MONOGRAPH

37th DAE SAFETY & OCCUPATIONAL HEALTH PROFESSIONALS MEET
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Challenges and Opportunities in Occupational Health during COVID-19 Pandemic
37th DAE SOHPM
Self Regulation for Safety

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&

Challenges and Opportunities in Occupational Health During COVID-19 Pandemic

आत्मनिर्भर भारत अभियान

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Atomic Energy Regulatory Board

Part-A

Self-Regulation for Safety

◊ Contributors ◊

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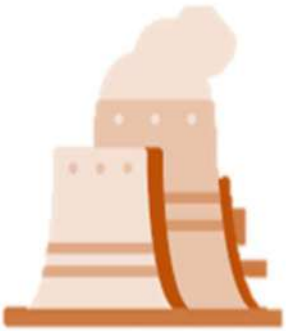
1.0 INTRODUCTION

1.1 Objective

Objective of this monograph is to elaborate the industrial safety theme of the Meet "Self-regulation for Safety" in comprehensive language for the reader. Term "Safety" in this monograph primarily refers to occupational/ industrial safety. Occupational safety deals with all aspects of physical, mental & social health and safety in a workplace with emphasis on efforts to prevent injuries and hazards in all work environments.

1.2 Scope

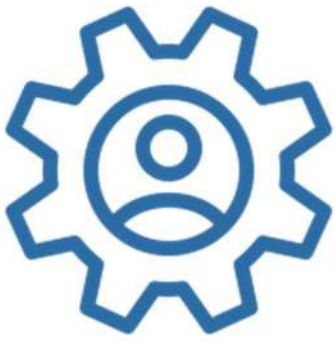
Scope of this monograph covers all DAE units irrespective of their activities, processes being implemented or end products/ services. This monograph intends to promote the concept of "Self-regulation for safety" amongst all the personnel working in various DAE units. It also intends to encourage them to volunteer themselves for the cause of safety and in turn prevent hazardous conditions at their respective workplaces to protect themselves and others.



To begin with, it is important to know about self-regulation. There is a well-known English proverb "Practice before you preach". It means that before preaching sermons to others, one should practice and set an example for others to emulate. We can correlate the term 'Self-regulation' with this proverb. One of the best examples of self-regulation, one can find in the memoirs of Mahatma Gandhi, famously known as "The Story of My Experiments with Truth". His every experiment was a manifestation of self-regulation. It also means "Lead by example".

1.3 Self-regulation – Industrial concept

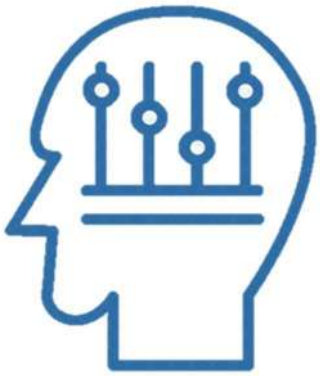
In simple words, self-regulation means control by oneself or itself. With regard to an industry, 'self-regulation' can be defined as a process whereby an organization (including its verticals & laterals) volunteers itself to monitor its own adherence to legal, ethical or safety standards rather than monitoring by any outside independent agency, such as a regulatory body or authorized agency in that field. In simpler words, self-regulation is controlling of a process or activity by the people or organization that are involved in it, rather than by an outside organization. Self-regulation ensures compliance of regulatory and statutory requirements in a more acceptable and efficient manner.



Self-regulation, in all its possible permutations, is a vital part of today's industrialization. Many industries including nuclear power, are implementing self-regulatory processes to govern industrial practices. Self-regulation addresses a range of safety issues such as

establishing industry standards to develop and apply codes of professional ethics, to boost public confidence. It may also help in increasing the public trust and combat negative public perceptions. Self-regulation complements existing laws by imposing supplementary rules/ policies which govern safety culture of the organization. Self-regulation uses self-policing as the primary mechanism to ensure compliance and provide remediation.

1.4 Types of self-regulation



Self-regulation may be implemented by using two methods which are (a) voluntary self-regulation and (b) mandated self-regulation. In voluntary self-regulation, the organization makes the rules towards self-regulation and enforces them on itself and also monitors their implementation. In mandated self-regulation, both rule making and enforcement will be conducted by the organization, but monitored by an independent agency to ensure their effectiveness. The first method is a form of 'pure' self-regulation, while the second is an example of co-regulation.

1.5 Benefits of self-regulation

Benefits of self-regulation can be listed as follows –

1. Self-regulation can make the organization more efficient, since policy making, its monitoring, corresponding enforcement actions and subsequent remediation process can be more adaptable than following acts, rules and statutory requirements.
2. Self-regulation can provide additional flexibility within the organization in comparison to regulatory, statutory requirement which are minimal but not limited, to achieve the desired level of safety.
3. Self-regulation promotes ownership which in turn may help in internalized ethical behaviour and principles since the rules are based on social norms and conduct of peers rather than top-down prescriptive rules. This may help to inculcate deeper respect and acceptance of the rules and improve safety culture. It also avoids adversarial situations in which organization tries to evade external imposed rules.

1.6 Application of self-regulation principle

Occupational/workplace safety is mainly governed by legal and statutory requirements. Consequently, occupational safety concern is confined to the compliance of these statutes only. In other words, safety and health at workplace are primarily a matter of detailed regulation by external authorities and workers (employers and employees) respond to regulations only. Understandably, these regulations are in generalized form and may not cover all industry specific hazards.

Managing safety and health at work place should not be limited to only legal statutory requirements for day-to-day circumstances. Rather, a framework should be created involving action by every individual to achieve better safety and health in the organization. In short, it should be aimed that occupational safety and health is self-regulated.

1.7 Goals of self-regulation for safety

Every industry/ organization/institution should be driven by following goals:

- Employer should ensure the safety, health and welfare of all employees by making and implementing policies encompassing work specific hazards.
- Employee should act, cooperate and comply with instructions and measures instituted by the organization for ensuring safety and health of self and others.

2.0 Fostering safety Culture for self-regulation

2.1 Introduction

Safety culture is defined as the way in which safety is managed in a workplace. It is the combination of beliefs, perceptions and attitudes of employees toward the safety of workers and the overall safety of the work environment. Cultivating a safety culture is a key aspect in maintaining workplace safety. Fostering safety culture itself is a challenge to the management of any industry. The more challenging thing one can find in fostering safety culture by self-regulation. An important concept in OSHA 1994 is self-regulation which was based on the Robens' Report. It defined self-regulation as the controlling of a process or activity by the people or organization that are involved in it rather than by an outside organization such as regulatory body. This report states that the responsibility for managing safety and health lies with the organization.

The safety culture of an organisation is the product of individual and group values, attitudes, perceptions, competencies, and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety management. A clear and consistent safety culture in the workplace helps to establish procedures and values for maintaining a safe work environment. The challenge of any management team is figuring out how to create a shared view of safety throughout the organization that will defend against accidents, illnesses, and injuries.

A safety culture cuts down on the injuries suffered by employees and nothing is more important than keeping workers free from harm. It is also a great way to cut down on injury and illness costs, which impacts a company's bottom line and improves its chances of surviving long term.

High performing organisations believe that every accident and injury is preventable, and this philosophy is embedded into every project through a combination of technical field procedures and ongoing training programs. Any unsafe behaviour must be managed, all unsafe conditions must be corrected, all accidents must be reported and investigated, and projects in all locations need to comply with this philosophical concept.

2.2 Characteristics of Safety Culture

An organization's safety culture is ultimately reflected in the way safety is managed in the workplace. A strong safety culture has a number of characteristics in common as given below:

1. **Communication.** Communication is most effective when it comprises a combination of top-down and bottom-up interaction. Senior management sets the strategic goals

and vision for the organization's safety program. It is vital that all levels of management (senior, middle, supervisory) communicate the strategy clearly to the workers who have to carry out the organization's mission. It is equally important that workers provide feedback on a practical level about what is working and what is not. Management needs to listen, take that feedback seriously, and act on it-or workers may stop giving it.

2. **Commitment.** It is one thing to **say** that safety is a priority; it is another thing to **show** that it is. When it comes to safety, actions truly speak louder than words. A lack of commitment, as demonstrated by action (or lack thereof), comes across loud and clear to staff. For example, requiring staff to work for excessive hours to meet productivity goals, which may result in fatigue and increased likelihood of an accident, sends a clear message that productivity is more important than employees' safety.
3. **Caring.** Caring takes commitment a step further. It involves showing concern for the personal safety of individuals, not just making a commitment to the overall idea of safety. Caring is about doing whatever is necessary to ensure employees return home safely every day. Again, **how** employees are treated is a much stronger indicator of caring than **what** the organization says.
4. **Cooperation.** Safety works best if management and workers feel like they are in the same team. Cooperation means working together to develop a strong safety program (e.g., management involving line workers in creating safety policies and procedures). It means that management seeks feedback from workers about safety issues—and uses that feedback to make improvements. And it means that there is no blame when incidents occur. Incident investigations focus on fact finding, not fault finding.
5. **Coaching.** It is difficult for everyone to remember everything required to maintain a safe working environment. Coaching each other—peer to peer, supervisor to employee, even employee to management— is an important way to keep everyone on track. Coaching involves non-judgmentally providing feedback for improvements and, correspondingly, accepting and incorporating that feedback as constructive criticism. Disciplinary actions are sometimes necessary for repeated rule violations, but punishment is not the first management action in a strong coaching culture.
6. **Procedures.** There should be documented, clear procedures for every task. This not only prevents disagreement about what is required, it also shows commitment when things are put in writing. Procedures should be developed jointly by management and workers for practicality and to encourage improved cooperation, communication, and acceptance. Procedures should be reviewed periodically and updated, as and when needed and it should be implemented.
7. **Training.** Training is a more formal, documented process for ensuring that employees follow safety processes and procedures. Management can demonstrate its

commitment to safety training by creating formal written training materials; tracking employees' training; and assessing employees' understanding. Formal training should be conducted frequently for employees to feel prepared to safely do their jobs.

8. **Tools.** All equipment and tools should be in good condition, free of debris, and functioning as intended. Inadequate tools directly impact safety/ protection and indirectly impact perception of management commitment. Organization should have programme for regular surveillance (inspection & discard) and condition monitoring of the tools. If the organization doesn't invest in appropriate Personal Protective Equipment (PPE), good housekeeping practices, or equipment maintenance, it sends a clear message that employee safety is not important.
9. **Personnel.** There must be enough workers to do each task safely. The organization should not sacrifice individual safety because of being understaffed (i.e., requiring shortcuts/ overtime to meet production goals). In addition, the organization should have safety experts among staff to whom employees can approach for safety-related questions.
10. **Trust.** Trust in the safety program, in senior management, and in each other is built when each of these characteristics is present and treated as utmost priority in the organization.

2.3 Safety Culture and Self-regulation

Occupational Safety and Health Administration (OSHA) states that self-regulation on safety culture fosters more compliance than externally regulated system of enforcement.

Typical model for self-regulation for safety culture is given in Figure-1:

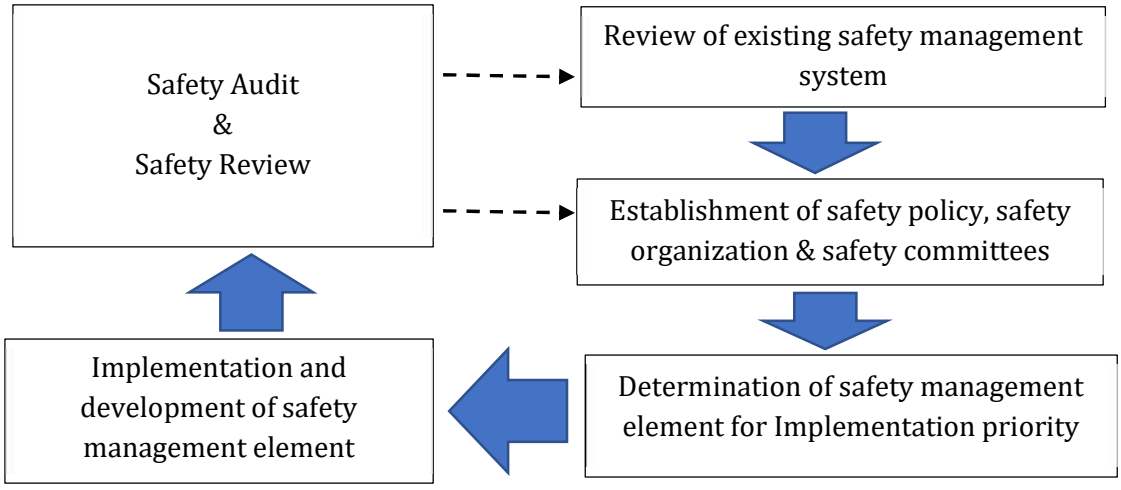


Figure 1: Self-regulatory approach to implement safety management elements

There are four basic self-regulation strategies to strengthen the safety culture:

i. Goal-setting,
ii. Self-monitoring,
iii. Effective use of self-instructions or self-talk,

iv. Self-reinforcement.

Goal setting theory is primarily aimed at task performance in the workplace. By their very nature, goals motivate people to focus their attention and action, to try harder and to persist until a desired future state has been reached. The main aim of any goal is to place sufficient demands and challenges upon people in order to motivate them to achieve higher levels of performance.

Self-monitoring explains that range of quantitative safety performance indicators relating to safety culture, which are routinely evaluated at the Organization's safety review meeting. The indicators reflect various attributes of a good safety culture and include features such as the number of plant inspections conducted, the amount of safety training carried out and the number of outstanding safety deficiencies. Overall, these indicators provide senior executives with an assessment of the degree to which actual safety practices are consistent with the desired safety culture at each site. An example of self-monitoring at work could include using a checklist to stay focused on the tasks that need to be completed and observing deviations towards non-work-related activities.

Self-instruction strategy is a self-regulation strategy that workers can use to manage themselves as learners and direct their own behaviour while learning. Self-instruction uses induced self-statements. It also serves many purposes like orienting, organizing, and/ or structuring behaviour.

Self-reinforcement is a process whereby individuals control their own behaviour by rewarding themselves when a certain standard of performance has been achieved. Self-reinforcement helps workers become pro-active in their personal and academic endeavours. It does so by giving them the personal belief that the outcomes and consequences of their efforts depend largely upon their efforts and actions.

Safety culture observations are a useful framework for assessing and reporting human, organizational and technological factors that impact safety.

2.4 Safety Sevak for self-regulation of safety

Safety Sevak concept is introduced in nuclear industry and it is important for implementation of self-regulation in an organization. The concept of Safety Sevak is described below:

2.4.1 Conceptualization

A mega construction site had implemented a new concept of "Safety Sevak". Though having staff committed towards occupational safety and necessary infrastructure for safe work place, the site had experienced near misses, non-reportable or reportable injuries. Subsequent detailed investigations revealed underlying subtle deficiencies in its safety culture. To overcome these deficiencies, the site came up with a unique concept of Safety Sevak.

2.4.2 Credentials for safety sevak

As mandated by site management, suitable technical qualification (preferably graduate/ diploma in engineering/ ITI in trade) are primary requisites for the Safety Sevak who are oriented towards safety.

Safety sevaks are deployed in designated worksites with the responsibility (in general) to ensure that:

(a) All workers deployed for the work have undergone safety induction training.

(b) All workers are provided with required PPEs and such PPEs are used appropriately.

(c) All works are carried out under safety work permits.

(d) Unsafe acts are corrected.

(e) Unsafe conditions are rectified.

2.4.3 Why safety sevak?

Safety Sevak system is a measure to boost safety surveillance at worksites and to ensure rectification of observed or reported safety deficiencies on-the-spot. Safety sevaks are the safety personnel deployed by management at worksites, in addition to the required number of Safety officers and Safety staff as necessitated in the legislations or management procedures (It may be "Factories Instruction on Industrial Safety for employees or contractors).

2.4.4 Benefits of safety sevak

This concept was also intended to make safety sevaks familiar with safety management system of factories and to help them gain experience. Upon acquiring required safety qualification or necessary period of experience, safety sevaks can be deployed at the site and later based on requisite qualification, the safety sevak may be designated as safety supervisor/ officer.

Experience at one of the mega construction site indicated that Safety sevaks have helped in bringing improvement in safety culture at worksites.

2.4.5 Role, Responsibilities and facilities

Few site-specific role, responsibilities and facilities of safety sevak are listed below:

1. Safety sevaks have the facility at work site and this facility contains necessary PPEs; which are given to the workmen who do not have required PPEs or use damaged ones at work sites. This helps in the improvement on use of PPEs to almost 100%.

2. Safety sevaks carry field safety observation book, wherein safety observations are recorded and compliance status is mentioned.
3. Safety sevaks are instrumental in implementation of use of cable connectors and heat shrinking insulating sleeves instead of use of insulation tapes on temporary electrical cable joints.
4. Safety sevaks are helpful in providing insulated S-hooks for overhead routing of temporary power cables.
5. Safety sevaks are helpful in providing portable poles/stands with concrete base for routing of temporary power cables in worksites.

2.4.6 Enhancing the number of Safety sevaks

At construction sites all buildings steadily rise up, constantly opening up new work fronts. Multitudes of diverse activities are performed at number of locations at same elevation of a building. The state of affairs becomes more complex as the project progresses.

Considering the existing scenario, the number of Safety sevaks to be deployed can be considered at the discretion of Site in-charges.

For example, during the initial days, deployment of one Safety sevak was sufficient for a building. With the progress of the work one Safety sevak will not be able to take up the responsibility of ensuring safety requirements in all the activities going on at different locations of the whole building. The deployment of safety sevaks under various works may be further increased.

As a general rule the number of Safety sevaks may be augmented by the management in the proportion of at least two Safety sevaks for one Safety supervisor or four safety sevaks for one safety officer.

Considering the area of the building, magnitude of works going on and number of workers engaged; additional number of Safety sevaks can also be considered.

2.4.7 Self-Regulation on Safety

Self-regulation in safety in the most basic sense, involves controlling one's behaviour, emotions, and thoughts in the pursuit of long-term goals.

To manage safety aspects safety sevaks may play vital role for controlling managements, site in-charges and workers emotions and behaviour in accordance with the demands of the situation.

Safety sevak system is a step towards fostering better safety culture by self-regulation. These ambassadors of safety constantly spread the message of safety to their fellow workmen through cordial conversations, progressively leading to assimilation of safe work culture into the basic nature of the workmen.

Though this concept was first implemented in a construction site, it can be equally effective in factories under operation too.

Safety sevaks will be implementer not imposer for spreading safety culture; he will be always techno-social worker.

After placement of safety sevaks, management may benefit as follows;

1. An increased sense of belongingness,
2. Support towards different work styles,
3. Affectionate adherence of safety protocols.

2.5 Conclusion

To conclude, the fostering of safety culture by the self-regulation is the controlling of a process or activity by the people or organizations that are involved in it rather than by an outside organization such as regulatory body. There is no clear dichotomy between self-regulation on the one hand and regulatory/ statutory requirements on the other. Rather, there is a scope of continual improvement in safety performance by adopting self-regulation while meeting the statutory/ regulatory requirement. It is also observed that introducing safety sevaks as forbearers of safety in an organization enhances its safety performance through self-regulation.

3.0 Emergency Preparedness

3.1 Introduction

An emergency is a sudden and unexpected event arising from natural or man-made causes, or by accident or negligence which requires immediate action. If the emergency becomes uncontrollable leading to damage to life and property in the premises and its neighbourhood, it may be defined as a "disaster". Disaster is a catastrophe, mishap, calamity or grave occurrence in any area, which results in substantial loss of life or human suffering or damage to, and destruction of, property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area.

Emergencies and disasters can strike anywhere and can lead to injuries, illnesses, loss of life, damage to property and adverse impact on environment. Chemical and Nuclear industries have potential to cause emergencies if not operated properly with due safety. This may be within the installation or may be both inside and outside of it. The reason for development of such emergency may be due to abnormal functioning of the devices within the installation or caused by third party or by natural factors. Emergency situations may include earthquakes, floods, chemical spills or releases, disease outbreaks, releases of biological agents, explosions involving nuclear or radiological sources, and many other hazards.

Employers and workers may be required to deal with an emergency when it is least expected and proper planning before an emergency is necessary to respond effectively. Many types of emergencies can be anticipated in the planning process, which can help employers and workers plan for other unpredictable situations. Planning in advance helps to ensure that everyone knows their responsibilities and actions to be taken during emergency situations.

3.2 Nuclear, Biological & Chemical Emergency (NBC)

There can be three types of emergencies viz. (i) nuclear emergency, (ii) biological emergency and (iii) chemical emergency.

3.2.1 Nuclear Emergency

Nuclear emergency can arise in two types of facilities:

1. Nuclear Power Plants
2. Other Nuclear/ Radiation Facilities

Nuclear power plants are designed with enough defense in depth safety mechanisms to prevent any untoward incidents. The event in Fukushima, Japan, have changed the way

Public Authorities, Regulators and Nuclear Plant Management look at the efficacy of Emergency Arrangements forever. Countries around the world (including India) have reassessed and improved the planning basis for Nuclear Emergency Preparedness and Response capabilities to better anticipate severe accidents and its impact in public domain. Department of Atomic Energy (DAE), NDMA (National Disaster management Authority) and Atomic Energy Regulatory Board (AERB) has taken efforts to develop nuclear emergency guidelines.

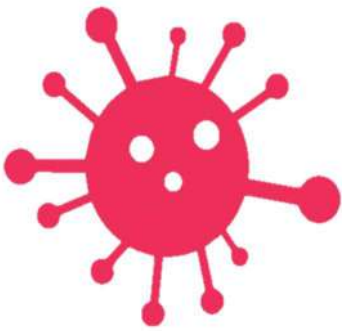
Post Fukushima lesson learnt has three major recommendations – (a) Clearer responsibility to various response agencies, (b) Clear technical guidance for early phase decision making and (c) More competencies to the decision makers including periodic assessment through exercises.

Subsequently AERB, BARC and NPCIL experts worked together to codify the subjective decision making process and make them user friendly. An exercise process was developed with more focus to decision making and trial run them at NPPs. Off-site emergency response template was also made segregating actions by different responding agencies.

Nuclear Power Plant Site management together with NPCIL HQ, supported by the Crisis Management Group (CMG) and BARC of Department of Atomic Energy, the District Administration & State Authority, NDRF of MHA, the AERB and NDMA, carries out a full scale off-site nuclear emergency exercise. Emergency exercise allow emergency response organizations at every level to test their exercise objectives as identified during the planning process.

3.2.2 Biological Emergency

Biological emergencies can be caused by bacteria, viruses, and poisons. They can be transmitted to human body through inhalation, ingestion or skin absorption. Biological emergency can be man-made or natural. Biological agents can be sprayed into the air, used to contaminate (poison) food, and put into drinking water. Some types of bio-agents can spread by person-to-person contact. This may have long term effects on humankind. Possible types of biological emergencies are Anthrax, Botulism, Pandemic Influenza, Plague, Smallpox, Tularaemia, Viral Hemorrhagic Fever (VHF), etc.



A biological emergency can happen by accident or when germs or other biological hazards are released on purpose to make people sick. Protection against biological emergencies depends on the type of germs. Some germs, like anthrax, cannot be passed on by someone who is infected. Other germs, like smallpox, can be passed from one person to another. If that happens, people who have gotten sick might have to be isolated. People who are exposed to the germs might have to be quarantined. In current time,

world is facing a widespread pandemic caused due to highly contagious SARS-CoV-2 (COVID-19) virus.

3.2.3 Chemical Emergency

A chemical emergency occurs when a hazardous chemical has been released and the release has the potential for harming people's health. Chemical releases can be unintentional, as in the case of an industrial accident, or intentional. Chemical agents are poisonous vapours, aerosols, liquids and solids that have toxic effects on people, animals or plants. Chemical agents can cause death but are difficult to deliver in deadly amounts because they dissipate quickly outdoors and are hard to produce. Scientists often categorize hazardous chemicals by the type of chemical or by the effects a chemical would have on people exposed to it.

3.3 Natural & Manmade Emergency/ Disaster

The cause of an emergency situation can be natural or manmade. Further manmade emergencies can be intentional or unintentional.

Natural disaster can be caused by Tsunami, Earthquakes, Extensive Rains, Floods, Tornadoes, Hurricanes and other severe storms, Disease outbreaks, etc.

Manmade emergencies can occur from industrial hazards such as fires, major structural/ automation failure, chemical spills, Loss of electrical power, Food & water supply contamination, etc.

3.4 Legal Provisions

Various constitutional and statutory provisions have been made for prevention and mitigation of emergencies/ disasters in India. Some of the important statutes concerned with emergencies/ disasters are listed here:

General Acts (Central Level):

The Water (Prevention and Control of Pollution) Act, 1974

The Air (Prevention and Control of Pollution) Act, 1981

The Environment (Protection) Act & Rules, 1986

The Occupational Safety, Health and Working Conditions Code, 2020

Public Liability Insurance Act, 1991

Disaster Management Act, 2005

The Disaster Management (National Disaster Response Force) Rules, 2008

Food Safety and Standards Act, 2006

Fire:

The Boilers Act, 1923

The Inflammable Substances Act, 1952

Indian Electricity Act, 2003

Explosives:

The Explosives Act, 1884

The Explosive Substances Act, 1908 (As Amended by the Amendment Act of 2001)

Petroleum Act, 1934

The Static and Mobile Pressure Vessels (Unfired) Rules, 2016 and amended in 2021

The Petroleum and Natural Gas Regulatory Board Act, 2006

The Explosives Rules, 2008

Hazardous & Other Wastes (Management & Transboundary) Rules 2016

The Gas Cylinder Rules, 2016

Flood, Dam Burst, Tsunami and Cyclone:

Dam Safety Bill, 2019

Coastal Regulation Zone Notification, 2019

Earthquake, Snow Avalanches/ Landslide:

Indian Standards on Earthquake Engineering

Model Town and Country Planning Act, 1960

Model Building By- Laws, 2016

National Building Code of India, 2016

Chemical/ Industrial/ Nuclear:

The Atomic Energy Act, 1962

Atomic Energy (Working of the Mines, Minerals and Handling of Prescribed Substances) Rules, 1984

Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987

The Bhopal Gas Leak Disaster (Processing of Claims) Act, 1985

Calcium Carbide Rules, 1987

The Manufacture, Storage and Import of Hazardous Chemical Rules, 1989

Chemical Accidents (Emergency Planning, Preparedness, and Response) Rules, 1996

The Major Accident Hazard Control Rules, 1997

Dumping and Disposal of Fly Ash Discharged from Coal or Lignite Based Thermal Power Plans on Land Rules 1999

The Chemical Weapons Convention Act, 2000

Atomic Energy (Radiation Protection) Rules 2004

Weapons of Mass Destruction and Their Delivery Systems (Prohibition of Unlawful Activities) Act, 2005

The Civil Liability for Nuclear Damage Act, 2010

Biological Disaster:

Bio- Medical Waste (Management and Handling) Rules 1998

The Municipal Solid Wastes (Management & Handling) Rules, 2000

Rules for the Manufacture, Use, Import, Export and Storage of Hazardous Micro Organisms Genetically Engineered Organisms or Cells 1989

Epidemic Disease Act 1897

Transportation Accident:

The Inland Vessels Act, 1917 and the Inland Vessels (Amendment) Act, 2007

Motor Vehicles Act, 1988

Central Motor Vehicles Rules, 1989

Out of the above, some important acts/rules directly related to management of emergencies and disaster are discussed here.

3.4.1 Disaster Management Act 2005:

The term "disaster management" is defined in Section 2(e) of the Disaster Management Act and it is defined as the continuous and integrated process of planning, organizing, coordination and implementation of measures essential or expedient for

- Prevention of disaster related danger
- Prevention of any disaster threat
- Mitigation of any disaster
- Risk reduction of disaster's severity or consequences
- Capacity-building and preparedness to combat disaster
- Rapid response to any threatening disaster situation

- To assess the magnitude of effects of any disaster
- Rescue, relief and evacuation
- Rehabilitation and reconstruction

The drawing up plans for strategic partnerships and course of actions to counter disasters of various degrees the act has made significant inroads in the following

- Detailed directions to guide disaster management efforts
- Capacity development in all spheres
- Consolidation of past initiatives and best practices
- Co-operation with agencies at national and international levels

The DM Act ensures effective implementation and monitoring of disaster management plans. It provides for a three-tier structural system to manage disasters with NDMA at the national level, State Disaster Management Authorities headed by Chief Ministers at the State level and District Disaster Management Authorities at district level. The legislation also envisages responsibility on the central government to constitute National Disaster Response Fund and National Disaster Mitigation Fund. For the purpose of specialist response to an emergency disaster situation which is threatening, provision related to constitution of the National Disaster Response Force has been envisaged in the legislation.

3.4.2 Manufacture, Storage & Import of Hazardous Chemicals (MSIHC) Rule, 1989

Objectives of MSIHC rules is to prevent major accidents arising from industrial activities; and limit the effects of such accidents. The Rules endeavor to achieve these objectives by having a quantity-based approach. The MSIHC rules require the occupier to disclose the necessary information to the public in the neighbourhood that is likely to be affected by a major accident at the site.

Rule13 of MSIHC Rules mandates an occupier of the industry to prepare and keep an up-to date on-site emergency plan containing details specified and detailing how major accidents will be dealt with on the site on which the industrial activity is carried on and that plan will include the name of the person who is responsible for safety on the site and the names of those who are authorized to take action in accordance with the plan in case of an emergency.

Salient features of the MSIHC Rules are:

- ❖ Mandatory prior notification of sites and approval of Chief Inspector of Factories (CIF) [Atomic Energy Regulatory Board (AERB) in case of DAE Units] for industrial activity.

- ❖ Prior notice of import to Chief Controller Imports and Exports (now DGFT).
- ❖ Major Accident Hazard (MAH) Unit: handling 179 Chemicals in quantities above prescribed threshold amounts.
- ❖ Preparation of on-site plans by the occupier and Off-site emergency plans by the district authorities.

- ❖ Preparation of Safety Data Sheets (SDS) by Manufacturers.
- ❖ Disclosure of necessary information to public in neighbourhood by occupier.
- ❖ Occupier to arrange third party safety audits; and
- ❖ Notify major chemical accidents to prescribed authorities.

3.4.3 Chemical Accidents (Emergency planning, Preparedness and response) Rules, 1996

A vast number of Chemicals are in use at present and they pose vital threat to the environment and mankind, unless handled and managed in proper way, and hence the Govt. of India has Rules under title Chemical Accidents (Emergency planning, Preparedness and response) Rules, 1996 framed to effectively deal with Chemical emergency. The prime features of these rules are as follows:

- ➢ These rules are complemented to MSIHC Rules and provide statutory backup to crisis management set up.
- ➢ A list of Hazardous Chemicals is also defined in the rules.
- ➢ Four-tier crisis management system are defined: Central, State, District and Local Crisis Groups.
- ➢ The Central Govt. shall constitute a Central Crisis Group to deal with various aspects of the rule. Functions of Central Crisis Group are also defined.
- ➢ The State Govt. constitutes State Crisis Group which shall be the apex body in the State to deal with major Chemical accidents and to provide expert guidance for handling major chemical accidents. Functions of the State Crisis Group are also defined in the rules.
- ➢ Provision of District Crisis Group, to be headed by District Collector and their functions, and Local Crisis Group, to be headed by S.D.M. along with their functions, are there in the rules.
- ➢ The major accident hazard (MAH) installations in the industrial pockets in the district shall aid, assist and facilitate functioning of District and Local Crises Group.

3.5 Emergency/ Disaster Management

The Emergency/ Disaster Management is a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for- (i) prevention of danger or threat of any emergency/ disaster; (ii) mitigation or reduction of risk of any emergency/ disaster or its severity or consequences; (iii) capacity-building; (iv) preparedness to deal with any emergency/ disaster; (v) prompt response to any threatening emergency/ disaster situation; (vi) assessing the severity or magnitude of effects of any emergency/ disaster; (vii) evacuation, rescue and relief; (viii) rehabilitation and reconstruction.

The important aspect in emergency management is to prevent by technical and organizational measures, the unintentional escape of hazardous materials out of the facility and minimize accidents and losses. Emergency planning demonstrates the organizational commitment to the safety of employees and increases our organization's safety awareness.

Every Industry or Institution should have their own Emergency Response Setup, plan & procedure. The whole aim is to put together an effective emergency action plan which involves conducting a hazard assessment to determine what, if any, physical or chemical hazards from inside or outside the workplace could cause an emergency. Preparedness plays a vital role in ensuring that employers & workers have the necessary resources, should know where to go, what to do and know how to keep themselves safe when an emergency occurs.

The objective of the Emergency Response Procedure is

- To control, localize and eliminate the hazards in minimum time.
- To minimize damage to property and environment.
- To render medical treatment to the injured quickly
- To speed up the rescue and head count operation
- To safe guard others by timely evacuation
- To ensure safety of the installation and persons before they re-enter and resume the work.
- To restore normalcy as quickly as possible.

For Nuclear facilities, AERB has published a series of safety guidelines which provide criteria for establishing an emergency preparedness and response plan to facilitate effective implementation of protective measures during an industrial, nuclear and radiological emergency situation. These guides provide basic consideration and goal for emergency response action, criteria for hazard categorization and hazard assessment of nuclear facilities, system for protective actions, other response actions, guidance on dose levels for emergency workers and the reference dose levels for emergency and post emergency existing exposure situation.

3.6 Emergency Exercises

Chemical plants and manufacturing facilities pose unique safety risks. Implementing and maintaining a robust response plan is an important responsibility for plant managers. But if staff are not regularly trained on the plan and conduct exercises to familiarize themselves with possible scenarios, that plan is not being used to its full potential. Prioritizing training and exercises can ensure staff are up to date on the unique aspects of their emergency response plan.

Periodic Emergency exercises should be carried out to check the adequacy of the control measures & infrastructure, effectiveness of the communication system, and response of the personnel and various agencies. The goal of the exercise program should be to improve the overall readiness and capabilities of emergency response program that encourages:

- Realistic scenarios
- Proper training validation
- Effective emergency plans
- Identification of action items
- Operational response capabilities
- Preparedness to respond to incidents, regardless of the threat or hazard

Management should ensure that:

- All aspects of response plans are fully exercised annually (at a minimum) with participation of the appropriate response, incident management, and support teams.
- Each response plan component is exercised at more frequent intervals, as appropriate, to prepare for the main annual exercise.
- Notification exercises for each team and response component are verified and practiced at least twice per year. This exercise should involve unannounced checks of the communication procedures, equipment and contact information.
- National and local training and exercise requirements should be used to assess the overall preparedness of response teams.

A good safety culture is the foundation of an establishment that can be promoted by senior management/leadership through commitment to safety, realistic practices for handling hazards, continuous organizational learning & training, random checks and care and concern for hazards shared across the workforce. It is important to note that these events are just the causes of emergency situations. The damage that results from these hazards are the actual emergencies that need to be planned for. Therefore, self-regulation on safety will enable the plant management to better prepare for emergency situations through periodical exercises and pro-active approach.

4.0 Safety management during COVID-19 pandemic

The Government of India had imposed nationwide lockdown during pandemic in various phases with progressive changes in restrictions. State Governments had also endorsed the lockdown and issued guidelines for immediate shutdown of industries except a few essential industries. All the DAE units were required to follow the guidelines laid by the central and respective state governments.

After declaring the first lockdown, there was an uncertainty about lifting of the lockdown. There was lack of knowledge about full scale impact of COVID-19 on the persons and its impact in running the plants. However, plants had to be monitored for safety during the pandemic. To ensure safety of the plants, monitoring services were maintained with respect to industrial, fire, radiological safety, security, engineering services, occupational health centre, transport, housekeeping, etc.

Even after relaxation of curfew conditions, there were doubts about the new phase and return to normalcy. There was unemployment and though some governments, NGOs and volunteers ensured supplies to meet essential needs, many of the outsourced workers had left to their native places. It is a huge task to motivate them back to the work with assurance about safety. Industries have to take a holistic approach for restarting of plants to ensure plant safety with focus on health of the personnel not only from the point of view of occupational issues but that of COVID-19 also. This is a paradigm shift that had to be adapted by the industries.

4.1 Preparedness for Safe operation during pandemic

With the gradual release of lockdown certain economic activities are being permitted by the government as per the prevailing circumstances.

Due to several weeks of lockdown and the closure of industrial units during the lockdown period, there is a possibility of overlooking the established Standard Operating Procedures (SOPs) for shutdown and in ensuring safety during shutdown/ scaled down operations. As a result, some of the production equipment, pipelines, valves, etc. may have residual chemicals that may pose risk. Some of the process vessels might have degraded chemicals. Some of the safety systems might have become non-functional/ developed malfunctioning issues due to poor/ no maintenance. The same is true for the storage facilities with hazardous chemicals and flammable materials.

When Lockout-Tagout (LOTO) procedures are not in place, many energy sources can prove to be hazardous to operators/supervisors who are servicing or maintaining electrical, mechanical or chemical equipment. When heavy machinery and equipment are not maintained periodically, they can become dangerous for the operators/engineers. Combustible liquids, contained gaseous substances, open wires, conveyor belts and automated vehicles make manufacturing facilities a high-risk environment. Improper enforcement of safety codes and improperly labelled chemicals can further pose serious health hazards. When an unexpected event occurs, managing rapid response becomes challenging. In order to minimise the risk and to ensure a safe restart of the industrial units, guidelines/ directives were issued by NDMA/ state government for compliance. Similar approach was followed by DAE units with guidance / advice from AERB, as below:

1. Preparation of SOPs and checklists for safe restarting of the plants. The sample checklists are enclosed as Figure-2.
2. Inspection of all equipment as per the safety protocols during the restart phase and certification by concerned agencies.
3. Technical audit as per the AERB technical specifications for chemical and radioactive plants.
4. Training to employees to attend the restart operations of the plant.
5. Deployment of skeletal staff varies from 15% to 100% in various DAE units with scattered office timings, re-arrangement of the work stations in the office area. Removal of biometrics and turnstile gates to avoid contact and thus prevent spread of virus if any.
6. Arrangement of facilities like sanitization, hand wash, temperature screening etc. in work areas
7. Display of Dos & Don'ts boards, LED screens with videos at prominent places of the plants to create awareness among the employees.
8. Testing of the equipment before the restart operations of the production followed by trial runs.
9. Restart of operations in stage wise manner to attain normal production levels.
10. Sensitization of employees working on specific equipment to be aware of the need to identify abnormalities like strange sounds or smell, exposed wires, vibrations, leaks, smoke, abnormal wobbling, irregular grinding or other potentially hazardous signs which indicate the need for an immediate maintenance or if required shutdown.

11. Observation of storage facilities for any signs of spills, wear and tear during the lockdown.
12. Checking for already opened storage vessels/ containers/ bags/ silos for possible oxidation/ chemical reaction/ rusting/ rotting etc.
13. Ventilation and proper lighting before entering the storage areas
14. Cleaning of pipelines, equipment and discharge lines: Mechanical cleaning followed by air/ water flushing and chemical cleaning based on the type of the process equipment.
15. Leak test of all the service lines, vacuum systems etc.

There were a few major industrial accidents in the country during restarting of industries after lockdown, affecting the people and environment, since India returned to the work after the COVID-19 lockdown.

However, there were no incidents in any of the DAE units during restarting operations of the plants. This was achieved with regulatory guidance and monitoring and compliance with established procedures and training.

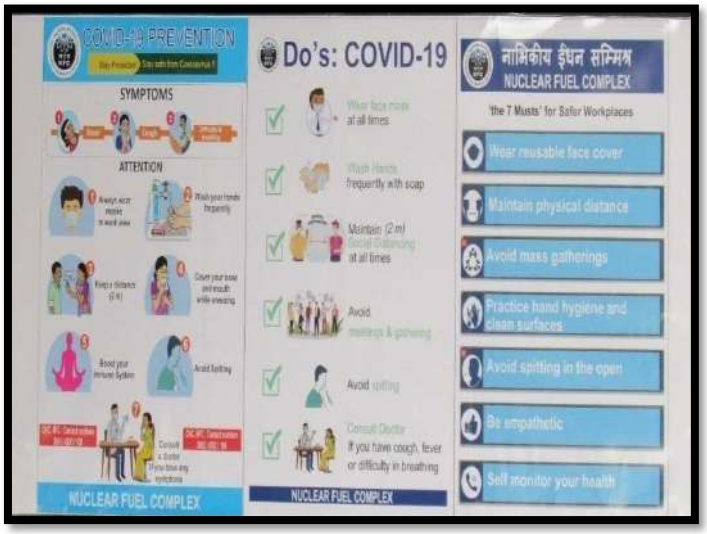
4.2 Preventive measures taken during pandemic

Measures required for protecting workers from exposure to and infection with COVID-19 depends on exposure risk. It varies with the type of work being performed, the potential for interaction (prolonged or otherwise) with people, and contamination of the work environment. All DAE units adopted infection prevention and control strategies based on a thorough workplace hazard assessment using appropriate combinations of engineering and administrative controls, safe work practices, and PPE to prevent worker exposures.

Preventive measures implemented are,

1. Staggered entry of employees to avoid crowding in a particular workplace/ office/ site as applicable.
2. Work from home in all feasible areas/ functions/ offices.
3. Contactless thermal screening of all irrespective of cadre/ status entering the workspace.

4. Stoppage of any person found with fever/ cough/ breathing problem and information to OHC/ concerned department/ contractors. Such persons with suspicious symptoms were taken to nearest quarantine facility and later to govt. hospital immediately.



5. Permission to enter and work, only with nose mask.
6. Intimation to plant authorities by employees about suspected COVID symptoms to self or relatives / visit to other places that are in quarantine zones / etc. to get advice from Occupational Health Centre (OHC) before getting permission to work.
7. Provision of contactless hand sanitizers and masks to all employees.
8. Provision of contactless hand wash facilities with hand wash / soap solutions at entrances of the work area.
9. Education to employees on safety steps to be taken in the workplace.

10. Avoiding physical meetings/ gatherings as far as possible and use of video conferencing (VC)/ Conference calls/ other modes.
11. Creating physical barriers to ensure the physical distance within the work area and dining facilities.
12. Staggered timings for work / food for the employees.
13. Frequent sanitisation of the work areas, office rooms, dining rooms etc.
14. Stoppage of dining at canteens, advice to employees to bring home food.
15. Advice to employees to report to local health care centres in case of any Covid-19 symptoms to them or their family members, travel to the Covid-19 affected areas.
16. Temporary suspension of bio-metric (Finger touch) swiping for attendance.
17. Use of electronic means for official works
18. In-house development of software for online work to avoid hard copy of files wherever possible and encourage employees to use soft copy for correspondences/ Digitally Signed Certificates for approvals and daily reporting.

19. Instructions to employees to maintain social distance and following Covid-appropriate behaviour.
20. Periodical cleaning, swabbing, disinfection and sanitization of bath rooms/ wash rooms.
21. Advice to employees to avoid use of lifts.
22. Display boards and LED screens with videos on Dos & don'ts of covid-19 at entrances/ prominent places.
23. Vehicles entering into the plant premises were sanitized at the entrance.
24. Employees were encouraged to use the AROGYA SETU app.
25. Undertaking was taken from the employees and outsourced workers on their and family health conditions from time to time.

4.3 Managing the resources during the pandemic

The curb on movement of people and non-essential goods has affected the supply chain, leading to shortage of raw materials in the industries. Units like UCIL, IREL, HWPs, NFC, NPCIL have faced the issues but were able to meet the prior commitments with proper planning of manpower and logistics. Necessary approvals were obtained from the respective state governments and support from local authorities was taken for smooth movement of the vehicles in India.

The movement of migrant labourers to their native places has further added to the ongoing problems of industries. The existing workforce also faced difficulties in reaching the factories due to curbs on the movement of people across and within states, thereby affecting the overall productivity of the organizations. Factory authorities had obtained permissions from local state authorities wherever possible to ensure availability of at least minimum required manpower for monitoring safety of the plants. With the limited

departmental manpower in shifts and shortage of outsourced manpower and shorter duration of work hours affected the capacity utilization of industries. Many construction works were affected due to the shortage of manpower and materials required for the work.

Few of the modifications done for the convenience of employees during Covid-19 are given below:

1. Markings were done at entrance of the industries keeping in view of maintaining the social distance.
2. Turnstile gates/ entry gates were removed to prevent the contact with metal surfaces.
3. Seating arrangements were modified in the cabins so that proper social distance shall be maintained.

4. Employees were advised to have their food at earmarked locations instead of change rooms / canteens.
5. Employees were advised to minimize usage of air conditioner and to ensure cross ventilation with open windows / doors.
6. Flexible office timings were given to avoid crowding at the entrances.
7. Entry of visitors was prohibited unless essential.
8. Food was provided to labourers during pandemic.

4.4 Remote regulatory inspection during pandemic

Regulatory Inspection is one of the core processes of AERB to independently assess the safety status of the Nuclear and Radiation Facilities (NRF) and their compliance to the safety & regulatory requirements, and licensing conditions by observing the in-field status of plant systems, structures, and equipment, work practices, and records at the Site. AERB conducts routine (safety & security) inspections to cover all the activities of the licensee in compliance with the regulatory requirements.

The regulatory inspection programme faced a major challenge during the Covid-19 pandemic, which restricted the movement of people across the country. During the pandemic, AERB took the first step by deciding not to send inspectors at sites and remote

regulatory inspection system was introduced as an alternative means for conducting inspections to continue its regulatory oversight over the licensed activities/ facilities.

This remote regulatory inspection process involves (1) assessment of the activity/facility by the facility itself as per the self-assessment checklists specially developed by AERB specific to the unit, (2) review of self-assessment reports by an inspection team for identifying the need for additional / supporting submissions (including records, documents, photographs, videos on sample basis) from the facility, (3) video conferencing with the licensee to verify certain compliances as necessary, and (4) issuance of inspection report after review of the evidences and submissions. The checklists developed for the remote regulatory inspections contain the checks done by the AERB inspectors at site during routine regulatory inspections. In this regard, AERB has also setup a Remote Inspection Centre in its premises to facilitate video conferencing with the licensee.

Figure 2: Remote Inspection Centre at AERB Premises

With the introduction of self-assessment by the licensee using checklists for various plant systems, functional areas and activities etc.; responsibility for safety by the licensee gets reinforced and certainly helps in developing a better safety culture towards self-regulation.

The remote regulatory inspection has its own limitations. While it is more suitable for inspections of facilities with low hazard potential and less security concern, onsite presence is essential for more secured and some high hazard facilities. Also, unannounced inspections and reactive inspections require physical presence at site.

Despite the pandemic situation AERB continued its regulatory oversight of DAE units under its purview through established process and able to review safety aspects and issued licenses in time bound manner. AERB ensured implementation of lockdown protocols along with safety supervision during the pandemic. During pandemic, AERB

had also performed on-site inspections of radiation facilities (medical and industrial) with strict implementation of prevailing pandemic protocols.

Figure 3: AERB Inspectors carrying out inspection with COVID protocols

4.5 Use of technology in workplace to avoid human contact

COVID-19 has dramatically altered the way of working. Many found themselves working from home for the first time; and others were adjusting to work environments and processes with new constraints, new kinds of tasks, and new risks. It is not known about which changes will be permanent, but it is understood that the technology is playing an important role in many activities. As a result, ensuring the long-term operation of a plant amid covid-19 pandemic becomes a critical but challenging task. To fulfil this task, the applications of smart and automation technologies have been regarded as an effective means.

Few of the technology development works taken in the units of DAE are,

1. Implementation of cloud based digital workspace for efficient work flow.
2. Encouraging paperless working and reduce human interactions.
3. Development of various software required for the approvals, reporting, material management, health management etc., which reduces human interaction.
4. Automation of the equipment which reduce human intervention in collecting and shifting the materials from one stage to another stage of process.
5. In-house production of the sanitizers/ disinfectants/ masks/ etc. due to shortage in the market.
6. Covid-19 booths for testing of suspected cases.
7. Development of automatic hand sanitizer dispensers.

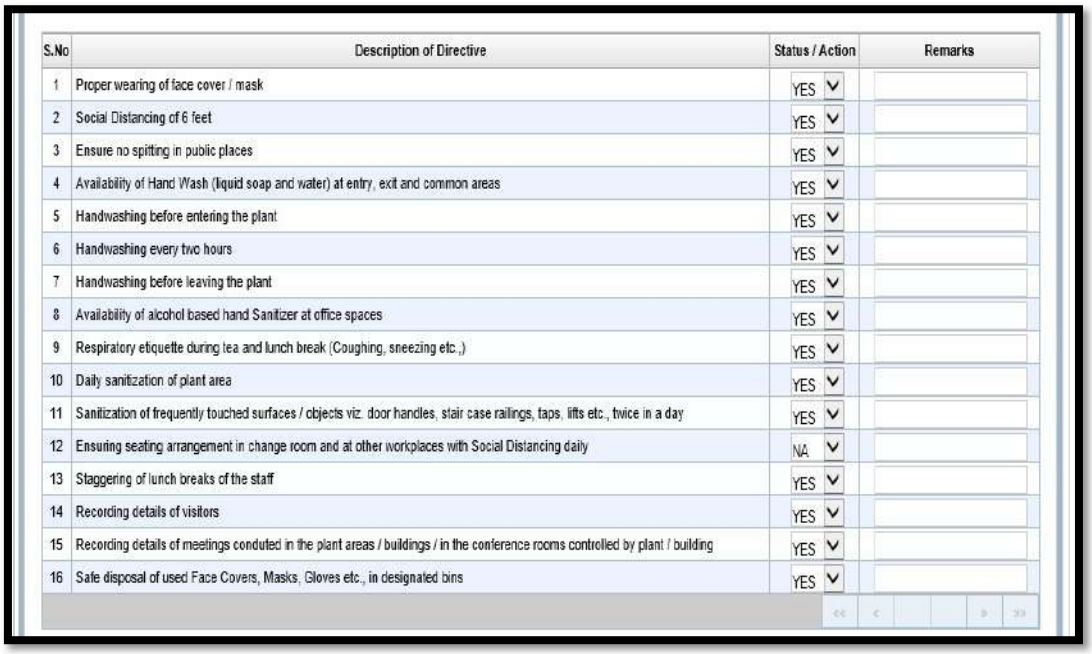
8. Development of UV/disinfection boxes.
9. Automated inspection systems.
10. Online training platform was created, so that employees can attend from the work station/ home instead of gathering at one place.

4.6 Coordination between industrial safety, occupational health & security

Safety, health and security is utmost important in DAE units. It helps in thorough elimination of the incidents of work-related injuries, diseases, fatalities, disasters and to enhance the wellbeing of employees in all the work areas.

The role played by the staff of safety, health and security is crucial in implementing preventive measures for staff, such as social distancing, personal hygiene measures, masks, temperature monitoring and quarantine after work travels etc., safe shutdown/ restart/ sustenance of plant operations/ transport of radioactive material, nuclear reactor components etc. The coordination among these agencies helped to ensure entry of personnel with no symptoms/ isolation of personnel with suspected symptoms and communication to respective plant in-charge as well as to OHC for further consultation. Periodical audits were conducted by safety and health professionals to review the work practices as per COVID guidelines and necessary actions were taken accordingly. These audits helped to improvise the practices and measures were taken to avoid the risk of infection.

Check lists were prepared by the organizations used for daily inspections and recording of the observations. The data was verified on daily basis by monitoring agencies to advice and ensure remedial actions. A sample checklist is shown in Figure 4 below:



S.No	Description of Directive	Status / Action	Remarks
1	Proper wearing of face cover / mask	YES	
2	Social Distancing of 6 feet	YES	
3	Ensure no spitting in public places	YES	
4	Availability of Hand Wash (liquid soap and water) at entry, exit and common areas	YES	
5	Handwashing before entering the plant	YES	
6	Handwashing every two hours	YES	
7	Handwashing before leaving the plant	YES	
8	Availability of alcohol based hand Sanitizer at office spaces	YES	
9	Respiratory etiquette during tea and lunch break (Coughing, sneezing etc.,)	YES	
10	Daily sanitization of plant area	YES	
11	Sanitization of frequently touched surfaces / objects viz. door handles, stair case railings, taps, lifts etc., twice in a day	YES	
12	Ensuring seating arrangement in change room and at other workplaces with Social Distancing daily	NA	
13	Staggering of lunch breaks of the staff	YES	
14	Recording details of visitors	YES	
15	Recording details of meetings conduted in the plant areas / buildings / in the conference rooms controlled by plant / building	YES	
16	Safe disposal of used Face Covers, Masks, Gloves etc., in designated bins	YES	

Figure 4: Sample checklist for restarting the plant after lockdown

After start of the vaccination drive by the government the employees were encouraged to get vaccinated at the earliest. Special vaccination drives at site/ townships/ labour camps were arranged for the employees and their family members.

5.0 Workers involvement in Safety management (to improve safety)

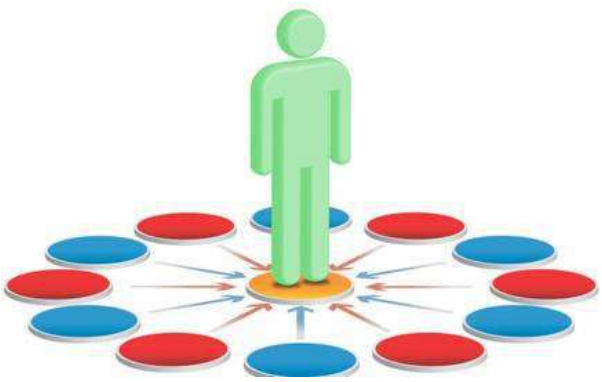
A vital element of any safety management system is active participation of workers to inculcate a good safety culture and help prevent accidents. A good safety culture can establish a healthy work atmosphere through complying Occupational Safety & Health (OSH) policies and procedures. Nevertheless, contribution from all levels of employees is essential to develop a good safety culture. Workers are the key contributors in incident reporting and employing corrective measures. It is of great importance that they must realize that they would be the first victim of any incident, their safety awareness and all accident prevention work is in their interest. Therefore, it is the most desirable that workers active participation in showing hazards and helping in removing them by joint efforts of management and all employees. In the following, some important areas of safety management system are discussed to improve the engagement of workers toward safety.

5.1 Commitment of Top Management

Top management actually directs and controls an organisation at the highest level. The OSH management system of an organisation is largely determined by the top management. It should be ensured that management and workers behaviour never loses track of the importance of health and safety issues at work. Some of the important elements that assess the commitment of the top management are as follows:

- The OSH policy clearly stating the employer's aims, the responsibilities of the employer, managers, supervisors and workers and awareness of these individual responsibilities at all levels of the organization.
- A system for accountability of health and safety roles and responsibilities at all levels of the organization.
- Active involvement of the all levels of employees in the safety management.
- Ensuring sufficient resources for health and safety.

5.2 Levels of supervision



A supervisor is an important link or key-man between management and the workers. He is constantly available on the shop floor, closer to the workers, devoting more time in close observation of performance. He converts management's policy into action with the cooperation of workers. Workers like to give their opinions or complaints through supervisors. Management likes to influence workers' behaviour through supervisor and the workers like to gain first-hand knowledge through supervisor. Therefore, good

supervisors are essential for effective implementation of management policy (including safety policy) on the shop floor.

It is fundamental to making sure that workers are not injured during the work. One of the most important ways to do this is to ensure that employees are competently and sufficiently supervised. Appropriate and effective supervision at all levels of an organization is critical in eliminating or minimizing risks to protect workers.

The specific duties of a supervisor within the workplace OSH management systems are as follows:

- Hazard identification, risk assessment and hazard control.
- Assurance of quality production within specified time and cost. He/ She has to see quality, quantity, efficiency and effectiveness all at a time.
- Constant watch over safe conditions and actions for accident-free production. He has to teach safety through his behaviour. His attitude is first reflected.
- Workplace inspections.
- Incident investigations.
- Worker training and orientation.
- He/ She pays attention on good maintenance of machines, materials, tools, etc. and also on good housekeeping and good health of the workers.

Sympathetic and intelligent support of the able supervisor is essential to any safety programme. Proper training of supervisors in accident prevention is essential. The status, responsibility and the degree of supervision of a supervisor varies according to the size and type of the industry, number of workers under control, position in hierarchy and extent of authority delegated.

5.3 Human factors & Behavioural Aspects

In order to address human factors in workplace safety settings, peoples' capabilities and limitations must first be understood.

Failures in reasoning and decision making can have severe implications for complex systems such as chemical plants, and for tasks like maintenance and planning. Safe and reliable robotic and unmanned systems should be used in hazardous areas wherever possible.

Environmental, organisational and job factors, in brief, influence the behaviour at work in a way which can affect health and safety. A simple way to view human factors is to think about three aspects: the individual, the job and the organisation and their impact on people's health and safety-related behaviour.

The typical examples of immediate causes and contributing factors for human failures are given below:

5.3.1 Psycho-Behavioural Factors: Psycho-Behavioural factors are factors when an individual's personality traits, psycho-social problems, psychological disorders or inappropriate motivation create an unsafe situation.

5.3.2 Adverse Physiological States: Adverse physiological states are factors when an individual experiences a physiologic event that compromises human performance and this decreases performance resulting in an unsafe situation.

5.3.3 Perceptual Factors: Perceptual factors are factors in a mishap when misperception of an object, threat or situation (visual, auditory, proprioceptive, or vestibular conditions) creates an unsafe situation. If investigators identify spatial disorientation (SD) in a mishap, the preceding causal illusion should also be identified. Vice versa, if an illusion is identified as a factor in a mishap, then the investigator should identify the resultant type of SD.

5.3.4 Self-Imposed Stress: Self-imposed stress is experienced in a mishap if the operator demonstrates disregard for rules and instructions that govern the individuals' readiness to perform, or exhibits poor judgment when it comes to readiness and results in human error or an unsafe situation. These are often violations of established rules that are in place to protect people from themselves and a subsequent unsafe condition.

5.3.5 Job factors:

- Unsafe design of equipment and instruments.
- Constant disturbances and interruptions.
- Missing or unclear instructions.
- Poorly maintained equipment.
- High workload.
- Noisy and unpleasant working conditions.

5.3.6 Organisation and Management Factors:

- Poor work planning, leading to high work pressure.
- Poor SOPs.
- Lack of safety systems and barriers.
- Inadequate responses to previous incident.
- Deficient co-ordination and responsibilities.
- Poor management of health and safety.
- Poor health and safety culture.

It is concluded that the performance of human being is strongly influenced by organizational, regulatory, cultural and environmental factors affecting the workplace. For example, organizational processes constitute the breeding grounds for many predictable human errors, including inadequate communication facilities, ambiguous procedures, unsatisfactory scheduling, insufficient resources, and unrealistic budgeting etc.

5.4 Contractor safety management

Now a days, contract workers are the integral part of the work force in almost every organization. It should be acknowledged that it has the same OSH obligations to contract workers as it does to its own employees. As in many cases, contract workers are being employed temporarily, selecting a qualified and skilled contractor is a major step toward achieving safe contractor performance. Proper framing of the scope of work, pre-qualification criteria, special contract requirement, experience profile of the contractor and its workmen/ supervisors etc. is essential for proper selection of a contractor. The OSH performance and safety culture of a contractor must be an integral part of the contractor's safety management process. Selection of contractor should consider the historical data of the OSH performance and that should play a major role in consideration of awarding the contract to any particular contractor.

The following attributes of the contractor should be considered before awarding any contract:

- Details of the Contractor Company/ organization.
- General information from management on safety.
- Safety records (organization as a whole).
- Construction size organization and personnel.
- Staff and qualification.
- Quality assurance / certification.
- Working environment.
- Resources/equipment.

Contract workers generally come from un-organized sectors. In many cases, they are unskilled workers as they need to work in a diverse field on need basis. Therefore, proper training of contract workers is very important to achieve safety goal.

5.5 Training Programme

Workplace safety training is as vital as workplace safety itself. It enables the management to ensure a safe and healthy work environment. It also helps the employees to recognize safety hazards and correct them. It enables them to understand best safety practices and expectations.

OSHA states that education and training provide employers, managers, supervisors, and workers with:

- Knowledge and skills needed to do their work safely and avoid creating hazards that could place themselves or others at risk.
- Awareness and understanding of workplace hazards and how to identify, report, and control them.
- Specialized training, when their work involves unique hazards.

Specifically, there are many benefits to training:

- Statistically, less accidents.
- Increased efficiency & productivity.
- Improves employee morale.
- Less time/manpower wasted on supervision and/ or micromanagement.

Beyond the obvious reasons – regulation and moral responsibility – there are plenty of advantages in investing more time and thought in a well-planned workplace safety training program. They are:

- Less productivity loss due to illness or injury.
- Higher employee satisfaction.
- Reduced worker compensation for medical leave due to work-related injuries and illnesses.
- Protection from liability lawsuits.
- Future incident prevention.

5.6 Safety Promotional and Motivational Activities

Safety promotional activities such as celebrating National Safety Day, having Safety Week, Fire Safety Week, giving Safety Shields/ Awards, organising Safety Poster Exhibitions, Safety Slogan & Safety Poster Competitions, distributing Safety Pamphlets, Calendars/ Diaries/ Cards/ Key Chains/ Pens with safety messages, installing digital safety poster displays at key locations, safety reports/ magazines etc. ensure the participation of employees in Occupational Safety.

6.0 Case Studies

Following case studies are described in this chapter to emphasize on significance of "Self-Regulation for Safety".

6.1 Injury due to electric shock

In an industry a trial run of 300m^3/hr. capacity blower was being carried out. The blower along with motor was received at the industry two years back and was stored since then till its installation. Blower along with the motor was installed in the designated area in and planned for temporary testing. Three phase power supply point was identified and 2.5 sq.mm 4 core copper flexible cable was laid temporarily. When blower was switched ON, it got tripped within few seconds. Suspecting mechanical jam, the in-charge engineer touched the blower keeping his right hand over the blower metal casing and his left hand on the adjacent metal piping for checking the free rotation of the blower. He received electrical shock for few seconds. The power was switched OFF immediately. Subsequently, he was given first aid. Then he was referred to hospital. Later he joined the duty with due fitness certification.

Findings

During investigation of the incident following deficiencies were noted:

a) It was observed that the 4Core 2.5 Sq.mm flexible cable was installed without lugs.
b) Before installation and commissioning at site, the motor was tested using a starter. However, it was noted the starter was kept horizontally during the trial run and not clamped rigidly.
c) Only single earth connection was provided for the motor and was not connected at its designated place. The connection point was also not cleaned properly and was having insulating paint beneath it, thus failing to provide safety function.

6.2 Entanglement with tagline rope due to sudden rotation of rope

Inside a building in the premises of an industry, a team of workers was engaged in erection of EOT crane assembly having the weight of 70MT with the help of 1350 MT crane. Two tag lines (ropes) were provided for controlling movement of the EOT crane assembly during its placement at the location. To control the taglines attached to the EOT crane assembly, 7 persons were positioned. The EOT crane assembly was lifted from outside of building to the required height. As per the work plan workers were required to go to the platform at lower elevation to guide further movement of the load. Therefore, workers untied their safety belt & tagline rope from anchored point. At that moment, all of a sudden, this suspended EOT crane assembly started rotating in anti-clockwise direction. Seeing the rotation, they tried to hold the tagline & control the load. However, there was heavy force, the crew members mutually decided to release the tagline and move sideways for ensuring their safety. During this course, one of the workers got entangled with this tagline rope lying on the platform. As a result, he got pulled away from

the platform from above the railing. The person caught the tagline rope to prevent his fall. He was rescued by the nearby people and was immediately taken to the hospital after the first aid treatment.

Findings

In-effective supervision and improper deployment of manpower resulted in entanglement of tagline with workers leg during un-controlled rotation of the load.

6.3 Fall of person from height

In a warehouse, two persons were assigned for the job to temporarily close one open window with wooden board, to prevent the ingress of rainy water, as its glass was broken. They carried a ladder to reach the window at a height of 3.25 m but couldn't utilize the ladder due to narrow space between east side wall and the metallic rack. As the ladder could not be utilized for executing the job, they climbed on the rack using ladder (height 1.8m) to approach the window to fix ply board.

While coming down from the metallic rack one person lost his balance and slipped. To maintain his body balance, he tried to take support of pipes kept on the rack but rack tilted toward the wall. He was caught in between the wall & the rack. He suffered injuries on the left side of the chest during this fall. He was taken to the hospital after the first aid treatment.

Findings

Subsequent investigation of the incident revealed following deficiencies:

1. There was lack of hazard identification and risk assessment
2. There was lack of supervision leading to unsafe act.
3. Safety work permit system was not followed.

Conclusion

Above incidents indicate deficiencies w.r.t hazard and risk assessment before execution of the jobs, effective supervision, implementation of safety measures such as work permit system, use of suitable PPEs etc. If these deficiencies were identified before execution of the job, then these incidents would have been averted. To avert such incidents in any workplace, self-regulation aspects (such as hazard assessment, effective supervision, use of suitable PPEs, implementation of approved procedures and work permits etc.) should be followed.

Acknowledgement:

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References

1. Ismail Bahari, University Kebangsaan, Malaysia - Occupational Safety and Health in the Universities: Fulfilling the fundamental requirement of OSHA & AELA, https://inis.iaea.org/collection (2000)
2. Daniel Castro - Benefits and Limitations of Self-Regulation for Online Behavioural Advertising, https://itif.org/files/2011-self-regulation-online-behavioral-advertising.pdf (2011)
3. Dr. Jefferelli Shamsul Bahrin - Self-Regulation and Occupational Safety and Health Act (OSHA), https://www.dosh.gov.my/ (1994)
4. Theories of Self-Regulated Learning and Academic Achievement: An Overview and Analysis. Zimmerman, B.J., https://psycnet.apa.org/ (2001).
5. Accidents and Apathy: The Construction of the 'Robens Philosophy' of Occupational Safety and Health Regulation in Britain, 1961–1974 by Christopher, Social History of Medicine, 29 (1), 66–88, (2016)
6. Characteristics of excellent Safety culture at Kesterel Management LLC and Tellevate LLC https://kestreltellevate.com/characteristics-of-an-excellent-safety-culture (2019)
7. W. K. Law and AHS Chan, Prioritising the safety management elements: A hierarchical analysis for manufacturing enterprises, Industrial Management & Data Systems 106(6):778-792 (2006)
8. Neil Gunningham, Investigation of Industry Self-Regulation in Workplace Health and Safety in New Zealand, http://regnet.anu.edu.au/ (2011)
9. Control and Prevention, OSHA, https://www.osha.gov/coronavirus/control-prevention
10. K. U. Mistry. Fundamentals of Industrial Safety and Health. Siddharth Prakashan, (2008).
11. Julia Flintrop, Commitment and leadership as key occupational health and safety principles, https://oshwiki.eu/wiki/
12. Management and Leadership Commitment, https://www.go2hr.ca/wp-content/uploads/2017/07/COR101-Element1.pdf
13. Strategies for reducing human error, http://www.hrdp-idrm.in/e5783/e17327/e28013/e28930/
14. Recommended practices for safety & health program, OSHA, https://www.osha.gov/safety-management/education-training

Part-B

Challenges and opportunities in Occupational Health during COVID-19 Pandemic

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CONTENTS

Chapter 1

INTRODUCTION

All the Department of Atomic Energy (DAE) Units has developed infrastructure to handle COVID cases and implemented COVID appropriate behaviours in their respective facilities.

Despite of the difficulties and limitations, all the DAE facilities carried out periodic/Statutory Medical Examination during pandemic period and met the statutory requirements. All the DAE facilities prepared the guidelines and SOPs during COVID lockdown period and the risks and limitation in doing medical check-up during the ongoing COVID pandemic. Certifying Surgeons of Nuclear Power Plants have developed protocol to be followed for COVID Screening, treatment quarantine and follow up. The entire focus was on Prevention of COVID-19 and its community spread by the Department. Certifying Surgeons of DAE prepared the prevention of community spread protocols for COVID during official tour duties and at respective work place. There were challenges in conducting the Annual Medical Examination requirement as per requirement mentioned in Atomic Energy (Factories) Rules, 1996 and Atomic Energy (Radiation) Protection Rules, 2004 during COVID pandemic period. The targeted employees/supporting staff involved in annual medical examination of workers could not conduct the medical check-up as per schedule due to manpower restriction during COVID lockdown. Hospital system including all technical manpower and investigation system were busy in COVID screening, treatment, quarantine and follow up. It is noted that with limited medical infrastructure, no definitive treatment protocol, caused too much uncertainty in COVID management. The DAE units MAPS, TAPS and UCIL got most affected due to COVID. Few of the doctors and few employees working in control room got infected by the Novel Corona Virus.

Few of the challenges in medical examination during pandemic period are as follows:

1. Challenges were there, that even after resuming the Medical Examination under new normal concept, Employee were not agreeing to come to Hospital. Under new normal concept, employees had apprehensions about getting cross infection, as COVID patients are also being treated in same hospital. Hence, they were not agreeing to come to Hospital for Annual Medical Examination.
2. Employees were motivated to come for Medical Examination after counselling, awareness and making them believe that all the safety measures are in place to prevent them from getting infections.

However, after managing successfully, the COVID situation came under control and medical examination requirement were able to be fulfilled as per statutory requirement. All these dedicated efforts lead to uninterrupted running of NPPs.

Chapter 2

IMPACT OF THE PANDEMIC ON OCCUPATIONAL HEALTH

2.1 Introduction

Adopting while accepting new challenges has always been integral to learning curve. COVID-19 Pandemic has yet again proved that we the Industrial Physicians are well equipped to handle any crisis learning from each other and being a part of technological revolution, it has brought about. This demanding situation on both body and mind has resulted in stress of a different kind often expressed as anger, anxiety, short temperedness etc. Though this cannot be avoided, it can for sure be directed and managed.

Occupational Health Centres of all DAE units played a major role in getting work places ready against COVID-19. Health Care Staffs were extremely dedicated to ensure that their patients are adequately provided care in these very difficult circumstances.

Occupational health aims at the promotion and maintenance of the highest degree of physical, mental and social wellbeing of workers in all occupations. It is a known fact that "No occupation is without any occupational disorder and further there is no occupational disorder which is not preventable." Therefore, the preventive programme has to play a vital role in the industrial growth of our country.

In Industrial situations all over the world occupational disorders due to ill-effects of various physical, chemical and biological agents are causing great concern. In India also the occupational health status of employee at work is getting due importance. The adverse health effects of various agents are found to be more amongst the workers exposed to specific pollutants. Physical agents like noise and heat had also contributed significantly in causing ill-health to the employee at work.

Accident investigations have also revealed that unsafe acts are leading to a greater number of accidents than the unsafe conditions.

It has been further documented by various research workers that contract/casual worker – a common feature in developing countries like India – who have neither vocational training nor previous industrial experience are predisposed to high risks of accidents and occupational diseases (compared to regular workers who are more qualified and trained).

The modern trends in occupational health and safety in our country are also three dimensional

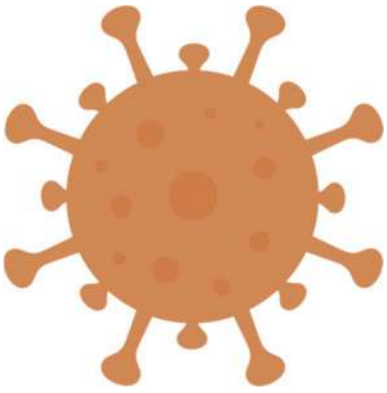
1. By research, education and effective training of the working population.
2. By establishing occupational health services.
3. By effective legislative measures.

Therefore, the training has to play a vital role in the prevention programme of occupational health problems of industrial workers of our country in general & DAE in particular.

2.2 Role of Factory Medical Officer

The factory medical officer has to play a very important and key role of catalyst and changing agent. He has to convey the intention of management of all concern that "Around here, we support positive health". He has to see that health education and training for preventing occupational diseases becomes an integral part of the organization's education and training policy.

2.3 Corona Virus – Background



Corona Virus Disease 2019 (COVID-19) first surfaced in Wuhan, China and was notified to WHO on 31st December 2019, but quickly escalated into a Public Health Emergency of International Concern on 30th January 2020, and declared a pandemic by WHO on 11th March 2020. As of 3rd September 2021, there have been 218,946,836 confirmed cases of COVID-19, including 4,539,723 deaths, reported to WHO. As of 31st August 2021, a total of 5,289,724,918 vaccine doses have been administered.

As COVID-19 Pandemic was a new experience for everyone, the mixed emotions of apprehension, anxiety and fear of getting infected while examining employees was unavoidable among the Health Care staff. It was a challenge to keep their moral up for dedicated and continuous work without absenteeism. To ensure health and safety of the employees and CHSS beneficiaries, health care staff was our priority. It was an excellent opportunity to provide Medicare as a team, appropriate and adequate supply of PPE, training in Corona precaution, updated corona disease awareness, easy access for

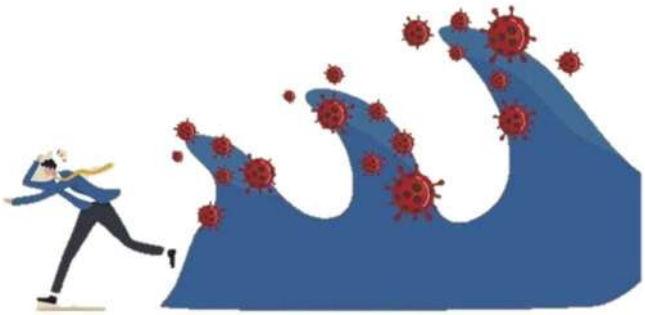
medical and diagnostic tests, medical and psychological support and friendly working environment was the key to success. This cohesiveness helped the team throughout Corona journey which had different and difficult to stop in between. WHO, ICMR, MOH & FW, MHA, NDA and Govt. Agencies were the good guides, provided guidelines, protocols and SOPs, time to time to update the preventive knowledge and treatment protocols of COVID-19 disease.

Various Quarantine Rules have been followed.

- Mild cases - Home Isolation
- Moderate cases - Institutional Quarantine
- Severe cases – Hospitalization

Home quarantine is also for suspects and primary contacts.

2.4 Corona Virus – First Wave



COVID-19 is a respiratory infection caused by beta corona virus, a type of human corona virus. It has a novel sequencing unique from the other six known corona virus subtypes. Clinical features include nonspecific symptoms such as dry cough and low-grade fever. Chest X-ray and Computed Tomography scans in 75% of patients showed bilateral pneumonia. Empirical treatment includes a combination of antiviral and antibacterial clinical interventions, and supportive treatment. Mechanical ventilations may be deployed for severe cases. COVID-19 is transmitted primarily through droplets generated when an infected person sneezes or coughs. Colleagues can get infected with COVID-19 by touching, contaminated surfaces or objects such as desks, tables or telephones, and then touching their own eyes, nose or mouth. They can also be infected by breathing in droplets generated within one meter of anyone with COVID-19.

The current stage of COVID-19 pandemic has been labelled as the second wave in Indian and in many other countries. In India, the peak from the first wave was around September/October 2020 with the second wave peak being reached around May 2021. After reaching a high of 4.14 lakhs on 8th May 2021, the daily count of cases has dropped significantly afterwards – the second wave affecting significantly more individuals with a lesser fatality rate.

2.5 Corona Virus – Second Wave

The causes for second wave are Political and Religious gatherings and alteration of viruses more importantly, people letting their guards down.

Vaccination against COVID -19 has shown to minimise effects from variants of concern. The government in an effort to ensure equitable vaccine access has now ensured direct

purchase from the manufacturers. Vaccination coupled with non-pharmaceutical measures such as universal masking, maintaining physical distancing and practicing hand hygiene would be key to preventing and mitigating the potential third wave in India.

A new double mutated / triple mutated strain of SARS-CoV – 2 has been detected in second wave. This is in addition to Brazilian, South African and UK strain. Mutant variant is B.1.617 variant of SARS - CoV - 2.

Mutations are - E 484Q and L4 52 R

1. E4 84 Q is similar to British and South African variants
2. L4 52R is similar to Californian variant
3. Third mutation: P 614 R

Investigations

1. RTPCR (confirmatory)
2. Rapid Antigen test
3. HRCT chest

	Score	**Viral Load**
RTPCR CT (Cycle Threshold)	17-24	High viral load
	24-35	Moderate viral load
	>35	Mild viral load

	Score	**CT severity**
HRCT Severity score	<8	Mild
	9 - 15	Moderate
	>15	Severe

2.6 Measures taken at DAE units

Due to ongoing pandemic many measures had to be adopted on war footing to ensure safety of employees and CHSS beneficiaries as well as implementation of strict measures to minimize disease spread. Some of the measures are mentioned below:

- Mandatory temperature checking at all Entry points.
- Vigilant Contact Tracing and Travel History based Quarantine method.

- Permission to Work from Home specifically for those suffering from serious co-morbidities as per Government Guidelines helped to safeguard against disease contraction.
- Different areas for quarantine were designated and were operational during the Lockdown Period.

- Triage areas at Health Centre were established to separate infected/non infected cases and for guiding them to designated OPDs.
- Dedicated and segregated Fever OPD Blocks were made functional fitted with HEPA Filters and negative pressure maintenance and separate patient Entry and Exit Points. It was also equipped with spray sanitizer for disinfection.
- Telemedicine was encouraged for consultation after prior appointment helped in decreasing crowd at OPD waiting areas.
- Extension of facilities like issue of three months medicines, permission to buy and reimburse monthly medicines and extension of Out Patient (OP) referral form validity in special cases helped in de-cluttering and smooth management of OP Corona Home Care Kit inclusive of Pulse Oximeter, Digital Thermometer and basic medicines was introduced.
- This was supplemented by daily calls from Health Care Workers which helped in decreasing unnecessary admission of patients.
- Permission for emergency admission to any Govt. recognised COVID care facility and reimbursement has been introduced.

- PPE Kits were procured for both permanent and casual work force at both the Health Centres to ensure the safety and safe disposal as per guidelines is being done.
- Vaccination drive was conducted at health care centres of different DAE units, where employees and family members, were given first dose and second dose of Corona protective vaccine was inoculated as per Government guidelines.
- Emphasis on Health Education, prevention of Corona took a centre stage.
- Educational multi-lingual videos prepared by in house Medical Officers and Nurses have been put on official website. A dedicated Corona Dash Board is also in place.
- Medical Social Worker makes planned Plant visits daily reiterating the need to continue to follow corona safety measures and submits the report.
- Required changes have been made in the change rooms with educational posters being put out at all public places.

2.7 Occupational Health Risks

A significant proportion of cases are related to occupational exposure. These include persons working in seafood and wet animal wholesale markets in the Wuhan outbreaks, healthcare workers treating infected patients, staff in the tourism, retail and hospitality industry, transport and security workers, and construction workers. Elderly and those with co-morbidities are at higher risk. Health care workers are also at highest risk of getting exposure to Covid-19 infection with different strains. Asymptomatic/ Pre-Symptomatic individuals are at risk of spreading infection. Hence, isolation is required.

Ro-value gives information on how contagious and infectious is the disease. It also indicates reproductive number of infective agent.

Ro > 1 = outbreak likely

Ro >1.5 = pandemic likely

Ro < 1 = likely end of the outbreak. Ideally Ro value < 0.8 is preferred.

Improper infection prevention contributed to disease spread earlier on and Antibodies were found to be lower in those who constantly wore a mask or respirator are at higher risk.

There are multiple factors to consider in the Covid-19 Return to Work (RTW) risk assessment. The same are shown in the Figure-1 below:

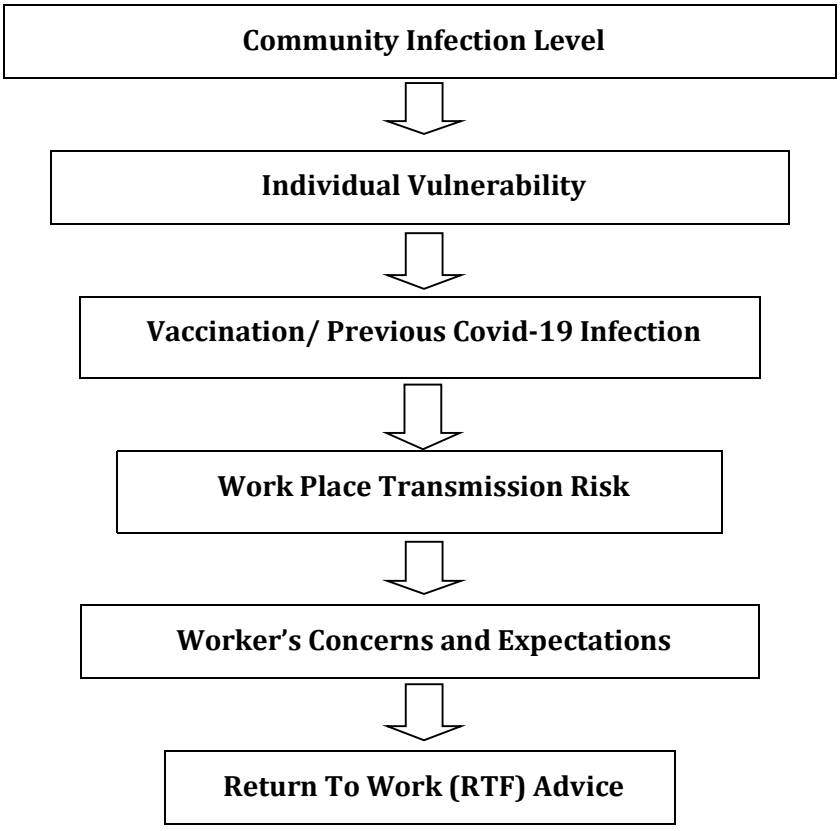


Figure 1: Factors to consider in the Covid-19 Return to Work (RTW)

a) Community Infection Level

The most important risk factor is the level of infection in the community. In recent weeks, we have seen substantial reductions in community transmission and death rates together with a successful and rapid roll-out of the vaccination programme since the start of the year. Control measures (social distance, hygiene, face mask) remain key to prevention of Covid-19 infection.

b) Individual Vulnerability

Shielding advice was based on an assumption that some conditions and treatments made employees more vulnerable to severe illness, hospitalization and death. And did not account for multi-morbidity (i.e., multiple health conditions and risk factors) with emerging evidence, we now understand that there are many factors that affect individual vulnerability (i.e., Age, ethnicity, BMI as well as medical factors (co-morbidities).

c) Previous Covid-19 Infection

Those who have had Covid-19 infection, naturally acquire immunity/antibodies provide 83% protection against reinfection, compared to people who have not had the infection. This protection appears to last for at least five months from first becoming ill. These individuals however, are still able to pass the virus on to others

d) Workplace Transmission Risk

Occupationally associated severe Covid-19 risk has been evident and concerning in essential workers, notably health care workers but also in social care and transport workers (given higher exposure to the SARS-COV2 virus due to the nature of their work) and individual work place outbreaks have occurred (Particularly in the food production/processing industry). However, there is little evidence to date that some of the work places in general are a high source of transmission. Consideration of travel to work is a key factor, notably risks associated with public transport.

e) Workers Concern and Expectations

While many employees will look forward to the social aspects and the routine of attending their work place, others may be more apprehensive, particularly those who are clinically vulnerable or perceive themselves to be. It is important that in any discussions by employees and health professionals that any psychological barriers are explored and steps that can be taken to address those are considered.

f) Return to Work (RTW) advice

We have finally been in a position to present their roadmaps out of lockdown. With lockdown measures easing, the challenge now is to get as many workers as possible back to work safely. We have also seen a successful and rapid roll out of the vaccination programme, and in recent weeks substantial reductions in community transmission compared to previous months. Studies of vaccinations shows that they are effective in preventing infection, hospitalization, death and transmission of the infection. We are

also still learning how effective the vaccines are against variants of viruses. Early research suggests vaccines may work against some variants but could be less effective against others.

2.8 Role of Occupational Health Practitioners

The battle against COVID-19 requires a multi-disciplinary and multi- pronged approach. Communication plays a key role, with conventional methods such as email broadcast taking the central stage. Other novel methods include the use of social media channels such as communication applications, messaging platforms etc., Communications include topics on education on mask use, and updates on the preventive measures by regulatory bodies and corporate policies. Occupational Health practitioners provide expertise opinion through professional input in policy decisions. Medical information is integrated with knowledge about the professions for a personalized approach for each organization.

Occupational Health practitioners play an important role to inform, educate and protect employees. Integration of business understanding, and preventive medicine knowledge will lead to effective measures being implemented. Occupational Health play a key role in leading the corporate readiness and response plans for employee health and well-being for the control of infectious diseases like COVID-19.

2.9 Conclusion

COVID-19 has taught us a new way of working and a new way to connect with each other. Although COVID-19 is a highly contagious disease which spreads fast and can infect any one of us, we can protect ourselves through social distancing, washing our hands regularly and following sneezing/ coughing etiquettes.

We need to talk positively and emphasize the effectiveness of prevention and treatment measures. For most people this is a disease they can overcome. There are simple steps we can all take to keep ourselves, our loved ones and the most vulnerable safe.

Stigma can be heightened by insufficient knowledge about how the new corona virus disease (COVID-19) is transmitted and treated, and how to prevent infection. In response, prioritize the collection, consolidation and

dissemination of accurate information about affected areas, individual and group vulnerability to COVID-19, treatment options and where to access health care and information.

Despite all precautions, if anybody catches the infection, it is not their fault. In situation of distress, the patient and the family need support and cooperation. It must be noted that the condition is curable and most people recover from it.

Everyone can help stop stigma related to COVID-19 by knowing the facts and sharing them with others in your community.

People who have confirmed COVID-19 and are in isolation, and people who may have been exposed to COVID-19 and are self-monitoring, are doing the right thing and help in to protect their communities. They should never be harassed and bullied, including through social media. We should offer compassion, support via phone and texts, and assistance as appropriate, but never hostility or judgment.

Social distancing, Mask and Sanitisation

VACCINATION DRIVE AT NFC

COVID Vaccination Drive & Fever Clinic

Chapter 3

COVID-19 WITH METABOLIC DISORDERS AND ITS SYSTEMIC INVOLVEMENT

3.1 Introduction

During pandemic period, several challenges faced by the Certifying surgeons/doctors while treating COVID-19 cases with co-morbidities as well as pregnant women. COVID-19 cases with co-morbidities are discussed below along with COVID pathogenesis.

COVID PATHOGENESIS

COVID pathogenesis is a process describing following pathway:

(i) SARS COV – 2 engage ACE-2 (as entry receptor)

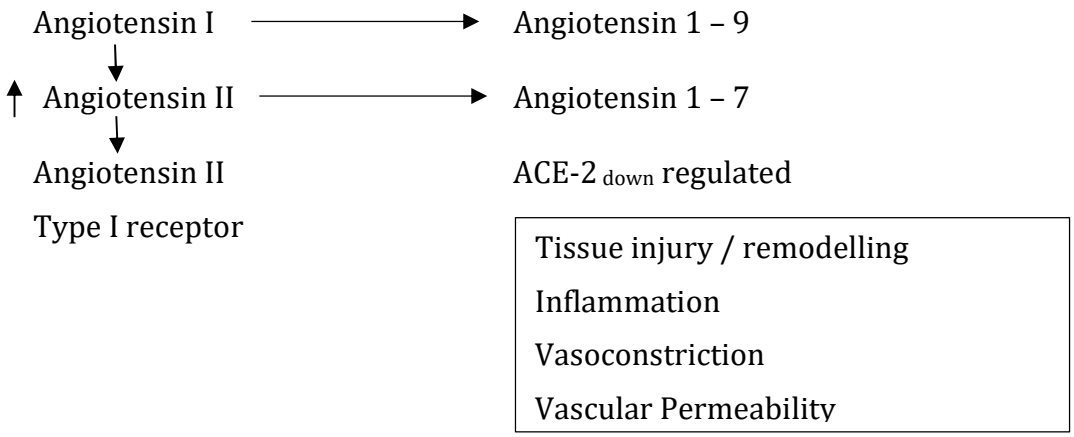
(ii) Cell entry requires priming of spike protein by cellular serine protease TMPRSS 2 or other proteases.

(iii) RBD (Receptor binding domain) of spike protein binds to ACE-2.

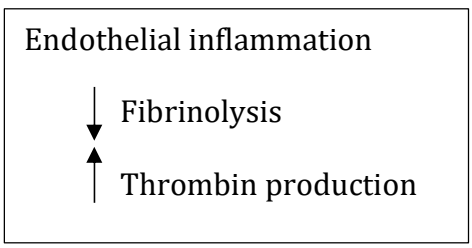
Effects

Patho physiology of COVID is described below:

1. Direct Cytotoxic effect
2. Dysregulation of RAAS



3. Endothelial cell damage & thrombo-inflammation



4. Dysregulated immune response

T cell lymphopenia
Inhibition of Interferon Signally by SARS COV-2
Hyperactive innate immunity

3.2 COVID in Patients Suffering from Diabetes Mellitus

Link between Diabetes & COVID – 19

Diabetic patients are more prone to get COVID infection and its correlations are mentioned below:

(i) Defective innate immunity

(ii) Role of ACE-2 receptors

(a) Hyperglycaemia upregulates the ACE-2

(b) ACE-2 expressed in beta cells of islets

(iii) DPP – 4 enzyme as functional receptor.

Preferred Oral Hypoglycemic Agents (OHA) in COVID

(i) Metformins

OHA to be avoided

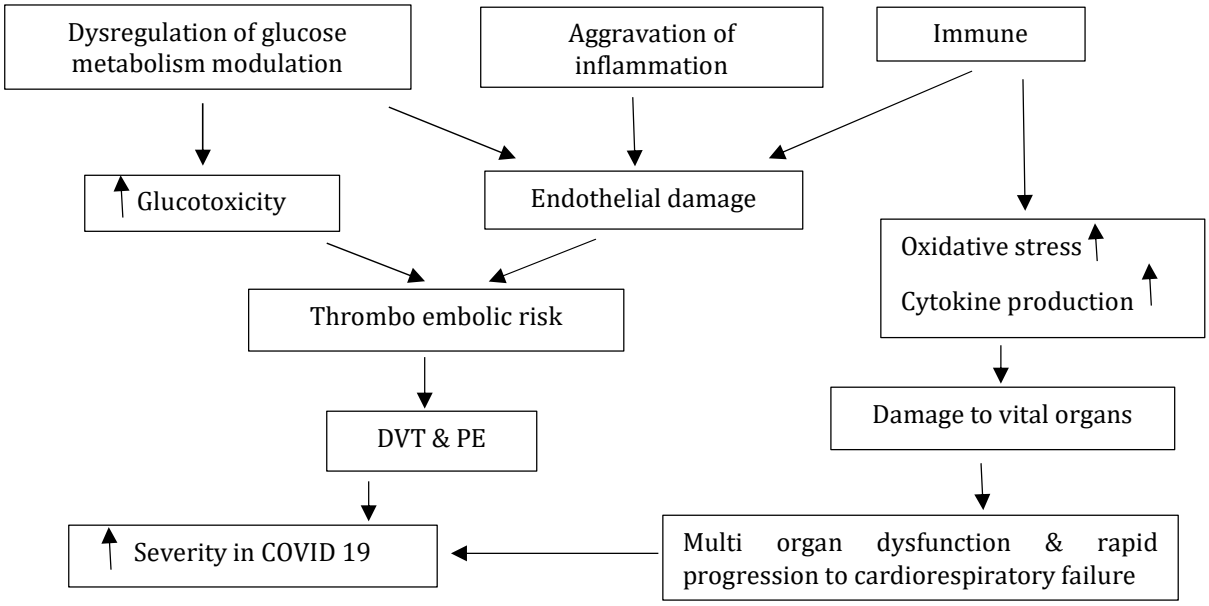
(i) SGLT inhibitors → Risk of dehydration

(ii) Gliptins → DKA during illness

Diabetic Control: Insulin is the safest option

Pathogenesis in Diabetes

The typical pathway of COVID-19 infection for a diabetic patient is shown below:



The above flow chart has simplified the pathogenesis in Diabetic cases. Person suffering from COVID having comorbidity like Diabetes mellites has aggravated inflammatory response contributed by dysregulation of glucose metabolism leading to increased glucotoxicity and Endothelial damage which in turn lead to increased risk of DVT and Pulmonary Embolism and rapid progression of disease, which may lead to Cardiorespiratory failure. Cellular damage further aggravates the vicious cycle of Oxidative stress leading to Cytokine storm and further worsen the prognosis by affective multiple organ damage.

3.3 COVID in patients suffering from cardiovascular diseases

In COVID associated cardiovascular complications due to Inflammation, Marker involved is IL-6 are discussed below:

(A) Arrhythmias

The cause of inflammation of Cardiovascular complications are described below:
Adrenergic stress

Myocardial fibrosis

Inherited arrhythmias

Plakoglobin displacement

hERG k+ inhibition

IL – 1

TNF - α

(B) Thromboembolic events

The causes of Thromboembolic events are described below:

(i) Endothelial dysfunction

(ii) Disordered cytokine signalling

(iii) Thrombotic Microangiopathy

(iv) Atrial Fibrillation

(v) Microvesicles, VIII, TLR, TF, VWF

(C) Acute Coronary Syndrome

The causes of Acute Coronary Syndrome are described below

↑ Metabolic demand

Microvascular dysfunction

Plague rupture

(D) Heart failure, Cardiomyopathy

The cause of Heart failure, Cardiomyopathy are described below

↑ Pulmonary Hypertension

DABK, BK 1

(E) Myocardial injury, Myocarditis

The causes of Myocardial injury, Myocarditis are described below

Th I cytokine storm

AngII, Nox_2

P38 MAPk.

Role of IL-6

The role of IL-6 on COVID infection is described below:

Elevated IL-6 ⟶ interact with NETS ⟶ drive thrombosis

Together with IL-1 & TNF-α ⟶ modulate the expression or function of k + & ca + ion channels in cardiomyocytes, potentially causing arrhythmias.

It is understood that COVID 19 viral infection aggravate the Cytokine storm, Interleukin 6 (IL-6) seems to be the central mediator of cytokine storm, in which it orchestrates the pro-inflammatory and activate further release of inflammatory cytokines like IL -1, TNF-α. This which stimulate more T lymphocytes, leading to a positive feedback loop of immune activation and myocardial damage.

COVID 19 Therapies & Potential cardiovascular complications

COVID-19 poses unique problems that were not encountered with the previous known viruses. The address the Cardio vascular Disease (CVD) complications, systemic and vascular inflammation, and to deal with comorbid risk like hypertension, diabetes and heart failure. Initial approaches made to emphasis on obstructing the viral replication and inflammation by using antiviral drugs, such as, Remdesivir, liponovir/ritonavir, hydroxy chloroquine (HCQ), corticosteroids and few antibiotics like Azithromycin etc. to address inflammation.

The adverse effects of drug treatments used for COVID-19 are summarize below:

HCQ	⟶	QT prolongation Cardiotoxicity
HCQ + Azithromycin	⟶	QT_C Prolongation
HCQ + Loop diuretics	⟶	QT_C Prolongation
Lopinairs + Ritonairs	⟶	Thrombosis (in clopidogrel users) Arrythmias
Remdesvir	⟶	Bradycardia

3.4 COVID (Renal Manifestation)

COVID induced kidney damage is expected to be multifactorial; directly it can infect the kidney podocytes and proximal tubular cells and based on an angiotensin-converting enzyme 2 (ACE2) pathway it can lead to acute tubular necrosis, protein leakage in Bowman's capsule, collapsing glomerulopathy and mitochondrial impairment.

The SARS-CoV-2-driven dysregulation of the immune responses including cytokine storm, macrophage activation syndrome, and lymphopenia can be other causes of the Acute kidney injury. Organ interactions, endothelial dysfunction, hypercoagulability, rhabdomyolysis, and sepsis are other potential mechanisms of kidney damage.

Pathophysiology

Following flowchart describes COVID -19 infection causing Kidney damage:

SARS CoV2 → ACE2 receptors in renal cells

↓

Prominent acute tubular injury

& Erythrocyte aggregation

↓

Obstruction in peritubular & glomerular capillary loops

Clinical Findings

The major Clinical findings related to Kidney damage caused by COVID-19 infection is described below:

AkI (Acute Kidney Injury)↑

Electrolyte abnormalities↓ (↑K, Na Na)

Proteinuria

Hematuria

Metabolic acidosis

Investigation

Typical investigations required to diagnosis of Kidney conditions is described below:

Urine analysis

Protein creatinine ratio

Management

Management of Kidney affected person due to COVID-19 is described below:

Avoid Hypervolemia

Sepsis management

Indication for CT imaging

Typical findings from CT imaging and requirements of CT imaging for COVID patient is described below:

1. Evaluate for exertional desaturation, e.g., using 40 steps walk test: if Spo2 <94% after exertion or a drop of 2% below baseline, consider CT imaging.
2. If Persistent fever ≥ 7 days and presence of ≥ 1 risk factor for progression to ventilation or mortality (e.g., age ≥ 60 years, obesity, comorbidity), consider CT imaging.

3.5 Hypertension and COVID-19 COPD cases

3.5.1 Hypertension

Hypertension is the single largest global contributor to disability-adjusted life years lost. The majority of the population aged over 60 years have hypertension and it has been suggested that they may be at increased risk from the effects of COVID-19.

This article seeks to summarize and interpret the current evidence for and against an increase in COVID-19 risk and severity for those with raised blood pressure, and discusses the implications for the choice of anti- hypertensive treatment.

New emerging evidence from the largest epidemiological study to date, examining over 17 million health records in England suggests that hypertension or a recorded blood pressure ≥140/90 mmHg taken together are not associated with COVID-19 in-hospital mortality after full adjustment.

Almost all available evidence suggests that hypertension increases the risk of severe COVID-19, defined as admission to intensive care, clinically defined severity or a combination of these or mortality. It was sometimes unclear, however, whether this risk was independent of other risk factors. Initial reports have identified higher rates of hypertension among severely ill, hospitalized COVID-19 patients, with overall hypertension rates of 50–56%. It had been unclear if this relationship was causal or confounded by age and other co morbidities associated with hypertension, including obesity, diabetes and chronic kidney disease.

Endothelial dysfunction is the common denominator for most COVID-19 co-morbidities such as hypertension, diabetes, and obesity. Smoking along with Hypertension itself worsen the endothelium. Endothelial dysfunction occurs in hypertensive patients. Sustained elevation of systemic pressure in the microvasculature leads to premature aging and increased turnover of endothelial cells, impairing the ability of endothelium to release endothelium-derived relaxing factors, resulting in vasoconstriction.

Mechanical stress evoked by high intraluminal pressure on the vascular wall triggers oxidative stress that leads to endothelial dysfunction in turn leads to a destructive cascade identified at the arterial wall, followed by chronic inflammation. Chronic inflammation results in vascular remodelling, increase in intima-media thickness and functional remodelling. With time, these developments lead to loss of homeostatic properties, a key role in protection against endothelial dysfunction.

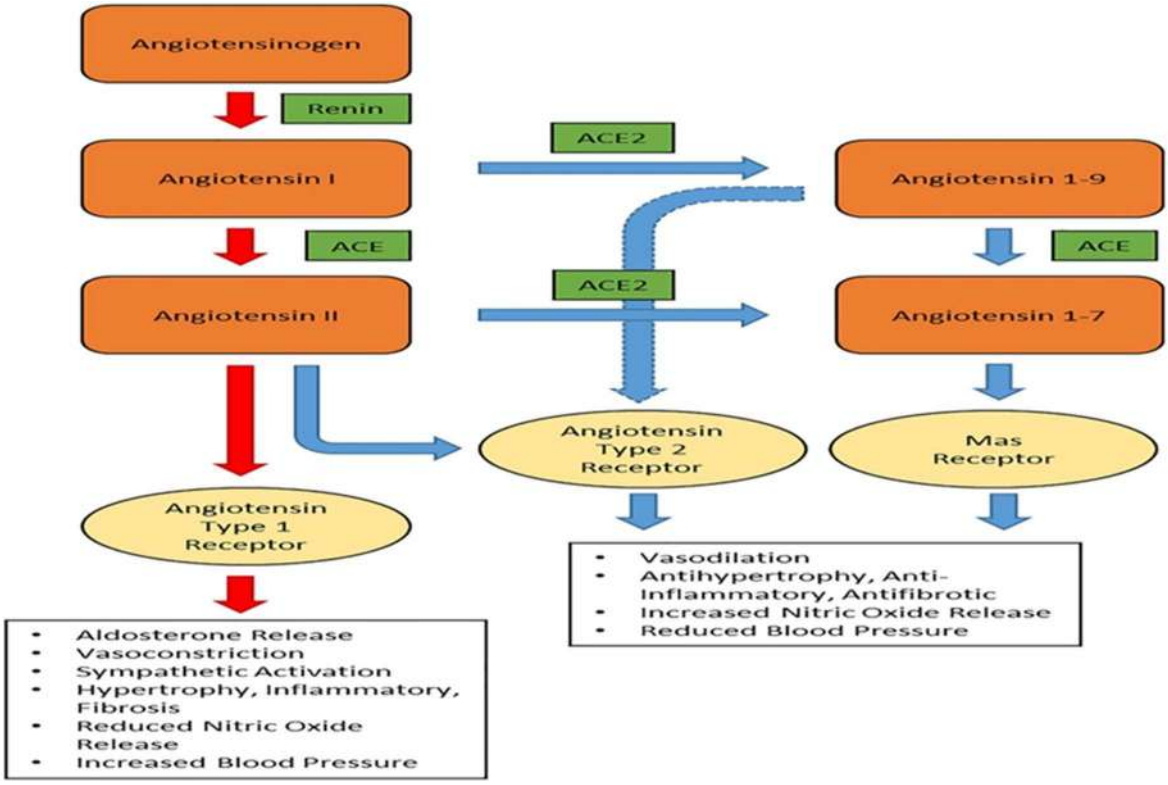


Figure 2: Renin–angiotensin–aldosterone system (RAAS) Pathway

The inflammatory cytokines such as TNF- α, IL-1 β and IL-6 induce the synthesis of acute phase proteins by the liver, including fibrinogen thereby producing a procoagulant state with influx of activated neutrophils and is prone to aggregate leading to neutrophils extracellular traps which in turn occlude the blood vessels.

Subsequently, the pro-adhesive and pro-thrombotic endothelium Cytokine storm, an expression of exaggerated host immune system response, was reported in patients with COVID-19. The cytokine storm is characterized by very high levels of erythrocyte sedimentation rate (ESR), CRP, TNF- α, IL- IRA, IL-2, IL-6, IL-7, IL-8, IL-9, IL-10, granulocyte- colony stimulating factor (GCSF). Elevated cytokine cause destabilization of endothelial cell to cell interactions, Capillary damage, diffuse alveolar damage –ARDS, multi organ failure and death.

WHO conducted a rapid review of evidence related to use of ACEs and Angiotensin Receptor Blocker (ARBs) in COVID patients which identified 11 observational studies. No studies addressed the potential benefit and harm in initiating ACEs and ARBs as treatment for patient with COVID -19. But discontinuation may worsen the outcomes of diagnosed COVID-19 with Hypertension with Myocardial injury and Heart Failure.

Hence it is being strongly encourage to continue ACEs and ARBs in COVID-19 infected patients.

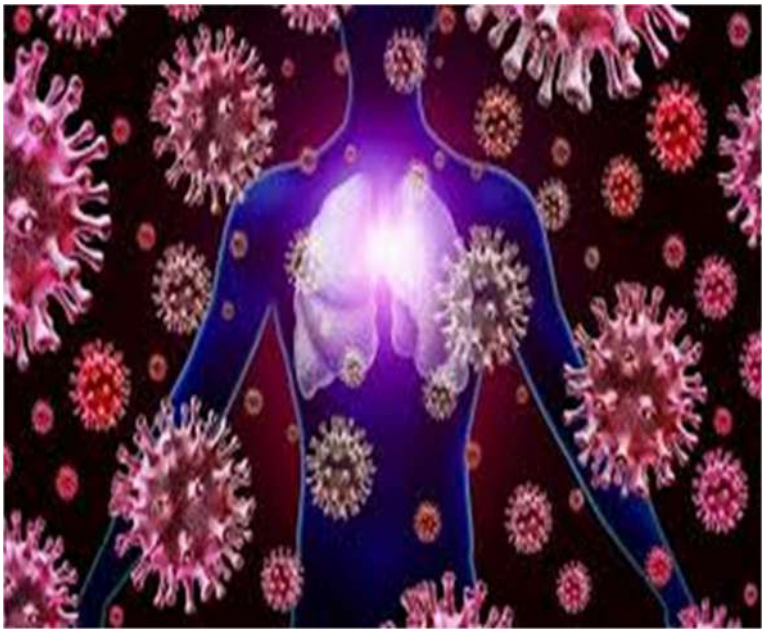
To date there are no clinical data to implicate ACEi or ARBs in either improvement or worsening of COVID-19 cases, or as a risk factor for COVID-19 infection. There is also no substantial evidence to support discontinuation of ACEi or ARBs or alternate pharmacotherapy to manage hypertension in patients with COVID-19. Large studies that consider all potential sources of biasness and confounding factors are warranted in near future to affirm the link between pre-existing hypertension and COVID- 19 severity and to devise better pharmacological management of COVID-19 patients with hypertension.

Figure 3: Prevention of Hypertension

3.5.2 COVID-19 COPD cases

COPD and COVID are major concerned. There were many challenges for the diagnosis and management. There was reduction in COPD admission during the pandemic. Major mechanism driving exacerbation reduction is a reduction in acquisition of respiratory viruses, through hand hygiene, face coverings and physical distancing in the general population, and shielding in those with COPD. However, there are alternative explanations also. Anxiety in association with COVID-19 might have resulted in an increase in medication adherence. Air pollutants add to the risk of COPD exacerbations and emissions of pollutants such as nitrogen dioxide (NO2) and indeed smoking were reported to be significantly reduced during the pandemic. More concerning, the reduction in COPD admissions could also reflect decreased presentation at hospitals, perhaps through fear and limited access. COPD hospitalizations were compared with admissions for other conditions including myocardial infarction and stroke and the reduction in COPD admissions was greater than that observed in other conditions. This also suggests that the reduction in COPD exacerbations in association with COVID-19

restrictions is indeed a real reduction rather than under-representation of COPD patients attending hospital services.



COPD exacerbations are challenging 60% cases cough breathlessness and fever. The additional symptoms like confusion diarrhoea nausea vomiting muscle aches pain, anosmia headache with COPD, test for CoV-2 should be considered. That doesn't exclude potential co-infection with other viruses.

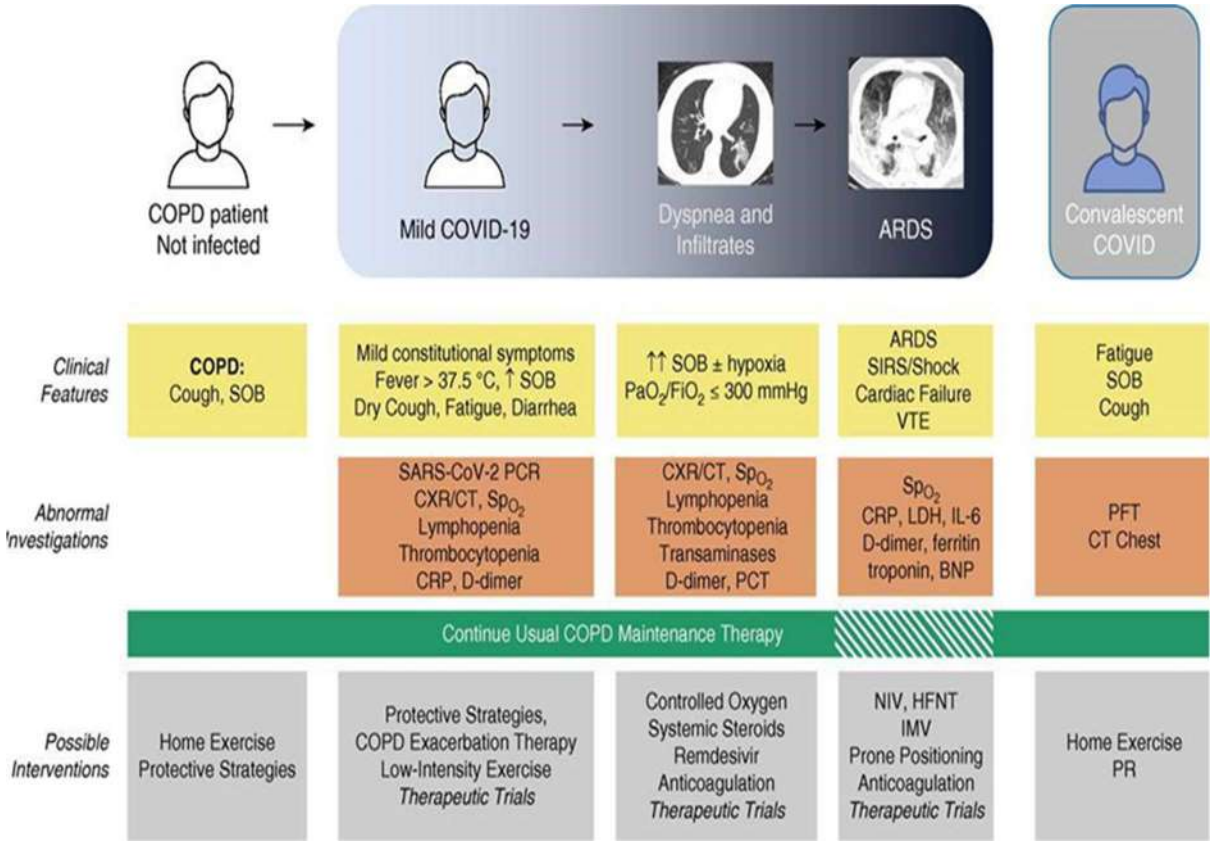


Figure 4: Treatment of COPD during pandemic

COPD patients with COVID infections appear worse outcome with Smoking. SARS-CoV-2 bears an envelope spike protein that is primed with cellular serine protease TMPSS2 to facilitate fusion of virus with the cell angiotensin converting enzyme-2 (ACE-2) receptor and subsequent cell entry. ACE-2 expression is elevated in COPD. Smoking further increases the ACE-2 expression than the non-smokers lead to increase severity of the disease.

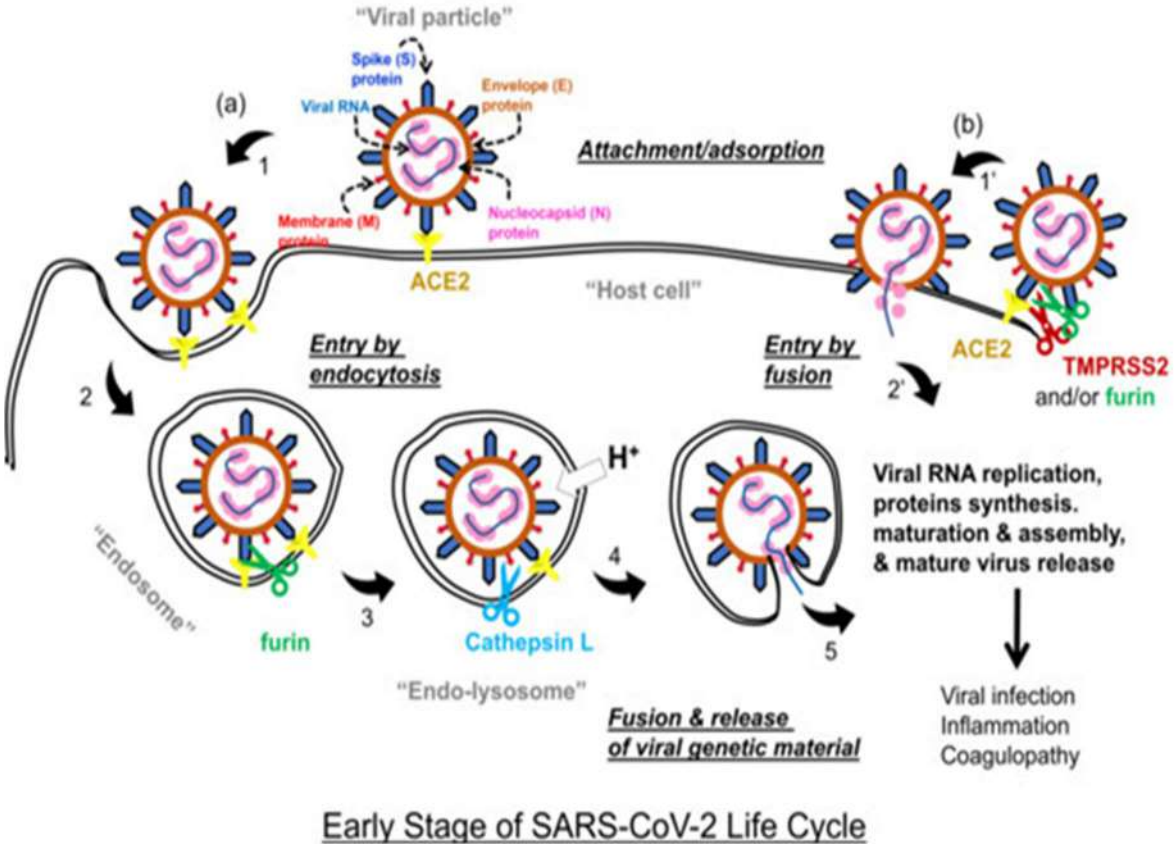


Figure 5: Early stages of SARS-CoV-2 Life Cycle

Chest radiography indicated in patients with COPD with moderate to severe symptoms of COVID 19 CT can also be done. Patients with COPD has increased risk of venous thrombo- embolism. CT pulmonary angio can be done to rule out pulmonary embolism.

Two challenges in clinical care emerged during pandemic. Question was common respiratory medications used like inhaled corticosteroids (ICS) or systemic steroids, short or long-acting Beta 2 agonists, short and long-acting muscarinic antagonist should be used. No studies had provided the necessary evidence required to determine these medications are harmful or beneficial in COVID-19, However recently shown ACE2 expression in airway epithelial cells obtained from asthmatic patients was decreased in those taking ICS compared to those who were not on ICS-showing that ICS restrict the entry of the viruses. Whether the same is true with COPD is not well documented.

Systemic steroids and antibiotics should be used according to the usual indications. Moderate to severe disease can be treated with evolving pharmco-therapeutic approach such as dexamethasone and anticoagulants to prevent venous thromboembolism.

Management of acute respiratory failure include O2 supplementation, prone positioning high flow nasal oxygen non-invasive ventilation and invasive ventilation if indicated.

Rehabilitation should be provided to all COPD patients recovering from COVID-19. Telehealth and virtual visits should be augmented and online rehabilitation programme should be used effectively.

The COVID 19 pandemic has led to many challenges for the routine management and diagnosis of COPD, as well as concerns about outcomes for patients. The GOLD 2021 report says that patient with COPD do not seem to be beat greatly increased risk of infection with severe acute respiratory syndrome corona virus possibly reflecting the protective strategy. The patients with COPD are at slightly increased risk of hospitalization for COVID 19 but the evidence about the risk of developing severe disease and death are contradictory.

3.6 COVID-19 in Pregnancy

Pregnant mother has a higher risk if COVID-19 occurs. Hence, a structured approach with integrated care delivery throughout the pregnancy to provide optimized care for the mother is the need of the hour. All COVID positive cases – antenatal, in labour or post-partum should be kept in the COVID dedicated hospital. Separate team of Gynaecologists (OBGY) should deal with them. The baby should be resuscitated by the Paediatric team there only.

Antenatal Care (ANC) is critical with the objective of timely & appropriate evidence-based actions as it reduces complications during pregnancy, childbirth, still births and perinatal deaths. Antenatal investigations are must and should not be delayed.

3.6.1 Treatment for COVID Positive Pregnant Women

Introduction:

Pregnant women do not appear more likely to contract the infection than the general population. However, pregnancy itself alters the body's immune system and response to viral infections in general, which can occasionally be related to more severe symptoms. It becomes necessary to have systematic approach to treat Pregnancy cases with COVID.

Investigations:	Typical investigations required for such patients are as follows: CBC, blood group and type, glucose screening, HIV, HEP B AG, VDRL/RPR, TSH, HEP C AG, Sickling, URINE - R/M & C/S, COVID AG, RTPCR, CBC, CRP, D dimer, LDH, Interleukin 6, LFT, KFT, Ferritin, CPK, HRCT
Antenatal visits	Minimum four visits are required, Critical evaluation, history and examination, Women planning to conceive, RT PCR negative and History of Contact with COVID positive case may undergo antibody titre levels. USG - DATING / NT SCAN,

	ANOMALY/TARGET SCAN, GROWTH SCAN at 12, 20, 28 and 36 weeks of gestation, Triple marker at 12 weeks and quadruple marker at 15 weeks. Fetal kick count has to be maintained, RT PCR 5 to 7 days before their EDD/ revised EDD/ Emergency.
Mild disease on investigations	SPO2 more than 94 to be treated conservatively. DOXYCYCLINE and IVERMECTINE are NOT indicated in pregnancy.
Moderate disease	Respiratory rate > =24/min, Oxygenation < 94%, High Risk Factor, Oxygen Support: Target SpO2: 92-96%, Sequential position changes every 1-2 hours. Antiviral Therapy: As per the physician opinion – Inj. Remdesivir 200 mg IV on day 1 followed by 100 mg IV OD for 5 days. Anti-Inflammatory therapy: Steroids: Dexamethasone 6mg IV/IM OD/BD for 48 Hours followed by OD for 5 to 10 Days (or) Inj. Methylprednisolone 0.5 to 1mg/kg IV in two divided doses for 5 to 10 days. Anticoagulation: For pregnant women unlikely to deliver within several days and postpartum. Low dose prophylactic Low Molecular weight heparin (LMWH) (weight based, e.g., Enoxaparin) 40 mg SC daily for one week. For women who may deliver within few days - Unfractionated heparin 5000 units S.C every 12 hours. PT INR levels to be monitored.
Severe disease	Respiratory rate >30/min, SpO2 < 90 Admission and Respiratory Support, use of HFNC in patients with increasing oxygen requirement, ventilatory management.
Antiviral Therapy:	Antivirals may be considered if duration of illness <10-14 Days, Inj. Remdesivir, Inj. Methylprednisolone, Anticoagulation as per existing protocol. Tocilizumab may be considered on a case-to-case basis preferably within 24 to 48 hrs. of progression to severe disease. Supportive measures: Maintain euvolemia, if sepsis/septic shock management and local antibiogram Monitoring: Serial CXR, HRCT Chest, Lab Monitoring: CRP, D-dimer & Ferritin 48-72 hourly; CBC.LFT, KFT 24-48 hourly, IL-6 levels to be done if deteriorating
Postpartum care	Early initiation of breast feeding, family planning advice and vaccination.

Chapter 4

VACCINATION AND COVID-19

4.1 Introduction

The world is in the midst of a COVID-19 pandemic due to Coronavirus disease (COVID 19) which is an infectious disease caused by a newly discovered novel coronavirus also known as severe acute respiratory syndrome coronavirus 2 {SARS-Cov-2 virus}. The SARS CoV 2 virus is a Spherical or Pleomorphic enveloped positive-sense single-stranded RNA viruses associated with a nucleoprotein within a capsid comprised of matrix protein and belongs to the family of viruses called Coronaviridae on the basis of the crown or halo-like appearance given by the glycoprotein-studded envelope on electron microscopy.

Now days several safe and effective vaccines are available globally that prevent people from getting seriously ill or dying from COVID-19, but needless to say that mass vaccination drive is only one part of managing COVID-19 pandemic, in addition to the main preventive measures like COVID appropriate behaviors like physical distancing from others, cleaning hands frequently, sneezing and coughing into their elbow, wearing an appropriate face mask and avoiding crowded, poorly ventilated spaces.

The COVID-19 vaccines produce, protection against the disease, as a result of developing an immune response to the SARS-CoV-2 virus and this acquired immunity reduces the risk of developing the serious COVID 19 illness, its short term or long-term complications, reduction in hospital admissions rate and most importantly almost Nil fatalities. Further by vaccinating the large populations, the chain of transmission of the disease can be reduced upto certain extent.

The first mass vaccination programme was started in early December 2020 in the World and in India, it was started in Mid-January 2021 for the HCW (Health Care Workers) & FLW (Front Line Workers) and later it was extended to the other general populations in phased manner. Epidemiologically speaking whenever an increasing number of people get vaccinated in the community, an indirect protection through herd immunity develops for the rest of population, however the proportion of the population that must be vaccinated against COVID-19 to begin inducing herd immunity is still not known.

4.2 Type of Vaccines

Scientists around the world were developing different types of vaccines against COVID-19, and all vaccines are designed to teach the body's immune system to safely recognize and block the virus that causes COVID-19. Several different types of potential vaccines for COVID-19 are in being developed (across 4 platforms) including:

Inactivated or weakened virus vaccines, which use a form of the virus that has been inactivated or weakened so that it doesn't cause disease, but still generates an immune response.

- **Protein-based vaccines**, which use harmless fragments of proteins or protein shells that mimic the COVID-19 virus to safely generate an immune response.
- **Viral vector vaccines**, which use a safe virus that cannot cause disease but serves as a platform to produce coronavirus proteins to generate an immune response.
- **RNA and DNA vaccines**, a cutting-edge approach that uses genetically engineered RNA or DNA to generate a protein that itself safely prompts an immune response.

As of 3rd June 2021, WHO (World Health Organizations) has evaluated that, the following vaccines against COVID-19 have met the necessary criteria for safety and efficacy:

AstraZeneca/Oxford vaccine, Johnson and Johnson, Moderna, Pfizer/BioNTech, Sino-pharm, Sinovac.

However at least 13 different type of vaccines (developed across 4 platforms) have been administered across the World is described in Table-1.

Table-1: Details of vaccines

Name of the Vaccine	Developed by	Target	Platforms
BNTb162b2	Pfizer/ BioNtech Comirnaty	Spike protein	mRNA vaccines
SII/Covishield	AstraZeneca/ Oxford	Spike protein	Weakened adenovirus (ChAdOx1-S; AZD1222 viral vector vaccine
AstraZeneca/ AZD1222	AstraZeneca/ Oxford	Spike protein	Weakened adenovirus (ChAdOx1-S; AZD1222 viral vector vaccine
Janssen/ Ad26.COV2.S	Johnson & Johnson	Spike protein	Viral vector vaccine
Sinopharm	Beijing Bio-Institute of Biological Products Co. Ltd, subsidiary of China National Biotec Group (CNBG).	Whole virus	Inactivated whole virus
mRNA-1273	Moderna	Spike protein	LNP-encapsulated mRNA vaccines,

Name of the Vaccine	Developed by	Target	Platforms
Corona Vac	Sinovac	Whole virus	Inactivated whole virus
Covaxin	Bharat Biotech International Limited Hyderabad,	Whole virus	Inactivated whole virus
Sputnik V	Gamaleya Research Institute Sputnik V	Spike protein	Deficient adenovirus-5

The Vaccines which are presently approved and available in India for Mass Vaccination are:

1. **Injections Covishield** (Marketed by AstraZeneca, developed by Oxford University UK and Manufactured at Serum Institute of Pune)

   The composition of vaccine includes inactivated adenovirus with segments of Coronavirus, Aluminium Hydroxide Gel, L-Histidine, L-Histidine Hydrochloride Monohydrate, Magnesium Chloride Hexahydrate, Polysorbate 80, Ethanol, Sucrose, Sodium Chloride, and Disodium Edetate Dihydrate (EDTA).

   The time interval between two doses of the Covishield vaccine has been extended from 4-8 weeks to 12-16 weeks.

2. **Injection Covaxin** (Developed and Manufactured by Bharat Biotech international limited Hyderabad)

   The composition of vaccine includes inactivated Coronavirus, Aluminum Hydroxide Gel, TLR 7/8 Agonist, 2-Phenoxyethanol and Phosphate Buffered Saline [NKA1].

   The time interval between two doses of the Covaxin vaccine is 4-6 weeks after the first dose.

3. **Injection Sputnik V** (Manufactured by Dr. Reddy laboratories and developed by Russia's Gamaleya Research Institute of Epidemiology and Microbiology):

   It is a viral vector vaccine Composition of this vaccine includes, two recombinant replication-defective human adenoviruses: Ad26 (serotype 26) and Ad5 (serotype 5). Tris (hydroxymethyl) aminomethane, Sodium chloride (salt), Sucrose (sugar), Magnesium chloride hexahydrate Disodium EDTA dihydrate (buffer), Polysorbate 80, Ethanol 95%, Water.

   The time interval between two doses of the Sputnik Vaccine is 21 days after the first dose.

RNA vaccines have shown very promising results in many pre-clinical studies with a significant success recently against COVID-19 with protection percentages of 95% and 94.5%.

4.3 Precautions to be taken before, during & after COVID- 19 Vaccinations

The COVID-19 vaccines are invariably safe for most people of age 18 years and above including those with pre-existing chronic disease and comorbidities like hypertension, Diabetes, Asthma, COPD, liver and kidney disease, malignancy as well as other chronic infections including auto-immune disorders which are stable and are under good control.

Reported side effects of COVID-19 vaccines have mostly been mild to moderate and short lasting. Common side effects after vaccination, which chiefly indicate that a person's body is building protection to COVID-19 infection includes:

- Arm soreness at injection site
- Mild fever
- Headaches
- Muscle or joint aches
- Tiredness

The chances of any of above side effects following COVID19 vaccination differs according to the specific type of vaccine being administered, further the effectiveness of the vaccine is also not dependent on any food or drink (especially alcohol) before or after taking the vaccine.

Taking painkillers such as paracetamol before receiving the COVID-19 vaccine to prevent side effects is not recommended, this is because it is not known how painkillers may affect how well the vaccine works. However, it is advisable that tablet paracetamol can be given safely, if patients develop bothersome side effects such as pain, fever, headache or muscle aches after vaccination.

A severe allergic reaction such as anaphylaxis Shock is a potential but rare side effect with any kind of vaccine. Hence utmost precautions must be taken in the individuals with a known risk, such as previous experience of an allergic reaction to the previous dose of the vaccine or any of the known components in the vaccine.

There has been reports of very rare cases of myocarditis and pericarditis following the second dose of mRNA COVID-19 vaccines. Cases have been mostly reported in younger men aged 12 – 29 (40.6 cases of myocarditis per million second doses) compared to females of the same age group (4.2 cases per million second doses). The individuals present mostly with new onset of persistent chest pain, palpitations and shortness of breath.

There have been reports of very rare but serious cases of blood clots accompanied by low platelet counts (known as thrombosis with thrombocytopenia syndrome (TTS)) occurring 3 to 30 days after vaccination with COVID-19 non-

replicant adenovirus vector-based vaccines (such as the AstraZeneca and Janssen vaccines). AstraZeneca vaccine, as of 15 July 2021, the data shows that these symptoms occur in about four to six people out of every million vaccinated (this figure varies based on age, sex and geographical location). Younger adults appear to be at higher risk than older adults. Mostly patients present with, severe, persistent headache, blurred vision, chest pain, severe abdominal pain, leg swelling or unusual skin bruising and shortness of breath between 3 to 30 days following vaccination. However, the risk of developing blood clots is far higher from COVID-19 disease itself than from the presently available vaccines. Table-2 describes contra-indications for COVID-19 vaccination.

Table 2: Contra Indications for COVID-19 Vaccination

Absolute	Deferred Vaccinations for 4-12 weeks after recovery
Persons with history of: • Anaphylactic or allergic reaction to a previous dose of COVID-19 vaccine. • Immediate or delayed-onset anaphylaxis or allergic reaction to vaccines or injectable therapies, pharmaceutical products, food-items etc. (check the compositions of the individual vaccines)	• Persons having active symptoms of SARS-CoV-2 infection. • SARS-CoV-2 patients who have been given anti-SARS-CoV-2 monoclonal antibodies or convalescent plasma. • Acutely unwell and hospitalized (with or without intensive care) patients due to any illness.

4.4 Vaccines for Special Groups (Children, Pregnant & Nursing Mothers)

WHO's Strategic Advisory Group of Experts (SAGE) has concluded that the Pfizer/ Bio NTech vaccine is suitable for use by people aged 12 years and above. Children aged between 12 and 15 who are at high risk may be offered this vaccine alongside other priority groups for vaccination. Vaccine trials for children are ongoing and WHO will update its recommendations when the evidence or epidemiological situation warrants a change in policy. However more evidence is needed on the use of the different COVID-19 vaccines in children's to be able to make general recommendations on vaccinating children against COVID-19. However, it is very important for children to continue to have the recommended childhood vaccines as per National Immunization Programme Schedule.

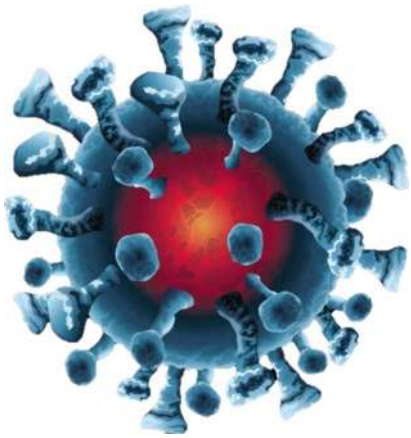
Considering the Benefit v/s Risk assessment in the local epidemiological context, the Ministry of Health & Family Welfare in India (MoHFW) has approved vaccination of pregnant women against COVID-19 with the conditions , that the pregnant women may be informed about the risks of exposure to COVID-19 infection along with the risks and benefits associated with the COVID-19 vaccines available in the country , hence based on the information provided, a pregnant woman will have the choice to take the vaccination.

A pregnant woman who opts for vaccination, could be vaccinated at any time of the pregnancy, however consent needs to be taken considering current limitations of safety data in pregnant women.

There is no need of pregnancy testing prior to vaccination or delaying pregnancy or terminating pregnancy because of vaccination. Further there is no need for discontinuation of breastfeeding after vaccination.

For the rest of the adult and high-risk population's group Pneumococcal vaccine, Seasonal Flu, Haemophilus influenza type B (Hib), Hepatitis B vaccines should be given as per the schedule.

4.5 COVID-19 Vaccinations: Hesitancy, Myths and Facts



As per the recent Survey the top five reasons for not taking vaccine in India includes "waiting for others to get it first" (42%), "other people need it more than me" (35%), "fear of any side-effects" (34%), "vaccines won't work (i.e., efficacy issues)" (21%) and "don't believe in the vaccine" (11%). Contrary to popular perception, the proportion of people choosing "high price of vaccines" and "religious belief" as reasons to opt-out, remains very minuscule. Certain Group of individuals also stated that they are waiting for the arrival / approval of newer vaccines of some foreign manufactures like Johnson & Johnson, Moderna and Pfizer etc in India.

Other rumours about infertility and death after taking the vaccine, combined with the inconvenience of registration/booking slots, low-risk perception for getting COVID-19 disease and the absence of incentives for rural and urban poor (one- or two-days wage loss on account of vaccinations and its side effects) etc., were also fuelling high vaccine hesitancy.

Some Myths and Facts are being clarified as under:

- Can the COVID-19 vaccine cause a positive test result for the disease, such as for a RT-PCR or antigen test?

  No, the COVID-19 vaccine will not cause a positive test result for a COVID-19 RT-PCR or antigen laboratory test. This is because the tests check for active disease and not whether an individual is immune or not. However, because the COVID-19 vaccine prompts an immune response, it may be possible to test positive in an antibody (serology) test that measures COVID-19 immunity in an individual.

- Should individual be vaccinated if they have had COVID-19?

  Even if the individuals already had COVID-19, then they should be vaccinated as per the current guidelines, as the protection that someone gains from having COVID-19 will vary from person to person, and we also don't know how long natural immunity might last.

- Is it possible that someone vaccinated against COVID-19 will still get infected?

  While COVID-19 vaccines have high levels of efficacy, especially against hospitalization and severe disease, no vaccine is 100% protective. As a result, there will be some small percentage of vaccinated people who fall ill with COVID-19 in spite of being vaccinated.

  For the first 14 days after getting vaccinated, the individuals shall not have significant levels of protection as the antibodies increases gradually. For a single dose vaccine, protection is generally considered to occur by two weeks after vaccination. For two-dose vaccines, both doses are needed to achieve the highest level of immunity possible. Adequate immune response takes 2-3 weeks after completion of entire vaccination schedule. Further Longevity of the immune response in vaccinated individuals is yet to be determined.

- Should women who are on their periods take the COVID-19 vaccine?

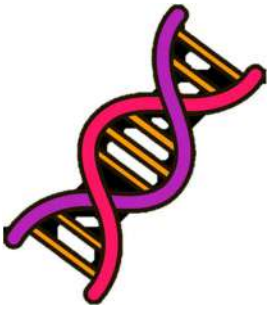
  Women can receive a vaccine at any point in their menstrual cycle.

- Does having side effects mean that the vaccine is working? What does no side effects mean?

  The vaccine stimulates the immune system to protect the individuals from the virus. This immunity process can sometimes cause side effects like fever, chills or headache, however not everyone experiences this. The presence or magnitude of the reaction the individual having after vaccination does not predict or reflect the immune response to the vaccine. Hence it is not necessary to have side effects in order to prove that the individual is protected.

  In addition to a vaccine's specific characteristics, several factors such as a person's age, their underlying health conditions, previous COVID-19 disease, current exposure to SARS-CoV-2, or the circulation of virus variants may have an impact on a vaccine's effectiveness. We still do not know how long immunity from different COVID-19 vaccines will last in the vaccinated person.

4.6 COVID-19 Vaccination: Future



DNA vaccines:

It is built on Plasmid DNA platforms and have many advantages, such as targeting and stimulating both humoral and cellular immune responses. It is three dose vaccines and claims that it is safe for children above age of 12 years. The ZyCoV-D vaccine

developed by Zydus Cadila, at Ahmedabad Vaccine Technology Centre is a needle-free vaccine administered using PharmaJet, a needle-free applicator, which ensures painless intradermal vaccine delivery. It is being claimed that this vaccine is 66.6% effective against symptomatic coronavirus cases and 100% for moderate COVID-19.

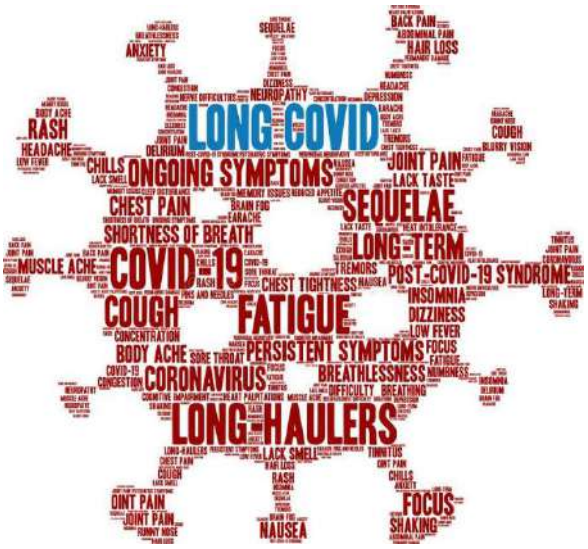
4.7 Summary

Administer whatever vaccine is available at our centre and ensure to vaccinate even the individuals who already had COVID-19. Although no vaccine is 100% protective but whatever approved COVID-19 vaccines are available provides a high degree of protection against getting seriously ill, suffering from long COVID Syndrome's and dying from the severe illness caused by the disease, provide some protection for the very close contacts and community by reducing rate of transmission, and can reduce the risk of severe disease from some variant strains. Research is underway to understand more side effects and make them as less as possible.

Chapter 5

POST COVID SEQUELAE

5.1 Introduction



Most people who have coronavirus disease (COVID-19) recover completely within a few weeks. But some people, even those who had mild versions of the disease, continue to experience symptoms after their initial recovery.

Severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) is the pathogen responsible for the corona virus disease, 2019 (COVID-19) pandemic, which has resulted in global healthcare crises and strained health resources. As the population of patients recovering from COVID-19 grows, it is paramount to establish an understanding of the healthcare issues surrounding them. COVID-19 is now recognized as a multi-organ disease with a broad spectrum of manifestations. Similar to post-acute viral syndromes described in survivors of other virulent coronavirus epidemics, there are increasing reports of persistent and prolonged ill effects after acute COVID-19. Patient advocacy groups, many members of which identify themselves as long haulers, have helped contribute to the recognition of post-acute COVID-19, a syndrome characterized by persistent symptoms and/or delayed or long-term complications beyond 4 weeks from the onset of symptoms.

Severe acute respiratory syndrome due to corona virus 2 (SARS-CoV-2) has caused unprecedented scale of morbidity and mortality in the entire world. Scientific and clinical evidence is evolving on the subacute and long-term effects of COVID-19, which can affect multiple organ systems. Early reports suggest residual effects of SARS-CoV-2 infection, such as fatigue, dyspnoea, chest pain, cognitive disturbances, arthralgia and decline in quality of life. Cellular damage, a robust innate immune response with inflammatory cytokine production, and a pro-coagulant state induced by SARS-CoV-2 infection may contribute to these sequelae. Survivors of previous corona virus infections, including the SARS epidemic of 2003 and the Middle East respiratory syndrome (MERS) outbreak of 2012, have demonstrated a similar constellation of persistent symptoms, reinforcing concern for clinically significant sequelae for COVID-19 too.

5.2 Immediate Complications

Immediate complications of COVID -19 patient are observed as below:

- Acute Respiratory Failure, Pneumonia
- Acute Respiratory Distress Syndrome (ARDS), Acute Liver Injury
- Acute Cardiac Injury, Secondary Infection, Acute Kidney Injury, Septic Shock
- Disseminated Intravascular Coagulation, Blood Clots
- Rhabdomyolysis

Till date, the most commonly reported persisting symptoms includes:

- Dyspnea or increased respiratory effort, Fatigue, Post-exertional malaise and/or poor endurance.
- "Brain fog," or cognitive impairment, Cough, Chest pain, Headache.
- Palpitations and/or tachycardia, Arthralgia, Myalgia, Paraesthesia, abdominal pain.
- Diarrhoea, Insomnia and other sleep difficulties, Fever, Light headedness.
- Impaired daily function and mobility, chest Pain, Skin Rashes (e.g., urticarial), Mood changes
- Anosmia or dysgeusia, menstrual cycle irregularities.

* Post-exertional malaise (PEM) is the worsening of symptoms following even minor physical or mental exertion, with symptoms typically worsening 12 to 48 hours after activity and lasting for days or even weeks.

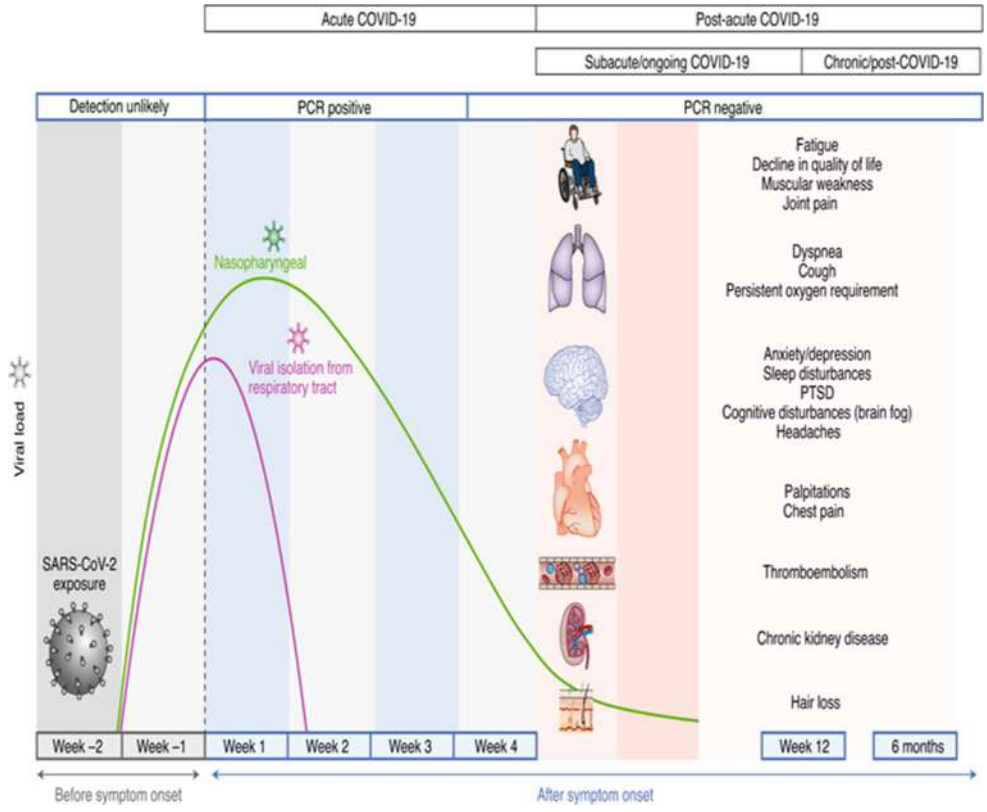


Figure 6: Immediate and persistent symptoms of COVID

Acute COVID-19 usually lasts until 4 weeks from the onset of symptoms, beyond which replication-competent SARS-CoV-2 has not been isolated. Post-acute COVID-19 is defined as persistent symptoms and/or delayed or long-term complications beyond 4 weeks from the onset of symptoms. The common symptoms observed in post-acute COVID-19 are summarized in Figure 6 above.

While the definition of the post-acute COVID-19 timeline is evolving, it has been suggested to include persistence of symptoms or development of sequelae beyond 3 or 4 weeks from the onset of acute symptoms of COVID-19 as replication-competent SARS-CoV-2 has not been isolated after 3 weeks. There are two types of post-acute COVID-19 presentations, as persistent symptoms and/or delayed or long-term complications of SARS-CoV-2 infection beyond 4 weeks from the onset of symptoms. It is further divided into two categories: (1) subacute or ongoing symptomatic COVID-19, which includes symptoms and abnormalities present from 4–12 weeks beyond acute COVID-19; and (2) chronic or post-COVID-19 syndrome, which includes symptoms and abnormalities persisting or present beyond 12 weeks of the onset of acute COVID-19.

Multidisciplinary collaboration is essential to provide integrated outpatient care to survivors of acute COVID-19 at specialized COVID-19 OP clinics as shown in Figure 7.

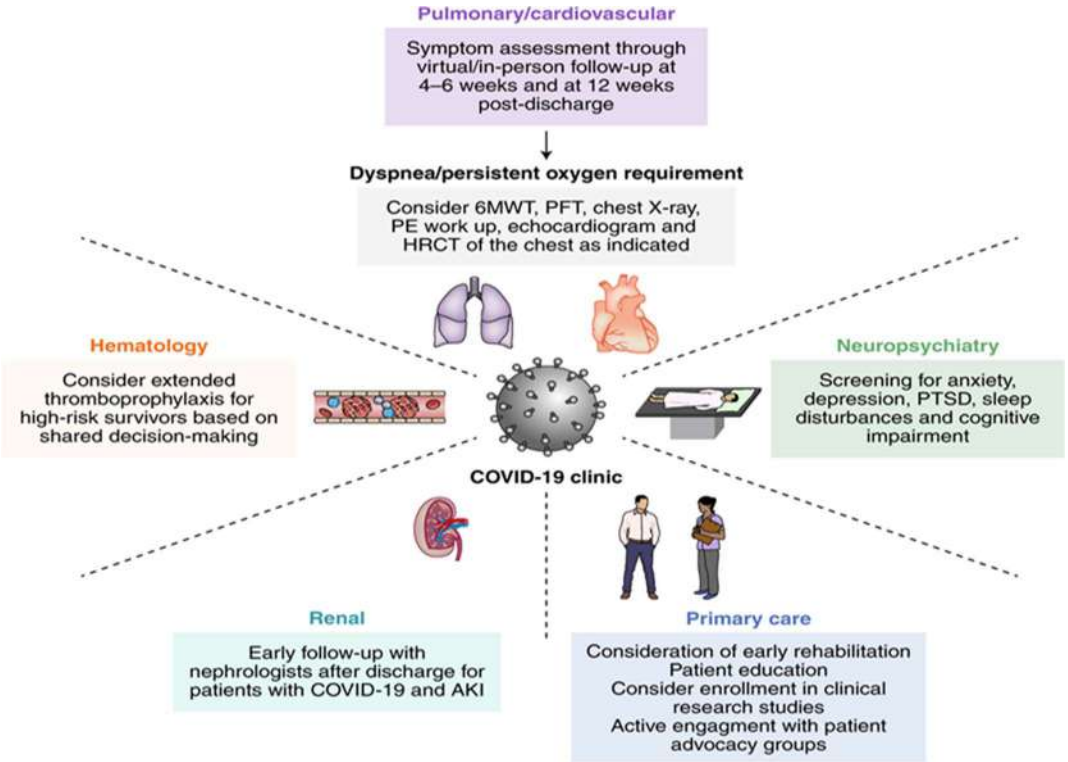


Figure 7: Management of COVID-19 at clinics

The most concerning complication which was seen to a great extent in Indian population is **Rhino-Orbital Mucormycosis** as discussed below:

There are increasing case reports of rhino-orbital mucormycosis in people with COVID-19, especially from India. Diabetes mellitus (DM) is an independent risk factor for both severe COVID-19 and mucormycosis.

Overall, 101 cases of mucormycosis in people with COVID-19 have been reported, of which 82 cases were from India and 19 from the rest of the world. Mucormycosis was predominantly seen in males (78.9%), both in people who were active (59.4%) or recovered (40.6%) from COVID-19. Pre-existing diabetes mellitus (DM) was present in 80% of cases, while concomitant diabetic ketoacidosis (DKA) was present in 14.9%. Corticosteroid intake for the treatment of COVID-19 was recorded in 76.3% of cases. Mucormycosis involving nose and sinuses (88.9%) was most common followed by rhino-orbital (56.7%). Mortality was noted in 30.7% of the cases.

The 1950 Smith and Krichnercriteria for the clinical diagnosis of mucormycosis are still considered to be gold standard and include:

(i) Black, necrotic turbinate's easily mistaken for dried, crusted blood,

(ii) Blood-tinged nasal discharge and facial pain, both on the same side,

(iii) Soft peri-orbital or peri-nasal swelling with discoloration and induration,

(iv) Ptosis of the eyelid, proptosis of the eyeball and complete ophthalmoplegia and

(v) Multiple cranial nerve palsies unrelated to documented lesions.

There appears to be a number of triggers that may precipitate mucormycosis in people with COVID-19 in relation to corticosteroids:

(i) Presence of DM with or without DKA increases the risk of contracting mucormycosis and DM is often associated with an increased severity of COVID-19,

(ii) Uncontrolled hyperglycemia and precipitation of DKA is often observed due to corticosteroid intake. Low pH due to acidosis is a fertile media for mucor spores to germinate. Moreover, steroid use reduces the phagocytic activity of WBC (both first line and second line defence mechanism), causes impairment of bronchoalveolar macrophages migration, ingestion, and phagolysosome fusion, making a diabetic patient exceptionally vulnerable to mucormycosis. COVID-19 often causes endothelialitis, endothelial damage, thrombosis, lymphopenia, and reduction in CD4+ and CD8+ T-cell level and thus predisposes to secondary or opportunistic fungal infection,

(iii) Free available iron is an ideal resource for mucormycosis. Hyperglycemia causes glycosylation of transferrin and ferritin, and reduces iron binding allowing increased free iron. Moreover, increase in cytokines in patients with COVID-19 especially interleukin-6, increases free iron by increasing ferritin levels due to increased synthesis and decreased iron transport. Furthermore, concomitant acidosis increases free iron by the same mechanism and additionally by reducing the ability of transferrin to chelate iron,

(iv) High glucose, low pH, free iron, and ketones in presence of decreased phagocytic activity of WBC, enhances the growth of mucor, coupled with several other shared risk factors including prolonged hospitalization with or without mechanical ventilators.

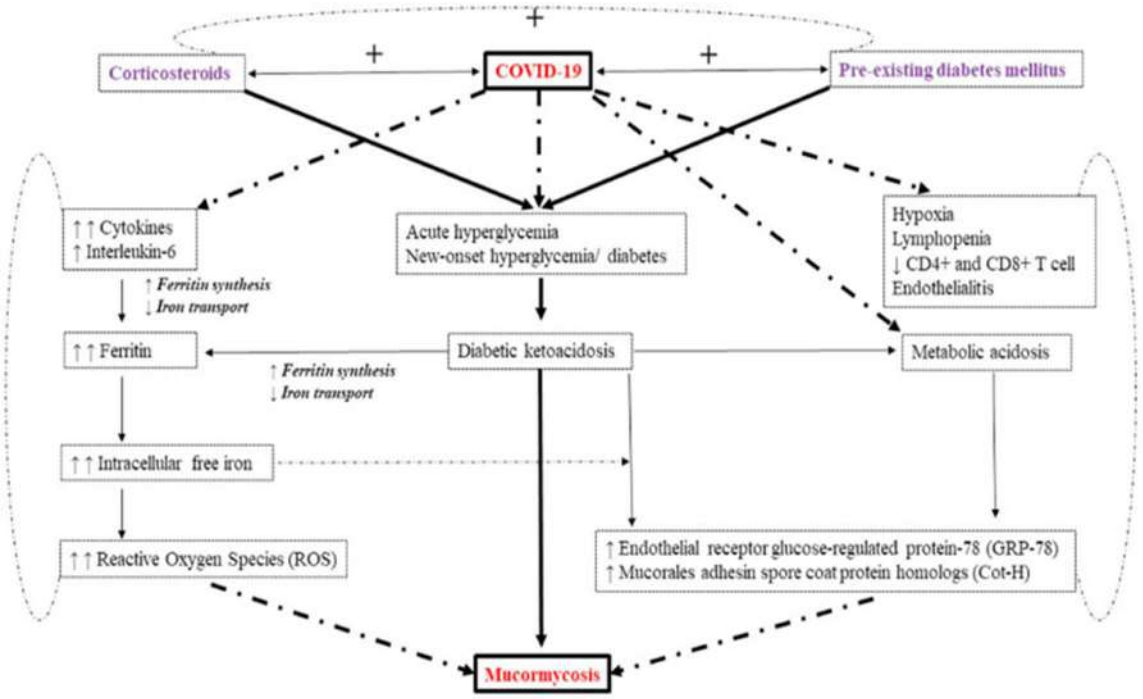


Figure 8: Correlation between COVID-19 and Diabetes

Figure 8 above shows the effect of COVID-19 for diabetic patients.

5.3 Late Complications & post-acute COVID-19 systemic involvement

Late complications and post-acute COVID-19 systemic involvement are discussed below:

Pulmonary

- Dyspnea, decreased exercise capacity and hypoxia are commonly persistent symptoms and signs.
- Reduced diffusion capacity, restrictive pulmonary physiology, and ground-glass opacities and fibrotic changes on imaging have been noted at follow-up.
- Assessment of progression or recovery of pulmonary disease and function may include home pulse oximetry, 6MWTs, PFTs, high-resolution computed tomography of the chest.
- Treatment with corticosteroids may be beneficial in a subset of patients with post-COVID inflammatory lung disease, as suggested by a preliminary observation of significant symptomatic and radiological improvement in COVID-19 survivors with organizing pneumonia at 6 weeks after hospital discharge.

Hematologic

- Thromboembolic events have been noted to be <5% in post-acute COVID-19. The duration of the hyperinflammatory state induced by infection with SARS-CoV-2 is unknown.

- Direct oral anticoagulants and low-molecular-weight heparin may be considered for extended thromboprophylaxis after risk–benefit discussion in patients with predisposing risk factors for immobility, persistently elevated d-dimer levels (greater than twice the upper limit of normal) and other high-risk comorbidities such as cancer.
- The role of antiplatelet agents such as aspirin as an alternative (or in conjunction with anticoagulation agents) for thromboprophylaxis in COVID-19 is under consideration.
- Physical activity and ambulation should be recommended to all patients early.

Cardiovascular

Persistent symptoms may include palpitations, dyspnea and chest pain. Long-term sequelae may include increased cardiometabolic demand, myocardial fibrosis or scarring, arrhythmias, tachycardia and autonomic dysfunction. Patients with cardiovascular complications during acute infection or those experiencing persistent cardiac symptoms may be monitored with serial clinical, echocardiogram and electrocardiogram follow-up.

Patients with postural orthostatic tachycardia syndrome and inappropriate sinus tachycardia may benefit from a low-dose beta blocker for heart rate management and reducing adrenergic activity. In patients with ventricular dysfunction, guideline-directed medical therapy should be initiated.

Neuropsychiatric

Persistent abnormalities may include fatigue, myalgia, headache, dysautonomia and cognitive impairment (brain fog). Anxiety, depression, sleep disturbances and Post Traumatic Stress Disorder (PTSD) have been reported in many of COVID-19 cases. The pathophysiology of neuropsychiatric complications is diverse and entails immune dysregulation, inflammation, microvascular thrombosis, and psychosocial impacts of infection. Neurologic complications such as headaches should be treated with imaging evaluation and referral to a specialist reserved for refractory headache.

Screening should be done to identify patients with anxiety, depression, sleep disturbances, PTSD, dysautonomia and fatigue and appropriate treatment should be started.

Renal

Resolution of Acute Renal Damage during acute COVID-19 occurs in the majority of patients; however, reduced eGFR has been reported at 6 months follow-up.

COVID-19 survivors with persistent impaired renal function may benefit from early and close follow-up.

Endocrine

Endocrine sequelae may include new or worsening control of existing diabetes mellitus, subacute thyroiditis and bone demineralization.

Patients with newly diagnosed diabetes in the absence of traditional risk factors for type 2 diabetes, or hyperthyroidism should undergo the appropriate laboratory testing and should be referred to endocrinology.

Gastrointestinal and Hepatobiliary

Prolonged viral faecal shedding can occur in COVID-19 even after negative nasopharyngeal swab testing.

COVID-19 has the potential to alter the gut microbiome, including enrichment of opportunistic organisms and depletion of beneficial commensals.

Dermatologic

Hair loss is the predominant symptom and has been reported in approximately 20% of COVID-19 survivors.

Pathophysiology

The predominant pathophysiologic mechanisms of acute COVID-19 include the following: direct viral toxicity; endothelial damage and microvascular injury; immune system dysregulation and stimulation of a hyperinflammatory state; hypercoagulability with resultant in situ thrombosis and macrothrombosis; and maladaptation of the angiotensin-converting enzyme 2 (ACE2) pathway. There is higher affinity of SARS-CoV-2 for ACE2 compared with SARS-CoV-1, which is probably due to differences in the receptor-binding domain of the spike protein that mediates contact with ACE2.

Potential mechanisms contributing to the pathophysiology of post-acute COVID-19 include: (1) virus-specific pathophysiologic changes; (2) immunologic aberrations and inflammatory damage in response to the acute infection; and (3) expected sequelae of post-critical illness. The pathophysiology of post-intensive care syndrome is multifactorial and has been proposed to involve microvascular ischemia and injury, immobility and metabolic alterations during critical illness

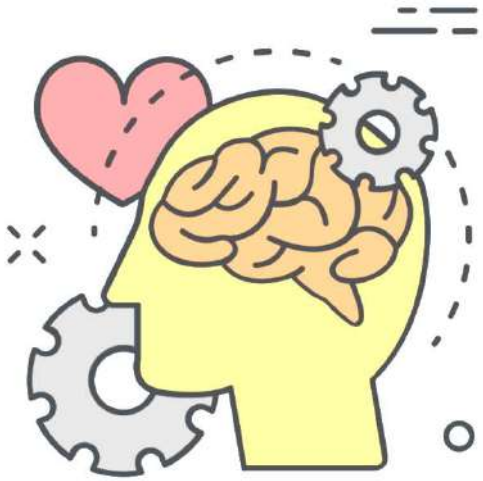
It is clear that care for patients with COVID-19 does not conclude at the time of hospital discharge, and interdisciplinary cooperation is needed for comprehensive care of these patient.

Chapter 6

PSYCHOLOGICAL IMPACT OF COVID 19

6.1 Introduction

As a result of the emergence of coronavirus disease 2019 (COVID-19) outbreak caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection in the Chinese city of Wuhan, a situation of socio-economic crisis and profound psychological distress rapidly occurred worldwide.



Various psychological problems and important consequences in terms of mental health including stress, anxiety, depression, frustration, uncertainty during COVID-19 outbreak emerged progressively.

The new realities of working from home, temporary unemployment, home-schooling of children, and lack of physical contact with other family members, friends and colleagues have taken time to get used to.

6.2 Psychological Reactions in the General Population

Existing evidence clearly showed the most relevant and profound psychological impact of the outbreaks on the general population.

Although a specific and uncontrolled fears related to infection, pervasive anxiety, frustration and boredom, loneliness have been hypothesized to impair subjective wellbeing and quality of life. Resilience and enhanced social support are protective factors that may help with regard to lifestyle changes and re-adaptation mechanisms.

Most relevant psychological reactions to COVID-19 infection:

The most relevant psychological reactions to COVID-19 infection are outlined below

1. A specific and uncontrolled fears related to infection

   This is commonly one of the most frequent psychological reactions to pandemics. Several existing studies demonstrated that those who have been exposed to the risk of infection may develop pervasive fears about their health, worries to infect others and fear infecting family members.

2. Pervasive anxiety

   Social isolation related to restrictions and lockdown measures are linked to feelings of uncertainty for the future, fear of new and unknown infective agents resulting in abnormally increased anxiety.

3. Frustration and boredom

   Distress, boredom, social isolation and frustration are directly related to confinement, abnormally reduced social/physical contact with others, and loss of usual habits.

4. Disabling loneliness

   The final effect of social isolation is pervasive loneliness and boredom, which have potential dramatic effects on both physical and mental individual well-being.

   Pervasive loneliness may be significantly associated with increased depression and suicidal behaviour. Unfortunately, the isolation is progressively enhanced by anxiety, panic or collective hysteria.

6.3 Psychological Impact of COVID-19 amongst children

During childhood, sound mental health is as important as physical health for achieving developmental milestones. It helps children with their emotional wellbeing and social skills.

The COVID-19 pandemic brought a complex array of challenges which had mental health repercussions for everyone, including children and adolescents. Grief, fear, uncertainty, social isolation, increased screen time, and parental fatigue have negatively affected the mental health of children. Friendships and family support are strong stabilizing forces for children, but the COVID-19 pandemic has also disrupted them.

Parents and caregivers know their child the best. If they notice a sudden significant difference in their child's behaviour for more than a week, they must seek professional clinical help. Such behavioural symptoms change over time as the child grows:

1. In children younger than five years: thumb sucking, bedwetting, clinging to parents, sleep disturbances, loss of appetite, fear of the dark, regression in behaviour or withdrawal from interaction.
2. In children between 5 to 10 years old: irritability, aggressiveness, clinginess, nightmares, school avoidance, poor concentration, and withdrawal from activities and friends.
3. In adolescents between 10 to 19 years old: hyperactivity or fidgeting, sleeping, and eating disturbances, agitation, increased conflicts, physical complaints, delinquent behaviour, and poor concentration.

In these challenging times, make sure to create an environment of positivity at home to try to make children feel happy and relaxed.

"Take care of yourself too - because if you are happy, your family will be happy"

6.4 Psychological Impact of COVID 19 amongst Students

The COVID-19 pandemic and lockdown haven't been kind to our student population. They are amongst the worst hit emotionally. As per the studies conducted, College students experienced a significant increase in their stress levels and severe deterioration in their emotions of anger, anxiety, loneliness, hopelessness, and happiness. Some of the issues pertaining to COVID-19 cases are discussed below:

1. **Relationship issues**

   The pandemic has tested many young relationships. Partners were unexpectedly separated from each other. For many, it led to breakups.

2. **Low confidence and self-esteem**

   Many were left anxious and worried about the impact the pandemic would have on their career prospects and placements.

3. **Loss of work-life balance**

   Many students found themselves either not focusing enough on their academic work or focusing so much that it seemed to consume other aspects of their lives.

6.5 Psychological Impact of COVID 19 amongst House Wives

Majority housewives become a victim of their husband's anger and frustrations. All these episodes, even if they occur just once, leave a dark and negative imprint on the mind of a woman. Many working women who were tied up at home during the COVID phase were also facing the same issues as those women who were not working and were totally dedicated to their households. In addition, the newly married women also faced the many issues because of which their relationships suffered from crisis.

6.6 Psychological Impact of COVID 19 amongst Health Care Workers

Most people working in health care emergencies are likely to experience some stress. Some of them may experience distress to the point of not being able to carry on.

The commonest disabling mental health issue experienced by personnel in the front-line of any pandemic is "burnout". Described classically as a triad of emotional exhaustion, depersonalization (loss of one's empathy, caring, and compassion), and a decreased sense of accomplishment.

Risk factors for burnout are:

- Long working hours
- Worry about risk to self and family
- Concerns about inadequate personal protection materials
- Separation from family/loved ones

Steps taken to reduce stress of the Health Care Workers at various DAE units

- ✓ Provided trainings to Health care Staff to deal with COVID 19 cases
- ✓ Good quality PPEs were made available to all class of Health Care Workers
- ✓ Mix and match policy for duty to ensure that Junior staff will work with their senior colleague with job rotation
- ✓ Flexible working schedules with proper work off are opted
- ✓ Appreciation from Team leader and Management worked as motivational force
- ✓ Proper care of families of Health care workers are ensured, in case of the staff opted to stay away from the family during their COVID duty
- ✓ Proper arrangement of the Accommodation/food etc was ensured
- ✓ Good Medical treatment facilities was arranged for self and their family members in case they suffered from COVID
- ✓ 100 percent vaccination was done to all Health Care Workers (HCW) during first phase of vaccination itself
- ✓ All these facilities were extended to contract HCW also
- ✓ Good communication and counselling facilities are provided

Tips and advice:

- ❖ **Keep informed -** Listen to advice and recommendations from your national and local authorities. Follow trusted news channels, such as local and national TV and radio, and keep up to date with the latest news.
- ❖ **Have a routine** - Keep up with daily routines as far as possible or make new ones.
    - Get up and go to bed at similar times every day.
    - Keep up with personal hygiene.
    - Eat healthy meals at regular times.
    - Exercise regularly.
    - Allocate time for working and time for resting.
    - Make time for doing things you enjoy.
- ❖ **Minimize newsfeeds -** Try to reduce how much you watch, read or listen to news that makes you feel anxious or distressed. Seek the latest information at specific times of the day, once or twice a day if needed.
- ❖ **Social contact is important** - If your movements are restricted, keep in regular contact with people close to you by telephone and online channels.
- ❖ **Alcohol and drug use** - Limit the amount of alcohol you drink or don't drink alcohol at all. Don't start drinking alcohol if you have not drunk alcohol before. Avoid using

alcohol and drugs as a way of dealing with fear, anxiety, boredom and social isolation.

- **Screen time** - Be aware of how much time you spend in front of a screen every day. Make sure that you take regular breaks from on-screen activities.
- **Video games** - While video games can be a way to relax, it can be tempting to spend much more time on them than usual when at home for long periods. Be sure to keep the right balance with off-line activities in your daily routine.
- **Social media** - Use your social media accounts to promote positive and hopeful stories. Correct misinformation wherever you see it.
- **Help others** - If you are able to, offer support to people in your community who may need it, such as helping them with food shopping.
- **Support health workers** - Take opportunities online or through your community to thank your country's health-care workers and all those working to respond to COVID-19.
- **Don't discriminate** - Be kind. Don't discriminate against people because of your fears of the spread of COVID-19. Don't discriminate against people who you think may have coronavirus. Don't discriminate against health workers. Health workers deserve our respect and gratitude.

If you are a parent

In times of stress, it is common for children to seek more of your attention.

What you can do:

- Maintain familiar routines as much as possible, or create new ones, especially if you must stay at home.
- Discuss the new coronavirus with your children in an honest way, using age-appropriate language.
- Support your children with at-home learning and make sure time is set aside for play.
- Help children find positive ways to express feelings such as fear and sadness. Sometimes engaging in a creative activity, such as playing or drawing, can help you with this process.
- Help children stay in contact with friends and family members through telephone and online channels.
- Make sure that your children have time away from screens every day and spend time doing off-line activities together. Do something creative: draw a picture,

write a poem, build something. Bake a cake. Sing or dance, or play in your garden, if you have one.

- Try and ensure that your children do not spend significantly more time than usual on video games.

If you are an older adult

- Keep in regular contact with loved ones, for example by telephone, e-mail, social media or video conference.
- Keep regular routines and schedules as much as possible for eating, sleeping, and activities you enjoy.
- Learn simple daily physical exercises to do at home when in quarantine so you can maintain mobility.
- Find out how to get practical help if needed, like calling a taxi, having food delivered or asking for medical care. Make sure you have a one-month supply or longer of your regular medicines. Ask family members, friends or neighbours for support, if needed.

If you have a mental health condition

- If you are being treated for a mental health condition, make sure that you continue to take medication as prescribed, and that you have a way of re-stocking your medication.
- Keep in touch with people who care for you and know who you can contact for support if your mental health declines

Chapter 7

HOSPITAL EXPERIENCES

7.1 Introduction

"COVID-THE AWAKENING" will be the appropriate term for the Corona Virus which shook the world during the years 2020 and 2021. COVID pandemic made us to realize the importance of health care workers (COVID warriors) and also the hidden knowledge of medicine from the beginning of the ancient traditional methods to the latest scientific medical treatment. The COVID pandemic was a massive challenge for the medical fraternity and also the government of different countries. The spreading of the Corona Virus diseases was so rapid that certain countries were unable to recover from the huge loss of lives (fatalities) and economy. Since COVID-19 is a new viral disease (SARS-CoV-2), there were no literature, information and treatment protocols. Therefore, all sorts of treatment with various permutations and combinations were used to treat the patients.

7.2 Challenges faced by the Medical Staff

Health care workers are at high risk of getting infected with COVID-19 infection.

1. Direct contact with patients

   The medical staffs are the first people to come in close contact with patients with COVID-19 in the hospital without PPE (except masks) and before testing.

2. Usage of PPE kits

   Medical staff cannot use PPE kit all the time during the working hours. Because there are protocols that when we should use PPE kit, mask and sanitisers.

3. Inability to differentiate COVID patients from other patients

   Medical staff cannot differentiate COVID patients from other patients without RT-PCR testing. Even though fever cases were treated separately, patient who does not have fever mingle with other people in the hospital.

4. Quarantine Facilities

   Initially all primary contacts were also quarantined, therefore every time when one patient becomes positive, the treated medical staff should be kept in quarantine which was causing much trouble to staff and also to the medical section.

   There were no proper quarantine facilities for the medical staff to get quarantined.

5. Quarantine Rules

   Quarantine rules had been changing every time, therefore maintaining the rules and regulation had been very tough. Even the quarantine facilities like Normal Hotel quarantine, home quarantine and Institutional quarantine have been changed frequently.

6. Contact with Family members

   Health workers are also amplifiers of outbreak, therefore after every duty, they should remain isolated or they should get tested and wait for the results. Home quarantine rule should be followed. Children at home are also at high risk of infection.

7. Supply of Masks

   Availability of masks during the lockdown & peak period was very less; therefore, lot of hard work should be done to procure the masks. Different type of masks should be used for different situations. Shortage of N95 mask was causing trouble to medical staff.

8. Supply of Sanitisers

   Adequate stock of sanitisers was not there during the lockdown periods. Sanitisers were prepared in Material Testing Laboratories (MTL) and supplied to all sections regularly.

9. Shortage of manpower due to Quarantine and travel restrictions

   Acute shortage of manpower happened regularly because of either quarantine of the medical staff or if they have travelled even to neighbouring districts. Manning the medical section round the clock was a Herculean task for the medical section.

10. Food facilities at work place (OHC-CHC)

    Since canteen was closed and even hotels have been closed, food for the medical staffs was not in place and hygiene of food was also at risk. Therefore, Occupational Health Centres (OHC) and Colony Health Centres (CHC) faced difficulties in arranging food during pandemic.

11. Procurement of Medical equipment.

    Challenges were faced to procure following medical equipment during pandemic

    i. IR Thermometers were to be procured, since there was demand for IR thermometers, getting at right time and right numbers was very tough.

    ii. Sanitisers: Shortage have been reported regularly, because of frequent usage and spillage also.

    iii. Oxygen cylinders: Though oxygen cylinders were available in OHC & CHC; but refilling the cylinders was not feasible & causing hardship.

iv. Pulse Oxymeters: Pulse Oxymeter were procured with much difficulty initially and later it was adequately available.

7.3 Challenges faced by Employees

1. **Lack of knowledge about COVID-19 -** Though employees get information from electronic media which sometimes are not authentic and also misleading. Therefore, employees don't have a clear-cut clarity about COVID-19.
2. **Phobia of Corona virus -** Because of the media fear and COVID phobia, people with any symptoms suspect themselves as COVID and become panic.
3. **Fear of Quarantine (Non-reporting of patients) -** There are many patients whom with typical COVID symptoms do not report to hospital because of testing quarantine fear and restrictions.
4. **Usage of Masks -** Using the mask itself is a huge task for employees such as when to use, where to wear, which type of mask they have to wear & in which place they have to use etc.
5. **Travel restrictions -** The travel restrictions and quarantine have made employees very difficult to visit their native place, attend sick or death of their family members and other important occasions.
6. **Food facilities at site -** Due to closure of canteen and gathering, employees were facing problem in getting food to work place.
7. **Hesitation to get vaccinated -** Due to myths and fear, employees were initially hesitated to get vaccinated and also, they were not convinced because the vaccine was new to them.
8. **Psychological factors – family -** Taking care of their elderly people (parents), spouse and children at home during lockdown was really depressing for the employees.
9. **Difficulty in getting regular medicines -** It was difficult task for employees whose parents are patients with co-morbid conditions to get their regular medicines. (Fear of contact of disease if they visit hospital).
10. **Recreational restrictions -** Employees cannot do their regular exercise at common facilities, because of lockdown & closure of public facilities. Even indoor games were not allowed.

7.4 Overcoming the Challenges

1. Awareness

   Simple and clear posters were circulated regarding dos and don'ts to the residents of DAE units.

2. Vacant Quarters

   Empty quarters are converted as quarantine facilities for isolated cases (1 case in a family). If empty quarters are available in the same block where the patient resides, it is allotted to particular patients, so that he or she can receive food & treatment from their family members.

3. Home Quarantine

   Home itself were used as quarantine facility as well as observation centre, if a whole family is to be quarantined or for COVID treatment. Medicines are supplied to their resident and regularly monitored. If they develop any complication, they will be shifted to COVID facilities.

4. CISF Empty barracks

   CISF non used barracks were also used as quarantine facilities as well as observation centres. Medicines are supplied to them through their representatives from CISF.

5. Daily Telephonic Counselling

   i. Quarantine: Persons who are quarantined were monitored daily by telephonic conversation and counselling. They are advised to inform if they develop any symptoms.

   ii. Out patients: COVID patients who are on treatment at home were regularly contacted through phone by health staffs & treated accordingly.

   iii. Inpatients: Patients who are admitted at COVID centres were monitored by contacting the hospital authorities as well as patient attenders.

6. Fever Clinics

   Fever clinics were regularly conducted at township areas. State medical authorities were called for RT-PCR testing for symptomatic patients as well as primary contacts. All State Government protocols have been followed.

7. Volunteers

   Volunteers were nominated for each block, so that they will get the food materials and medicines to the patient's residence.

8. Food Facilities

   Parcel system was introduced in canteen and Guest houses, thereby providing food to their doorsteps during the crisis period.

9. Vaccination Camps

   All medical staffs were vaccinated first because they are the frontline workers (COVID Warriors). First, persons aged above 60 years and persons with co-morbid conditions were vaccinated. Later above 45 years and below 45 with co-morbid conditions were vaccinated. Recently all above 18 years were vaccinated. Vaccination camps have been conducted at DAE Facilities Township. As on date most of the DAE employees and their dependents were vaccinated. Even contract employees have been vaccinated as far as possible. Vaccine drive is still going on.

10. Masks

    Masks were procured and supplied to all medical staffs. Cloth masks were distributed to all employees & CISF.

11. Sanitisers

    Sanitisers were prepared in MTL section at DAE facilities and regularly distributed to all sections & also placed in all common places. Leg operated sanitiser stands were placed at all vantage points.

12. Daily reporting

    Daily reporting and updating of cases were done regularly. Various data and vaccine documentation were done daily. Daily reports were sent to head Quarters.

13. Co-ordination with State Government Health authorities

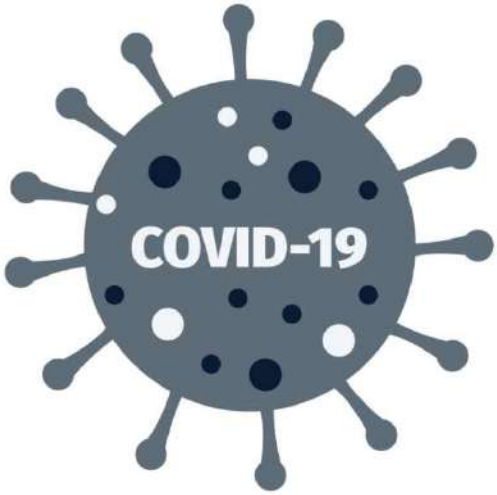
    Fever clinics, contact tracing and Vaccine camps conducted with the co-ordination of State Government Health authorities. All state government organisation were followed up regularly and updated accordingly.

14. Team Work

    Medical Section along with other sections unitedly worked together during the COVID pandemic crisis for the welfare of our people and mankind. All staffs of medical section worked tirelessly during the emergencies and crucial period. The co-operation and dedication of medical section to fight COVID-19 will continue till the COVID pandemic ends.

Chapter 8

CONCLUSION



COVID-19 continues to make its effects felt across the world. To remain safe and healthy, taking precautions is the only weapon we have in hand as one can easily get and give the infection. COVID-19 spread is also emotionally challenging for all sections of society including employers and employees. Everyone should play a role to protect themselves and each other and help prevent further spread of the disease. As we witness this pandemic, we have clearly realised that no health system in the world is capable of dealing a surge of this magnitude. Adopting the crisis standard of care is the only way to conserve resources, do best for the most of time is now.

As we continue to evolve and wade through various phases of lockdown, it has resulted in a lot of insights for both the employees and employers. This include higher adoption of technology solutions, adoptability and flexibility, investment on building skills and capability and numerous ways of maintain our resilience, this is a laudable effort for all of us.

We should promote a culture of use of masks covering the nose and mouth properly, frequent cleaning of hands, avoiding physical contact with other persons, social distancing, regular cleaning and disinfecting the surfaces of desks and workstations door handles, telephones, keyboards and work tools & regular disinfect common areas such as sanitary facilities and elevators.

It is predicted that we have to live with the virus for a long time. Hence, these measures will help the organizations over a long period, to control infections and ensure availability of personnel for productive works. Also, valuable time and money can be saved by adopting the above procedures.

In these times of crisis, nobody can deny the important role played by the health care professionals in controlling and minimizing the ill effects of COVID virus. These frontline workers braced against all odds and were at the forefront to carry out critical health care management in spite of knowing the risk of exposure. As we saw in the media, they have stayed for days together in the hospitals, wore all PPE bearing the inconvenience caused even to attend nature calls for the sake of protecting the humanity. Apart from treatment, education and counselling was done to the affected persons to engage them and keep motivated so that they can recover fast by following the procedures. Dispelling the notions about vaccination also was another important

role carried out efficiently by the doctors. As the saying goes, 'Vaidyo Narayana Hari', they were Gods to the affected people.

The COVID-19 pandemic in India is a part of the worldwide pandemic of Coronavirus disease 2019 (COVID-19) caused by Severe Acute Respiratory Syndrome Corona virus 2 (SARS-CoV-2). As of August 2021, according to official figures, India has the second-highest number of confirmed cases in the world (after the United States) with 32.2 million reported cases of COVID-19 infection and the third-highest number of COVID-19 deaths (after the United States and Brazil) at 432,079 deaths. However, these figures exhibit severe under-reporting.

The first cases of COVID-19 in India were reported on 30th January 2020 in three towns of Kerala, among three Indian medical students who had returned from Wuhan, the epicentre of the pandemic. Lockdowns were announced in Kerala on 23rd March and in the rest of the country on 25th March. On 10th June, India's recoveries exceeded active cases for the first time. Infection rates started to drop in September, along with the number of new and active cases. Daily cases peaked mid-September with over 90,000 cases reported per-day, dropping to below 15,000 in January 2021.

A second wave beginning in March 2021 was much more devastating than the first, with shortages of vaccines, hospital beds, oxygen cylinders and other medical supplies in parts of the country. By late April, India led the world in new and active cases. On 30th April 2021, it became the first country to report over 400,000 new cases in a 24-hour period. Experts stated that the virus may reach an endemic stage in India rather than completely disappear.

India began its vaccination programme on 16th January 2021 with AstraZeneca vaccine (Covishield) and the indigenous Covaxin. Later, Sputnik V and the Moderna vaccine were approved for emergency use too. As of August 2021, the country had administered over 550 million vaccine doses.

Multiple factors have been proposed to have potentially contributed to the sudden spike in cases, including highly-infectious variants, a lack of preparations as temporary hospitals were often dismantled after cases started to decline, and new facilities were not built, and health and safety precautions being poorly-implemented or enforced during weddings, festivals, etc., which was linked to numerous positive cases, sporting events such as IPL, state and local elections held in several states.

An economic slowdown put pressure on the government to lift restrictions, and there had been a feeling of exceptionalism based on the hope that India's young population and childhood immunization scheme would blunt the impact of the virus. Models may have underestimated projected cases and deaths due to the under-reporting of cases in the country.

The second wave placed a major strain on the healthcare system, including a shortage of liquid medical oxygen, logistic issues, and a lack of cryogenic tankers. A large number of new oxygen plants were announced; the installation burden being shared by the center, coordination with foreign countries with regard to oxygen plants received in the form of aid, and DRDO. A number of countries sent emergency aid to India in the form of oxygen supplies, medicines, raw material for vaccines and ventilators.

The number of new cases had begun to steadily drop by late-May; on 25th May 2021, the country reported 195,994 new cases; its lowest daily increase since 13th April 2021. However, the mortality rate has remained high. In May 2021, WHO declared that two variants first found in India will be referred to as 'Delta' and 'Kappa'.

On 25th August 2021, Soumya Swaminathan said that India "may be entering some kind of stage of endemicity where there is low level transmission or moderate level transmission going on" but nothing as severe as before. In other words, India is learning to live with the virus.

Therefore it may be concluded although the occupational health centres of DAE faced lots of challenges but they could successfully treat the employee and family members and able to reduce mortality and morbidity due to COVID-19 in timely manner and taking care of routine chronic illness, medical and surgical emergencies. Certifying surgeons/medical doctors of DAE units were able to achieve the periodic medical requirement for the DAE employees during pandemic. COVID-19 has given following opportunities during the pandemic situation:

- Mass vaccination drive for adults gave opportunity to DAE doctors to handle more-effectively and seamlessly.
- Reduction of non-communicable diseases, OPDs, ICU & IPD cases occurred due to more hygiene consciousness and handling of regular illness at home.
- Easing of arranging logistics (like PPE kits, sanitizers etc.) from the local resources.
- Infrastructure development to handle highly contagious infections like COVID.
- Learnt maximum healthcare with minimum infrastructure.
- Introduce concept of tele-medicines and video consultation at DAE facilities.

REFERENCES

1) US Vaccine Adverse Events Reporting System (VAERS), https://www.vaers.hhs.gov/, World Health organization/News Room, (2021).
2) Global Advisory Committee on Vaccine Safety (GACVS) review of latest evidence of rare adverse blood coagulation events with AstraZeneca COVID-19 Vaccine (Vaxzevria and Covishield) (2021).
3) Statement of the COVID-19 subcommittee of the WHO Global Advisory Committee on Vaccine Safety (GACVS) on safety signals related to the Johnson & Johnson/Janssen COVID-19 vaccine. World Health organization. (2021)
4) Medical Microbiology. 4th edition. Baron S, editor. Galveston (TX): University of Texas Medical Branch at Galveston. Galveston (TX): University of Texas Medical Branch at Galveston; ISBN-10: 0-9631172-1-1(1996).
5) Dong, E., Du, H. & Gardner, L. An interactive web-based dashboard to track COVID-19 in real time. Lancet Infect. Dis. 20, 533–534 (2020)
6) CAS Pub Med Central Google Scholar, https://www.nature.com/articles/s41579-020-00459-7 (2020).
7) Gupta, A. et al. Extrapulmonary manifestations of COVID-19. Nat. Med. 26, 1017–1032 (2020).
8) Carfi, A., Bernabei, R., Landi, F. & Gemelli against COVID-19 Post-Acute Care Study Group. Persistent symptoms in patients after acute COVID-19. J. Am. Med. Assoc. 324, 603–605 (2020).
9) Tenforde, M. W. et al. Symptom duration and risk factors for delayed return to usual health among outpatients with COVID-19 in a multistate health care systems network—United States, March–June 2020. Morb. Mortal. Wkly Rep. 69, 993–998 (2020).
10) Huang, C. et al. 6-month consequences of COVID-19 in patients discharged from hospital: a cohort study. Lancet 397, 220–232 (2021).