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**Health and Population:
Perspectives and Issues**



आरोग्यम् सुखसम्पदा

राष्ट्रीय स्वास्थ्य एवं परिवार कल्याण संस्थान

स्वास्थ्य एवं परिवार कल्याण मंत्रालय, भारत सरकार के अंतर्गत एक स्वायत्तशासी निकाय

The National Institute of Health and Family Welfare

An autonomous organization, under the Ministry of health and Family Welfare, Government of India

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Editorial

Increasing Stress and Burnout among Health Care Providers during the COVID 19 Management: Challenges and Preventive Strategies

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Burnout is a syndrome characterized by high emotional exhaustion, high depersonalization (i.e., cynicism) and a low sense of personal accomplishment from work. It is known to be a major occupational problem among healthcare providers. In the wake of the unprecedented challenges created by the COVID-19 pandemic and the accompanying global public health emergency, the frontline health care providers (HCPs) are experiencing increased workload with an increasing number of confirmed cases; long periods of isolation from family; critical lack of psychosocial support; fears of transmitting the virus to family/others in addition to decreasing sleep and minimum required rest; progressively depleted workforce due to getting infected/isolation, incidents of stigma/discrimination/hostility; and shortage of personal equipment at certain times.

As they navigate these difficult challenges while continuing fulfilling their professional responsibilities, this has presented grave dilemmas for the HCPs ranging from balancing physical, mental and emotional needs to aligning patient needs with the needs of their own family along with the continuous care for severely sick patients.

It has become vital to recognize how the present workplace-related stress is increasingly affecting their mental and emotional wellbeing leading to burnout symptoms. The global research, focused to identify the impact of covid-19 on HCPs, reported considerable rates of depression anxiety, insomnia and non-specific symptoms of psychological distress among HCPs due to excess workload in providing health services. While these frontline providers are holding us together, supporting their well-being requires sustained attention at the national, state and institutional level. Thus, the need for adopting multipronged evidence-based approaches addressing burnout during this pandemic is crucial.

To prevent burnout through effective measures by ensuring the mental and emotional wellbeing of healthcare providers globally, we need interventions ranging from increasing the awareness of work-related stress and burnout, promoting mindfulness and self-care practices for promoting mental wellbeing. Ensuring optimal mental health services and interventions, revising organizational policies and practices, issues such as paucity of health care providers and constrained resources as the reasons of burnout are required to be addressed soon. The policymakers and practitioners should adopt such interventions and develop context-specific approaches promoting a healthy workplace and preventing burnout during the COVID-19 pandemic.

Violence against Frontline Health Care Warriors amid COVID-19 Pandemic and Its Impact on Their Psycho-Social Health

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Abstract

Physicians, nurses, and other frontline health-care workers are keeping the community together. These warriors have been celebrated in many countries, including India, as heroes for their work during the COVID-19 pandemic. But unfortunately, not everyone appreciates their efforts and contributions. As the corona virus spreads across the world from end 2019, health-care providers including physicians, nurses, paramedics, have been facing attacks, both physical and psychological due to the stigma and discrimination from the fearful and prejudiced people. The health system as a whole has been under extreme pressure. Experiencing such violence, stigma and discrimination has definitely taken a toll on the mental and emotional health of health care workers across the world. Though the Government agencies have acted swiftly with several measures to contain this violence, much more actions are required at the level of the civil society to protect the health-care personnel, our most valuable assets in our fight against the COVID-19 pandemic.

This unprecedented public health emergency of COVID-19 pandemic has shown that health facilities, medical transport, patients as well as health care workers and their families can become targets everywhere. This alarming trend emphasizes the need for improved measures to protect them from such acts of violence. Attacks on health care providers not only affect the psycho-social health of frontline workers in the health sector but also diminishes the ability of the health system to provide quality health care. This paper is a brief overview of violence against healthcare providers, how it has affected healthcare globally; and discusses the measures which can be taken to prevent such kinds of unwarranted incidents.

Key words: Workplace violence, Health care providers, Psycho-social health, legislation.

Introduction

Doctors have turned into soldiers these days. They have been going to work every single day, while the rest of the country has been in a state of lockdown since March 2020. Against all odds, they are adhering to their hypocrite oath and trying to serve the patients to the best of their abilities. Doctors are working non-stop often without protective gear. Their mental health is being pushed to the limit because they are afraid of going back home to families, worried that we may be carriers of Corona virus. But what has really broken their hearts in the past few days is the violence they have faced. Deeply disturbed by the number of attacks

on medical personnel by patients and their families, the government has to declare attacks on doctors a non-bailable offence. The pain behind this message resonates the mental and emotional trauma these circumstances are leading to for the doctors.

In January 2020, COVID – 19 outbreak was declared as a Public Health Emergency of International Concern (PHEIC) by World Health Organization (WHO). But later in March 2020, after the assessment, COVID – 19 was characterized as a pandemic¹. During the initial days of outbreak, government requested everyone to stay at home while the healthcare professionals fought this raging COVID – 19 pandemic on the front line. During this present unprecedented crisis, it's the healthcare providers (HCPs)– the main frontline warriors, struggling to hold the population together. Health workers, since the beginning, have been on the front line of the COVID-19 outbreak response and as such have been continuously exposed to hazards that put them at risk of infection. Hazards include pathogen exposure, long working hours, psychological distress, fatigue, occupational burnout, stigma, and physical and psychological violence. In spite of putting their life in danger to protect the world from this pandemic, and most unfortunately in some instances, these warriors are being seen as a threat, who are in fact the fire-fighters in the current crisis.

It is heartening to note the worth that is given to the frontline health care providers by the people, right from the top leadership of the country to the destitute and slum dwellers. When the Prime Minister of India appealed to the nation to applaud the health care providers and front line workers on 22 March 2020 and the social media covered a lot of footage of the people applauding across the country, at the same time, in several places, some people started attacking healthcare providers. The healthcare workers across the world are most susceptible to workplace violence but their concerns are the least discussed and deliberated upon. According to the World Health Organization, around 8 to 38 per cent of the healthcare workers suffer physical violence at some point in their careers². A study conducted by the Indian Medical Association had found that at least 75 per cent of the Indian doctors have faced some form of violence, 12 per cent of whom suffered some form of physical violence³.

On one side, the physicians, nurses, and other front-line health-care workers have been celebrated and applauded around the world, and tributes are pouring in amid the covid-19 pandemic for their relentless services as frontline workers. They have been saluted as heroes and given standing ovations in India as well. Unfortunately, the incidents of violence against healthcare workers have been reported from all parts of India, which has increased manifold during the COVID-19 outbreak, and most of these attacks are perpetrated when the healthcare workers are sent to collect samples of suspected COVID-19 patients. Since the beginning of this pandemic, stories of health-care personnel facing attacks as they travel to and from health-care facilities are being reported. Cases have been reported of people affected with COVID-19 attacking healthcare workers, sanitary workers and police who are in the frontline for the management of the outbreak. These frontline warriors are facing discrimination on account of heightened fear and misinformation about the infection. In some cases, those who recovered from COVID-19 also face such discrimination. Further, certain communities and areas are being labeled as harmful, purely based on false reports floating in the social media and elsewhere. The social stigma associated with COVID-19 public health emergencies seems to have caused fear and anxiety leading to prejudices against people and communities resulting in social isolation. Apart from hazardous risk of infection, anxiety and being separated from their families, they are also increasingly dealing with social ostracism, harassment, stigmatism and even assault. From across India, reports describe health-care workers being beaten, stoned, spat on, threatened, and evicted from their homes.

It is extremely unfortunate to see these incidents happening on daily basis and healthcare providers being attacked both physically and emotionally. There have been multiple cases across India, when healthcare professionals were evicted from their rented houses due to fear of Corona virus. Healthcare workers are paying a heavy price in this battle against COVID-19. Some of such instances are described below:

- A resident of AIIMS, Bhopal posted on his Facebook that he was assaulted one night by a policeman while he was returning home from emergency duty. According to the doctor, the policeman said that doctors were responsible for spreading the virus.
- In New Delhi, a middle-aged man attacked two doctors who had gone out to buy some fruits, after accusing them of spreading the virus⁴.
- A psychiatrist in Surat, found to her horror that her neighbours were not much better. When she came back from hospital to her apartment, a neighbour told her he was sure she had the virus. The next day, the same neighbour began shouting and tried to hit her⁵.
- A video of healthcare workers being pelted with stones as they were chased away from a locality went viral. This was from Indore, Madhya Pradesh. Of the five health workers, who were in the area to screen suspected COVID-19 patients, two women doctors suffered injuries⁶.
- On 1 April 2020, doctors were attacked by relatives of a COVID-19 patient in a southern Telangana hospital, after his death⁷.
- A disheartening incident took place in Chennai, when a 55 year old neurosurgeon, who died of corona virus while serving in the hospital, was later denied a proper burial of the body. Locals protested at the cemetery, pelted stones and attacked the ambulance which was carrying the body of the doctor for burial⁸.

An Unprecedented Global Catastrophe

Healthcare workers in India, are not the only targets who are facing these problems, There have been cases in other countries too. An increasing number of attacks against the healthcare providers, engaged in the pandemic response, are being reported worldwide from Mexico, Europe, the Middle East, the US, Latin America, Australia, Asia, the Pacific and Africa. In the Philippines, a nurse was reportedly attacked by men who poured bleach on his face, damaging his vision⁹.

There have been many acts of violence reported from New York, USA like slashing of tyres of vehicles, trashing the lobbies of hospitals as well as coughing and spitting on healthcare providers. Another similar act of violence occurred in Oklahoma University Medical Centre in Oklahoma City on 2 April, the reason behind which is expected to be that the suspect believed that the victims (nurses) were exposing others to the corona virus¹⁰.

In Philippines, a man in Quezon province allegedly shot an ambulance driver for the fear that the vehicle was going to spread the virus when it entered a subdivision. Days before this, a mob ganged up and threw bleach all over the face of a front-line worker, who was on his way to the hospital in Tacurong City in Sultan Kudarat to report for his duty. Two nurses in Cebu were refused entry in the condominium where they were staying after they told that they were nurses¹¹.

Consequences of Attacks on HCPs in the Present Scenario

Attacks on health care providers not only directly affect the ability of the health systems to deliver services but also take a heavy toll on the psycho-social health of patients, critical healthcare providers on the frontline and their families. Several causes have been reported/identified by various researchers for violence against the doctors. The outcome and the impact of such a violence which may be in the range of physical to verbal, may lead to burnout, stress and in extreme cases as the reason for turnover¹²⁻¹⁶.

A study conducted in Wuhan, China reported that how this COVID-19 pandemic is affecting the mental health of medical and nursing staff, and causing mental health disturbances (depression, anxiety, insomnia and distress). A study suggests that out of total participants, a considerable proportion had symptoms of depression (50.4%), anxiety (44.6%), insomnia (34%) and distress (71.5%)¹⁷. Another study from China suggested that 36.9 per cent of the medical staff had sub-threshold mental health disturbances, 34.4 per cent had mild disturbances, 22.4 per cent had moderate and 6.2 per cent had severe disturbances¹⁸.

It has also been already established that whenever there is violence against healthcare providers, it leads to burnout, emotional and psychosocial stress¹⁹. And workplace violence not only affects the psycho-social health of healthcare providers but also has financial impacts. These impacts have been divided into two: direct and indirect cost of workplace violence. Direct cost results from the subsequent litigation from the party or parties involved in the incidents of violence. Indirect cost is rather difficult to calculate due to challenge of quantifying the burden of indirect costs related to workplace violence. For example, the lost work days due to a violent event and lost wages lead to higher than average turnover, increased requests for medical leaves and stress related illnesses²⁰.

From these data, it can be concluded that how violence amid this pandemic is causing a double burden on mental health of HCPs. These incidents of abuse and assault lead to the further burden on the infrastructure, police and other protective agencies. In these circumstances, we are very concerned that this might lead to a devastating impact and long-lasting consequences on the mental health of the HCPs. Hopefully, we may come out of this COVID 19 pandemic but this violence during these hours of the time, is going to leave an imprint on the mental health of HCPs.

Prevention of Violence against HCP

There is an urgent need to counter such prejudices and to rise as a community by responding appropriately in the face of this adversity. All the responsible citizens need to understand that health workers deserve our support, praise and appreciation.

In India, the Union Cabinet approved the promulgation of an Ordinance to amend the Epidemic Disease Act, 1897 in the light of pandemic of COVID-19 to protect the health care providers and property during the epidemic. The amendment makes 'acts of violence' cognizable and non-bailable offences. Commission or abetment of such acts of violence shall be punished with imprisonment for a term of three months to five years, and with fine of Rs.50,000/- to Rs.2,00,000/-. In case of causing grievous hurt, imprisonment shall be for a term six months to seven years and with fine of Rs.1,00,000/- to Rs.5,00,000/-. In addition, the offender shall also be liable to pay compensation to the victim and twice the fair market value for damage of property²¹. As this amendment is in the Epidemic Disease Act, 1897, lone, so this punishment will be applicable during the epidemics only. Then what will happen to the perpetrators when this epidemic will be over, will they be allowed to attack the HCPs?

There is a need of a Central Law to check the violence against HCPs. Indian Medical Association demanded the same in 2019 after which a bill- “The Health Services Personnel and Clinical Establishments (Prohibition of Violence and Damage to Property) Bill, 2019” was drafted by the Health Ministry and put in public domain for feedback²². This bill was approved by the Law Ministry but the Home Ministry dismissed the need of a separate law to check violence against HCPs stating that there should be no specific law for a particular profession, and the IPC and CrPC are sufficient to deal with it²³.

Though the Indian Government is playing a very important role in providing protection to the HCPs by not only making laws against violence but also by taking measures to provide hospitals and other healthcare facilities a safer environment by better allocation of GDP in healthcare.

The government agencies also need to pay attention to improve the conditions of the Government hospitals and fill the vacant positions which will address the shortage of staff. The primary and secondary centres should be equipped with adequate drugs, instruments and staff so that many conditions can be cured at this level itself which will lead to decrease in burden at the tertiary level and will give more time to doctors to deal with patients who require skilled interventions²⁴.

Hospitals can be equipped with a sound alarm and cameras security system dedicated to violence incidents so that in case of any emergency, doctors can get the help easily and early. Number of relatives of a patient entering in the hospital should be restricted. There should be a standard operating procedure (SOP) to handle these kinds of situations. The doctor also plays a crucial role in these situations. Doctor should know his abilities and limits and when to refer to more competent colleagues.

Communication skills should be developed for building a doctor-patient relationship. Proper counseling of the patient and families should be carried out, by doctors to explain about the illness, possible treatment options and their potential complications, if any; expected duration of the treatment, possible outcome if untreated, overall prognosis and financial implications.

The doctor should also be alert about signs that a patient or relative may turn violent. He/she should look for STAMP²⁴:

- Staring to intimidate
- Tone and volume of voice, yelling, sarcastic, and caustic replies
- Anxiety approaching dangerous levels
- Mumbling- suggesting increasing frustration
- Pacing around the room in agitation.

The Health Care in Danger (HCID) team at the International Committee of the Red Cross (ICRC) has developed a checklist which provides practical and actionable summary of measures for preventing, reducing and mitigating the effects of violence against healthcare workers and patients during COVID-19 response²⁵. This checklist provides recommendations which can help in prevention and reduction of violence against healthcare providers. These recommendations include multiple dimensions.

1. Support of health-care workers with high exposure to stress and violence by helping them to stay vigilant about protocols by making information easily available, create a schedule for rest and meal breaks,

encourage them to communicate about their stress, fears, concerns and frustrations and being attentive to signs of burnout and other stressors.

2. Assess the risks and implement preparedness measures by creating emergency contingency plan and ensuring that it covers what to do if there is a security threat or incident, and the protocol for managing it. Conduct a risk analysis of a particular context, as each healthcare service faces a unique set of risks; and list of possible actions to prevent them or mitigate their consequences for people and workflow. Closely monitor the likelihood of violence and do not neglect indirect forms of violence. While isolating the patients keep the gender and other factors in mind, as quarantine and isolation enhance tensions and separate people from their loved ones.
3. Understand and promote the rights and responsibilities of staff to provide respectful and ethical care. It must be ensured that protocols for triage and care comply with the ethical principles of healthcare: prioritization should be based solely on clinical need, impartiality, confidentiality, do-not-harm, patient autonomy; and informed, voluntary consent by the patient. Needs of vulnerable groups such as children, women, elderly, people with mental health conditions and ethnic minorities should not be neglected. In those kind of situations where patient's autonomy conflicts with the public health imperatives, it is to be made sure that all the decisions are fully disclosed and discussed with the patient(s), staff and the management.
4. Engage, listen and communicate with the public. It is necessary to communicate clearly about the parameters and protocols which have been adopted, in the interest of openness, transparency and accountability. Remember that the public's perception and acceptance of health-care services and staff are crucial for these efforts.
5. Coordinate with security forces and other services. Stay up to date on the new policies of the hospital, state and country concerning the health sector. There should be a contingency plan for evacuation of staff members and patients in case of an emergency. Coordination with the security personnel accordingly and making it sure that they are aware of these plans and infection prevention and control measures are too important.
6. Documentation, monitoring and reporting of violent incidents, discrimination and/or stigmatization happening in the area where healthcare is being provided are to be looked into carefully.

Conclusion

Although the Ordinance to amend the Epidemic Act provides some relief amid the present trend of attacks, it cannot be considered as a permanent solution for the attacks against healthcare providers. As soon as the epidemic ends, Epidemic Act will cease to function, and situation will become as it was before the epidemic. There is need of some permanent solution, if we actually want to stop the violence against healthcare workers. Healthcare Service Personnel and Clinical Establishments (Prohibition of Violence and Damage to Property) Bill which was proposed by the Ministry of Health and Family Welfare may play an important role in achieving this.

At the end, this should also be kept in mind that it is not the responsibility of the Government only to protect the healthcare providers from violence. Active participation of the society/community is also required in the prevention of this violence. Media must put forth unbiased news to the public and not wrap them up in with

unverified and unsubstantiated stories to increase the TRP. The general public and bystanders should try to mitigate such situations rather than turn into hooligans by blindly following the mob, or worse, by standing there and recording the incident. We also need a social shift towards a culture that does not think that violence is an unavoidable content or accept that violence is necessary. This culture is not simply about individuals but extends to the whole society.

References

1. Corona virus disease (COVID-19) outbreak [Internet]. [cited 2020 May 3]. Available on: <https://www.who.int/westernpacific/emergencies/covid-19>
2. WHO | Violence against health workers [Internet]. World Health Organization; [cited 2020 Aug 13]. Available on: http://www.who.int/violence_injury_prevention/violence/workplace/en/
3. Over 75% of doctors have faced violence at work, study finds | India News, Times of India [Internet]. [cited 2020 Aug 13]. Available from: <https://timesofindia.indiatimes.com/india/Over-75-of-doctors-have-faced-violence-at-work-study-finds/articleshow/47143806.cms>
4. Delhi, 9 April 2020: 1st 2020 06:00. Delhi: Two women resident doctors assaulted by man for “spreading” Covid-19 [Internet]. India Today. [cited on 3 May 2020]. Available on: <https://www.indiatoday.in/india/story/delhi-two-women-resident-doctors-assaulted-by-man-spreading-covid19-1664923-2020-04-09>.
5. They think I will bring corona virus to building: Surat doctor on being attacked, abused by neighbours - MSN-IT News [Internet]. [cited on 3 May 2020]. Available on: <https://www.indiatoday.in/msn-it/story/they-think-i-will-bring-coronavirus-to-building-surat-doctor-on-being-attacked-abused-by-neighbours-1664084-2020-04-07>.
6. Corona virus lockdown India: On camera, COVID-19 health staff attacked, chased Aaway In Madhya Pradesh's Indore [Internet]. [cited on 3 May 2020]. Available on: <https://www.ndtv.com/india-news/coronavirus-lockdown-india-on-camera-health-workers-attacked-in-madhya-pradesh-indore-2-doctors-inj-2204649>.
7. Reporter S. Doctor assaulted over death of COVID-19 patient. The Hindu [Internet]. 2020 Apr 1 [cited on 3 May 2020]; Available on: <https://www.thehindu.com/news/national/telangana/doctor-assaulted-over-death-of-covid-19-patient/article31230546.ece>
8. Chennai, 21 April 2020 SL: Mob denies burial to Chennai doctor after Covid-19 death, many ask is clapping hands enough | 10 points [Internet]. India Today. [cited 2020 May 3]. Available from: <https://www.indiatoday.in/india/story/chennai-doctor-dies-of-coronavirus-denied-burial-10-points-1669313-2020-04-21>.
9. Health workers become unexpected targets during covid-19. The Economist [Internet]. [cited on 13 August 2020]. Available on: <https://www.economist.com/international/2020/05/11/health-workers-become-unexpected-targets-during-covid-19>.
10. Health workers face attack, abuse on corona virus front line | Miami Herald [Internet]. [cited on 3 May 2020]. Available on: <https://www.miamiherald.com/news/coronavirus/article241967281.html>
11. Stigmatisation of coronavirus front-line health workers appalling: Inquirer, Asia News & Top Stories - The Straits Times [Internet]. [cited on 3 May 2020]. Available on: <https://www.straitstimes.com/asia/stigmatisation-of-frontline-health-workers-appalling-inquirer>

12. di Martino V. Workplace violence in the health sector. 2003: 38.
13. Mayhew C & Chappell D. Workplace violence in the health sector – A case study in Australia. *J Occup Health Saf.* 1 Jan. 2003: 19.
14. Reddy IR, Ukrani J, Indla V & Ukrani V. Violence against doctors: A viral epidemic? *Indian J Psychiatry.* 1 April 2019; 61(10): 782.
15. Stebbing J & Powles T. Stress in the workplace amongst medical professionals. *J Postgrad Med.* 4 Jan. 2007; 53(2): 83.
16. The epidemic of violence against healthcare workers | *Occupational & Environmental Medicine* [Internet]. [cited on 19 Oct. 2019]. Available on: <https://oem.bmj.com/content/61/8/649.1>
17. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to Corona virus Disease 2019. *JAMA Netw Open.* 2 Mar. 2020; 3(3): e203976–e203976
18. Kang L, Ma S, Chen M, Yang J, Wang Y, Li R, et al. Impact on mental health and perceptions of psychological care among medical and nursing staff in Wuhan during the 2019 novel corona virus disease outbreak: A cross-sectional study. *Brain Behav Immun* [Internet]. 2020 Mar 30 [cited 2020 May 3]; Available on: <http://www.sciencedirect.com/science/article/pii/S0889159120303482>.
19. Shi J, Wang S, Zhou P, Shi L, Zhang Y, Bai F, et al. The frequency of patient-initiated violence and its psychological impact on physicians in China: A cross-sectional study. *PLoS ONE* [Internet]. 1 June 2015 [cited on 3 May 2020]; 10(6). Available on: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4450867/>
20. Catlette M. A descriptive study of the perceptions of workplace violence and safety strategies of nurses working in Level I Trauma Centers. *J Emerg Nurs.* Dec 2005; 31(6): 519–25.
21. Promulgation of an Ordinance to amend the Epidemic Diseases Act, 1897 in the light of the pandemic situation of COVID-19 [Internet]. [cited on 3 May 2020]. Available on: <https://pib.gov.in/newsite/PrintRelease.aspx?relid=202493>.
22. Sheth H. IMA demands Central law on violence against healthcare workers [Internet]. @businessline. [cited on 7 Aug. 2020]. Available on: <https://www.thehindubusinessline.com/news/imademands-central-law-against-violence-on-doctors/article31393785.ece>.
23. MHA opposition puts bill to check violence against doctors on backburner- *The Economic Times* [Internet]. [cited on 3 May 2020]. Available on: <https://economictimes.indiatimes.com/news/politics-and-nation/mha-opposition-puts-bill-to-check-violence-against-doctors-on-backburner/articleshow/72677503.cms?from=mdr>.
24. Sen M & Honavar SG. It's a doc's life- Workplace violence against doctors. *Indian J Ophthalmol.* 1 June 2019; 67(7): 981.
25. COVID-19 and violence against health care | Safer COVID-19 response: Checklist for health-care services- *World* [Internet]. ReliefWeb. [cited on 9 Aug. 2020]. Available on: <https://reliefweb.int/report/world/covid-19-and-violence-against-health-care-safer-covid-19-response-checklist-health-care>.

कोविड-19 महामारी के बीच अग्रपंक्ति स्वास्थ्य परिचर्या सेवा प्रदाता योद्धाओं के विरुद्ध हिंसा पूर्ण घटनाएं तथा इसका उनके मनो-सामाजिक स्वास्थ्य पर प्रभाव ।
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सारांश

चिकित्सकों, नर्सों एवं अन्य अग्रपंक्ति स्वास्थ्य परिचर्या सेवा कार्यकर्ताओं द्वारा समुदाय को एक जुट रखने में महत्वपूर्ण भूमिका निभाई जा रही है। कोविड-19 महामारी प्रसार के दौरान भारत सहित अनेक देशों में इन योद्धाओं द्वारा किए गए अनूठे कार्यों के लिए उन्हें एक राष्ट्र सेनानी नायक के रूप में सम्मानित किया गया है। किन्तु दुर्भाग्य से, प्रत्येक व्यक्ति ने उनके प्रयासों तथा योगदान की सराहना नहीं की गई है। चूंकि वर्ष 2019 के अंत से कोरोना वायरस पूरे विश्व में फैल गया है, फिर भी चिकित्सकों, नर्सों, पैराचिकित्सकों सहित स्वास्थ्य परिचर्या सेवा प्रदाताओं को कुछ भयभीत व अंधविश्वासी लोगों से होने वाले कलंक तथा भेदभाव के कारण शारीरिक और मानसिक दोनों तरह के हमलों का सामना किया जा रहा है। इससे संपूर्ण स्वास्थ्य व्यवस्था पर अत्यधिक दबाव अनुभव किया जा रहा है। इस प्रकार की हिंसा, कलंक और भेदभाव का अनुभव होने से पूरे विश्व में स्वास्थ्य परिचर्या कार्यकर्ताओं के मानसिक एवं भावनात्मक स्वास्थ्य पर निश्चित रूप से आघात हुआ है। यद्यपि सरकारी एजेंसियों ने इस प्रकार की हिंसा को रोकने के लिए कई उपाय करते हुए तेजी से कार्यवाई की है, फिर भी कोविड-19 महामारी के खिलाफ हमारी लड़ाई में हमारी सबसे बहुमूल्य संपदा के रूप में स्वास्थ्य परिचर्या सेवा प्रदाता कार्मिकों की रक्षा करने के लिए सिविल सोसायटी के स्तर पर भी बहुत अधिक कार्रवाई की जानी अपेक्षित है।

कोविड-19 महामारी के इस अभूतपूर्व जन-स्वास्थ्य आपातकालीन स्थिति से यह प्रदर्शित हुआ है कि स्वास्थ्य सुविधाएं, चिकित्सा परिवहन, रोगियों के साथ-साथ स्वास्थ्य परिचर्या सेवा कार्यकर्ताओं तथा उनके परिवारिक सदस्यों को कहीं भी लक्ष्य बनाया जा सकता है। इस चेतावनीपूर्ण प्रवृत्ति हिंसा के ऐसे घटनाओं से उनकी सुरक्षा करने के लिए और बेहतर उपायों की आवश्यकता पर बल दिया गया है। स्वास्थ्य परिचर्या सेवा प्रदाताओं पर किए गए ऐसे हमलों से न केवल स्वास्थ्य क्षेत्र में अग्रपंक्ति कार्यकर्ताओं के मनो-सामाजिक स्वास्थ्य पर बुरा प्रभाव पड़ता है, बल्कि गुणवत्तापूर्ण स्वास्थ्य परिचर्या सेवाएं उपलब्ध कराने की योग्यताक्षमता भी घट जाती है। प्रकृत लेख में स्वास्थ्य परिचर्या सेवा प्रदाताओं के विरुद्ध हिंसा वैश्विक रूप में स्वास्थ्य परिचर्या सेवा पर इसके प्रभाव कैसे पड़ते हैं, के बारे में एक संक्षिप्त सिंघवलोकन किया गया है। इस प्रकार की अवांछनीय घटनाओं को रोकने के लिए किए जाने वाले उपायों पर चर्चा की गई है।

प्रमुख शब्द: कार्यस्थल पर हिंसा, स्वास्थ्य परिचर्या सेवा प्रदाता, मनो-सामाजिक स्वास्थ्य, विधि/विधि निर्माण

The Vaccine Trials in COVID-19

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Abstract

Corona virus, started in December 2019, which weighs less than an attogram (10^{-18} grams, symbol: ag), brought the 'advanced' 21st century's civilized world to its knees. It infected three million people and killed a quarter million in less than four months! Though battered and defeated, the humankind started inventing vaccines to contain this virus. The first COVID-19 vaccine entered the human clinical testing with unprecedented speed on 3 March 2020. On 11-12 February 2020, WHO, in collaboration with the Global Research Collaboration for Infectious Disease Preparedness and Response (GLOPID-R) organized a Global Forum on research and innovation for COVID-19 (Global Research Forum). The Coalition for Epidemic Preparedness Innovations (CEPI) is working with global health authorities and vaccine developers to support the development of vaccines against COVID-19. The COVID-19 pandemic has prompted strategies to fast-track the timeline for licensing a vaccine against COVID-19, especially by compressing (to a few months) the usually lengthy duration of Phase II-III trials (typically, many years). Using RNA allows us to be fast because the genetic sequence can be made synthetically in the lab, and because it can self-amplify, we need only a very low dose of the vaccine for it to be effective – we can make the equivalent of a million doses in one litre of reaction material. This allows us to scale up very quickly and it is feasible to be making 10s of millions of doses per week from our lab. RNA vaccines are quick and relatively easy to make, which is why they are already being tested in people. There are so many vaccine manufacturers across the globe are tirelessly working to develop a vaccine, and some of them have started human trials also. Once the vaccine is invented, the disease could be eradicated from the world at an unprecedented pace but the logistics of vaccinating the planet could be the biggest challenge in history.

Key words: Covid-19 Vaccine, Pandemic, Human trial, RNA.

A virus weighing less than an attogram (10^{-18} grams, symbol: ag) brought the 'advanced' 21st century's civilized world to its knees. Three million infections and a quarter million deaths in less than four months! Battered and defeated but not conquered humankind decided to fight back and eradicate the virus from the planet. The race for vaccine against COVID- 19 has begun.

The first vaccine, which subsequently eradicated the disease, was discovered after approximately 4000 years of smallpox (though there are references of inoculation against smallpox by scabs of the infected

persons in Ayurveda). The human trials of COVID -19 vaccine started in less than four months of the first case identified. The genetic sequence of SARS-CoV-2, the corona virus that causes COVID-19, was published on 11 January 2020¹, and the first COVID-19 vaccine candidate entered human clinical testing with unprecedented rapidity on 3 March 2020 in an unbelievable 51 days!

Taken by surprise by the unforeseen calamity, the unprepared (thought they were well prepared) and overconfident human kind put its act together in overcoming the initial shock. Getting over the internal differences and market forces, it united in their fight against COVID-19.

On 11-12 February 2020, WHO, in collaboration with the Global Research Collaboration for Infectious Disease Preparedness and Response (GLOPID-R), organized a Global Forum on research and innovation for COVID-19 (Global Research Forum). Its objective was to accelerate research which can contribute to containing the spread of this epidemic and encouraging accelerated research, development and equitable access, based on public health needs, to diagnostics, therapeutics and vaccines². The Coalition for Epidemic Preparedness Innovations (CEPI) is working with the global health authorities and vaccine developers to support the development of vaccines against COVID-19².

Once a safe and effective vaccine becomes available, it will be vital that it is accessible to everyone who needs it³. WHO is aligning R&D, fast-tracking regulatory approvals and manufacturing and trying for all populations can have access to a vaccine, once available. The “equitable distribution” pledged in the Alma Ata conference on Primary Health Care and “expansion” in terms of population in the Expanded Programme on Immunization, both in 1978, are being committed again and seriously being tried to be achieved after 42 years. Heads of state, global health leaders, institutions and industry made an unprecedented commitment and came together, guided by a common vision of a planet protected from human suffering and the devastating social and economic consequences of COVID-19, to launch this groundbreaking collaboration and pledged to work towards an equitable global access based on an unprecedented level of partnership³. They agreed to create a strong unified voice, to build on the past experiences and to be accountable to the world, to communities and to one another and shared commitment to ensure all people have access to all the tools to prevent, detect, treat and defeat COVID-19³.

Vaccine Technology

The vaccine technologies being developed for COVID-19 are not like vaccines already in use to prevent influenza, but rather are using "next-generation" strategies for precision on the COVID-19 infection mechanisms, while hastening development for eventually preventing infection with a new vaccine⁴. Vaccine platforms in development are also designed to address mechanisms for infection susceptibility to COVID-19 in specific population subgroups, such as the elderly, children, pregnant women, or people with existing weakened immune systems⁴.

CEPI classifies development stages for vaccines as either "exploratory" (planning and designing a candidate, with no evaluation in vivo yet), "preclinical" (in vivo evaluation with preparation for manufacturing a compound to test in humans), or initiation of Phase-I safety studies in healthy people⁴. Major platform targets those have advanced into the Phase-I safety studies include:

- nucleic acid (DNA and RNA)
- viral vector
- virus-like particle involved in DNA replication
- peptides
- recombinant proteins
- live attenuated viruses
- inactivated viruses.⁵

Genetic material looking like bits of a microbe stimulates the body to produce an immune response. There's no chance of accidental infection because no virus is actually used. For corona virus, one hope is that using messenger RNA- the genetic material that directs cells to produce something, will offer the quickest and safest path. In this case, the RNA vaccine would stimulate cells to make those spike proteins that look like pieces of coronavirus⁶. If it works properly, upon being exposed to those engineered fragments of the virus, the body would be taught to recognize them, and be prepared to defend against them if there is a future attack or infection⁶. When the vaccine is injected into the body, muscle cells naturally "amplify" it by producing copies of the spike protein which the immune system detects as a threat. This trains the body's immune system to defend against SARS-CoV-2 through being able to recognize the spike protein if it encounters again⁶.

Using RNA allows us to be fast because the genetic sequence can be made synthetically in the lab, and because it can self-amplify, we need only a very low dose of the vaccine for it to be effective– we can make the equivalent of a million doses in one litre of reaction material⁷. This allows us to scale up very quickly and it is feasible to be making tens of millions of doses per week from our labs⁷. RNA vaccines are quick and relatively easy to make which is why they are already being tested in people. All a lab needs is the genetic sequence of the virus⁶. However, it will be the first such vaccine to be approved.

Another, more time-tested approach to fighting corona virus employs viral vector vaccines⁶. These are harmless to people, genetically engineered to carry bits of the target virus- in this case, the Covid-19 virus. The harmless virus causes a symptom-free infection, and the immune system learns to recognize the harmful genes.

According to CEPI, the platforms based on DNA or messenger RNA offer a considerable promise to alter COVID-19 antigen functions for strong immune responses, and can be rapidly assessed, refined for long-term stability, and prepared for large-scale production capacity^{4,5}.

Preclinical Research: Challenge Studies Controversy

The COVID-19 pandemic has prompted strategies to fast-track the timeline for licensing a vaccine against COVID-19, especially by compressing (to a few months) the usually lengthy duration of Phase II and III trials which are normally runs for many years^{6,8}. Following preliminary proof of safety and efficacy of a candidate vaccine in laboratory animals and healthy humans, controlled "challenge" studies may be implemented to bypass typical Phase III research, providing an accelerated path to license a vaccine for

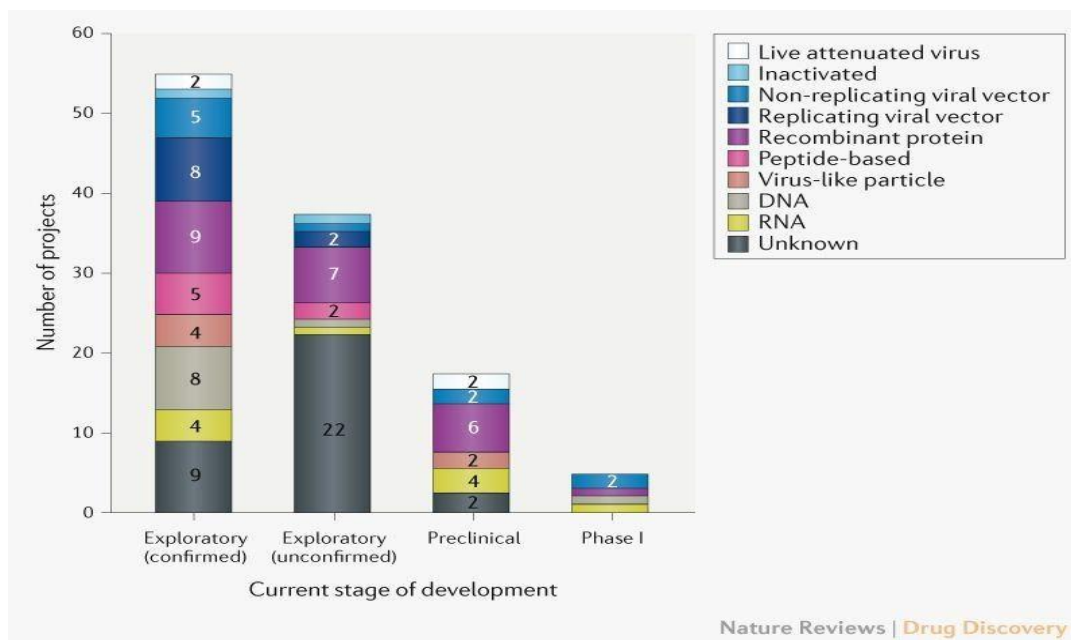
widespread prevention against COVID-19. Challenge studies have been implemented previously for diseases less deadly than COVID-19 infection, such as common influenza, typhoid fever, cholera, and malaria⁸.

The design of a challenge study involves first, simultaneously testing a vaccine candidate for immunogenicity and safety in laboratory animals and healthy adult volunteers (100 or fewer) which is usually a sequential process using animals first; and second, rapidly advancing its effective dose into a large-scale Phase II-III trials in previously-uninfected, low-risk volunteers (such as young adults) who would then be deliberately infected with COVID-19 for comparison with a placebo control group. Following the challenge, the volunteers would be monitored closely in clinics with life-saving resources, if needed. Although challenge studies are ethically questionable due to the unknown hazards for the volunteers of possible COVID-19 disease enhancement and whether the vaccine received has long-term safety (among other cautions), challenge studies may be the only option available as the COVID-19 pandemic worsens.

Non-specific Vaccine

Some vaccines have heterologous effects, also called non-specific effects. That means they can have benefits beyond the disease they prevent. On comparing various nations' BCG vaccination policies with their COVID-19 mortality rate; astonishing results were found in which a 'positive correlation' was found between the year when universal BCG vaccination policies were adopted and the country's mortality rate. In other words, the earlier the vaccination policy adopted, the more likely that a significant portion of the population, especially the elderly, would be protected. The death rate in nations with a BCG vaccination programme was 4.28 per million, while in countries without the programme, was 40 per million. Clinical trials of BCG are focused on two groups at high-risk for COVID-19 --health care workers at the forefront and the elderly, who are more vulnerable to the deadlier form of infection. The vaccine is also believed to protect the body against different types of respiratory infections, which have similar symptoms to COVID-19, the researchers said. Randomized trials were held in Netherland, Australia, Egypt, Boston and Houston. Indian doctors, however, say that there is a need to conduct 'large-scale epidemiological studies' before coming to any conclusion.

Current Stage of Development of COVID-19 Vaccine



Pipeline of COVID-19 vaccine candidates by technology platform. Exploratory projects (split into confirmed

and unconfirmed) are in the early planning stage with no in-vivo testing, and preclinical projects are at the stage of in-vivo testing and/or manufacturing clinical trials material⁹.

Clinical Trials of COVID 19 Vaccine¹⁰

1. Ad5-nCoVCanSino Biologics and Academy of Mry Medical Sciences, China

Recombinant adenovirus type 5 vector. Phase II China Non-replicating adenovirus 5 (Ad5) vector carrying the gene for the SARS-CoV-2 spike protein is injected into the arm. Adenoviruses are well established vaccine vectors and the vaccine generated “strong immune responses in animal models” and has “a good safety profile.” Phase I and Phase II clinical trials are underway in Wuhan, China.

2. ChAdOx1 nCoV-19 (University of Oxford) adenovirus vector Phase II, The UK ChAdOx1 nCoV-19 is an ostensible recombinant viral vector vaccine¹⁰. A chimpanzee adenovirus vaccine vector (ChAdOx1) carrying the gene for the SARS-CoV-2. The gene for the SARS-CoV-2 spike protein is injected into the arm. Phases I and II trial are underway in the UK. The vaccine moves by training the immune system to identify and attack the corona virus. Individuals aged between 18 and 55 years are being enrolled in the early and mid-stage randomized, controlled trial. The Phase I and II studies will be dividing the 510 volunteers into groups of five, who will then be monitored for close to six months, with a choice of a follow-up visit about a year after joining the trial. Of the five groups, one group will be given a second intramuscular shot of the vaccine four weeks after the preliminary immunization. A vaccine against meningococcal disease will be administered to the participants, randomly assigned to receive a placebo for control reasons. The Serum Institute of India (SII), Pune, India, will manufacture the vaccines and supply to the Asian and developing countries. The ChAdOx1 nCoV-19 vaccine was not tested in animals.

3. BNT162 (a1, b1, b2, c2) RNA Phases I and II, Germany (BioNTech [de], Fosun Pharma, Pfizer)

The mRNA-based corona virus vaccine BNT162: different mRNA-based vaccine candidates aimed at preventing COVID-19 infection. Exploits highly potent Lipid-Nano-Particulate (LNP) mRNA vaccine platforms for the prevention of infectious diseases¹¹.

4. Unnamed (Sinovac Biotech) inactivated SARS-CoV-2 virus Phases I-II, China

Inactivated SARS-CoV-2 In animal studies, the vaccine candidate provides protection against virus strains from different countries Phase 1/2 trial Underway

5. INO-4800 (Inovio Pharmaceuticals DNA plasmid delivered), USA and S. Korea

The vaccine candidate works by injecting a specifically engineered DNA plasmid (a small, independent genetic structure) by electroporation into a patient so that their cells can produce the desired antibody to fight off a specific infection. A special device administers spikeprotein– encoding DNA molecules through the skin. Mice and guinea pigs mounted immune responses against the virus. It is now testing the vaccine in monkeys. Phase I trial is underway. DNA vaccines, while available and approved for a variety of animal infections in veterinary medicine, have not yet been approved for human use.

6. mRNA-1273 (Moderna, US National Institute of Allergy and Infectious Diseases)

Lipid nano particles containing mRNAs for the SARS-CoV-2 spike protein are injected into the arm. The mRNA-1273 is a mRNA vaccine that encodes for a pre-fusion stabilized form of the Spike (S) protein. Because the vaccine does not contain the actual virus, there is no possibility the participants will become infected from the vaccine. The goal of the test is to evaluate any safety issues and determine the appropriate dose to stimulate an effective immune response. The SARSCoV-2 mRNA-1273 was not tested in animals before the start of the ongoing Phase I trial.

7. Covid-19/aAPC (Shenzhen Geno-Immune Medical Institute) China, Phase I

Lentiviral vector is a pathogen-specific artificial antigen presenting dendritic cells. The Covid-19/aAPC vaccine is prepared by applying lentivirus modification including immune modulatory genes and the viral minigenes to the artificial antigen presenting cells (aAPCs). The Covid-19/aAPCs are then inactivated for proliferation and extensively safety tested. The subjects receive a total of 5×10^6 cells each time by subcutaneous injection at 0, 14 and 28 days. The subjects are followed-up with peripheral blood tests at 0, 14, 21, 28 and 60 days until the end of the test¹².

8. LV-SMENP-DC(Shenzhen Geno-Immune Medical Institute) Phase I, China

Lentiviral minigene vaccine: Dendritic cells modified with lentiviral vector LV-SMENP-DC vaccine is made by modifying DC with lentivirus vectors expressing Covid-19 minigene SMENP and immune modulatory genes. CTLs will be activated by LV-DC presenting Covid-19 specific antigens. LV-DC vaccine and antigen-specific CTLs are prepared in 7~21 days. Subject will receive total 5×10^6 cells of LV-DC vaccine and 1×10^8 antigen-specific CTLs via sub-cutaneous injection and IV infusion, respectively. Patients are followed weekly for one month after the infusion, monthly for 3 months, and then every 3 months until the trial ends.

9. bacTRL-Spike Symvivo Canada, Phase I DNA, bacterial medium (oral)

Orally administered Bifidobacterium probiotic engineered to carry DNA encoding the SARS-CoV. In addition to this, the vaccine is currently in human testing, and Phase 1 clinical is trial underway.

10. Unnamed (Beijing Institute of Biological Products, Wuhan Institute of Biological Products) inactivated COVID-19 virus (vero cells) Phase I, China.

Vaccines for Trials in the Near Future

1. Bharat Biotech's CoroFlu One Drop COVID 19 Nasal Vaccine¹³

CoroFlu will build on the backbone of FluGen's flu vaccine candidate known as M2SR which is a self limiting version of the influenza virus that induces an immune response against the flu. Gene sequences from SARS-CoV-2 into M2SR will be inserted so that the new vaccine will also induce immunity against the corona virus. Refinement of the CoroFlu vaccine concept and testing in laboratory animal models at UW-Madison is expected to take three to six months. Bharat Biotech in Hyderabad, India will then begin production scale-up for safety and efficacy testing in humans. CoroFlu could be in human clinical trials by

the fall of 2020. CoroFlu will also express the influenza virus hemagglutinin protein which is the major influenza virus antigen. So, there should be immune responses to both corona virus and influenza.

M2SR is a unique form of the flu virus. It lacks a gene called M2, which restricts the virus to undergo only a single round of replication in cells. "The single replication means the virus can enter the cell, but it can't leave, so, in essence it tricks the body into thinking it's infected with flu, which triggers a full immune response. But since it can't replicate further, you don't get sick."

2. IIL and Griffith University⁷

IIL and Griffith University are preparing a Live Attenuated SARS - CoV-2 vaccine or COVID-19 vaccine using the latest codon de-optimization technology. This technology looks promising for developing a vaccine for prophylactic, active, single dose immunization against corona virus in humans with an enhanced safety profile. The vaccine is expected to provide long-lasting protection. As this vaccine will be a live attenuated vaccine, it is expected to be highly effective as it will provide very strong cellular and antibody immune responses against the virus. The other benefit of such a vaccine is that it will have a proven track record for economical large-scale manufacturing and well known regulatory approval pathway.

3. Imperial College London, The UK

In this, self-amplifying RNA molecules are injected into the muscle. It is expected to start clinical testing in the summer.

4. Wuhan Institute of Biological Products and China National Pharmaceutical Group (Sinopharm), China

Inactivated SARS-CoV-2 Studies in monkeys, mice, rabbits, and guinea pigs supported the vaccine candidate's approval for testing in humans. This vaccine is in its early stage trial.

5. University of Pittsburgh School of Medicine, The US

Micro needle patch delivers pieces of the spike protein through the skin. Vaccinated mice produced antibodies specific to SARS-CoV-2 at levels that would likely neutralize the virus. Expected to start clinical testing in the next few months.

6. Janssen Belgium

Nonreplicating adenovirus 26 (Ad26) vector carrying undisclosed genetic material of SARS-CoV-2 is administered intranasally. This is expected to start clinical testing in September 2020.

7. Novavax, The US

Nanoparticles carrying antigens derived from the SARS-CoV-2 spike protein (with Matrix-Madjuvant). This is expected to start clinical testing in mid-May.

8. Vaxart, The US

This is a pill containing different SARS-CoV-2 antigens which has five vaccine candidates based on different antigen combinations are being tested in animals, with several generating immune responses after a single dose. The company has other oral recombinant vaccine candidates that have shown success in clinical trials. This vaccine is expected to start clinical testing early in the second half of 2020.

9. Medicago, The US

Virus-like particles that resemble SARS-CoV-2 are produced in a close relative of tobacco. This is expected to start clinical testing in July or August 2020.

10. Takis Biotech and Applied DNA Sciences, Italy and The US is exploring DNA based candidates based on the SARS-CoV-2 spike protein.

The vaccine candidates contain PCR-produced pieces of linear DNA, as opposed to the more traditional circular plasmids which could have several advantages including quick production. No vaccines using this approach have yet been tested in humans. This is expected to start clinical testing in the fall.

11. Sanofi and GSK, France and The UK

This is a vaccine which is antigen-based on SARSCoV-2 spike protein (with adjuvant) using recombinant DNA technology which is expected to start clinical testing in the second half of 2020.

Conclusion

COVID-19 has caused huge losses in terms of life, illness and economic slowdown. Yet the silver lining is that the entire world is united and fought shoulder to shoulder. The prejudice of caste, creed, religion, race, colour and money were set aside and the humankind has decided to work towards eradicating this disease from the planet. As of 1 June 2020, the stage is set with the vaccine likely to develop within six months to a year; and the disease could be eradicated from the world at an unprecedented pace. The logistics of vaccinating the planet, once developed, could be the biggest challenge in history. It will be the greatest achievement of mankind— scientific, equity, cooperation, coordination, human rights, pooling and raising funds which may well be in trillions of dollars.

References

1. Tung Thanh Le, Zacharias Andreadakis, Arun Kumar, Raúl Gómez Román, Stig Tollefsen, Melanie Saville & Stephen Mayhew <https://www.nature.com/articles/d41573-020-00073-5>
2. <https://www.who.int/publications/m/item/a-coordinated-global-research-roadmap>
https://en.wikipedia.org/wiki/Coalition_for_Epidemic_Preparedness_Innovations
3. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/global-research-on-novel-coronavirus-2019-ncov/accelerating-a-safe-and-effective-covid-19-vaccine>.
4. https://en.wikipedia.org/wiki/COVID-19_vaccine, COVID-19 vaccine, Wikipedia 71d.gzdjnswn.cn › wiki › COVID-19_vaccine

5. Thanh Le, Tung; Andreadakis, Zacharias; Kumar, Arun; Gómez Román, Raúl; Tollefsen, Stig; Saville, Melanie; Mayhew, Stephen (9 April 2020). "The COVID-19 vaccine development landscape". *Nature Reviews Drug Discovery*. doi:10.1038/d41573-020-00073-5. ISSN 1474-1776. PMID 32273591.
6. <https://www.kq2.com/content/national/569941582.html>
<https://www.bloomberg.com/news/articles/2020-04-27/vaccine-coalition-sees-potential-to-go-even-faster-in-covid-race> <https://md.tatkanikuly.ru/436>
7. Gale In Context: Global Issues- Document - ILL, Griffith Univ join hands to develop Covid vaccine. 4/26/20, 11:39 PM <https://go-gale.com.ezaccess.libraries.psu.edu/ps/i.do?p=GIC&u=psucic&id=GALE%7CA619956536&v=2.1&it=r&sid=summon>
8. Eyal, Nir; Lipsitch, Marc; Smith, Peter G. (31 March 2020). "Human challenge studies to accelerate corona virus vaccine licensure". *The Journal of Infectious Diseases*. doi: 10.1093/infdis/jiaa152. PMID 32232474.
9. Callaway, Ewen (26 March 2020). Should scientists infect healthy people with the coronavirus to test vaccines? *Nature*. 580 (7801): 17. doi: 10.1038/d41586-020-00927-3. PMID 32218549.
10. <https://www.news18.com/news/world/coronavirus-vaccine-trial-cure-oxford-university-2583007.html>
11. <https://www.nature.com/articles/d41573-020-00073-5>
12. https://en.wikipedia.org/wiki/COVID-19_vaccine
13. <https://investors.biontech.de/static-files/398d9bd8-e2cb-49ca-9d6d-7dfd01c66b8a>
14. <https://clinicaltrials.gov/ct2/show/NCT04299724>
15. Business World; New Delhi (Apr 3, 2020)
16. <https://www.weforum.org/agenda/2020/05/covid19-vaccine-researcher-questions/>

कोविड-19 के संदर्भ में टीके की प्रायोगिक जाँच (ट्रायल)

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सारांश

कोरोना वायरस का वजन एक ऑटोग्राफ (10–18 ग्राम, प्रतीकरू एजी) से भी कम है तथा इस महामारी का प्रसार दिसंबर 2019 में शुरू हुआ है। तथा इसने शून्यतः, 21वीं सदी के सभ्य विश्व को अपने घुटनों पर ला दिया। इसने चार माह से कम की अवधि में तीन मिलियन लोगों को संक्रमित किया है तथा इसके संक्रमण से एक चौथाई मिलियन लोगों की मृत्यु हो गई है! हालांकि पस्त और पराजित, मानव जाति के लोगों ने इस वायरस को रोकने के लिए टीकों का आविष्कार करना प्रारंभ कर दिया है। पहले कोविड-19 वैक्सीन का 3 मार्च 2020 को अभूतपूर्व गति के साथ मानव नैदानिक परीक्षण में किया गया है। विश्व स्वास्थ्य संगठन ने ग्लोबल रिसर्च कोलैबरेशन फॉर इन्फेक्शस डिजीज प्रीपेरडनस एंड रिस्पॉन्स (ळस्व्क्-त्) के सहयोग से कोविड-19 के संबंध में अनुसंधान और नवाचार के लिए 11–12 फरवरी 2020 को एक वैश्विक मंच (ग्लोबल रिसर्च फोरम) का आयोजन किया। कोअलिशन फॉर एपिडिमिक प्रीपेरडनस इनवेशन (बन्च), वैश्विक स्वास्थ्य अधिकारियों तथा वैक्सीन विकासकारों के साथ मिलकर कोविड-19 महामारी के बचाव हेतु टीके के विकास का कार्य कर रहे हैं। कोविड-19 महामारी ने टीके के लिए दिए जाने वाले लाइसेंस की प्रक्रिया में तेजी ला दी है जिससे चरण –५ के प्रायोगिक जाँच (ट्रायल) की अवधि कुछ वर्षों से घटाकर कुछ महीने हो गई है। आरएनए का प्रयोग करके यह कार्य तेजी से किया जा सकता है क्योंकि आनुवंशिक अनुक्रम को प्रयोगशाला में कृत्रिम रूप से बनाया जा सकता है। यह आत्म-प्रवर्धन कर सकता है, इसलिए इसके प्रभावी होने के लिए वैक्सीन की केवल बहुत कम खुराक की आवश्यकता है। एक लीटर रीएक्शन पदार्थ से एक लाख खुराक की मात्रा के बराबर वैक्सीन तैयार की जा सकती है। इससे हम बहुत जल्दी बड़े पैमाने पर टीके बना सकते हैं तथा हमारी प्रयोगशाला से प्रति सप्ताह 10 लाख खुराकें बनाना संभव है। आरएनए के टीके शीघ्र तथा अपेक्षाकृत आसानी से तैयार होते हैं, इसलिए पहले से ही लोगों पर इसका परीक्षण किया जा रहा है। विश्वभर में अनेक वैक्सीन निर्माता हैं जो वैक्सीन विकसित करने के लिए अथक प्रयास कर रहे हैं तथा उनमें से कुछ ने मानव परीक्षण भी प्रारंभ कर दिया है। टीके के आविष्कार के पश्चात विश्व में रोग का उन्मूलन अभूतपूर्व गति से हो सकता है, किन्तु ग्रह के सभी लोगों को टीका लगाना इतिहास की सबसे बड़ी चुनौती हो सकती है।

प्रमुख शब्द: कोविड –19 वैक्सीन, महामारी, मानव परीक्षण, आरएनए।

Initiatives of Rajasthan Government in the Fight against COVID-19 Pandemic

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Abstract

After the emergence of COVID-19 in China in December 2019, this new strain of Corona virus spread rapidly to over 200 countries in January 2020, with local transmission reported in more than 160 countries. Later, based on the speed and scale of the transmission, WHO declared this outbreak a pandemic on 11 March 2020. In India, the first case of COVID-19 was reported on 30 January 2020 and the total number of confirmed cases reached around 27,000 on 26 April 2020. A large number of cases has been reported from Maharashtra, Gujarat, Delhi, Rajasthan, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Telangana and Andhra Pradesh. In the present paper, an attempt has been made to overview the timeline of COVID-19 pandemic and initiatives taken by the Government of Rajasthan to prevent its spread in the state. The findings of the present paper shows that during March 2020, there were only few cases of COVID-19 in Rajasthan but there was an exponential rise in the number of confirmed cases in the following month. As on 26 April 2020, Rajasthan had a total of 2,185 confirmed cases, 629 recoveries and 41 deaths. District-wise distribution of confirmed cases, active cases, recoveries and deaths shows that there were large differences in the districts in terms of both confirmed cases and deaths. Out of 33 districts, 7 districts had reported more than 100 cases, 9 districts had reported 10-100 cases and 12 districts had reported <10 cases of COVID-19 whereas 5 districts of the state didn't report even a single case of the disease. The Bhilwara district of the state was once emerged as an epicenter of corona virus but due to the efforts taken by Rajasthan Government and local administration, the district came back on track and became the role model for other districts and states to contain the spread of COVID-19. The Government of Rajasthan took several initiatives in the war against corona virus which includes surveillance and screening, expanded testing, contact tracing, isolation of infected persons and quarantining their contacts, imposing lockdown in the entire state. This paper concludes that timely implementation of lockdown and the preventive measures taken have been proved to be effective in lowering the average growth rate of infectious cases, and slowing down the process of transmission. Thus, these efficient steps resulted in reducing severe illnesses and deaths in the times of COVID-19 pandemic in Rajasthan.

Key words: COVID-19, Corona virus, Pandemic, Isolation, Quarantine, Rajasthan.

Introduction

On 31 December 2019, the World Health Organization (WHO), China Country Office was informed cases of pneumonia of unknown etiology were detected in Wuhan city, in Hubei province of China. On 7 January 2020, Chinese authorities identified a new strain of Corona virus as the causative agent for the disease¹.

The WHO has named the disease as COVID-19, and based on its similarity to SARS-CoV (2002-2003), the CoV Study Group of the International Committee on Taxonomy of Viruses (ICTV) has named the virus as SARS-CoV-2².

On 30 January 2020, the WHO declared the outbreak as a public health emergency of international concern (PHEIC) as the disease spread in different countries³. Later, based on the speed and scale of transmission reported from several countries worldwide, WHO titled this outbreak a pandemic on 11 March 2020^{4,5}. Since its emergence, the disease has now rapidly spread to over 200 countries/territories, with reports of local transmission happening in more than 160 of these countries/territories¹. According to the WHO, there has been a total of 28,04,796 confirmed cases and 1,93,710 deaths (as on 26 April 2020) due to COVID-19 worldwide⁶.

The COVID-19 virus affects different people in different ways. Most of the people infected with this virus will develop mild to moderate respiratory illness and recover without requiring special treatment. People with co-morbid diseases like cardio-vascular diseases, chronic respiratory diseases, diabetes and cancer and those over 60 years old are more likely to develop serious illness⁷. The most common symptoms include fever, fatigue, dry cough and the other symptoms include shortness of breath, aches and pains, sore throat and very few people will report diarrhoea, nausea/ vomiting or runny nose^{1,7}.

The transmission of this virus in human can occur primarily through respiratory secretions- directly through droplets from coughing and sneezing, or indirectly by touching the contaminated objects or surfaces as well as by close contacts^{1,7}. To prevent infection and to slow down the transmission of COVID-19, it is essential to practice standard precautionary measures recommended by WHO- wash hands frequently with soap and water or clean them with alcohol based hand sanitizer, maintain social distancing, avoid touching the eyes, nose and mouth, use of personal protective equipment, practice respiratory and cough etiquettes, seek medical care early if someone has fever, cough and difficulty in breathing and follow the advice given by the healthcare provider⁷.

The first case of COVID-19 in India was reported from Trissur, Kerala on 30 January 2020⁵. In India, as on 26 April 2020, a total of 26,917 COVID-19 confirmed cases including 111 foreign nationals were reported from 32 states/union territories which included 5913 cured/discharged, one migrated and 826 deaths⁸. A large number of cases has been reported from Maharashtra, Gujarat, Delhi, Rajasthan, Madhya Pradesh, Tamil Nadu, Uttar Pradesh, Telangana and Andhra Pradesh⁹. In the present paper, an attempt has been made to overview the timeline of COVID-19 pandemic and initiatives taken to prevent its spread in the state of Rajasthan.

Timeline of COVID-19 Pandemic in Rajasthan

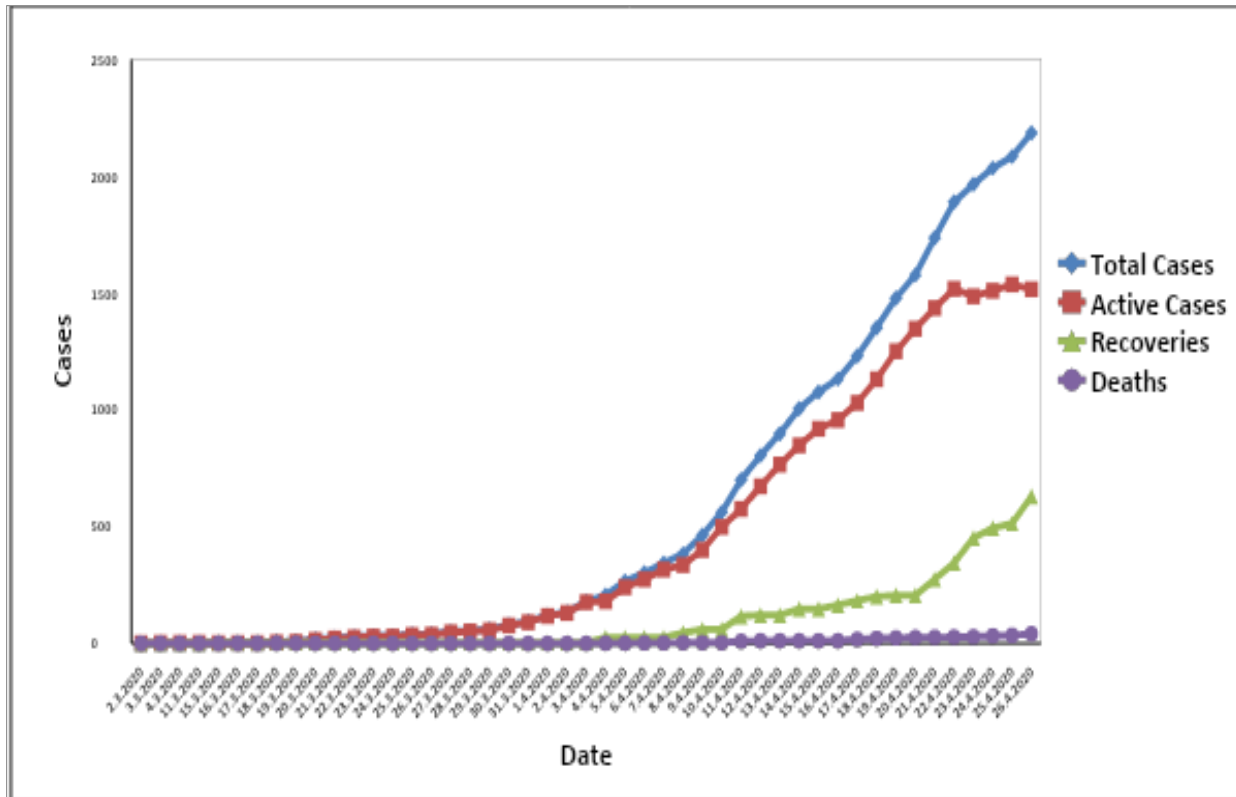
The first case of COVID-19 pandemic was reported in Jaipur on 2 March 2020. A 69-year old Italian tourist who was a part of 23 tourists from Italy, was found Corona positive. On 11 March 2020, an 85-year old man with travel history to Dubai was found Corona positive in Jaipur. On 18 March 2020, in Jhunjhunu district, three people of a family returned from Italy, were positive for COVID-19. On 20 March 2020, in Bhilwara district, three doctors of a private hospital along with 6 other staffs were confirmed Corona positive. On 26 March 2020, a 45-year old man belonging to Ramganj in Jaipur with travel history from Oman, found Corona positive which later emerged as a super spreader in the Jaipur district; and Jaipur emerged as a new hotspot in the state. Till 31 March 2020, the total number of confirmed cases of Corona virus was only 90¹⁰.

As on 3 April 2020, there were 179 cases including nine evacuees from Iran and 33 Tablighi Jamaat participants. Four districts namely- Bharatpur, Bikaner, Dausa and Dholpur had reported their first cases who were Tablighi Jamaat members. By 13 April 2020, the total tally of confirmed cases was 815. As on 19 April 2020, eight districts of the state- Bikaner, Bharatpur, Banswara, Tonk, Kota, Jhalawar, Jodhpur and Jaisalmer had emerged as new hotspots of COVID-19. By 20 April 2020, 98 new cases were reported, mostly from Jaipur (50) and Jodhpur (33). BY 21 April 2020, the total number of newly reported cases was 159, which was the highest number of cases reported during this period (Jaipur-72, Ajmer-35, Jodhpur-16, Nagaur-10). As on 22 April 2020, the reported number of newly confirmed cases was 153 which was slightly lesser than the number reported on the previous day (Jaipur-68, Ajmer-44, Tonk-17, Jodhpur-11). Ajmer's Dargah area also emerged as a new hotspot by 22 April 2020.

During 23 – 25 April 2020, there was a decrease in the number of newly confirmed cases. However, as on 26 April 2020, there was again rise in the newly confirmed cases (102) from different districts of Rajasthan. The total number of confirmed cases by 26 April 2020 was 2,185 in the state. There was a decline in the growth rate of 10 per cent by 21 April 2020 to 2 percent as on 25 April 2020. However, it again increased to five per cent on 26 April 2020¹⁰. The lower growth rate of newly confirmed cases suggests that the combination of lockdown and preventive protective measures slowed down the spread of COVID-19 in the state.

The day-wise cumulative number of COVID-19 confirmed cases, active cases, recoveries and deaths in the state of Rajasthan from 2 March to 26 April 2020 has been shown in Figure 1. The figure depicts that during March 2020, the COVID-19 infection had started emerging in Rajasthan, there were only few cases and sources could be identified and all the persons in contact with the infected persons could be identified and quarantined. However, there is an exponential rise in the total number of confirmed cases and active cases in the month of April 2020. Likewise, in many parts of India, the Tablighi Jamaat members with Corona positive had dramatically changed the COVID-19 situation in Rajasthan in the month of April 2020. Apart from this, the partial increase in the total numbers of confirmed cases could be due to the increased testing and reporting, identification of hotspot areas and screening of all residents in these areas.

Figure 1



Day-wise Status of Corona Virus Pandemic in Rajasthan during 2 March – 26 April 2020

Source: Department of Medical, Health and Family Welfare, Government of Rajasthan (as of 26 April 2020)¹¹

The district-wise distribution of total number of COVID-19 confirmed cases, recoveries, discharged and deaths in Rajasthan, as on 26 April 2020, has been presented in Table 1. The table illustrates that as on 26 April 2020, there were 2,185 confirmed cases in Rajasthan which included 629 recoveries and 41 deaths. Out of 33 districts in Rajasthan, 28 districts in the state had reported confirmed cases of COVID-19. The table also shows that there are large differences between districts in terms of both confirmed cases and deaths. Jaipur was the worst affected district reported the maximum number of active cases (808) in the state. After Jaipur, the maximum number of COVID-19 cases was reported from six districts namely- Jodhpur (364), Kota (158), Ajmer (123), Tonk (115), Nagaur (113) and Bharatpur (110). Nine districts reported cases between 10 to 100, and 12 districts reported <10 confirmed cases of COVID-19. Five districts of the state namely- Baran, Bundi, Jalore, Sirohi and Sri Ganganagar did not report any single case of COVID-19 till 26 April 2020.

Table 1

District-wise Status of Corona Virus Pandemic in Rajasthan as on 26 April 2020

Sl. No.	District/ Country	Total Sample Received	New Cases as on 26.4.2020	Positive Cases	Recovered	Discharged	Deaths
1	Ajmer	2936	11	123	5	0	0
2	Alwar	2310	0	7	4	1	1
3	Banswara	1678	1	62	21	21	0
4	Barmer	208	0	2	1	0	0
5	Bharatpur	2938	1	110	5	0	1
6	Bhilwara	7990	0	33	30	24	2
7	Bikaner	1611	0	37	32	32	1
8	Churu	909	0	14	11	9	0
9	Chittorgarh	623	0	1	0	0	0
10	Dausa	1736	0	21	7	5	0
11	Dholpur	593	2	5	1	0	0
12	Dungarpur	734	0	6	5	5	0
13	Hanumangarh	792	1	11	2	2	0
14	Jaipur	17852	16	808	222	52	21
15	Jaisalmer	1755	0	34	26	23	0
16	Jhalawar	1768	1	30	16	0	0
17	Jhunjhunu	4340	0	42	32	17	0
18	Jodhpur	14436	38	364	50	41	5
19	Karauli	559	0	3	2	1	0
20	Kota	4550	9	158	80	0	4
21	Nagaur	1783	20	113	7	0	1
22	Pali	239	0	2	2	2	0
23	Pratapgarh	266	0	2	2	2	0
24	Rajsamand	321	0	1	0	0	0
25	S. Madhopur	1475	0	8	0	0	0
26	Sikar	1219	1	5	1	1	2
27	Tonk	2611	0	115	32	15	1
28	Udaipur	1518	1	5	4	0	0
	Other District/ State Sample	3192	0	0	2	0	2
Total		82942	102	2122	602	253	41
Other (Italy)			0	2	2	2	0
Evacuees			0	61	25	8	0
Grand Total			102	2185	629	263	41

Source: Department of Medical, Health and Family Welfare, Government of Rajasthan (as of 26th April 2020)¹¹

Initiatives Taken by Rajasthan Government

The initiatives taken by Rajasthan in reducing the risk of emergence of COVID-19 is described here. As we see the timeline, the first confirmed case of COVID-19 in the state was an Italian tourist. Since this Italian group had travelled to various tourist destinations in the state, all the hotels were sanitized where this group resided; in order to control the outbreak. On 18 March 2020, after the confirmation of COVID-19 positive in three people in Jhunjhunu district, who had return from Italy, movement restrictions were enforced immediately in a radius of 1 km² from their residence. To contain the spread, on 19 March 2020, the state imposed Section 144 of IPC across the entire state which restricted gathering of five or more people. The state also imposed curfew around the family's residence and surveillance was carried out to prevent the formation of cluster of COVID-19 positive cases. The Government of Rajasthan had also screened all the passengers reaching Jaipur by international flights, and the persons who showed flu like symptoms were kept in home isolation for 14 days¹⁰.

On 20 March 2020, in Bhilwara district, a doctor from a private hospital was tested Corona positive and by the end of March 2020, the total number of Corona cases rose to 27 which was considered the worst hit in Rajasthan; and the Bhilwara district emerged as the epicenter of Corona virus. But due to dedicated efforts of the Rajasthan Government and local administration, the district came back on track^{10,12}. By 10 April 2020, out of 27 positive cases; 25 patients were recovered and 15 were discharged from hospital and two died. Between 30 March to 10 April 2020, only two new cases were reported from the district. The containment strategy followed by the local administration was praised nationwide due to its effectiveness to contain the virus and this strategy was termed as 'Bhilwara Model'¹⁰.

The Bhilwara model to contain the spread of COVID-19 was centered around the following major steps:

Step 1: It included the immediate sealing of Bhilwara city. Then the entire district was isolated by imposing a strict curfew, sealing the entire district border with check posts at entry and exit points, suspend all essential services except healthcare and police^{13,14}.

Step 2: Any locality where a Corona positive person was found, that area was declared a "no movement zone"¹⁴.

Step 3: Screening Strategy- Door to door screening was carried out by the local administration. For this task, 3072 teams were deployed in the city in three phases and 1937 teams were engaged in the rural areas in two phases. The team comprised Government officials, teachers and ASHAs. These teams screened the 25 lakh population of the Bhilwara district out of which, around 16,000 persons found with flu like symptoms of cold and cough. These people were screened again and 1215 persons who were still suffering from cold, were isolated at home^{13,14}.

Step 4: Quarantine at home/centre- Aggressive contact tracing was implemented by the administration and the persons who came in contact with the infected persons were placed under strict home quarantine. As the Government facilities were unable to handle the strain of COVID-19, the district administration increased the quarantine facilities by taking over four private hospitals and 27 hotels with 1,541 rooms^{13,14}.

Step 5: Monitoring in rural areas: The state administration increased the monitoring in rural areas. All the government officials, teachers and ASHA workers at village level had monitored the persons at home quarantine, medical contingencies, supply of food and food packets etc.¹⁴

In addition to these steps, the disinfection drives were conducted all over the town¹³. To provide medical assistance during this lockdown period, a district control room was setup and its number was circulated through social media, public announcements and portals so that anyone who required medicines, he/she needed to just call and get in touch with the nearest shop for delivery of medicines at their doorstep¹⁴.

The local administration and teams on the ground level were allowed to take the necessary action for containment of the disease. Ruthless containment and empowerment of the local administration were the key reasons behind the success of the operation and breaking the chain of corona transmission¹³. Now, Bhilwara district in Rajasthan has set an example not only for state but also for the whole country to contain the spread of COVID-19¹⁵.

On 21 March 2020, Rajasthan was the first among all Indian states to announce the complete lockdown starting from 22 March 2020, except essential and medical services. The public transportation was also banned in the state. On 24 March 2020, the number of COVID-19 cases crossed 32, so the state also banned all the private vehicles on the roads¹⁰. It had also banned spitting in public, and those who violate this will be punished with one-month imprisonment or Rs. 200 or both¹⁴.

Before announcing this entire lockdown in the state, the Government had made all necessary arrangements across the state for prevention and protection against COVID-19 like preparation of isolation wards in hospitals in all districts, designate a team of doctors for dealing with COVID-19 cases, maintain supply of medicines and course of treatment to be decided in consultation with experts from SMS Hospital, Jaipur. The Government officials also monitored the social distancing in all the districts, no gathering or crowd should be allowed. Also, strict action should be taken against those who violate these rules. In small towns and villages, raising awareness regarding the precautionary measures of COVID-19 had been done on war footing¹⁶. The Rajasthan Government had implemented the modified lockdown in the state in phased manner from 21 April to 1 May 2020 that will allow industrial units in rural areas to operate¹⁷.

The Rajasthan State Government had also announced free ration for two months for families covered under the National Food Security Act (NFSA)¹¹. On 11 April 2020, the state Government announced the financial assistance of Rs. 50 lakhs to the family of the frontline

COVID-19 workers who die on duty¹⁰. It covers all municipal and health workers, AWWs and ASHAs, home guards and civil defense staff¹⁴.

Rajasthan Corona Sahayata Yojana

During the lockdown for Corona crises, the poor and the needy people were the worst affected as they don't have any source of earning. To help them, Rajasthan Government has launched a scheme named "Rajasthan Corona Sahayata Yojana" with the aim that "no person in the state sleeps hungry". It is basically a one-time ex-gratia payment scheme for getting relief during COVID-19 which is in effect from 25 March 2020¹⁸.

Under this scheme, the beneficiaries are provided a financial assistance of total Rs. 2500/- in two installments under two different phases. In phase-I, an amount of Rs. 1000/- is transferred through Direct

Bank Transfer (DBT) to the account of beneficiaries. This amount is being given by the Department of Labour and Employment of the Government of Rajasthan. Under phase-II, family of each beneficiary is given a financial assistance of Rs. 1500/- by the Department of Social Justice and Empowerment of the Government of India. Approximate 30 lakh households of the state were expected to be benefited by this scheme¹⁸.

Use of Aayu and Sehat Saathi App

The Government of Rajasthan has an exclusive partnership with healthcare startup MedCords in order to provide free 24x7 online consultations and home delivery of medicines to the people of Rajasthan through its integrated solution “Aayu and Sehat Saathi App”. At present, this solution is fully adopted by seven districts of Rajasthan, and soon it would be rolled out in the whole state. Currently, this app is helping more than 10,000 patients a day with consultations from doctors; and provides free home delivery of medicines through its *Sehat Saathi App*, so that no individual is suffered from health problems during the lockdown period, especially in the remote and rural areas. The people who have smart phone, can download these apps from Google play store, and the people who don't have smart phone, they can call a helpline number from anywhere in India to receive consultation from the doctors. The apps and the helpline number support both Hindi and English languages, so that all people can easily use it. Another important feature of this app is built-in comprehensive guide on corona virus to clear the myths and check the symptoms of the users¹⁹.

Under the CSR initiative, the Power Finance Corporation Limited (PFC Ltd.) provided a financial aid of Rs. 50 lakh to the Indian Red Cross Society in the state of Rajasthan. This aid was used for distribution of health masks and sanitizers, as a preventive measure against COVID-19²⁰.

Testing to Identify New Cases of COVID-19

On 18 April 2020, the Rajasthan state was the first to start rapid testing for COVID-19 cases through rapid testing kits. These kits help in quickly isolating the suspected person by giving

instant results based on the presence of antibodies in blood. However, three days later, the state stopped using of these kits because of low accuracy (5.4%) rather than expected accuracy of 90 percent¹⁰. The ICMR also banned the use of these kits for now in other states also. To detect the asymptomatic persons infected with Corona, the Rajasthan Government is now relying on increasing the capacity of RT-PCR tests²¹.

Treatment of COVID-19 Positive Cases

Currently, there is no specific antiviral drug which could be recommended to treat COVID-19 patients, and no vaccine is available hitherto. However, in Rajasthan, three patients recovered during March 2020 with the administration of a combination of anti-malaria, anti swine-flu and anti-HIV drugs. For treatment of severely ill patients, the Rajasthan Government has also sought permission from ICMR for the clinical trials of convalescent plasma therapy at Swai Man Singh Hospital in Jaipur¹⁰.

Conclusion

In December 2019, after the emergence of COVID-19 in China, this new strain of corona virus spread rapidly to over 200 countries/ territories by January 2020, with local transmission was reported in more than

160 countries/ territories. In India, the first case of COVID-19 was reported on 30 January 2020 and the total number of confirmed cases reached around 27,000 by 26 April 2020. In order to prevent the local transmission of infection, most of the countries imposed lock down. In India also, the nation-wide lockdown for 21 days was imposed barring essential and medical services, which was further extended to 3 May 2020. In India, the Rajasthan state was on fourth position which reported a large number of confirmed cases after Maharashtra, Gujarat and Delhi as on 26 April 2020.

In the present paper, the timeline of COVID-19 pandemic in Rajasthan shows that during March 2020, there were only a few cases of COVID-19 but there was an exponential rise in the number of confirmed cases in the month of April. As on 26 April 2020, Rajasthan had reported a total of 2,185 confirmed cases, 629 recoveries and 41 deaths.

District-wise distribution of confirmed cases, active cases, recoveries and deaths shows that there were large differences in the districts in terms of both confirmed and deaths. Out of 33 districts, 28 districts reported confirmed cases of COVID-19. Amongst all the 28 districts, Jaipur was the worst affected district. It may be due to that person in Ramganj, Jaipur who had returned from Oman and tested positive, didn't follow the self-quarantine rules and emerged as a super spreader in the district. Total seven districts including Jaipur had reported more than 100 cases, nine districts had reported 10-100 cases and 12 districts had reported <10 cases of COVID-19 whereas five districts of the state didn't report even a single case of the disease.

The Bhilwara district of the state was once emerged as an epicenter of Corona virus but due to the efforts taken by the Rajasthan Government and local administration, the district came back on track; and became a role model for other districts and states to contain the spread of COVID-19.

The Government of Rajasthan had taken several initiatives in the war against Corona virus which included surveillance and screening, expanded testing, contact tracing, isolation of infected persons and quarantining their contacts, imposing lockdown in the entire state. Due to the collaborative efforts of the Government, media, doctors, researchers, religious gurus, community leaders, police and other stakeholders of the society, today there is a widespread awareness among the population regarding the precautionary measures such as social distancing, hand hygiene and respiratory etiquettes to prevent the infection. Efforts were made to ensure that the supply of essential and medical services was maintained during the lockdown period.

The COVID-19 pandemic and the measures to contain and control it have adversely impacted the livelihoods, growth of economy, food supply, food safety and quality of life of all strata of society. However,

the poor and marginalized segments of the population have been the worst affected. To help this segment of population, the Government provided free ration for families covered under the National Food Security Act (NFSA). The Government launched a scheme "Rajasthan Corona *Sahayata Yojana*" for the poor and needy people of the state, and provided financial assistance of Rs. 2500/-. The government also announced to provide financial aid of Rs. 50 lakhs to the families of the frontline workers who died of during the fight against COVID-19. During this lockdown period, the State also provides the medical assistance to the people through telemedicine using the *Aayu* and *Sehat Saathi* Apps.

Rajasthan was the first state in India to start a rapid testing of COVID-19 cases by using rapid testing kits. However, as these kits gave lower accuracy results; the Government discontinued this and is now relying

on increasing the capacity of RT-PCR tests to detect the asymptomatic persons infected with Corona. In the last, it can be concluded that the timely implementation of lockdown and preventive precautionary measures proved to be effective in lowering the average growth rate of the infectious cases, and slowing down the process of transmission. Thus, these steps of the Government reduced the severe illness and deaths during the times of COVID-19 pandemic in Rajasthan.

References

1. Ministry of Health and Family Welfare. Containment plan for large outbreaks novel Corona virus Disease 2019 (COVID-19). MoHFW, Government of India. Available on: <https://www.mohfw.gov.in/pdf/3ContainmentPlanforLargeOutbreaksofCOVID19Final.pdf>, accessed on 23 April 2020.
2. Gupta et al. Laboratory preparedness for SARS-CoV-2 testing in India: Harnessing a network of Virus Research & Diagnostic Laboratories. *Indian J Med Res.* 2020. DOI: 10.4103/ijmr.IJMR_594_20.
3. Gupta et al. Severe acute respiratory illness surveillance for corona virus disease 2019, India, 2020. *Indian J Med Res.* 2020. DOI: 10.4103/ijmr.IJMR_1035_20.
4. Kalaivani K & Ramachandran P. COVID-19 in India: Challenges to health, food security and nutrition. *Bulletin of the Nutrition Foundation of India*; 2020, 41 (2): 1-8.
5. Varghese GM & John R. COVID-19 in India: Moving from containment to mitigation. *Indian J Med Res.* 2020. DOI: 10.4103/ijmr.IJMR_860_20.
6. World Health Organization. Corona virus disease 2019 (COVID-19) situation report – 97. WHO. 2020. Available on: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports>, accessed on April 28, 2020.
7. World Health Organization. Corona virus. WHO. 2020. Available on: <https://www.who.int/health-topics/coronavirus>, accessed on April 23, 2020.
8. World Health Organization. Novel Corona virus Disease (COVID-19) situation update report– 13. WHO India. 2020. Available on: <https://www.who.int/india/emergencies/india-situation-report>, accessed on April 28, 2020.
9. Ministry of Health and Family Welfare, Government of India. Available on: <https://www.mohfw.gov.in>, Accessed on April 26, 2020.
10. 2020 corona virus pandemic in Rajasthan. Wikipedia. Available on: https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_Rajasthan, accessed on April 26, 2020.
11. Medical, Health and Family Welfare Department, Government of Rajasthan. Available on: <https://www.rajswasthya.nic.in>, accessed on 26 April 2020.
12. COVID-19: Bhilwara Model sets example to break the chain. *Bio Voice News.* Available on: <https://www.biovoicenews.com/covid-19-bhilwara-model-sets-example-to-break-the-chain/>, accessed on 26 April 2020.
13. Bhilwara model: India's COVID-19 containment strategy. *WION News.* Available on: <https://www.wionews.com/india-news/bhilwara-model-indias-covid-19-containment-strategy-291620>, accessed on 26 April 2020.
14. Five steps that enabled Bhilwara to defeat COVID-19 and become a model containment zone. *Citizen Matters.* Available on: <https://citizenmatters.in/jaipur-the-big-hotspot-and-the-bhilwara-model-of-containment-17397>, accessed on 26 April 2020.
15. COVID-19: Scaling testing numbers proves to be the real test for India. *Sakal Times.* Available on: <https://www.sakaltimes.com/opinion-nation/covid-19-scaling-testing-numbers-proves-be-real-test-india-49015>, accessed on 26 April 2020.

16. Rajasthan CM reviews COVID-19 preparedness. ANI News. Available on: <https://www.bignewsnetwork.com/news/264360878/rajasthan-cm-reviews-covid-19-preparedness>, accessed on 26 April 2020.
17. Corona virus: Modified lockdown in Rajasthan from April 21 | List of services available. India Today. Available on: <https://www.indiatoday.in/india/story/coronavirus-modified-lockdown-in-rajasthan-from-april-21-list-of-services-available-1668635-2020-04-19>, accessed on 23 April 2020.
18. Rajasthan Corona Sahayata Yojana COVID-19 Anugrah Rashi Bhugtan List I-II Rs. 1000-1500 Status. Kvsro Lucknow. Available on: <https://www.kvsrolucknow.org.in/rajasthan-corona-sahayata-yojana/>, accessed on 26 April 2020.
19. Rajasthan Govt partners with healthcare App 'Aayu' to tackle COVID-19. Express Computer. Available on: <https://www.expresscomputer.in/industries/healthcare/rajasthan-govt-partners-with-healthcare-app-aayu-to-tackle-covid-19/53474/>, accessed on 26 April 2020.
20. PFC extends support to fight COVID-19 in Rajasthan. PSU Connect. Available on: <https://www.psuconnect.in/news/PFC-extends-support-to-fight-COVID-19-in-Rajasthan/22020/>, accessed on 26 April 2020.
21. Corona virus: Rajasthan Govt steps up capacity for RT-PCR tests to detect asymptomatic patients. India Today. Available on: <https://www.indiatoday.in/india/story/coronavirus-rajasthan-govt-steps-up-capacity-for-rt-pcr-tests-to-detect-asymptomatic-patients-1670301-2020-04-23>, accessed on 26 April 2020.

कोविड-19 महामारी के विरुद्ध लड़ाई में राजस्थान सरकार की पहल

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सारांश

दिसंबर 2019 में चीन में कोविड-19 वायरस के सामने आने के पश्चात, जनवरी 2020 में यह नया कोरोना वायरस 200 से अधिक देशों में तेजी से फैल गया, जिसमें 160 से अधिक देशों में स्थानीय प्रसार की सूचना प्राप्त हुई। विश्व स्वास्थ्य संगठन ने वायरस के संक्रमण की गति एवं प्रसार पैमाने के आधार पर इसे 11 मार्च 2020 को एक महामारी घोषित कर दिया। भारत में, कोविड-19 का पहला मामला 30 जनवरी 2020 को दर्ज किया गया तथा 26 अप्रैल 2020 तक कुल पुष्ट मामलों की संख्या लगभग 27,000 तक पहुँच गई। महाराष्ट्र, गुजरात, दिल्ली, राजस्थान, मध्य प्रदेश, तमिलनाडु, उत्तर प्रदेश, तेलंगाना और आंध्र प्रदेश से बड़ी संख्या में मामले सामने आए। वर्तमान लेख में राज्य में इस प्रसार को रोकने के लिए राजस्थान सरकार द्वारा की गई समन्वित और व्यापक कार्रवाही का सिंहावलोकन करने का प्रयास किया गया है। वर्तमान लेख के निष्कर्षों से पता चलता है कि मार्च 2020 की अवधि के दौरान, राजस्थान में कोविड-19 के कुछ ही मामले सामने आये थे, लेकिन अगले माह में पुष्ट होने वाले मामलों की संख्या में तेजी से वृद्धि हुई है। 26 अप्रैल 2020 तक, राजस्थान में कुल 2,185 पुष्ट मामले थे जिसमें से 629 ठीक हुए थे तथा 41 मौतें हुई थीं। पुष्ट मामलों, सक्रिय मामलों, ठीक हुए तथा मृत्यु के जिलेवार वितरण से पता चलता है कि दोनों पुष्ट मामलों तथा मौतों के मामलों में जिलों में काफी अंतर पाया गया। 33 जिलों में से, 7 जिलों में 100 से अधिक मामले दर्ज किए गए थे, 9 जिलों में 10-100 मामले तथा 12 जिलों में 10 से कम मामले थे, जबकि राज्य के 5 जिलों में एक भी मामला दर्ज नहीं हुआ था। राज्य का भीलवाड़ा जिला एक बार कोरोना वायरस के एक महामारी उपरिकेंद्र के रूप में उभरा था, लेकिन राजस्थान सरकार तथा स्थानीय प्रशासन द्वारा किए गए प्रयासों से, जिला पुनरु अनुकूल स्थिति में आ गया तथा अन्य जिलों एवं राज्यों के लिए कोविड-19 रोकथाम हेतु हुए प्रयासों में रोल मॉडल बन गया। राजस्थान सरकार ने कोरोना वायरस के विरुद्ध युद्ध में कई पहल की जिसमें निगरानी एवं स्क्रीनिंग, बड़ी संख्या में परीक्षण, संपर्क में आए लोगों का पता लगाना (कॉन्टैक्ट ट्रेसिंग), संक्रमित व्यक्तियों को अलग करना तथा उनके संपर्कों को अन्य व्यक्तियों से अलग करना (क्वारेन्टाइन), पूरे राज्य में लॉकडाउन लागू करना शामिल था। इससे यह निष्कर्ष निकालता है कि लॉकडाउन का समय पर कार्यान्वयन तथा उठाए गए निवारक उपाय संक्रामक मामलों की औसत वृद्धि दर को कम करने एवं महामारी प्रसारध्वंसचरण की प्रक्रिया की गति धीमी करने में प्रभावी सिद्ध हुए थे। इस प्रकार, इन कुशल उपायों के परिणामस्वरूप राजस्थान में कोविड-19 महामारी के गंभीर रोगों तथा मृत्यु दर में कमी आई।

प्रमुख शब्दरू कोविड-19, कोरोना वायरस, महामारी, अलगाव, संगरोध (क्वारेन्टाइन), राजस्थान।

Digital Health Tools Available for Programme Managers to Manage public Health Emergencies Like COVID-19

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Abstract

Corona virus disease 2019 (COVID-19) has led to an emergency of international concern and a challenge to the national health care system. This article describes how digital health technologies are being or could be used for COVID-19 mitigation. The COVID-19 crisis is demonstrating the potential of digital health technologies in managing the public health challenges. This paper presents several current digital health initiatives used by India and the world as well in managing the COVID-19 pandemic. To discuss the digital health tools for the programme managers to handle public health emergency, the article has tried to cover the currently available digital health tools for the effective containment of COVID-19 pandemic. A secondary data analysis using the Google search engine was used with relevant key words. The study was done using an extensive review of literature on various digital tools available for managing COVID-19.

Developing a flexible, scalable, resilient, and most importantly, interoperable digital health tools are essential to ensure that the necessary digital health ecosystem is present to respond to the current and future health emergencies. The use of digital health tools can be further expanded at various levels of health care system like training of health care staff, monitoring, supervision, situational analysis, tracing, clinical management of health care emergency like Covid-19, public awareness, communication, etc. The overarching goal for all the countries is to control the pandemic by slowing down the transmission and reducing the mortality associated with COVID-19. For controlling and slowing down the pandemic, digital health tools have contributed enormously, and this paper is an attempt to summarize a few of the tools for reference.

Key words: Public health emergency, Digital health tool, Hotspot mapping, Contacttracing, Covid-19

Introduction

In December 2019, a group of patients with pneumonia of an unidentified source was identified in Wuhan province of China. A previously unknown beta corona virus was discovered using sequencing in samples from patients with pneumonia. Human airway epithelial cells were used to isolate the novel corona virus, named 2019-nCoV which formed a clade within the subgenus Sarbeco virus, Ortho Coronaviridae subfamily. Different from both MERS-CoV and SARS-CoV, 2019-nCoV is the seventh member of the family of corona viruses that infect humans. Further investigations are underway to understand the disease pattern better¹.

To address the health needs, digital health or the use of digital technologies for health has become a prominent field of exercise for engaging routine and progressive forms of information and communications technology (ICT). The term digital health is deep-rooted in eHealth, which is defined as “the use of information and communications technology in support of health and health-related fields”. Mobile health (mHealth) is a subset of eHealth and is defined as “the use of mobile wireless technologies for health”. More recently, the term digital health was introduced as “a broad umbrella term encompassing eHealth which includes mHealth, as well as emerging areas, such as the use of advanced computing sciences in ‘big data’, genomics and artificial intelligence”.²

Technologies and surveillance systems play a vital, growing, and evolving role in supporting public health responses to outbreaks and other public health concerns. The functions supported might include event detection, event characterization, enhanced surveillance, situational awareness, formal epidemiologic investigations, identification and management of exposed persons, and monitoring of the response itself and its effectiveness. In any field investigation, decisions need to be made early and strategically regarding methods, data sources, systems, and technologies. The skillful initial selection of optimal tools and approaches improves and strengthens the investigation³.

The COVID-19 crisis is demonstrating the potential of digital health technology in managing the public health challenges and emergencies. The Center for Disease Control and Prevention has also recognized that technology and surveillance systems can play an integral role in supporting the public health response to outbreaks. India is also equally affected by the COVID 19 pandemic where the first case of the 2019–20 corona virus pandemic was reported on 30 January 2020, and as on 26 April 2020, the Ministry of Health and Family Welfare has confirmed a total of 26,917 cases; 5,914 recoveries including one migration, and 826 deaths in the country⁴.

The use of digital technologies such as big data, artificial intelligence (AI), cloud computing to better support the epidemic monitoring analysis, virus attribution, epidemic prevention, control, treatment, and resource allocation⁵ are just a few examples of how technology has the potential to play an integral role in limiting the spread of the virus, assisting in the treatment of infected individuals. Thus, technology helps flattening the curve of the disease progression. Perhaps the positive impact of these technologies will further accelerate the Identification and adoption of digital innovation in healthcare. However, such innovation still needs to be balanced with the continued need for safety⁶.

This commentary presents a number of the current digital health initiatives used world over in managing the emergencies of Covid-19 pandemic.

Various technological tools and their use in India

India is the topmost off-shoring destination for IT companies across the world. Having proven its capabilities in delivering both on-shore and off-shore services to global clients, emerging technologies now offer an entire new gamut of opportunities for top IT firms in India. Government of India also utilized the major strength and developed various IT-based tools in managing the Covid-19 pandemic in the country.

Table 1

Digital Health Tools Contributing to the Pandemic Management

Sr. No.	Activity	Tool	Detail	Link
1	Tracking the corona virus pandemic worldwide	Real-time web-based tool	An online dashboard shows all confirmed, suspected and recovered corona virus patients, as well as deaths	https://www.who.int/emergencies/diseases/novel-coronavirus-2019
2	Generation of reliable dataset	Standardized excel based tool	Real time reporting by testing laboratories, hospitals	https://www.mohfw.gov.in/ & Ref. 7
3	Hotspot mapping	Base map file and spatial clustering	An online tool to geographically map the hotspots of Covid-19	https://www.covid19india.org/
4	Contact tracing	GPS & Bluetooth enabled phones with internet connection	Development of an mobile application named <i>Aarogya Setu</i> for tracing the infections	<i>Aarogya Setu</i> Mobile App
5	Ensuring quarantine practices	GPS, camera-enabled phones with Internet connection	Mobile applications using different technologies like GPS tracking, sharing selfies, etc.	Reference no. 10,11,12
6	Spreading awareness in the community	Audio, Video, Animations, IEC, BCC, audio messages, mobile hello tunes, media briefing, Police march-past etc.	Utilization of various Print media, digital media, mobile and web based tools and applications	
7	Mapping of Covid-19 hospitals	Web based tool	All the COVID-19 health facilities & Testing labs plotted on India's map	https://maps.mapmyindia.com/corona
8	Training and capacity building	Online web and mobile based tool	Already existing government online platform for training named IGOT used	https://igot.nic.in/

Tracking the Corona Virus Pandemic Worldwide

In the times of a pandemic, it is essential to keep a close watch on the global situation to review the policies, taking timely decisions and take corrective measures. WHO has designed an online dashboard to show all confirmed, suspected and recovered corona virus patients as well as deaths worldwide. The real-time data provide everyone with the opportunity to take timely decisions. Similarly, the Ministry of Health and Family Welfare (MoHFW), Government of India has also created its real-time dashboard providing state and district-wise number of Covid-19 cases.

Generation of Reliable Dataset

To understand how the pandemic is progressing, a reliable dataset is required. Without data, we cannot respond appropriately to the pandemic; neither as individuals nor as a society. Nor we can learn where the counter measures against the pandemic are working and where not. The speed in which the Covid-19 is spreading, is itself an emergency for creating some reliable datasets across the globe. This has made it

challenging for the medical research community. In this regard, India has adopted bottom to top reporting approach by identified Covid-19 management centers and testing labs. The identified testing labs report the testing data through email to ICMR⁷ and MoHFW. This generates the district and state-wise datasets for decision making and deciding the pandemic management interventions. The same information is being updated daily to MoHFW official website for the use of general audiences.

Hotspot Mapping

Hotspot analysis is a spatial analysis and mapping technique interested in the identification of clustering of spatial phenomena. These spatial phenomena are depicted as points in a map and refer to locations of events or objects⁸. In Management of Covid-19, hotspot mapping technique is very effectively used to map the cases in different locations of the country. Based on the mapping of Covid-19 cases geographically, the programme managers were able to identify the areas which need immediate focus. In hotspot mapping, geographical clustering of the cases is also being done to develop strategies based on the caseload for deciding containment and buffer zones. The data then, using heat mapping technologies and predictive analytics, guide in marking the buffer zones⁹.

Contact Tracing

In an infectious disease like Covid-19, when we get a positive case, it becomes essential to track the visiting history of the positive case for timely identification of suspected contacts. If we get a list of these people quickly, it is ensured that they are prioritized for testing and isolation before further spreading the infection. This is one of the effective means to interrupt the chain of transmission.

Several approaches are being proposed where phones detect what other phones are near them. It would involve using Bluetooth plus sending a sound out that humans can't hear but that verifies that the two phones are reasonably close to each other. The idea is that if someone tests positive then their phone can send a message to notify people around through text messages and alerts their owners to get tested. If most people voluntarily installed this kind of application, it would probably help some.

Ministry of Electronics and IT, Gol has developed a mobile application named "*Aarogya Setu*" to track the individuals. The tracking is done through a Bluetooth and location-generated social graph which can show your interaction with anyone who has tested positive.

To break the chain of Transmission of infection, it is important to provide medical help and advisory to people who may potentially be at risk, especially asymptomatic people i.e. people who may have contracted the infection but haven't shown the symptoms yet. *Aarogya Setu* enables early identification and prevention of potential risk of infection, through contact tracing, and thus, acts as a shield for users, their family and community. Also, when user takes the self-assessment test on the *Aarogya Setu* app, by correlating the symptoms that user report along with location information, the Government of India will have

the ability to identify potential hotspots (where the disease may be spreading) early enough so that necessary interventions can be done to control and mitigate the spread of COVID-19.¹⁰

Ensuring Quarantine

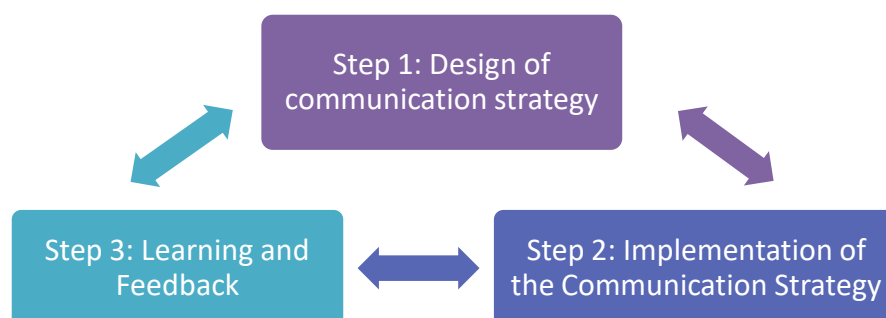
To ensure people, who are quarantined for COVID-19, do not stray from the confines of their homes, there are mobile applications to track and monitor such people. In India, different states have used different methodologies using mobile technologies to ensure quarantine of suspected cases. Some examples are as follow:

- To effectively track the home-quarantine citizens and ensure they are staying in the home, a mobile application named “*Saiyam*” has been developed by the Pune Municipal Corporation under the Smart Cities Mission (SCM). The city administration has appointed dedicated teams for five zones to conduct a follow-up with people under home quarantine daily. The teams will check on people who have recently returned from international trips and those discharged after treatment for COVID-19. Accordingly, the teams will seek updates from quarantined people on their health status, and the details of persons in contact with them. For persons sporting the home quarantine stamp, the teams will check if separate food, bed, utensils, clothes and washrooms are provided to them. All the home-quarantined citizens are given the mandate to download the app and install it. These identified citizens are advised to keep the GPS feature on the device always switched-on and the mobile device should be switched-on throughout 24 hours during the quarantine period. Citizens’ movements can be monitored centrally in real-time from the monitoring cell and are marked as red, amber or green. Red signifies that the person has ventured out for a longer duration; amber signifies that the person has limited movements and green signifies that the person is confined to house limits¹¹.
- To ensure people, who are quarantined for COVID-19, do not stray from the confines of their homes, the state Government of Himachal Pradesh has developed a mobile application to track and monitor such people. The state’s department of information technology has started using a 'Corona Mukh Himachal' mobile app. The health workers of the Health Department monitor the people, especially those on home-quarantine through this app. This is an OTP-based application which has been given by the health worker, and violation of quarantine will be monitored through this tracking application¹².
- The Karnataka Government has devised a GPS coordinate-based mechanism that tracks persons under the order of home quarantine and has instructed them to send selfies or photos to the monitoring team to ensure they are following the isolation norms. The Government has developed the mobile app and is instructing all persons under the order of home quarantine to send their selfies to the government every one hour from home. The selfie or photo contains GPS coordinates. So, the location of the sender gets known. Every selfie is examined by a government photo verification team. If the home quarantine person fails to send a selfie every hour (except sleep time from 10 pm to 7 a.m.), the government team will reach such defaulters and they are liable to be shifted to a Government-run mass quarantine facility¹³.

Spreading Community Awareness

COVID-19 is a novel disease for which effective vaccines and medicines are in the process of development. In the absence of an effective treatment protocol maintaining social distancing, frequent hand

washing and maintain respiratory hygiene are the key preventive measures identified to protect the community from this pandemic. It was a big challenge to make everyone understand the importance of these key measures. Sharing the right information with the community is emerging as an important need in tackling the COVID-19 pandemic. MoHFW designed the specific communication strategy by identifying the different stakeholders. The communication strategy was divided into 3 steps as illustrated here¹⁴.



To achieve the said objectives, various digital health tools were used by MoHFW i.e. Web tool, Mobile applications, Animated videos, Social media platforms, etc.

Mapping of Covid-19 Hospitals and Testing Labs

Mapping of Covid-19 hospitals and testing labs is essential when we need help or we want to help. If we need help related to COVID-19, the first thing we need to know is the location of a facility or hospital which is conducting test or providing treatment and isolation for COVID-19. In a country like India, it was a challenge to display all the COVID health facilities and testing labs in a simple way. Plotting all the facilities on the map is an easy way to demonstrate the information. The tool should be user-friendly and accessible to everyone. There are various applications available which are tremendously developed; one such example is 'maps of India'¹⁵.

Training and Capacity Building of the Health Care Workforce

Covid-19 pandemic has changed our lives and work culture in different ways. Training and capacity building of health workforce is an essential component in a new disease like Covid-19. Use of digital health, especially when organization of large gatherings is an issue, proved to be the most important component in training and capacity building in pandemic situations. Various digital health platforms like mLearning, eLearning, educational videos, small quizzes, research questionnaire, webinar and many others have been designed and used by different organizations in different areas.

To reach up to the last mile including Doctors, Nurses, Paramedics, Hygiene workers, Technicians, Auxiliary Nursing Midwives (ANMs), State Government Officers, Civil Defense Officials, various Police Organizations, National Cadet Corps (NCC), Nehru Yuva Kendra Sangathans (NYKS), Indian Red Cross Society (IRCS), Bharat Scout and Guides (BSG) and other volunteers; the MoHFW identified the existing online platform i.e. Integrated Government Online Training (iGOT) for training and capacity building. The platform provides online modules on flextime and on site-basis so that Covid-19 response can be delivered at scale for the workforce needed to tackle the pandemic.

The MoHFW has designed more than 47 types of different resource materials for the capacity building of various stakeholders. To facilitate these 47 types¹⁶ of resource materials, various videos and reading materials have also been made.

Limitations

Digital health has the potential to help address problems such as distance and access but still has many of the underlying challenges faced by health system interventions in general, including poor management, insufficient training, infrastructural limitations, and data privacy. These considerations need to be addressed in addition to the specific implementation requirements introduced by digital health.

Conclusion

Recent national and global occasions have demonstrated the effect of a large-scale health care emergency on the present health care foundations and the challenges faced by health care facilities to surge to meet these demands. One approach to meet these challenges is to clout existing mobile and other digital health technologies to expand local, regional, and national health care capability and capacity. Developing a flexible, scalable, resilient, and most importantly, interoperable digital health tools are essential in ensuring that the necessary digital health ecosystem is present to respond when future disasters or emergencies strike. The capacity and capabilities gained from sustained digital health tools, now and between crises, would allow for enhanced care provision, distribution, and rapid deployment at scale to make our nation safer.

Recommendations

The use of digital media tool can be further expanded at various levels of health care system like training and capacity building of health care staff, monitoring, supervision, situational analysis, mapping, quarantine-monitoring, tracing, clinical management of health care emergency like Covid-19, public awareness, communication, etc. Apart from the health department, use of digital media can also be extended in the other public sector departments like education, transportation, food and drugs, and defense, etc. to strengthen the public health care emergency management.

References

1. <https://www.nejm.org/doi/full/10.1056/NEJMoa2001017>.
2. https://www.who.int/health-topics/digital-health#tab=tab_1.
3. <https://www.cdc.gov/eis/field-epi-manual/chapters/data-collection-management.html>.
4. https://en.wikipedia.org/wiki/2020_coronavirus_pandemic_in_India.
5. <http://www.caict.ac.cn/english/yjcg/qwsj/202003/P020200325657818669882.pdf>.
6. <https://www.covingtondigitalhealth.com/2020/03/the-potential-benefits-of-digital-health-technology-in-managing-covid-19/>.
7. <https://www.mohfw.gov.in/pdf/NotificationofICMguidelinesforCOVID19testinginprivatelaboratoriesIndia.pdf>.
8. <https://www.mailman.columbia.edu/research/population-health-methods/hot-spot-detection#websites>.
9. <https://www.covid19india.org/>.
10. https://static.mygov.in/rest/s3fs-public/mygov_159056978751307401.pdf

11. <https://pib.gov.in/PressReleasePage.aspx?PRID=1616686>.
12. <https://government.economictimes.indiatimes.com/news/digital-india/hp-govt-develops-mobile-app-to-monitor-quarantined-people/74907032>.
13. <https://www.thehindubusinessline.com/info-tech/karnataka-develops-app-to-track-home-quarantined-persons/article31214354.ece>.
14. <https://www.mohfw.gov.in/pdf/1PreliminaryStakeholderEngagementPlan.pdf>.
15. <https://maps.mapmyindia.com/corona>.
16. <https://www.mohfw.gov.in/pdf/BASEDOCforRESOURCESrev06042020.pdf>.

जन स्वास्थ्य आपात स्थितियों जैसे कोविड -19 के प्रबंधन हेतु प्रबंधकों के लिए उपलब्ध डिजिटल स्वास्थ्य उपकरण

‘संजय गुप्ता, “लोकेश शर्मा, “शशिकांत,
“राकेश कुमार, “दीप्ति सिंघल और “हितेश कुमार

‘प्रोफेसर एवं नोडल अधिकारी, एनसीसीवीएमआरसी, रास्वापकसं, मुनिरका, नई दिल्ली -110067

“एनसीसीवीएमआरसी, रास्वापकसं, मुनिरका, नई दिल्ली -110067

सह-संपादक: डॉ. नीलेश गावडे, सहायक प्रोफेसर, टाटा इंस्टीट्यूट ऑफ सोशल साइंसेज (टीआईएसएस), मुंबई, महाराष्ट्र।

समीक्षक:

डॉ मनीष राणा, सहायक प्रोफेसर, सामुदायिक चिकित्सा, जीएमईआरएस मेडिकल कॉलेज, सोला, अहमदाबाद, गुजरात।

डॉ. दीपक एस खिसमात्राओ, सह-प्रोफेसर, सिम्बायोसिस मेडिकल कॉलेज फॉर विमेन, सिम्बायोसिस इंटरनेशनल डीम्ड यूनिवर्सिटी, पुणे।

सारांश

कोरोना वायरस रोग 2019 (कोविड-19) एक आपातकालीन स्थिति के रूप में उभरकर सामने आया है जो अंतरराष्ट्रीय चिंता का विषय बना हुआ है एवं राष्ट्रीय स्वास्थ्य देखभाल प्रणाली के लिए एक चुनौती। इस लेख में वर्णन किया गया है कि कोविड -19 के प्रसार में कमी लाने के लिए डिजिटल स्वास्थ्य तकनीकों का उपयोग कैसे किया जा रहा है या किया जा सकता है। कोविड-19 महामारी का संकट जन स्वास्थ्य चुनौतियों के उपचार प्रबंधन में डिजिटल स्वास्थ्य प्रौद्योगिकियों की क्षमता को प्रदर्शित कर रहा है। इस लेख में भारत तथा विश्व द्वारा वर्तमान में प्रयोग की जाने वाली डिजिटल स्वास्थ्य पहलों को प्रस्तुत किया गया है साथ ही कोविड-19 महामारी के उपचार प्रबंधन में डिजिटल स्वास्थ्य पहलों के उपयोग को दर्शाता है। इस लेख में कोविड-19 महामारी के प्रभावी नियंत्रण के लिए वर्तमान में उपलब्ध डिजिटल स्वास्थ्य उपकरणों को शामिल कर जन स्वास्थ्य आपातकाल की स्थिति के उपचार प्रबंधन हेतु कार्यक्रम प्रबंधकों के लिए डिजिटल स्वास्थ्य उपकरणों के बारे में चर्चा की गई है। गूगल सर्च इंजन का प्रयोग करते हुए प्रासंगिक प्रमुख शब्दों के साथ गौण आंकड़ा विश्लेषण किया गया। कोविड-19 के उपचार प्रबंधन के लिए उपलब्ध विभिन्न डिजिटल उपकरणों पर साहित्य की व्यापक समीक्षा का प्रयोग करते हुए अध्ययन किया गया।

यह सुनिश्चित करने के लिए अनिवार्य है कि आवश्यक डिजिटल स्वास्थ्य पारिस्थितिकी तंत्र वर्तमान तथा भावी स्वास्थ्य आपात स्थितियों के बारे में प्रतिक्रिया देने के लिए विद्यमान हैं, इसके लिए लचीले, मापनीय, लोचदार तथा अति महत्वपूर्ण रूप से अंतर्निहित डिजिटल स्वास्थ्य उपकरण विकसित किए जाने आवश्यक हैं। स्वास्थ्य देखभाल प्रणाली के विभिन्न स्तरों पर प्रशिक्षण, निगरानी, पर्यवेक्षण, स्थितिपरक विश्लेषण, अनुरेखण, स्वास्थ्य देखभाल आपात स्थिति के नैदानिक उपचार प्रबंधन जैसे कोविड-19, जन जागरूकता, संचार आदि में डिजिटल स्वास्थ्य उपकरणों के प्रयोग का अधिक विस्तार किया जा सकता है। सभी देशों का मुख्य लक्ष्य महामारी की प्रसार गति को धीमा करके तथा कोविड-19 से जुड़े मृत्यु के मामलों को कम करके महामारी को नियंत्रण करना है। महामारी को नियंत्रित करने तथा धीमा करने के लिए, डिजिटल स्वास्थ्य उपकरणों ने बहुत महत्वपूर्ण योगदान दिया है, तथा इसलिए इस लेख द्वारा कुछ उपकरणों के संक्षेप विवरण संदर्भ हेतु प्रस्तुत किया गया है।

प्रमुख शब्द: जन स्वास्थ्य आपातकाल, डिजिटल स्वास्थ्य उपकरण, हॉटस्पॉट मैपिंग, संपर्क अनुरेखण, कोविड-19

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Example of References

Journal Article

1. Halpen SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. *N Engl J Med.* 2002 Jul 25;374(4):284-287

Journal article with more than 6 authors

2. Kawamura R, Miyazaki M, Shimizu K, Matsumoto Y, Silberberg YR, Ramachandra Rao S, et al. A new cell separation method based on Antibody-immobilized nanoneedle arrays for the detection of intracellular markers, *Nano Lett.* 2017 Nov 8;17(11):7117-7124

Book/Monograph Entry

3. Carlson BM. *Human embryology and developmental biology.* 3rd ed. St. Louis: Mosby; 2004.

Chapter in a Book

4. Yadav A, Sharma KKN. Awareness of reproductive and child health care programme among Rajgonds tribe of Sagar district, Madhya Pradesh. In: Sharma K.K.N., editor. *Reproductive and child health problem in India.* New Delhi: Academic Excellence; 2005, pp. 592-597.

Electronic material

5. World Health Organization (WHO). Mortality country fact sheet 2006 [internet]. Geneva: WHO; 2006. Available from: www.who.int/whosis/mort_emro_pak_pakistan.pdf (Accessed 27 August 2018)

Reports

6. Reddy, K, Srinath, and Gupta, Prakash C (ed). *Tobacco Control in India.* Ministry of Health and Family Welfare, Government of India, Centre for Disease Control and Prevention, USA and World Health Organization. Report, 2004.

THE NATIONAL INSTITUTE OF HEALTH AND FAMILY WELFARE

The National Institute of Health and Family Welfare (NIHFW) an autonomous organization, under the Ministry of health and Family Welfare, Government of India, acts as an 'apex technical institute' as well as 'think tank' for the promotion of Health and Family Welfare programmes in the country. The NIHFW is known for its Education, Training, Research, and Specialized advisory services.

Educational activities: The educational activities of the Institute contribute to Human resource development for better management of health and family welfare programmes in the country. The on campus courses are: Three-year Post-graduate Degree in Community Health Administration, a two-year Post-Graduate Diploma in health Administration, and a one year Post-Graduate Diploma in learning mode of one year duration each. These are: Health and Family Welfare management, Hospital management, health Promotion, health Communication, Public Health Nutrition and Applied Epidemiology. These courses are need based and multidisciplinary in nature. The Institute has also developed certificate courses through e-learning mode for enhancing the skills and competencies of in-service middle level health professionals in the areas of 'Professional Development in Public health and Health Sector Reforms' for Medical Officers, and "Programme Management for Public Health care for the Programme Managers working in national health Mission or in the health sector.

Training and Workshops: The training courses and workshops (intramural and extramural), numbering around 45-50 are organized by the Institute every year with an aim to familiarize the participants with the goals and the objectives of health and family welfare programmes; updating their knowledge and understanding of operational difficulties in implementation and suggesting remedial measures to overcome such constraints.

Research and Evaluation: The Institute gives priority attention to research in various aspects of health and family welfare. The Institute has an Academic Committee and a high level Programme Advisory Committee for ensuring the quality in academic endeavours. The Institute also conducts evaluation studies of National Health Programmes and various other related activities initiated by the Government of India.

Specialized Services: Specialized services of the Institute include Clinical services, National Cold Chain and Vaccine Resource management Centre (NCCVMRC), Centre for Health Informatics, Skill Lab, National Documentation Centre and publications. The ministry of health and Family Welfare (MoHFW) has entrusted the Institute to act as a "National Nodal Agency" to organize, coordinate and monitor the training programmes of Reproductive and Child health (RCH) in the country. The main objective of the Clinic is to render Mother and Child Health services. The clinical work in relation to infertility, reproductive disorders, especially endocrinology and sexual dysfunctions deserve special mention. NIHFW in partnership with UNICEF through the National Cold Chain Management Information System, is responsible for the overall maintenance, implantation and monitoring of NCCMIS across the country including providing support to the end users. The reference, referral, press clipping and bibliographic services of the National Documentation Centre; and the publication, art and projection services of the Department of Communication compliment the activities of the Institute.

Advisory and Consultancy Services: The Director and faculty members of the Institute provide advisory and consultancy services to various national, international and voluntary organizations in various capacities.

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