A Review on Corona Virus (COVID-19) Pandemic, Its Global Emergency Outbreak and Its Consequences in India

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Abstract

The outbreak of COVID-19(Severe Acute Respiratory Syndrome Coronavirus- 2) caused threatening viral pneumonia by the end of year 2019. It affects the respiratory tract mainly by binding to the ACE-2 receptors and TMPRSS2. SARS-CoV-2 belongs to the genus Betacoronavirus, caused the global epicentre in Wuhan, China, and then transformed into a pandemic affecting millions across the world.

In India, The World Health Organization and The Central Government of India are ensuring detection and Administrative management of cases suffering from SARS-CoV-2. Recommended guidelines are released by the Central Government of India, Department of Health Research (DHR) and The Indian Council of Medical Research (ICMR). These organisations are able to control and measure the infection of SARS-CoV-2 in accordance to the guidelines of WHO and The Centre for Disease Control and Prevention (CDC) health care professionals and research scientists are trying to identify, isolate, collect specimen and identify the different courses of transmission in humans, manage affected cases of covid-19 by using these recommended guidelines. The detailed genomic sequence(Compare of SARS-CoV-2, SARS-CoV, and MERS-CoV), have many similarities and differences in their genomic structures based on its phylogenetic relationships and is useful for developing diagnostic kits, efficient anti corona virus drugs and also in development of vaccinations. The National Institutes of Health (NIH) providing funding opportunities on COVID-19 clinical trials. In this review article we are trying to focus all these points mainly in Indian perspective and our centre’s experiences that may help prevent the further spread of the pandemic.

Key words: Covid-19, lockdown, Indian Situation, recommended guidelines, SARS-CoV-2, SARS-CoV, and MERS-CoV

Background

COVID-19 is an acute, sometimes severe, respiratory illness caused by a novel coronavirus SARS-CoV-2 previously known as 2019 novel coronavirus (2019-nCoV), it began in the city of Wuhan, China in end of 2019. The WHO characterized coronavirus disease of 2019 (COVID-19) as a pandemic beginning of this year 2020 It was renamed “severe acute respiratory syndrome coronavirus-2,” or SARS-CoV-2 by the International Committee on Taxonomy of Viruses on February. It belongs to the Beta-coronavirus genus originating probably from bats. Beta coronaviruses infected mammals especially human and can cause severe respiratory disease. Other viruses in this family are SARS and MERS coronavirus ¹.²

Coronavirus disease of 2019 (COVID-19) in India: Current Scenario

It was an alarming situation for India in terms of public health arrangements during COVID-19 pandemic then the first positive case of COVID-19 was detected on 30th of January, 2020, in Kerala. The number of confirmed cases continually growing in India and the recovery rate is also very good as compared to other developed countries. Our health system not very relative compared to other developed countries, as we all know our population is very high, the high risk cases or severe cases require hospitalizations and intensive care units (ICU).

Assuming these situations our honourable prime minister took quick actions on this pandemic conditions the government assumed the number of cases in the near future and realized the infrastructure requirements to avoid adverse situations and protection of every Indian citizen. The result we all know as compared to our population our COVID-19 positive number is less and recovery rate is good. It is possible due to close monitoring by the government, quick decision of lockdown, national and international travel restrictions, essential quarantine in any suspected condition, started manufacturing PPE kits, face masks, sanitizers, diagnostic laboratories for testing of COVID-19, etc. started new opportunities in health care system such as drugs, vaccination, diagnostic kits, ventilators, mobile app, mobile hospitals with ICU facility for public health, etc. Despite of the pandemic, the government planned very well and presented itself as ‘Atmanirbhar Bharat’ (self-dependent India) which is the vision of the honourable Prime Minister of India Mr. Narendra Modi of making India a self-dependent nation not only in the field of health care for this pandemic situation but also related to Indian economy. As we all
know before the month of May the personal protective equipment (PPE) production was zero in India and now the manufacture rate is more than 1,50,000 pieces per day. The Central Drugs Standard Control Organization (CDSCO) of India has taken a series of actions to fast-track development of diagnostic kit, vaccines and drugs for use in the management of the COVID-19 pandemic. As a result, first oral antiviral Indian medication for treatment of COVID-19 named FabiFlu (Favipiravir) is manufactured by Glenmark Pharmaceuticals for mild and moderate cases. Although scientists are actively involved in clinical research on COVID-19, approximately 1.2% of such trials are currently taking place in the country due to strict regulations for human clinical trials. The Serum Institute of India and Cadila Healthcare are involved in developing a COVID-19 vaccine, it is in the pre-clinical stage and human trials are under process \textsuperscript{11-16}.

The ‘Atmanirbhar Bharat’ does not mean that India is isolating itself from the world but it proves that India can be a bigger and more important part of the global economy. The Government of India, Ministry of Health & Family welfare broadcasts the recommendations of World Health Organization (WHO) and Center for Disease Control and prevention (CDC) healthy practices to prevent the infection of COVID-19 because only home quarantine is not enough. In the recommendations (table-2): Avoid touching the eyes, nose mouth with unwashed hands and washing of hands for at least 20 seconds efficiently removes the virus. Hand wash with any kind of soup and at least 60% alcohol hand sanitizers are enough to prevent the virus. Face mask, social distancing is compulsory to reduce the chance of viral spread. Although national and international travel have been restricted, but still there are recommendations after travel to prevent the viral spread: Asymptomatic passengers, who are presented as mild risk suspects, travelling from COVID-19 affected cities or countries were home quarantined for 14 days and should be kept under medical observation. Persons who has comorbidities and asymptomatic presented as moderate risk were quarantined for 14 days at medical observation by the state governments. Passengers, who have fever, cough and breath problems were presented as severe or high risk and quarantined for 14 days at medical observation by the state governments. All asymptomatic healthcare workers and asymptomatic associates of laboratory test confirmation cases at medical observation by the state governments \textsuperscript{17-20}.

Contaminated Zones were designated as per guidelines (table-3) issued by the Ministry of Home Affairs to monitor and manage COVID-19 pandemic. District authorities identified within Red Zones and Orange Zones, clusters of colonies or wards or towns in urban areas and villages or panchayats or blocks in rural areas as containment zones is where life is severely restricted. Then containment areas within Red and Orange Zones will be identified separately by local authorities. These zones define as: Red Zone: Areas or the hotspots classified as those with the highest caseload. Orange Zone: Areas which have reported a limited number of cases in the past and no surge in positive cases recently. Green Zone: Areas with zero confirmed cases till date or no confirmed cases in the last 21 days. Guidelines for setting up isolation facility ward in COVID-19 outbreaks from National Centre for Disease Control, Directorate General of Health Services Ministry of Health and Family Welfare announced that there should be strict adherence to infection prevention control practices in all health services. All healthcare personnel are well aware and appropriate measures for necessary personal protective equipment (PPE) and hand sanitizer, soap, water etc. are in place. The designated hospitals will ensure that all healthcare staff is trained in washing of hands, respiratory etiquettes, donning/doffing & proper disposal of personal protective equipment(PPE)s and bio-medical waste management. At all times doctors, nurses and paramedics working in the clinical areas will wear three layered surgical mask and gloves. The medical personnel working in isolation and critical care facilities will wear full complement of PPE including N95 masks. The support of staff engaged in cleaning and disinfection will also wear full complement of PPE (table-2, 3, 4). Environmental cleaning should be done twice daily and consist of damp dusting \textsuperscript{31-25}.

Structure of SARS-CoV-2 (COVID-19)

SARS-CoV-2 has enveloped, positive-sense, single-stranded RNA (ssRNA) coronavirus virus and spherical. Two-thirds of viral RNA, mainly located in the first open reading frame (ORF 1a and 1b), encodes 16 non-structural proteins (NSP). The rest part of the virus genome encodes four essential structural proteins: spike (S) glycoprotein, small envelope (E) protein, matrix (M) protein is the most abundant, responsible for the shape of the envelope and nucleocapsid (N) protein. It affects the respiratory tract mainly by binding to the ACE-2 receptors and TMPRSS2 which get attached to the cell membranes of cells of lungs and other organs of the body. Spike S glycoprotein of SARS-CoV-2 binds to host cell receptors, angiotensin-converting enzyme 2 (ACE2) that is a critical step for virus entry. S protein is cleaved by cellular Trans-membrane Serine Protease 2 (TMPRSS2) into two separate polypeptides S1 and S2. S1 also consists of a receptor binding domain (RBD) which binds to virus receptor ACE2. S2 mediates virus cell membrane fusion by heptad repeats-(1HR1) and heptad repeats-(2HR2) N proteins remain associated with the RNA forming a nucleocapsid inside the envelope and also numerous addition proteins. N protein is largely involved in processes relating to the viral genome, it is also involved in other aspects of the SARS-CoV-2 replication cycle and the host cellular response to viral infection. (table-1) This virus-receptor interaction allows the viral genome to be delivered to the host cell cytoplasm for replication \textsuperscript{26-32}. Severe acute respiratory syndrome (SARS) is a severe, acute respiratory illness caused by the SARS coronavirus and Middle East respiratory syndrome (MERS) is a severe, acute respiratory illness caused by the MERS coronavirus (MERS-CoV). Literature suggested that SARS-CoV-2 to identify 79% approximately sequence to SARS-CoV and 50% approximately to MERS-CoV. SARS-CoV-2 have a similar receptor-binding domain structure as SARS-CoV which shows SARS-CoV-2 uses ACE2 receptor in humans for infection \textsuperscript{33-39} (table-1).

Researchers firstly identified a coronavirus in 1937, isolating one that was responsible for a type of bronchitis in birds that had the potential to devastate poultry stocks. Scientists found evidence of human coronaviruses in the 1960s, in the noses of people with the common cold. Human coronaviruses that are particularly prevalent include 229E, NL63, OC43, and HKU1 \textsuperscript{40-42}. Symptoms of COVID-19 According to the CDC, people may start to experience symptoms 2-14 days after exposure to the virus. Symptoms may include: Muscle pain, headache, fever, cough, loss of taste or smell, nausea or vomiting, diarrhea , chills, sore throat, congestion, shortness of breath , runny nose, and fatigue\textsuperscript{22,23,25}. The Lancet and Cell Press, more than 30,000 related articles and book chapters free to access on ScienceDirect(table-2). The National Institutes of Health (NIH) 2684 studies found for: COVID-19(funded internationally). NIH explores 346,147 research studies in all 50 states and in 216 countries (table-4).

In countries where the BCG vaccine (TB vaccine) remains an essential vaccination has significantly lower mortality rate. BCG vaccine has shown protective effects against non-mycobacterial infections so it is assumed that the cytokines have a role in providing immunoprotection against COVID-19 to those who have been BCG vaccinated. Although WHO does not consider BCG vaccination for COVID-19 treatment \textsuperscript{43,44}.  

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In May first week COVID-19 testing 315-government laboratories and 111-qualified private laboratories have also been made functional in our country, and in July approx. 1000 laboratories are testing COVID-19. A total of 1,43,81,303 samples have been tested in July first week in India. 402529 active cases and 724577 cases cured or discharged from COVID hospitals where 28084 deaths have been reported at Indian government webpage (table-3).

**Laboratory Testing**

Indian Council of Medical Research has issued guidance on the use of TrueNat (disease specific real time micro PCR tests) 45 Beta-coronavirus as a screening test on April 14, 2020. Asymptomatic direct and high-risk contacts of a confirmed case should be tested once between day 5 and day 14 of coming in contact. Issued guidance for hotspots in large meetings or migrants centers require all symptoms fever, cough and sore throat to be tested within 7 days of illness by RT-PCR method and after 7 days of illness there should be antibody testing even negative or confirmed by rRT-PCR). Indian Council of Medical Research Department of Health Research, Ministry of Health and Family Welfare, Government of India announced on the 19th of May 2020 that the TrueNat system is now a comprehensive assay for screening and confirmation of COVID-19 cases. First sample is collected in viral lysis buffer and therefore biosafety and biosecurity requirements for use of TrueNat machines are minimal. Second assay comprises of following two levels.

Level I: This is E gene screening assay. All samples of suspect COVID-19 should be first tested by this assay. All negatives are to be considered as true negatives. All positive samples should be subjected to confirmation by next level. Level II RdRp gene is confirmatory assay. All samples that test positive by this assay must be considered as true positive. No further RT-PCR based confirmation is required for samples that are positive after these two levels of the assay mentioned above. Finally all positive and negative results must be reported to ICMR portal in real time manner (Table-3). We are also using TrueNat testing of COVID-19 at our center.

**Drawback of lockdown and Covid-19 pandemic situation:**

In India there are number of people suffering from poverty, illiteracy and migration for jobs from their birth place and also local people who demand jobs, lot of them are suffering from low education mainly migrant labourers. Government of India is conducting many schemes for their education, health, even providing houses, grains, medical treatment in low cost as ‘Poshan Abhiyaan’ for women and child development, the Mahatma Gandhi National Rural Employment Guarantee Act 2005, Samagra Shiksha and Mid-Day Meal for school education and literacy, National Health Mission many more. These public schemes cannot facilitate every citizen because of the communication gap between citizens and government due to illiteracy, lack of documentation and identifications. Less educated labourers are not hygienic and they can spread COVID-19 as carriers via migration. In the situation of COVID-19 lockdown many citizens lost their jobs and were forced to move back to their birth place. This is a disastrous situation and many problems can rise in pre and post lockdown as crime may increase, along with unemployment, economic loss, psychological illnesses etc. In the field of health care, the patients who are suffering from chronic diseases and need urgent treatment or surgery are being treated by doctors wearing PPEs. Government is providing PPE, face masks, COVID-19 testing at subsidized rate or free in many places. These problems are not only faced by India but worldwide. As doctors and supportive paramedical staff are treating the COVID-19 patients day and night, they left their home in this time of crisis and continually saving the life , in these days they are the real hero who are saving many life , we salute our these real heroes.

Our government has massive challenges and focussed approach is required. The government’s efforts are very appreciative because the government is not only working for India but for other countries as well 14, 15, 24.

The terminology used to understand different preventive management to protect the infection of COVID-19 follows 21. Social distancing or physical distancing: It refers to keeping space between yourself and other people while going out or in crowded spaces. Quarantine: Refer to keeping someone home and separated from other people if they might have been exposed to the virus. Isolation: Refer to keeping sick people away from healthy people, including using a separate bedroom and bathroom whenever possible (table-2.3.6).

**Pandemic and our Centre’s Experience:**

As our center is investigating the perception of risks and psychological states of Health Care Workers in the early phases of the COVID-19 outbreak in Northern parts of India. Data collection will be used for research purposes title” Psycho-social impact of COVID-19 on Health Care Workers” in their webpage, a questionnaire is available for employees to participate and record responses.

The COVID-19 disaster has influence on patients, employees and business of a hospital as it affect on the quality and revenues, some important precautions can help cope up with this disaster. Most of the hospitals in India are taking various precautionary measures for safety of their patients and employees to understand various strategies of their quality, business operations, and revenues during this disaster. As we mentioned above, during lockdown hospitals have been giving treatment to their patients via telecommunication by giving treatment at the comfort of their home and keep them safe from COVID-19. At our center patients who had being suffering from chronic diseases of heart, kidney, liver, even dental issues or cancer etc. are being treated. Patients requiring transplantation, or if they have to come routinely for dialysis, chemotherapy, are treated with all precautions and are regularly tested for COVID-19. The details are summarized in table-5 and table-6 which has been of great help in the prevention of spreading the disease at our center.

**Conclusions**

We have investigated the problem of COVID-19 spread in India. We have observed the data through internet and government web pages and surveyed the actual data trend of COVID-19 spread in India. It has been proved that social distancing, lockdown and personal hygiene plays an important role in preventing this disease. The effect of lockdown has been proved with different recovery rates. To conclude, follow the recommended guidelines and take preventive medication in daily practical life it as helps us recovering from this pandemic. A hospital has huge number of employees, patients and visitors, infection can spread very fast in this environment but due to good awareness and strictly following the recommended guidelines, the infection can be prevented by following the information in table-5 and 6. The safety
recommendations to our centre’s employees have shown zero COVID-19 cases. In the coming days of July 2020 or further any patient or employee is found to be positive for COVID-19 will be isolated as per guidelines.

Acknowledgement

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Medical Director, Dr.Rakesh Kapoor &
Covid-19 Crisis Management Committee Chairman, Dr. Raj Kumar Sharma Director of Nephrology Medanta hospital Lucknow.

Conflict of Interest: There is no conflict of interest.

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31. Shiirikushna Subhash Unhale, Quazi Bilal Ansar, Shubham Sanap, Suraj Thakhre, Shreya Wadatkar, Rohit Bairagi, Prof. Suraj Sagrule and Prof. Dr. K. R. Biyani. A review on coronavirus (COVID-19) wjpls, 2020, Vol. 6, Issue 4, 109-115. ISSN 2454-2229

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<table>
<thead>
<tr>
<th>Characteristic</th>
<th>(MERS-CoV)</th>
<th>SARS-CoV</th>
<th>SARS-CoV-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmission type</td>
<td>Animal to human then person to person Bats-Camels-Human</td>
<td>Animal to human then person to person Bats-Civet &amp; Raccoon Dogs-Human</td>
<td>Animal to human then person to person Probably Bats-Not identified-Human</td>
</tr>
<tr>
<td>Transmission Modes</td>
<td>Droplet, contact, airborne</td>
<td>Droplet, contact, airborne</td>
<td>Droplet, contact, airborne</td>
</tr>
<tr>
<td>Measurements for Infection control</td>
<td>Standard, contact, and droplet safety measures; airborne</td>
<td>Standard, contact, and droplet safety measures; airborne</td>
<td>Standard, contact, and droplet, safety measures; airborne</td>
</tr>
<tr>
<td>Non-structural proteins</td>
<td>non-structural proteins, size almost same in all</td>
<td>non-structural proteins, size almost same in all</td>
<td>non-structural proteins, size almost same in all</td>
</tr>
<tr>
<td>Structural proteins</td>
<td>(S) spike, envelope (E), membrane (M), and nucleocapsid(N) are represented of the four structural proteins , but differences in structural proteins arrangement from SARS and SARS-2</td>
<td>(S) spike, envelope (E), membrane (M), and nucleocapsid(N) are represented of the four structural proteins , but differences in structural proteins arrangement from MARS and SARS-2</td>
<td>(S) spike, envelope (E), membrane (M), and nucleocapsid(N) are represented of the four structural proteins , but differences in Structural proteins arrangement from MARS and SARS</td>
</tr>
<tr>
<td>Similarities between these</td>
<td>MERS-CoV similar to SARS-CoV-2 about 50%</td>
<td>SARS-CoV similar to SARS-CoV-2 about 79%</td>
<td>SARS-CoV similar to SARS-CoV-2 about 79%</td>
</tr>
<tr>
<td>Cell entry pathway</td>
<td>Cell membrane fusion</td>
<td>Endosomal fusion</td>
<td>Endosomal fusion</td>
</tr>
<tr>
<td>Viral phylogencity</td>
<td>Lineage C βCoV</td>
<td>Lineage B βCoV</td>
<td>Lineage B βCoV</td>
</tr>
<tr>
<td>Host receptor</td>
<td>DPP4 (CD26)</td>
<td>Cathepsin L, TMPRSS2, HAT</td>
<td>Cathepsin L, TMPRSS2, HAT</td>
</tr>
<tr>
<td>Major host proteases that activate spike protein</td>
<td>Cathepsin L, TMPRSS2</td>
<td>The attachment protein “spike” of the new coronavirus COVID-19 , cellular attachment factor (ACE2) and the cellular protease TMPRSS2 for their activation.</td>
<td>The attachment protein “spike” of the new coronavirus COVID-19 , cellular attachment factor (ACE2) and the cellular protease TMPRSS2 for their activation.</td>
</tr>
<tr>
<td>Clinical syndrome</td>
<td>pneumonia in elderly with multiple comorbidities; upper respiratory tract infection, asymptomatic infection in children and immune-compatible persons</td>
<td>pneumonia in elderly with multiple comorbidities; upper respiratory tract infection, asymptomatic infection in children and immune-compatible persons</td>
<td>pneumonia in elderly with multiple comorbidities; upper respiratory tract infection, asymptomatic infection in children and immune-compatible persons</td>
</tr>
<tr>
<td>Common symptoms</td>
<td>Acute kidney injury and diarrhea</td>
<td>Acute kidney injury and diarrhea, fever, cough</td>
<td>Acute kidney injury and diarrhea, fever, cough</td>
</tr>
<tr>
<td>Common changes in blood tests</td>
<td>Low levels of leukocytes, lymphocytes, platelets, reduced liver and kidney function</td>
<td>Low levels of leukocytes, lymphocytes, platelets, reduced liver and kidney function increased SGPT and SGOT levels,</td>
<td>Low levels of leukocytes, lymphocytes, platelets. reduced liver and kidney function , increased SGPT and SGOT, LDH, Ferritin levels</td>
</tr>
<tr>
<td>Severe complications</td>
<td>Acute respiratory distress syndrome(ARDS), Acute kidney injury</td>
<td>Acute respiratory distress syndrome(ARDS), Acute kidney injury</td>
<td>Acute respiratory distress syndrome(ARDS), Acute kidney injury, multi organ failure</td>
</tr>
<tr>
<td>Specimens for diagnosis with positive viral RNA</td>
<td>nasopharyngeal aspirate or swab, nasal and/or throat swab; extrapulmonary—urine, feces, blood, tissue biopsy bronchoalveolar lavage</td>
<td>nasopharyngeal aspirate or swab, nasal and/or throat swab; extrapulmonary—urine, feces, blood, tissue biopsy bronchoalveolar lavage</td>
<td>nasopharyngeal aspirate or swab, nasal and/or throat swab; extrapulmonary—urine, feces, blood, tissue biopsy bronchoalveolar lavage</td>
</tr>
<tr>
<td>RT-PCR</td>
<td>S1 Available</td>
<td>Recombinant S protein fragment mice immunized with SARS-CoV receptor-binding domain (RBD)</td>
<td>SARS-CoV-2 RBD exhibited significantly higher binding affinity to ACE2 ... to a host receptor through the receptor-binding domain (RBD) in</td>
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<td>Antibody testing</td>
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<tr>
<td>Active immunization</td>
<td>Immune to SARS-CoV antibody through the vaccination</td>
<td>Recombinant S protein fragment mice immunized with SARS-CoV receptor-binding domain (RBD)</td>
<td>SARS-CoV-2 RBD exhibited significantly higher binding affinity to ACE2 ... to a host receptor through the receptor-binding domain (RBD) in</td>
</tr>
<tr>
<td>Passive immunization</td>
<td>anti-MERS-CoV S antibodies which accelerated virus clearance in mice</td>
<td>plasma therapy used in humans for recovery</td>
<td>plasma therapy used in humans for recovery</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Table-2: Recommended Guidance with their web page links</th>
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COVID-19 is an emerging, rapidly evolving situation: [https://www.nih.gov/coronavirus](https://www.nih.gov/coronavirus)
[https://www.covid19treatmentguidelines.nih.gov/overview/](https://www.covid19treatmentguidelines.nih.gov/overview/)

National Institutes of Health COVID-19 page: [https://www.nih.gov/health-information](https://www.nih.gov/health-information)


The World Society for Pediatric Infectious Diseases (WSPID) is a non-profit organization and a confederation of national and international Pediatric Infectious Diseases (PID) societies. [https://wspid.org/covid-19/](https://wspid.org/covid-19/)


In Elsevier web page under the research tab, the latest early-stage and peer-reviewed research on COVID-19 from journals including Novel Coronavirus Information Center: [https://www.elsevier.com/connect/coronavirus-information-center](https://www.elsevier.com/connect/coronavirus-information-center)

Australia’s healthcare professionals with continually updated, evidence-based clinical guidelines: [https://covid19evidence.net.au/](https://covid19evidence.net.au/)


The World Society for Pediatric Infectious Diseases (WSPID) is a non-profit organization and a confederation of national and international Pediatric Infectious Diseases (PID) societies. WSPID’s webpage has included guidelines and links resources for health care professionals and children around the world. [https://wspid.org/covid-19/](https://wspid.org/covid-19/)

the S1 immunization is not yet being done.
Table-3: Indian guidelines of covid-19

Government of India, Ministry of Health & Family welfare, Ministry of Home affairs broadcast the recommendations of World Health Organization (WHO) and Center for Disease Control and prevention (CDC) healthy practices to prevent the infection of covid-19.

National Informatics Centre: https://www.mygov.in/covid-19
National Centre for Disease Control https://ncdc.gov.in/index1.php?lang=1&level=1&sublinkid=703&lid=550

Table-4: Resources from National Institutes of Health (NIH): Guidelines Coronavirus (COVID-19) Web Links

<table>
<thead>
<tr>
<th>Resource</th>
<th>URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>OpenData COVID-19 portal <a href="https://opensources.nih.gov/covid19/">https://opensources.nih.gov/covid19/</a></td>
<td></td>
</tr>
<tr>
<td>Disaster Research Response (DR2) <a href="https://dr2.nlm.nih.gov/">https://dr2.nlm.nih.gov/</a></td>
<td></td>
</tr>
<tr>
<td>Scientists and Organizations can submit COVID-19 asset candidates to this portal <a href="https://grants.nih.gov/grants/rfi/rfi.cfm?ID=107">https://grants.nih.gov/grants/rfi/rfi.cfm?ID=107</a></td>
<td></td>
</tr>
<tr>
<td>SARS-CoV-2 Images and B-roll (National Institute of Allergy and Infectious Diseases) (link is external) <a href="https://www.flickr.com/photos/niaid/albums/721577712914621487">https://www.flickr.com/photos/niaid/albums/721577712914621487</a></td>
<td></td>
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<tr>
<td>COVID Digital Pathology Repository <a href="https://covid19pathology.nih.gov/">https://covid19pathology.nih.gov/</a></td>
<td></td>
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<tr>
<td>Coronavirus (National Institute of Allergy and Infectious Diseases) <a href="https://www.niaid.nih.gov/diseases-conditions/coronaviruses">https://www.niaid.nih.gov/diseases-conditions/coronaviruses</a></td>
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<tr>
<td>Coronavirus news and resources for global health researchers (Fogarty International Center) <a href="https://www.fic.nih.gov/ResearchTopics/Pages/infectiousdiseases-coronavirus-cov.aspx">https://www.fic.nih.gov/ResearchTopics/Pages/infectiousdiseases-coronavirus-cov.aspx</a></td>
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<tr>
<td>NIH Guidance on Travel and Meetings (Office of the Director) <a href="https://www.nih.gov/health-information/nih-guidance-travel-meetings">https://www.nih.gov/health-information/nih-guidance-travel-meetings</a></td>
<td></td>
</tr>
</tbody>
</table>
Table-5: summarizes lines of actions protocols, education resources, events dates and the etiquette we are following in our center.

<table>
<thead>
<tr>
<th>Precautionary measures</th>
<th>Guild lines from WHO, CDC, ICMR Directorate General of Health Services and other organizations</th>
<th>Education resources in our center</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education on Corona Virus for all employees and patients</td>
<td>1- E-mails have being circulated to spread awareness of Corona Virus</td>
<td>Our webpage (Medanta App.), posters, web-classes power point presentations.</td>
<td>07/03/2020 to 9/7/2020 every day and amendments as per changes in recommended guild lines from many national and international organizations</td>
</tr>
<tr>
<td></td>
<td>2-Corona Virus awareness programmes have being conducted by Medical team</td>
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<td></td>
<td>3-Circulation of the list of Do’s and Don’ts Do’s to stop spread the infection,</td>
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<td>4-Public transportation is avoided by employees and also patients.</td>
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<td></td>
<td>5- Awareness for Corona Virus testing availably and home sample collection has been circulated</td>
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<td></td>
<td>6-Crisis Management Committee for covid-19 pandemic situation.</td>
<td></td>
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<tr>
<td>Human Resources department has an important role</td>
<td>Allowed work-from-home for employees</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1-Work from home made mandatory for all pregnant female employees and other employees with medical history</td>
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<td></td>
<td>2-Face to Face Interviews avoided.</td>
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<td>3-Special levels facility for infected employees or lack of transport during lockdown.</td>
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<tr>
<td>Sanitisation and health safety measures for all employees and patients</td>
<td>1-Regular sanitization of door handles and taps</td>
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<td></td>
<td>2-Sufficient availability of sanitizers, soaps at relevant points in center</td>
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<td>3-Increased Frequency of housekeeping</td>
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<td>4-Temperature checking and sanitizers at entry points of the center</td>
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<td>5-Employees with mildest of symptoms are advised to home quarantine and employees with any symptoms of covid-19 are asked to contact nearby Government covid-19 special Hospital for check-up.</td>
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<td>6- Masks gloves, sanitizers have been made available for all employees</td>
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<td>7- Isolation rooms are provided at entry point if anyone is found positive. They cannot enter our center and are being send to government covid centres.</td>
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<tr>
<td>Instructions for travel, meetings and entry of patients and other visitors.</td>
<td>1- All kinds of meetings, trainings &amp; other employee crowds have been stopped during covid-19 pandemic.</td>
<td>Our webpage (Medanta App.), IT department, References lab of testing, web cameras</td>
<td>14/03/2020, 17/03/2020</td>
</tr>
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<td>2-Most meetings with comorbidity patients, vendors, and other visitors have been held telephonically or via video-conference. In special case any of these allowed to visit with all the mandatory precautions, such as temperature check, sanitized and covid-19 test report and patients’ travel history is also checked. Visitors and patients are asked to filled self-declaration form.</td>
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<td>3- Any important personal travel if required should be permitted or be reported back to Human Resources (HR).</td>
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<td>4-Official travel is not allowed</td>
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<td></td>
<td>5- Face masks have been made compulsory for all employees, patients and visitors</td>
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<tr>
<td>Measures to manage sales and revenue</td>
<td>Discounts are offered on procedure charges and testing as per government guidelines to increase sales in domestic market after lockdown.</td>
<td>official mails</td>
<td>24/03/2020</td>
</tr>
</tbody>
</table>
Measures related to operations for patients services

1. Keep high inventory of raw materials
2. Offer Work from home option to (our centre) employees, they are also trying to address the cyber security concerns associated with such schemes.
3. Prepare alternate broadcast up-linking and downlinking plans in the event of quarantine situation of telecast facilities for continuing education and conferences. Hospitals are finding alternates to business travel; meetings are being held only via teleconference/video conference.

Web-classes, power point presentations, official mails

• Measures to manage costs and finances: number of patients surgeries and new patients admission have being stop in lockdown period

<table>
<thead>
<tr>
<th>Reducing credit</th>
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<tbody>
<tr>
<td>1. Hospitals are restricting overall operating costs and all non-essential expenses</td>
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<td>2. Even some essential costs are being reduced such as marketing cost, vehicle supply cost, business development cost, customer care cost, etc.</td>
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<td>3. New testing launches are being cancelled</td>
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<tr>
<td>4. Negotiating with vendors for increased credit period</td>
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</tbody>
</table>

Official mails

Table 6: To easily understand about covid-19 and its preventions, our center educated every employee with the help of the following safety guidelines:

How to monitor covid-19 symptoms and what to do?

Monitor your body temperature at home

- Difficulty in breathing or shortness of breath
- Fever, cough, chills and muscle pain
- Loss of taste or smell and sore throat
- Other less common symptoms include: nausea, vomiting or diarrhea
- Self-medication for fever should not be taken
- Self-monitor symptoms and timely report them

How to maintain healthy habits?

- Get enough sleep
- Do Exercise or Yoga routinely
- Eat healthy foods
- Drink plenty of water and exercise
- Keep immune system strong by eating healthy foods and maintaining a healthy lifestyle

What is social distancing?

Social distancing is also called “physical distancing,” It means keeping space between yourself and other people outside of your home. To practice social or physical distancing:

Stay at least 6 feet (about 2 arms’ length) away from other people

- Do not meet in groups
- Stay out of crowded places and avoid mass gatherings

Why practice social distancing?

COVID-19 spreads primarily among people who are in close contact (within 6 feet) for an extended period. Spread happens when an infected person coughs, sneezes, or talks, and droplets from their mouth or nose are propelled into the air and land in the mouths or noses of people nearby or are inhaled into the lungs.

- Touching a contaminated surface or object can also spread infection and social distancing aids in limiting such opportunities.
- Recent studies indicate that infected but asymptomatic people possibly also play a role in the spread of COVID-19.

Why Hospital Entrance is important?

- Everyone should wear a mask at all times inside hospital premises as well as outside
- Cloth masks should be washed every day at home
- Thermal screening should be done at all entry points
- Hand sanitizer should be done at all entry points

What is the importance of Face Mask and why it’s mandatory?

- Correct use of face mask is very important in avoiding infection
- Use the face mask as recommended for your area of work
- Do not touch the front of the mask at any time to adjust the mask.
- Use the strings. In case you do, wash/sanitize your hands
- Do not wear the mask below the nose or let it slip below the nose
f) Do not remove mask when in common areas or near other people

How to use door and lift in right way?
Most of the doors should be kept open
If any door is closed, use your elbow or tissue to open the door
  a) Avoid touching any door handles
  b) If touching door handles, doors or anything wash with soap or sanitize your hands
  c) Lifts should have maximum 5 people facing the walls

Why Stairs to be preferred over lifts?
  a) Do not touch side rails while taking staircase.
  b) In case you accidentally touch the hand rails, sanitize your hands
  c) PPE should be used by all employees according to the guidelines set for different work areas

Is social distancing good enough to stop the spread of infection?
Everyone has to maintain social distancing at all times at all places, and also during travel to work because infection from aerosolized droplets can remain in the air and travel long distances.
  a) Ensure work stations are more than 6 feet apart
  b) Clean and disinfect work stations and chair regularly
  c) Avoid sharing office stationery items

Is Hand washing work as undying protector?
Wash or sanitize the hands when:
  a) Before entering and when exiting the hospital
  b) Before wearing the mask and after removing the mask
  c) Avoid touching any door handles
  d) After using any shared office equipment (landline phone/computer/fax etc.)
  e) After restroom use
  f) After touching door knobs, lift buttons, stair railings etc.
  g) Before eating
  h) After blowing your nose, coughing or sneezing
  i) Whenever they look dirty
  j) WHO five moments of hand hygiene during patient care

What should be the line of action after reaching home?
Disinfect your shoes before entering your house or leave them out
  a) Wash your hands, take a shower and change clothes
  b) Wash clothes with detergent
  c) Sanitize your mobiles, pens etc.

How to avoid fomite transmission?
  a) Use digital currency; avoid taking/paying cash currency
  b) Do not give your phone to anyone nor touch anyone’s phone

What precautions should be taken at eating time?
  a) In all the cafeterias, maintain social distancing
  b) Chairs on each table have been reduced and placed at diagonal ends of the table, do not pull them then to sit opposite each other
  c) Self-servings should be done away with in cafeterias
  d) During lunch, leave your visor/ goggles etc. at your work area, do not take them to the cafeteria
  e) Do not share glasses, cups and spoons
  f) Preferably carry your own water bottles and tea/coffee mugs to work
  g) Clean them yourselves rather than asking someone to clean or use disposable ones

How to avoid fomite transmission?
  a) Use digital currency; avoid taking/paying cash currency
  b) Do not give your phone to anyone nor touch anyone’s phone

What are steps should be taken immediately if one of your colleagues or patient tests positive?
Infection Control team should be maintained that does contact tracing for all positives patients and staff
  a) They will get in touch with you and evaluate your risk of exposure
  b) If you have a high risk exposure, you will be quarantined and tested on 7th day after exposure

Is attendance and identification?
  a) Everyone must download and use Aarogya Setu app from government of India to their mobiles
  b) Use your Employee ID Card for marking attendance
  c) Always wear your ID card as your face will be covered with the mask
What special kind of counselling service for employees during covid-19?
In case of anxiety or stress, free consultation and counselling over phone should be made available.

Abbreviations:

1. ACE2 Angiotensin Converting Enzyme 2
2. ARDS Acute Respiratory Distress Syndrome
3. BCG Bacillus Calmette Guérin
4. CDC Centre for Disease Control and Prevention
5. DHR Department of Health Research
6. HR1 Heptad Repeats-1
7. HR2 Heptad Repeats-2
8. ICU intensive care unit
9. ICMR Indian Council of Medical Research
10. MERS-CoV Middle East respiratory syndrome coronavirus
11. NIH National Institutes of Health
12. NSP Non-Structure Proteins
13. PPE personal protective equipment
14. RBD Receptor Binding Domain
15. RT-PCR reverse transcription polymerase chain reaction
16. SARS-CoV severe acute respiratory syndrome coronavirus
17. SGPT Serum Glutamic Pyruvic Transaminase.
18. SGOT Serum Glutamic Oxaloacetic Transaminase
19. ssRNA Sense, Single-Stranded Ribonucleic acid
20. TB Tuberculosis
21. TMPRSS2 Trans-Membrane Serine Protease 2
22. WHO World Health Organization