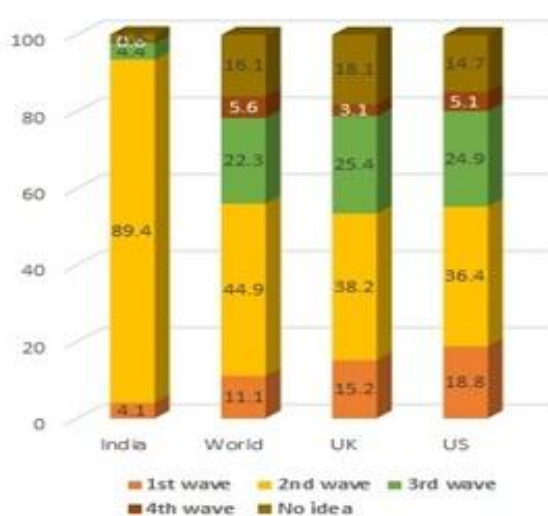


Fig. 2b. Knowledge on Disease wave in India, US, UK and World

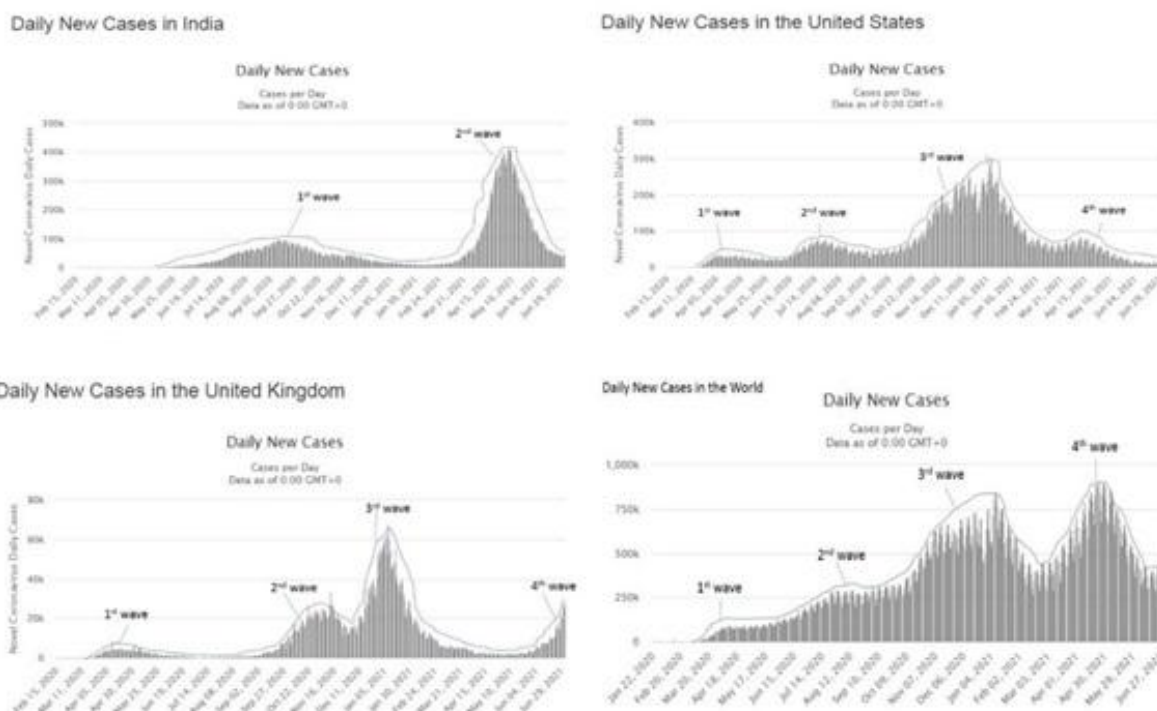


Fig. 2c. Comparative graph showing the disease spread in India, US, UK and World (Source: worldometer.com)

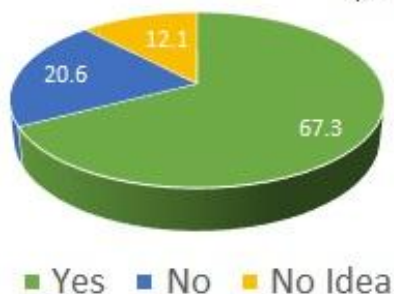


Fig. 2d. Belief on Vaccine in controlling COVID-19

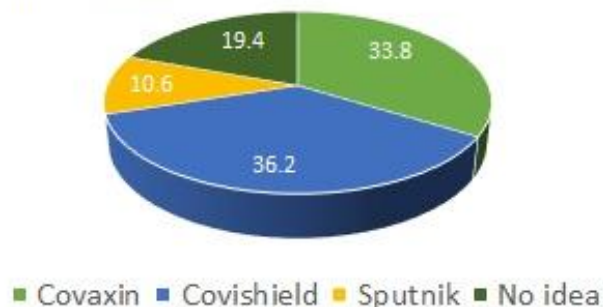
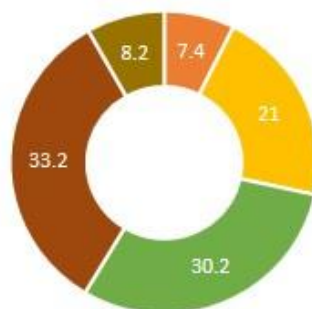


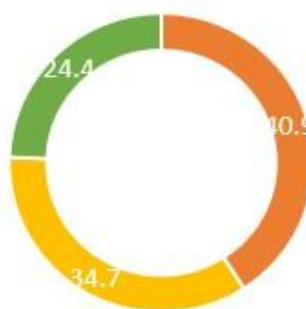
Fig. 2e. Preference of Vaccine

Figure 2. Knowledge on Airborne Nature, Disease Spread and Belief on Vaccine



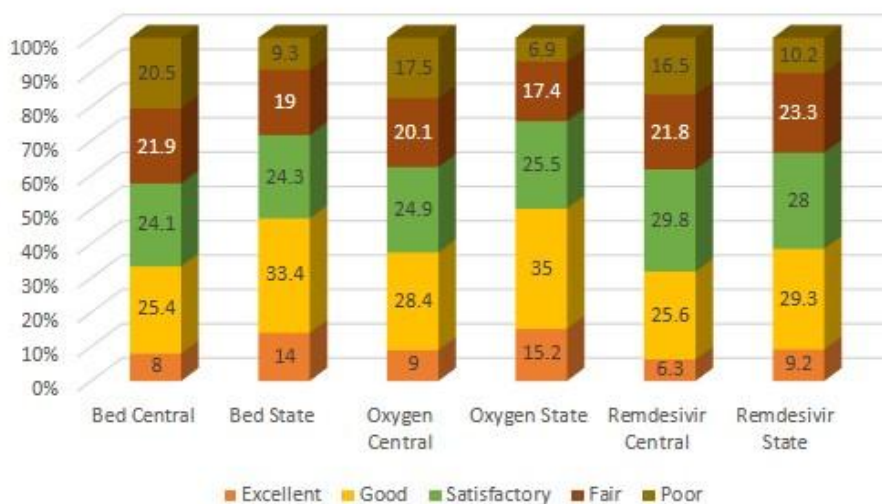
■ less than 100 ■ less than 95 ■ less than 90 ■ less than 85 ■ No idea

**Fig. 3a. Response to the Requirement of Oxygen**



■ Yes ■ No ■ No Idea

**Fig. 3b. Belief on Remdesivir in controlling COVID-19**



**Fig. 3c. Government response on supplying Beds, Oxygen and Remdesivir**

**Figure 3. Response to Oxygen Requirement, Remdesivir in Controlling Covid-19 and Government Response on Supplying Beds, Oxygen and Remdesivir**

**DISCUSSION**

Among the survey conducted, maximum respondents i.e. nearly 487 people belonged to the age group of 17-25. This is

attributed to the mode of a survey conducted, i.e. using social media. It is known that the young population are highly active in social media like Facebook, WhatsApp and Instagram. This echoes their education, which shows that the largest number of respondents were studying for a baccalaureate or master's degree.

In a previous study conducted by the authors,<sup>5</sup> around 59.6 % of respondents believed that the virus was airborne. An increase in acceptance of the airborne nature of the virus is seen in this study where 69.7 % of respondents said that the virus was airborne, thus awareness is increased. The airborne nature of the virus due to its size and shape makes them buoyant and their transport to long distances is easy.<sup>6</sup> Airborne nature of the SARS-CoV-2 virus was revealed by many studies. SARS-CoV-2 was collected from the air of a clinic within a university student health centre in Florida<sup>7</sup> and from a hospital room with Covid-19 patients.<sup>8</sup> The aerosol and surface stability of SARS-CoV-2 were reported.<sup>9</sup> Morawska and Cao (2020)<sup>10</sup> reiterated that the world should face the reality as the SARS-CoV-2 is transmitted through the air. Similar to their belief, the same percentage of respondents said that WHO<sup>11</sup> has accepted the virus as airborne and only 66 % said that CDC<sup>12</sup> has also accepted the virus as airborne. This difference is attributed to the Indian people's understanding of WHO rather than CDC.

Although it is known that India is facing the second wave of Covid-19, maximum respondents said that a second wave was seen only in the UK, US and around the world. This is because they continued to hear the second wave of India through the audio-visual media which made the impact. Daily new cases recorded in India, UK, US and countries affected by Covid-19 in the world<sup>1</sup> is provided in figure 2c for comparison.

The largest number of respondents supported the implementation of lockdown to control Covid-19. Implementation of lockdown was widely followed by many countries whenever there was a disease surge. This was also experienced in India when the first wave of Covid-19 was controlled by implementing lockdown. Maximum respondents supported the vaccine to control Covid-19. They also supported Covishield and Covaxin which were produced in India when compared to Sputnik as the vaccine was imported. Vaccination is widely used to combat Covid across the world. More than half of the respondents supported exporting vaccines to other countries which echoes the state of the generosity of the Indian population.

Most of the respondents correctly pointed out that the Covid associated mucormycosis was caused by the fungus. Similarly, maximum number of people stated the term 'Black fungus' although it is a misnomer.<sup>13</sup> One third of the respondents stated eye and one fifth stated lungs as the route of entry for CAM. However, the nasal system is the route of entry for rhinocerebral mucormycosis. Most of the respondents, i.e. 38 % said that mortality recorded for CAM was around 2 %. India recorded around 7.5 % mortality rate for CAM,<sup>14</sup> However, 40 % of the mortality rate was recorded for mucormycosis before the pandemic.<sup>15</sup>

Among the reason behind the CAM, 32 % of respondents stated mask as the reason. However, masks were used even during the first wave of Covid-19 in India where CAM was not reported. The authors suspect that the unused cylinders which were used during the second wave for the supply of oxygen to be the reason. It is believed that the environment within the cylinder plays a major role as a micro-environment with enough moisture, temperature and darkness which favours the growth of mucoraceous fungi.

Nearly 54 % of the respondents stated that the reason for CAM was due to a diabetic condition, use of steroids, and immunocompromised status of the individuals. The three major factors in combination favour the infection of mucormycosis. Maximum respondents also said that swollen eyes, black spots and affecting the brain were the major symptoms. One-sided facial swelling, headache, nasal or sinus congestion, black lesions on the nasal bridge or upper inside of the mouth that quickly become more severe, and fever were reported as major symptoms of rhinocerebral mucormycosis.<sup>16</sup> Related to antimycotic agents, major respondents stated amphotericin B as the better antibiotic to control COVID. Due to their improved safety and effectiveness, lipid formulations of amphotericin B are the usual therapy for mucormycosis.<sup>17</sup>

The supply of oxygen using the external system is recommended in case of emergency and disease maintenance of Covid-19. When the question was posed to the respondents, confused answers were received. More than 33 % of the respondents said, that oxygen supply was required whenever SpO<sub>2</sub> level was decreased to 85 %. However, the Indian Council of Medical Research (ICMR) guidelines recommend the use of oxygen for invasive ventilation in non-ICU beds when the SpO<sub>2</sub> level in ICU beds is between 90 – 93 % and less than 90 %.<sup>18</sup> Similarly, more than 40 % of the people believed that remdesivir controls the disease although WHO recommends against the use of remdesivir in Covid-19 patients.<sup>19</sup>

As far as the government's response in providing hospital beds and supplying oxygen was concerned, the respondents were highly satisfied with their state governments. There is a wide gap (13-14 %) existing between the satisfactory level of the respondents between the state and central governments. The central government scored 13 % lower level of satisfaction from the respondents when compared to the state government. Regarding supplying of remdesivir, the respondents were satisfied with both state and central governments. The difference in satisfactory level was attributed to the proximity of the state government to the general public rather than the central government.

## CONCLUSIONS

The study provides detailed information on the public's awareness of Covid-19 during the second wave and Covid associated mucormycosis in India. The details on understanding the disease spread at the global level, the emergence of Covid associated mucormycosis (CAM), their symptoms, route of entry, the public's level of satisfaction towards the response by both Central Government of India and state governments in India are evaluated in this study. A total of 690 people responded to the questionnaire. The people were well aware of the airborne spread of the Covid-19 virus, the role of lockdown and vaccine in controlling the disease. However, there is a lack of understanding of the spread of the disease in the world, the United States and the United Kingdom. More than 60 - 75 % of the general public is satisfied with the response of the Central Government of India and State Governments in India. This study clearly shows that the public is confused about the understanding of CAM. Therefore, it is very important to raise public

awareness of CAM. Central and state governments, as well as policymakers in India, can use this research as insights to raise public awareness of CAM disease.

### Limitations

- a. Owing to the study's educational background, it may be skewed. The response of the people who lack appropriate education must be taken into account.
- b. Only the users of social media have responded to this study.

Data sharing statement provided by the authors is available with the full text of this article at jemds.com.

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Disclosure forms provided by the authors are available with the full text of this article at jemds.com.

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