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Health and Population: Perspectives and Issues

आरोग्यम् सुखसम्पदा

राष्ट्रीय स्वास्थ्य एवं परिवार कल्याण संस्थान

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

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Editorial

AAPADA MAI AVSAR (Opportunity amidst Crisis): Post-Corona Neo-Normal

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Everything, good or bad, always comes to an end; and so will this corona pandemic despite the havoc it has created globally, though we do not know when. Pandemics have been mass killers and history is replete of their stories causing billions of deaths like 200 million deaths by plague in the 14th century, 500 million by Smallpox and 100 million by Spanish Flu in the 20th century[1]. The current Corona pandemic has brought in many social, economic and behavioural changes affecting all facets of life. Some of these changes have been adopted voluntarily and some reluctantly enforced through legislation or societal pressure. Many of these changes will persist even when this pandemic is over and influence various spheres of our lives, including health. These changes would have evolved naturally over time but the pandemic facilitated and fast-tracked them.

Universalization of E-learning: Lockdown led to closure of offline courses in all educational, vocational and professional institutes. One of the fastest changes seen was adoption of Web-based learning. The online platform was leveraged, in an unprecedented way, for teaching, training, mentoring pupils ranging from pre-school toddlers to doctors. While the current e-learning might not be very interactive or fall short in catering to psychomotor domain and soft skills; in future, it will evolve to address this as well. Though the Medical Council of India (MCI) does not approve online teaching, it is going to become an integral part of the teaching-learning methods in medical colleges as well. Universalization of smartphones with cheap data has enabled this revolution in the education system. However, this transformation is challenging in underdeveloped areas as some students in tribal and rural areas were seen running here and there, even climbing on trees, to get net connectivity to attend their e classes[2].

Virtual Meetings: People spend varying hours, 2–30 hours a week, in meetings. In the current crisis, many meetings are either cancelled or if held, are virtual and shorter. Video conferencing has removed the global restrictions on the participants. Anyone anywhere can attend anytime. One major advantage is that it obviates the need to travel for the meeting. Minimising travel has multidimensional benefits from saving the time, fuel, decrease in road accidents, environmental pollution, exposure to exotic diseases (Yellow Fever, Tuberculosis, Cholera) and re-emerging diseases (Zika, Ebola, SARS and MERS) associated with travel to an endemic area. Further, this virtual videoconferencing has been very effectively used for monitoring and supervision as well as tele-mentoring. Several conferences, lectures are now being organized online thereby catering to a much larger audience. This is knowledge without borders in true sense.

Telemedicine: A National Telemedicine Task Force was set up by the Health Ministry of India in 2005. However, in the absence of clear guidelines and mandates, telemedicine had been implemented with a limited scope, coverage and success in improving accessibility of medical care, especially in hard to reach areas[3]. Telemedicine Practice Guidelines- Enabling Registered Medical Practitioners to Provide Healthcare

Using Telemedicine released by the MoHFW in March 2020 coupled with wide availability of smartphones and cheap internet data has provided the much-needed impetus to this platform. The Union Health Ministry's e-Sanjeevani telemedicine platform is being used by over 12000 practitioners across 26 states and has crossed 4 lakh consultations[4]. This new era of telemedicine along with e-prescription, tele counselling, net pharmacy would change the current healthcare industry. While it may adversely affect the neighbourhood general practitioner and chemists, if followed as per guidelines, would be a better option than quacks or faith healers. Rural India has 227 million active internet users, surpassing the urban India by 10 per cent. The creation of demand for internet under the Digital India programme can be leveraged by telemedicine as well.

Tele working and Results only Work Environment: Earlier, these concepts were associated with various multinational tech companies. This innovative work culture is now becoming the new normal. Coronavirus forced many organizations to break through the slow procedures, rigid hierarchies, etc. and act instantly, allowing employees to work from home. Geographically neutral work environment is a boon specially for women who can now fulfill their domestic expectations without compromising the professional aspects. In fact, when both spouses are working from home, the pre-defined gender roles will be blurred and males as equal partners, may shoulder more domestic responsibilities. Outsourcing of work by organization based in metros can later be outsourced to rural areas.

Digitalization: This is probably the most pervasive change precipitated by COVID. Various business models and processes are now leveraging digital technology to improve outputs; from app-based food delivery to net-banking. Those who were earlier reluctant to adapt to this, consumers and providers both, have now started learning. Digitalization has now gone beyond business and refers to the ongoing adoption of digital technologies across all possible societal and human activities from reading, learning, teaching, telemedicine to shopping, entertainment (apps), eating, dating, socializing and more.

Positive Behaviours: A clarion call from experts for living with the virus for some time, have led to a "realisation" dawned on us regarding our needs and greed. Never has the behavioural response been so drastic as seen in the COVID pandemic. People have been prompt to adopt positive behaviours. Various measures widely practiced during this pandemic such as social distancing, avoidance of crowds or mass gatherings, use of face mask, frequent hand washing have improved levels of personal hygiene. If these measures continue post pandemic will have a definite impact on the incidence of communicable diseases mainly those transmitted by air route or by fomites. List of such diseases is endless such as tuberculosis, measles, chickenpox, diphtheria, influenza, Swine Flu Trachoma, food poisoning, typhoid, gastroenteritis, etc.

Health Insurance: One thing that Covid has taught us is that no one is immune. In view of high cost of medical care during the pandemic, more and more people will opt for higher health insurance cover, thereby giving a boost to this sector. However, some capping or vigilant action is required from regulatory bodies so that the private operators do not take undue advantages. As such, the health cover in India is very less as compared to other countries and the loosely regulated heterogenous healthcare sector will need time to adapt.

Effect on Industry, Trade and Commerce: By the time the pandemic recedes, businesses and the global economy will continue to be significantly impacted. Some of the sectors will be adversely affected (Real estate, Aviation, Tourism, Auto, Apparel, Shipping) while others might see a rise (digital and internet, pharma, chemicals, FMCG). The international restrictions have given an impetus to boost the local-

made/manufactured goods; and the Prime Minister of India has also called for “Vocal for Local” initiative. The Government of India (GOI) has already announced the Production Linked Incentive (PLI) scheme, offering incentives up to Rs 48,000 crore ($7 billion) to enhance the electronics manufacturing and domestic jobs. GOI has also announced incentive schemes for domestic manufacture of APIs (Active Pharmaceuticals Ingredients). India's manufacturing industry is diversified; majority of workers are employed in the small and medium scale enterprises. Current lockdown has disrupted their livelihood leading to de-urbanization (people migrating out of larger cities to their home towns). State Governments shall create jobs in the same sectors by strengthening local start-ups and small-medium enterprises which can ensure employment for these migrants in their home towns. This backward migration also provides an opportunity for the government to correct the rural-urban imbalance through development of the agriculture sector. Making the agricultural sector more robust, thereby ensuring livelihoods and sustenance is the trajectory to rural development.

Due to the post-COVID changing global scenario, India has been able to attract lots of FDI. Some examples are[5]: $10bn investment by Google over next 5-7 years to accelerate the pace of "Digital India", over a billion dollars by Foxconn to expand a factory to assemble Apple iPhones, Facebook's $5.7 billion investment, for a 9.99 per cent stake in Jio in April 2020.

Focus on Public Health: Public Health has come to limelight, as never before. Policymakers have realized that the health of the economy is completely dependent on the health of people and not vice versa. Public health system has been neglected world over and as a result, it has been ill-equipped to deal with such pandemics. Public health infrastructure in India is grossly inadequate to the healthcare needs (doctor-population ratio of 1:1456 and 1.7 nurses per 1000 population; both short of WHO norms of 1:1000 and 3:1000 respectively. This pandemic has brought the focus on healthcare to ensure universal access to affordable quality care. National Health Policy aims at increasing its health budget to 2.5 per cent of GDP by 2025 against the current expenditure at 1.28 per cent[6] which seems difficult, though not impossible. Hopefully, post-pandemic there will be some serious thoughts in this regard. Hon PM’s call of making India self-reliant to mitigate the impact of COVID-19 can be accomplished if we look at the current crisis as a social experiment to implement public healthcare reforms which can ensure health as a determinant for economic growth and poverty alleviation. Finance Ministry has allocated Rs 8,000 crore (USD 1.1 billion) for the National Mission on Quantum Computing and Technology which could promote private players to invest in Machine Learning, AI and Robotics to support Healthcare sector; and in early April 2020, the government exempted import duty from ventilators, surgical masks, Personal Protection Equipment (PPE), etc. for six months to help the Indian patients [7].

A SWOT analysis[8] reveals that COVID has not only threats but also opportunities. The pandemic dramatically decreased the industrial activities, surface and aerial transport and a significant reduction in air, water and land pollution. Media reports said that the snow-clad mountain peaks of Shivalik range became visible from the dusty plains of Punjab for the first time. Time is most valuable yet sparse and suddenly we all have lots of extra time (except health-care and other crucial sectors). We can spend this time to pursue hobbies, to reflect and reconsider what matters and what doesn’t. Inability to physically socialize along with the feeling of “we’re in this together” has provided opportunities to reconnect and create more social coherence which may continue to the post-pandemic times as well. It provides an opportunity to accept with modesty that many things are beyond our control.

Corona has taught all of us many lessons. The new normal ways of life are silently accepted. It now appears that future pandemics shall always be imminent. Though those cannot be prevented but perhaps

with foresight, strategic preparedness and effective implementation of evidence-based, practical, validated interventions; we can ensure to be well-prepared[9]. Kerala, for example, benefited from the earlier experience of managing the Nipah outbreak and could thus, handle the current pandemic better[10]. Riding over the silver linings as mentioned in these dark moments, we see the country emerging from the aftermath. It is imperative that we not only make sure to prioritize our social, economic and environmental concerns while fighting the pandemic but also ensure post COVID-19 sustainability with a healthy living for all.

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Special Paper

A COmfortably Vented, Indigenously Designed (COVID) Fabric Helmet to Curb Infection Spread in Education, Healthcare and Other Community Settings

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Abstract

Considering the current scenario of Coronavirus outbreak and the post-pandemic situation, the need for protective gears such as face-masks assumes utmost importance for the common populace, as well as in the areas of concern such as the community and healthcare settings. Earlier reported researches show that although masks' usage may help curb the infection spread, a major issue stems from the lack of adherence to proper ways of wearing/taking off masks. The users touch their face, ears, eyes, nose, etc. after taking off the masks, ultimately making themselves more susceptible to infection and thus, reducing the efficacy of the suggested measure of using face-masks. The existing masks are quite inadequate. It covers only the nose and mouth, leaving room for the users to touch their face, ears, nose, and eyes, all the vulnerable gates for infection transmission. The masks are uncomfortable and require regular adjustment, there are problems of humidity build-up inside the masks, high chances of leakage, problems with breathing, and one even needs to take off the mask for ingesting liquids, food, medicine, etc. even if one is in a community setting or a crowded region. Further, since these masks provide insufficient protection, there is an additional burden on the supply chain requirements for other personal protective gear. The researchers have designed a low-cost COmfortably Vented, Indigenously Designed (COVID) fabric helmet to address these limitations of the commercially available masks. It is designed so that usage of this cheap helmet, along with the usually worn cloth, is enough to provide complete protection to an individual. The fabric helmet is integrated with many innovative design features that will not only address the concerns of the users but will also be comfortable, cheap, and ease pressure on the requirement for expensive and already scarce personal protective equipment; and thus, greatly curtail the COVID-19 infection spread in the country. Most importantly, the design will serve as a very effective device in protecting the pediatric population in the educational institutions and in residential and healthcare settings, as situations spring back to normalcy in communities around the globe.

Keywords: COVID-19, Coronavirus, Facemask, Mask, PPE, Infection spread, Helmet.

Introduction

In an emerging outbreak of an infectious disease such as the current COVID-19 scenario, non-pharmacological measures such as an adequate hand hygiene program, respiratory precautions and proper coughing etiquette, contacts control, use of personal protective equipment such as face-masks and respirators are one of the few most promising means of protection available, particularly in the face of a dearth of a clear-cut pharmacological intervention such as a vaccine. Literature suggests that the possible modes of transmission of the virus, such as SARS-CoV-2, are via droplets through respiratory route[1] and possibly through feco-oral routes. Evidence further suggests that COVID-19 could be transmitted before the onset of symptoms, and thus community spread of infection could be drastically reduced if everyone, including asymptomatic contagious individuals, wears masks[2]. Various personal protective equipment used in healthcare and community settings worldwide can be broadly categorized into three divisions: cloth, cotton, or gauze masks (i.e., cloth or non-surgical masks); medical, surgical, or procedure mask (i.e., medical masks); and respirators of filtering facepiece respirators such as N95, N99, etc.[3] Cloth masks (hereafter "face-masks") are designed to prevent the spread of infection from wearers to others or vice-versa and are made of one or two layers of cotton fabric material, and these vary widely in their filtration efficacy[4]. The surgical masks can further be subdivided into two-layered or three-layered masks, depending upon its structure. A triple-layer mask consists of an outer hydrophobic non-woven layer that repels droplets, blood, water, etc., an intermediate melt-blown filter layer, and an inner soft non-absorbent layer. The two-layered surgical masks do not contain a filter layer, which reduces its effectiveness against bacteria and viruses compared to the triple-layer masks[5]. However, even these triple-layered masks are quite ineffective in blocking the very small particles which are formed as a result of aerosol-generating procedures such as swab collection, intubation, and laboratory processing of specimens in healthcare settings. These airborne contaminants are removed, however, in respirators which contain a mechanical filter and filter particles through interception. The prior literature has few reported findings that conclusively corroborate the efficacy of different kinds in preventing the spread of infectious diseases, particularly in a variety of community settings[6].

Jefferson et al., in his systematic reviews published in BMJ on the physical interventions to interrupt or reduce the spread of respiratory viruses, found that medical masks halted the spread of respiratory viruses from likely infected patients[7,8]. In particular, studies conducted during the 2003 outbreak of SARS-CoV reported that masks alone were 68 percent effective at preventing the virus[7,8]. More specifically, the recent work of McIntyre and Chungtai[4] investigated the mask usage among people in community settings, particularly colleges and households. Their findings indicate that wearing a mask protected people from infections, especially when coupled with an adequate hand hygiene protocol. However, a major problem was compliance: the common populace was found to be inept at wearing masks, which reduced their effectiveness considerably. But, the authors concluded that if the masks are used early and consistently in a proper way, they are indeed efficacious in protection against infection. Apart from the reported findings in the literature, it is a prevalent notion that wearing a mask may reduce one's chances of infection through viruses that are airborne or are carried through fine droplets or aerosols. However, according to the recently released guidelines from the Center for Disease Control and Prevention (CDC), USA, in the wake of the Coronavirus pandemic, this fact needs a closer examination. According to CDC, in the event of one fidgeting with one's mask, and especially if one touches one's face in the process, the chances are high

that one may infect himself with virus-containing droplets intercepted by the mask. The CDC offers some tips for how to properly use a mask, and among all the guidelines issued, the primary ones are to not touch the mask or parts of the face, especially eyes, mouth, and nose, which are vulnerable to infection. People touching their face and nose inadvertently is; thus, it becomes an important mode of transmission. An average person touches his face 16 to 24 times an hour, and this fact poses a potential risk in undermining the efficiency of infection prevention using a mask[9]. A protective mask may reduce the chances of infection spread but cannot completely eliminate the risk, especially if the disease has more than a single means of transmission. Thus, every mask, irrespective of its efficiency, has to be used in conjunction with a host of other preventive measures and etiquettes such as respiratory etiquettes, hand hygiene, and physical distancing[10].

This is clearly a matter of concern from many standpoints. Firstly, in the event of huge supply chain disruptions, the procurement of personal protective equipment is a challenge[2]. The general populace even stands unclear of the exact requirements for protection against infection spread for visiting a healthcare setting– a face visor, a coverall, or a mask. Secondly, as life springs back to normalcy in many countries post lifting of nation-wide lockdowns, the safety of school children and others raises disconcerting questions. Are children expected to solemnly follow the social distancing norms? Can the children be expected to religiously understand and adhere to the etiquette of masking their eyes, face, and nose? Can they be expected to manage the face-masks well, and above all, not touch their faces? Can they don the conventional face-masks for an extended period of time? Finally, choices of personal protective gear viz. face-masks for the pediatric section of the population are very limited, and the adult respirators are not recommended for them because of the underlying risks of asphyxiation, injury, and the inability of the children to wear these due to high breathing resistance[11]. Clearly, there is a gap that needs to be filled with suitable engineering design intervention, considering the smooth transition from the current phases of lockdowns to normalcy, and simultaneously ensuring the proper protection of the pediatric population, and to quell the fears and apprehensions of the community in general. The current paper presents a novel engineering design of a COmfortably Vented and Indigenously Designed (COVID) Fabric helmet, which can possibly play a major role in ensuring the smooth transition of community living to normalcy and curb the infection spread in community settings such as education and healthcare. The next section of this paper summarily provides a description of the problems with the existing face-masks. Subsequently, it presents an innovative fabric helmet design of protective face-mask with a description of its several features outlining its superiority over a conventional face-mask. The authors also present an array of variants of manufactured prototype designs. This is followed by a conclusive assessment of the potential impact of the fabric helmet design upon implementation.

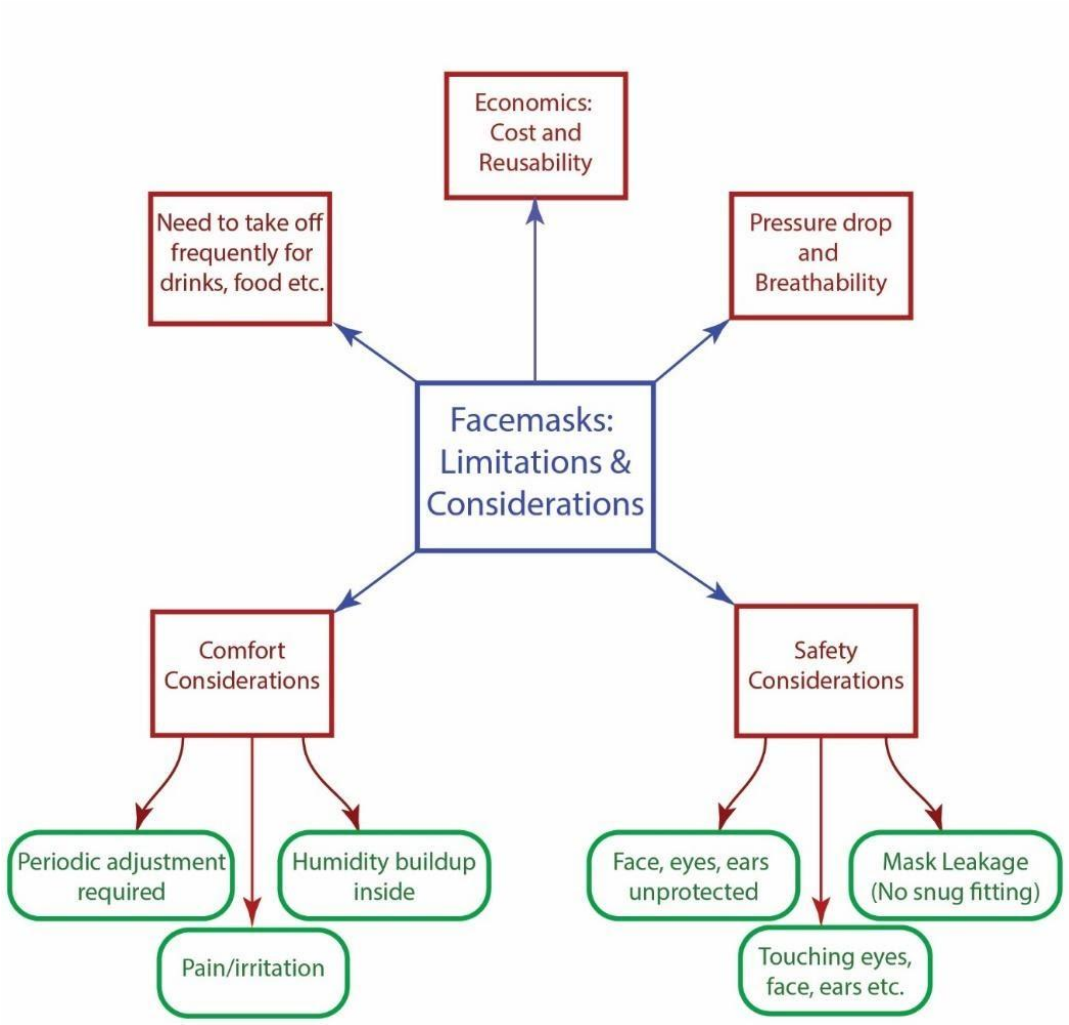
Existing Problem with Conventional Masks and Better Alternative Designs

In spite of the widespread usage of masks worldwide, the commercially available masks (both cloth as well as medical masks) have fundamental limitations, which may significantly reduce their efficacy in control and spread of the Coronavirus (or any other viral) pandemic. While Figure 1 presents a schematic diagram of the various limitations of the existing face-masks as well as important considerations in the design of adequate protective equipment, Figure 2 depicts the cons of the masks that are currently used widely. These limitations/considerations can broadly be categorized under five main divisions: Safety considerations, comfort considerations, pressure drop, and breathability, and the need to take off the masks frequently to ingest drinks, food, etc. First, there are three important factors with respect to safety which are worth considering: most of the commercially available masks in the market cover only the nose

and mouth; leaving eyes, ears, head, and other portions of the face bare, making it susceptible to infection by virus/ fine droplets/aerosols. These masks don't provide sufficient protection, and there is an additional requirement of Personal Protective Equipment (PPE) if an individual wishes to enter into infected areas/ hospitals, etc. Also, the current masks do not feel snugly over the nose and mouth, and the chances of leakage are high, and so is the probability of infection spread when worn by an infected patient. Even in the case of fit-tested masks and respirators, the presence of facial hair may substantially increase the magnitude of leakage through the device[5]. Finally, there are chances that an individual may end up touching his/her eyes, ears, face, etc. and thus, may acquire infection. Secondly, comfort considerations are extremely crucial in the design of a face-mask, particularly considering the pediatric population, and may further be attributed to three primary reasons. Many conventional face-masks are fastened at the back of ears or are tied at the back of the head and require regular adjustment or removal after regular periods of time due to pain or irritation. Users of most of the cloth masks complain of a humidity build-up near the nose and the mouth and thus an irritating sensation after a while. Another important cause of concern is that one needs to frequently take off these masks in case of drinking liquids or minor food/ medicine, even if one is in a community setting or in a place where social distancing is not possible. Lastly, many face-masks (such as cloth masks) constrict the nasal passage, which is a cause of concern for those who have respiratory ailments or have short breaths. In general, the tighter the fabric structure, the better the potential for filtration. However, with the increasing tightness of the structure, the pressure drop or breathing resistance increases, affecting user comfort[5]. Another important consideration stems out from economics: the initial cost and reusability of the face-masks. One or more of the above-mentioned factors may pose a serious limitation on the usage or effectiveness of the masks in providing protection.

Figure 1

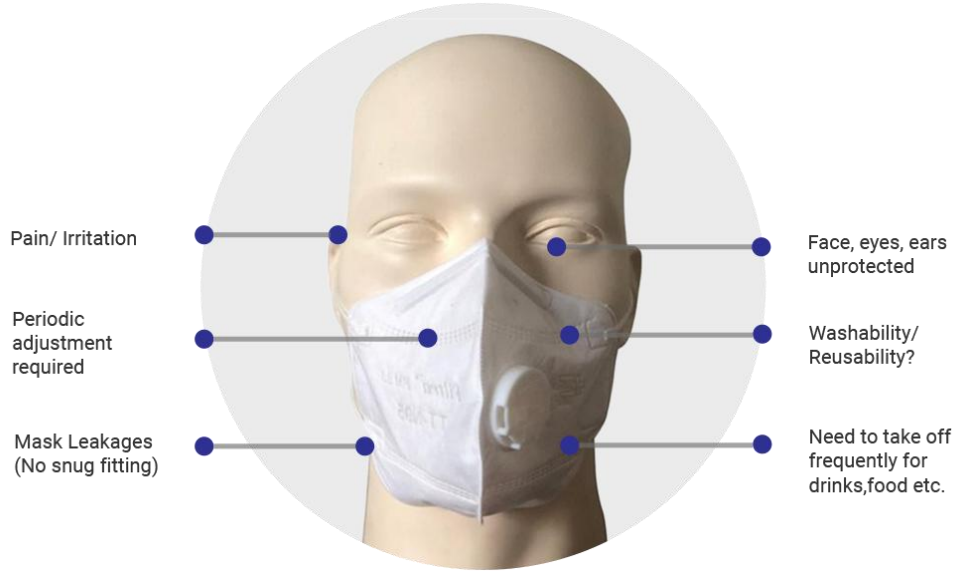
Limitations of the Existing Face-masks



In the event of a virus-based pandemic like the COVID-19, many sick individuals are expected to be quarantined or treated at home. Thus, caregivers and other family members stay in close proximity to the infected patient and face the same risk of exposure as experienced by the healthcare workers[5]. Apart from the household settings, extra protection is required for healthcare workers, people visiting healthcare facilities, and a large pediatric population post-pandemic lockdown. Prior literature has suggested that the children's tolerance of a protective wear is negatively affected by a host of psychophysical factors such as moisture and heat build-up, breathing resistance, facial pressure as well as a dearth of parental and societal pressure and persuasion[12]. In order to suitably address all the limitations as indicated in Figure 2, an alternative design of a protective gear is absolutely imperative to cater to these requirements.

Figure 2

Cons of the Masks being Currently Used Widely

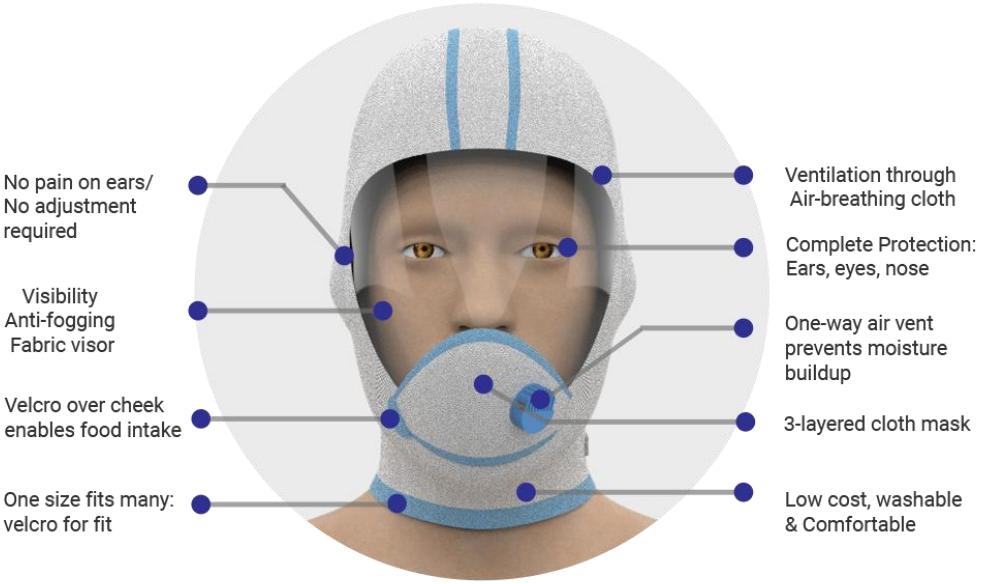


The Proposed Innovation and Its Novelty

In order to circumvent these issues faced by the users, a COmfortably Vented and Indigenously Designed (COVID) fabric helmet has been designed which not only circumvents these problems, but adds further to the safety of its users, as well as, comes at an economical price (around INR 200, or < $3). Figure 3 summarizes the novel features of the currently proposed design of a fabric helmet.

Figure 3

A Schematic of the Different Features of Fabric-Helmet

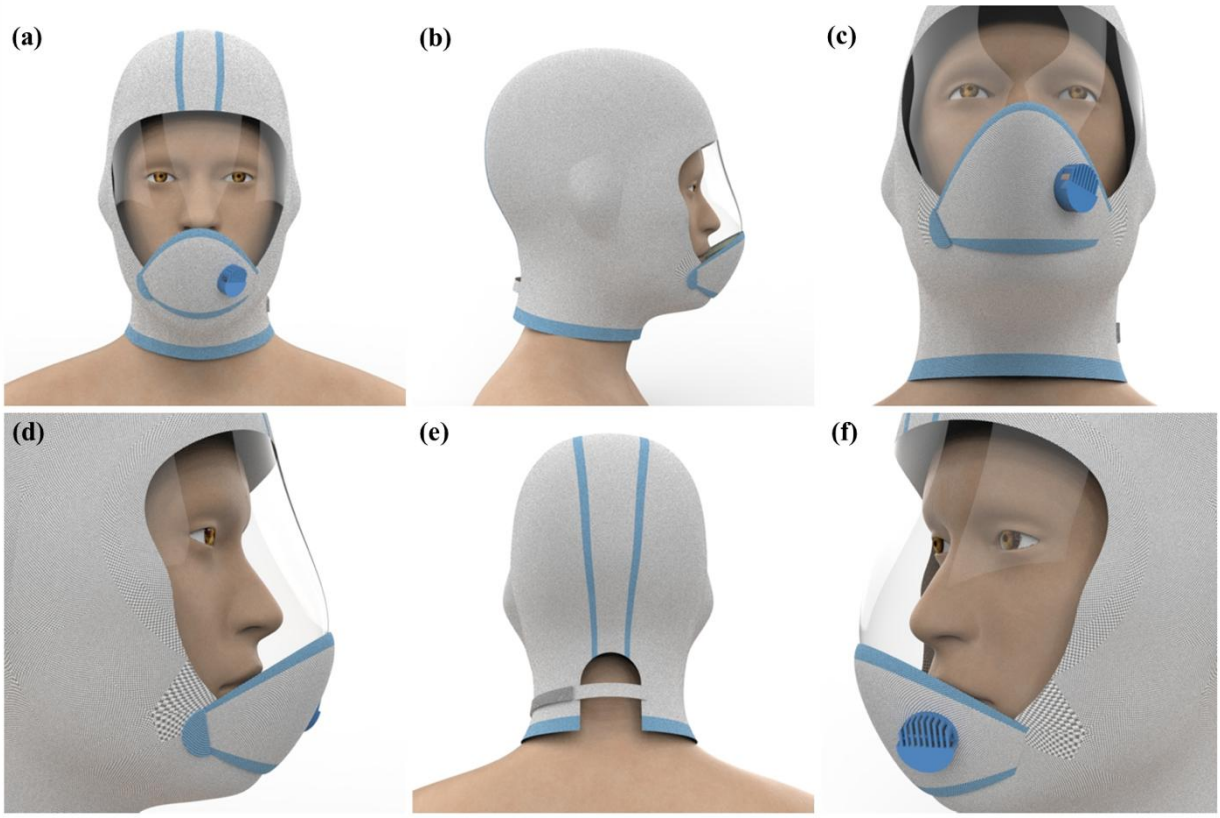


First, true to its name and its intended user base (among others, the pediatric population in schools and colleges), An air-breathing cloth above the head and around the sides ensures that there is a proper vent for the air and the body heat to escape, making the users feel comfortable over a longer period of time (Figure 4. It is worth pointing out that different grades of the air-venting fabric have been tested, experimented and used, and the subjects have reported that the fabric helmets are extremely comfortable to wear. Second, as shown in Figure 4 b, unlike the conventional masks, the fabric helmet sits around the head, is sturdy, does not require frequent adjustment, and it does not cause any pain at the back of the ears. Third, Figures 4 a-4 c suggest that this fabric-based soft-helmet provides complete protection to the entire face, including the hair, eyes, ears, nose, and head, minimizing vulnerability to infection. Unlike the currently-used masks, it does not allow the users to inadvertently touch the nose, ears, eyes, face, etc. thus minimizing the chances of infection. The air that is inhaled passes through an N95 mask cloth over the nose, and there exists a snug fit reducing all possibility of leakage, as depicted in Figure 4 d. Fourth, additional comfort is facilitated by the presence of a one-sided air vent guarantees that only the exhaled air goes out of the mask, whereas the inhaled air enters only through the N95 mask cloth. This air vent, shown in Figure 4 e, ensures that there is no humidity build-up inside the mask, and thus, the user may feel comfortable over longer periods of time. It should be pointed out that several design variants are typically possible as far as the location of the one-way air vent is considered. However, the governing consideration is that the vent should be placed as close to the mouth as possible. It is worth noting that the exhalation valves bypass the filter media and significantly reduce the effort required to exhale and increases comfort by significantly reducing heat and moisture build-up[5]. As shown in the back-side view in Figure 4 e, some space has been provided at the back for ventilation, and the 'lifted nose' design of the transparent fabric shield ensures that the visor does not touch the nose. Overall, these different factors add greatly to the comfort of wearing this fabric helmet over extended durations.

Next, as far as the economics of the fabric helmet is concerned, the cost may vary depending upon the different variants of the basic proposed design. In our study, we have fabricated three different designs for healthcare, household, and educational settings. Typically, these designs can be marketed under a low and high price segment, the basic difference being the presence of an N95 face-mask embedded in the case of an expensive version. Yet, these fabric helmets are cheap, costing merely around INR 200-250 (i.e., < $3) in India. Further, these masks are completely washable and reusable after sterilization or disinfection, as long as due care is taken while washing. It is recommended that these fabric helmets be washed and dried separately for longer life. It is worth pointing out that the fabric helmet comes with a unique feature of cheek-velcro as shown in Figure 4 f (in some design variants), wherein a velcro placed over the cheek may be engaged/ disengaged in case the wearer needs to sip water, ingest medicine or some light foodstuff, particularly in a crowded or community setting, thereby significantly reducing chances of infection spread. It should be reiterated that the velcro has necessarily been placed on the cheek so as to ensure that the user does not touch the areas close to the nose and mouth, which are more susceptible to contamination. In addition, the question of proper fit and adjustability is worth emphasizing. The fabric helmet comes with thin elastic straps/velcro that sits over the neck as well as on the head and allows users with a variety of head/neck sizes to comfortably wear it. The transparent visor is made of a flexible material, pressed at its top end, in such a way that it leaves some gap over the nose, thus facilitating breathing as compared to the cloth wrapped around the nose (particularly for people with respiratory problems). Finally, complete visibility is ensured by the usage of transparent grade Polystyrene/ Polycarbonate plastic with an anti-fogging coating, thus keeping it lightweight, comfortable and wearable over long durations.

Figure 4

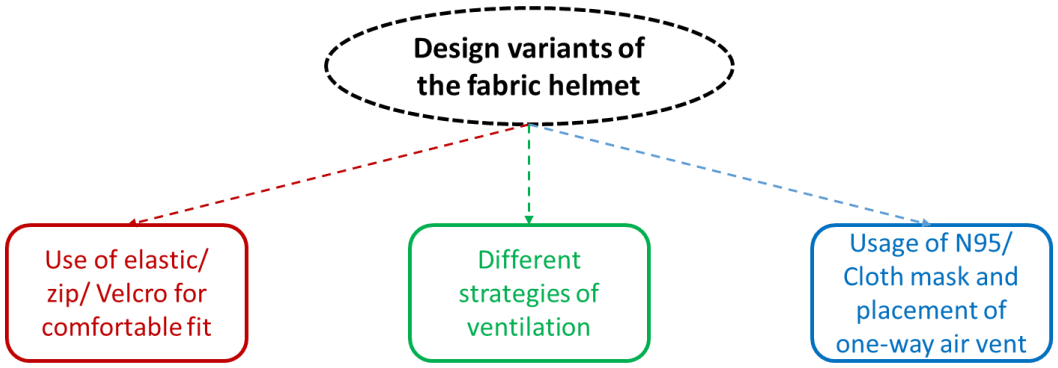
Different Views of the Proposed Protective COVID Fabric Helmet



(a) Front view (b) Side view (c) Bottom view (d) a close right-side view showing the cheek velcro (represented by blue colored section), (e) back-side view, and (f) a close left-hand view showing the one-way air vent. The black strips indicate an elastic/Velcro

Figure 5

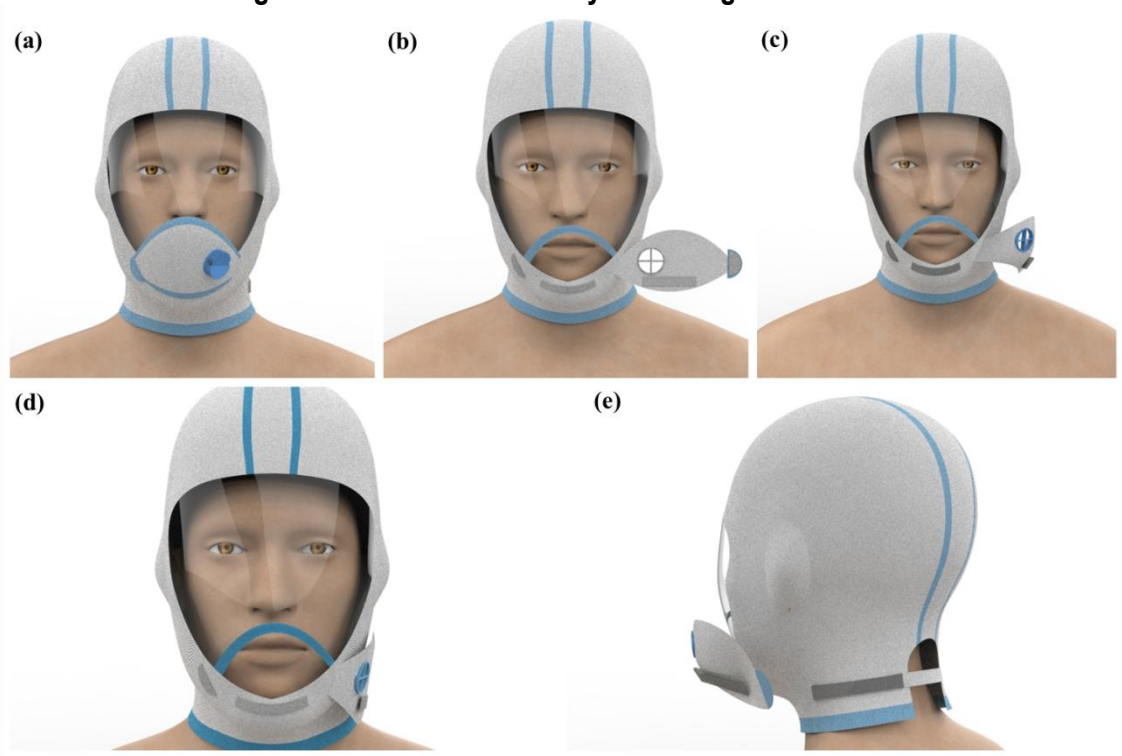
Strategies for the Preparation of Some Design Variants of the COVID Fabric Helmet



Typically, infectious diseases spread through droplets, respiratory aerosols, or contact with contaminated surfaces. Large particles such as droplets (>5 μm), which are emitted during sneezing or coughing, can be efficiently filtered out by medical masks, whereas aerosol particles (< 5 μm) can remain suspended in the air for several hours and are intercepted only by a respirator. It is expected that the proposed fabric helmet provides protection against multiple modes of transmission, including airborne, droplet, and hand to mouth/nose transmission, and is thus very effective in curbing infection. However, the effectiveness and wearability of these fabric helmets over long durations can be significantly enhanced significantly by incorporating some minor design modifications.

Figure 6

Stages in Food/Water Intake by Removing Cheek-Velcro



(a) Cheek Velcro closed, (b) Velcro detached, (c) Velcro taken backward, (d) Velcro fastened near the neck, and (e) the back-side view showing how the Velcro can also be attached to the back during the ingestion process

To improve the effectiveness and wearability of this fabric helmet, different fabric helmet variant design prototypes were fabricated for testing in order to cater to the needs arising in the pandemic and the post-pandemic situation. As shown in Figure 7, the different strategies for the fabrication of these different design variants are as follows: first, to ensure proper comfort to the users with respect to the fit, an elastic band or a Velcro was used to account for different head shapes and hairstyles. Second, a set of design variants were created, keeping different ventilation strategies in mind, and finally, the usage of an N95 mask or a cloth mask that is embedded in the fabric helmet and the location of the one-way air vent.

Finally, the suitability of the integration of cloth masks vis-à-vis N95 respirators with fabric helmets is worth pointing out. A recent study in this regard published in the American Chemical Society reports that the filtration efficiency of many common fabrics and their results with regard to the efficacy of the cloth masks are quite promising. In fact, the best part is that these hybrid three-layered cloth masks are superior to N95

for particles smaller than 300 nm, which is roughly the size of Coronavirus (80~120 nm). Figure 6 shows plots of filtration efficiency for different cloth masks as compared to N95 masks, and also the effect of 1 percent gap on the filtration efficiency. As evident from Figure 7 (A), N95 respirators, although has a high filtration efficiency in the size range greater than 300 nm, it drops down considerably in the smaller size range. Table 1 shows that the N95 masks provide an average filtration efficiency of 85 percent for particle size less than 300 nm. However, with a leakage gap as less as 1 percent, the average filtration efficiency drastically drops down to a mere 34 percent, which is quite low and unsafe in community settings. Also, as pointed earlier in this paper, a leakage gap of more than 1 percent is not unexpected during the usage of N95 respirators. In fact, the filter efficiency as reported by most of the face-masks in the market are for particles in the size range of 3 microns, which is much larger than the size of any virus, and thus the reported high filter efficiencies do not hold much relevance in the present context with respect to viral load protection. Since the chances of leakage with respect to snug-fitting over the nose is negligible in the COVID fabric helmet because of its design, these fabric helmets will invariably operate in the high-efficiency range and thus may prove more effective for protection from infection spread.

Figure 7 shows different views of the fabric helmet with the three-layered cloth masks (although three-layers are not visible in the figures). Based on the filter efficiencies data as observed from Table 1, four different design variants are fabricated by varying mask cloths and overhead fabric specifications. Table 2 provides detail of these design variants.

Figure 7

Filtration Efficiency of Cloth Masks vis-à-vis N95 Respirators with and without Gap of One Percent as a Function of Particle Size (Reproduced from[13])

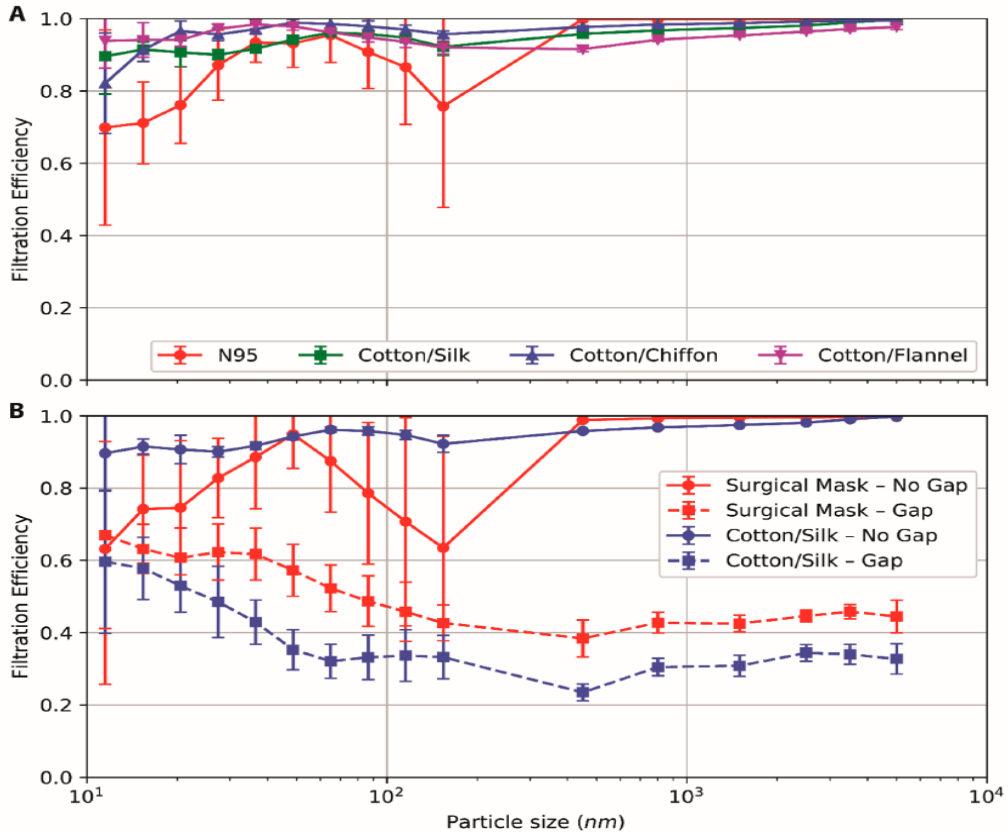


Table 1

Filtration Efficiencies of Various Test Specimens at a Flow Rate of 1.2 CFM and the Corresponding Differential Pressure (ΔP) across the Specimen (Reproduced from [13]).

Sample/fabric	Flow rate: 1.2 cfm		
	Filter efficiency (%)		Pressure differential
	<300 nm particles	>300 nm particles	Δp (Pa)
N95 (no gap)	85 ± 15	99.9 ± 0.1	2.2
N95 (with 1% gap)	34 ± 15	12 ± 3	2.2
Surgical mask (no gap)	76 ± 22	99.6 ± 0.1	2.5
Surgical mask (with a gap)	50 ± 7	44 ± 3	2.5
Cotton quilt	96 ± 2	96.1 ± 0.3	2.7
Quilter's cotton (80 TPI), 1 layer	9 ± 13	14 ± 1	2.2
Quilter's cotton (80 TPI), 2 layers	38 ± 11	49 ± 3	2.5
flannel	57 ± 8	44 ± 2	2.2
Cotton (600 TPI), 1 layer	79 ± 23	98.4 ± 0.2	2.5
Cotton (600 TPI), 2 layers	82 ± 19	99.5 ± 0.1	2.5
Chiffon, 1 layer	67 ± 16	73 ± 2	2.7
Chiffon, 2 layers	83 ± 9	90 ± 1	3.0
Natural silk, 1 layer	54 ± 8	56 ± 2	2.5
Natural silk, 2 layers	65 ± 10	65 ± 2	2.7
Natural silk, 4 layers	86 ± 5	88 ± 1	2.7
Hybrid 1: cotton/chiffon	97 ± 2	99.2 ± 0.2	3.0
Hybrid 2: cotton/silk (no gap)	94 ± 2	98.5 ± 0.2	3.0
Hybrid 2: cotton/silk (gap)	37 ± 7	32 ± 3	3.0
Hybrid 3: cotton/flannel	95 ± 2	96 ± 1	3.0

Table 2

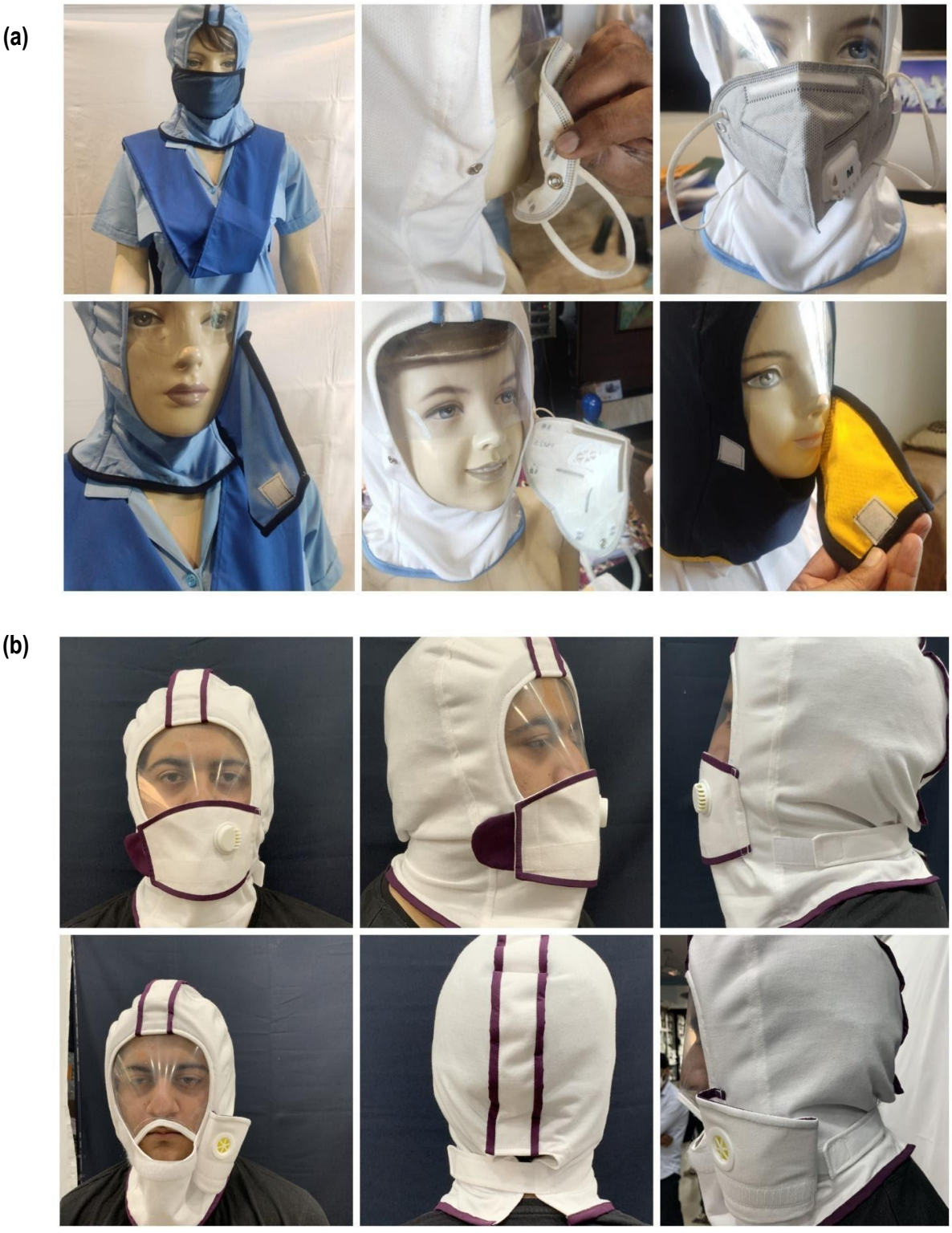
Filtration Efficiencies of Various Test Specimens at a Flow Rate of 1.2 CFM and the Corresponding Differential Pressure (ΔP) across the Specimen

Variant-1	Anti-fogging visor	600 μm PET (food grade quality)
	Cloth Mask Specifications	Cotton quilt first layer – 120 TPI, pure cotton second layer – 95% cotton, 5% polyester third layer – 120 TPI, pure cotton
	Fabric (overhead) Specifications	Two layers of anti-microbial coating
Variant-2	Anti-fogging visor	600 μm PET (food grade quality)
	Cloth Mask Specifications	Hybrid 1 first layer – 600 TPI, pure cotton second layer – 90% polyester, 10% spandex third layer – 90% polyester, 10% spandex
	Fabric (overhead) Specifications	Two layers of anti-microbial coating
Variant-3	Anti-fogging visor	600. μm PET (food grade quality)
	Cloth Mask Specifications	Hybrid 2 first layer – 600 TPI, pure cotton second layer – pure silk third layer – pure silk
	Fabric (overhead) Specifications	Two layers of anti-microbial coating
Variant-4	Anti-fogging visor	600. μm PET (food grade quality)
	Cloth Mask Specifications	Hybrid 3 first layer – 600 TPI, pure cotton second layer – 65% cotton, 35% polyester
	Fabric (overhead) Specifications	Two layers of anti-microbial coating

Finally, we present some of the designs we have tried to fabric these comfortably vented fabric helmets. Figure 8 (a) shows three basic designs of these fabric helmets on mannequin models, primarily intended for school/college students. As Figure 4 a-f shows, the designs differ in the use of chit buttons/velcros to engage/disengage the masks and whether an N95 or a cloth mask has been embedded in the fabric helmet. There are indeed several such designs possible, and it is hoped that the proposed idea of a soft fabric helmet during the pandemic and post-pandemic situation will be a very helpful low-cost contribution to the nations across the globe as they prepare to spring back to normalcy post the lockdown situation. Figure 8 (b) presents different views of a typical design of such a fabric helmet on an individual. The proposed COVID fabric helmet can be used not only in schools and colleges but also in air-conditioned offices, buses and trains, and also in hospitals and other pathological labs and testing facilities.

Figure 8

Designs of Fabric Helmets for Students



(a) Mannequin models wearing different prototype designs of COVID fabric helmets designed for school children during the testing phase, and (b) different views of one of the prototype models as worn by an individual

Conclusions: Potential Impact of the Proposed Innovation

The proposed innovation (COVID Fabric Helmet), if implemented, will greatly improve the safety of people in community settings or in situations where social distancing is difficult. It will also significantly improve the user comfort in wearing masks and encourage people to wear masks for significantly larger periods of time, particularly in places such as a workplace, during travel, etc. without worrying about adjusting. Thus, the current innovation will also greatly improve the efficacy of masks in curtailing the spread of COVID infection. This mask can be manufactured easily and also used in hospitals and other public places. This fabric helmet will reduce the need for coveralls and PPEs (which are getting scarce in the market, currently) because apart from covering the body with the cloth, the current masks are insufficient in covering the head and face. This proposed innovation will bridge that gap and reduce the need for expensive PPEs. Particularly, in developing countries, the requirement of providing PPE to all the healthcare workers (doctors, nurses, ICU technicians, lab technicians, support staff, etc.), infected and non-infected patients, relatives of patients, police and security personnel, etc. poses an immense burden on the economy. This adds to the immense healthcare burden, and so the need to design low-cost and simple PPE is the need of the hour to prevent the spread of COVID-19. Moreover, the designed intervention does not only cater to the healthcare settings but may also serve as a useful tool in addressing the post-COVID scenario in the nation, particularly in community settings such as educational institutions, where the health and safety of the pediatric population is a matter of great concern. It is hoped that educational institutions worldwide may get initial ideas for proper protective equipment to safeguard children around the world. Other institutions, such as offices, hospitals, pathological labs, and other testing facilities, may also benefit from this low-cost fabric helmet design. Further, professionals who are required to come in close proximity with other individuals/customers during their profession, such as dentists, barbers, etc. may also benefit from this design of fabric helmet.

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स्वास्थ्य और जनसंख्याः
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शिक्षण संस्थानों, स्वास्थ्य कर्मियों तथा अन्य समुदाय में संक्रमण को रोकने हेतु आरामदायक बनावट तथा स्वदेशी रूप से डिज़ाइन किया हुआ कोविड फैब्रिक हेलमेट

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सारांश

कोरोनावायरस के प्रकोप के वर्तमान परिदृश्य और महामारी के बाद की स्थिति को ध्यान में रखते हुए, फेस–मास्क जैसे सुरक्षात्मक उपकरण की आवश्यकता आम जन–समुदाय के साथ– साथ सामुदायिक और स्वास्थ्य देखभाल जैसे क्षेत्रों में भी है। इससे पहले किए गए शोधों से पता चलता है कि मास्क का उपयोग संक्रमण फैलने पर अंकुश लगाने में मददगार हो सकता है, मास्क पहनने/उतारने में उचित तरीकों के पालन की कमी भी एक प्रमुख मुद्दा है। उपयोगकर्ता मास्क उतारने के बाद अपने चेहरे, कान, आंख, नाक आदि को स्पर्श करते हैं, अंत में खुद को संक्रमण के लिए अतिसंवेदनशील बना लेते हैं, और इस प्रकार, फेस–मास्क का उपयोग करने के सुझाए गए उपाय की प्रभावकारिता कम हो जाती है। मास्क असुविधाजनक होते हैं और उन्हें नियमित रूप से समायोजन की आवश्यकता होती है, मास्क के अंदर नमी आ जाने के कारण, रिसाव की संभावना के कारण, साँस लेने में समस्या के कारण, और किसी को तरल पदार्थ, भोजन, दवा इत्यादि के सेवन के लिए भी मास्क उतारना पड़ता है चाहे वह भीड़भाड़ वाले स्थान पर क्यों न हो। इसके अलावा, चूंकि ये मास्क अपर्याप्त सुरक्षा प्रदान करते हैं, इसलिए अन्य व्यक्तिगत सुरक्षा उपकरणों की आपूर्ति पर एक अतिरिक्त बोझ पड़ता है। व्यावसायिक रूप से उपलब्ध मास्क की सीमाओं को तय करने के लिए, शोधकर्ताओं ने कम लागत वाले आरामदायक मास्क के साथ स्वदेशी रूप से कोविड फैब्रिक वाले हेलमेट डिजाइन किए हैं। इसे इस तरह से डिज़ाइन किया गया है कि आमतौर पर पहने हुए कपड़े के मास्क के साथ इस सस्ते हेलमेट का उपयोग किसी व्यक्ति को पूरी सुरक्षा प्रदान करने के लिए पर्याप्त है। फैब्रिक हेलमेट कई नवीन विशेषताओं से युक्त है जो कि न केवल उपयोगकर्ताओं की असुविधाओं को दूर करेगा बल्कि यह आरामदायक, सस्ता तथा सुरक्षा उपकरणों की कमी को दूर करने वाला है जो देश में फैलने वाले कोविड–19 के संक्रमण को कम करेगा। सबसे महत्वपूर्ण, यह सुरक्षा उपकरण शैक्षणिक संस्थानों में पढ़ने वाले बच्चों के साथ–साथ आवासीय तथा स्वास्थ्य कार्यकर्ताओं के संरक्षण में भी एक बहुत प्रभावी उपकरण के रूप में काम करेगा जब तक दुनिया भर में स्तिथि सामान्य नहीं हो जाती है।

मुख्य शब्दः कोविड–19, कोरोनावायरस, फेसमास्क, मास्क, पीपीई, संक्रमण का फैलना, हेलमेट।

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Breastfeeding in the COVID-19 Era: A Perspective

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Abstract

COVID-19 has emerged as a public health concerning in the recent times. The effect of COVID-19 on breastfeeding practices worldwide is a subject of study in view of the prevailing global scenario. Breastfeeding, with its protective benefits, is essential and desirable but its safety during these challenging times is not backed up by rigorous evidence. There are various challenges in providing and sustaining exclusive breast feeding in the pandemic situation as donor human milk has its own challenges. At this point, it becomes prime responsibility of healthcare providers to find plausible solutions for maximising breast milk availability for all neonates. Also, it is the need of the hour to rapidly generate more evidence on feasibility, sustainability and logistics of breastfeeding in the COVID era.

Key words: COVID-19, Breastfeeding, Donor human milk.

Introduction

The novel SARS-CoV-2 has emerged as a compelling public health challenge in recent times. Of particular interest to global health is its effect on breastfeeding practices worldwide. Ensuring safe access to mother's milk is a necessity but there are challenges which need to be addressed with concerted efforts of health bodies. The authors wish to discuss here a few perspectives on breastfeeding in this COVID era, that emanate from the existing limited evidence; ground challenges in providing and sustaining exclusive breast feeding; and suggest plausible solutions for maximising breast milk availability for all neonates amidst the current pandemic.

The Evidence

At this point of time, there is limited conflicting data to safely conclude and believe that SARS-CoV-2 is not excreted in breast milk. Lackey et al. identified 13 studies with small sample sizes reporting human milk testing for SARS-CoV-2, out of which one study reported the presence of virus in milk and another reported presence of antibodies[1]. A systematic review quoted in a scientific report by WHO showed that breast milk samples from 3 out of 46 COVID positive mothers tested positive for virus by RT-PCR[2]. One possible reason that RT-PCR on milk samples was negative is that the methods used were neither designed nor validated for human milk. Additionally, none of these studies described the methods of handling, storage and collection of milk; and very little is known about the stability of virus in human milk. Grob et al. recently described the detection of SARS-CoV-2 RNA in milk samples from a COVID positive mother for 4 consecutive days[3]. The baby tested positive for COVID, although it still remains unclear whether baby was infected by breastfeeding or other modes of transmission. Thus, safety of breastfeeding in COVID era is not backed up by rigorous evidence.

It is also imperative to note that there is dearth of literature on the actual existing breastfeeding and isolation practices for mother baby dyad worldwide in the given scenario. The case reports, case series and systematic reviews describing perinatal and mostly favorable neonatal outcomes have not revealed any details on breastfeeding and isolation practices, both in hospital as well as post-discharge[4-6]. Most of the data stem out from Chinese studies where isolation was the norm and breastfeeding was avoided[7]. Although WHO and UNICEF have unanimously advised continuation of breastfeeding and rooming in but at this point, we are really unaware of the implementation of the same at the ground level and what proportion of babies born to suspected or confirmed COVID mothers are actually receiving exclusive breastfeeding, both in facility as well as post-discharge. Thus, it is prudent to have data on these outcome variables, so as to identify the barriers and enablers for safe breastfeeding in COVID era, and also to determine the feasibility of breastfeeding in the first place, in these critical times.

The Challenges

At the ground level, the challenges of providing and sustaining breastfeeding in these times are multipronged. In healthcare facilities where mother and baby are separated because of logistic issues, the challenges of getting expressed breast milk (EBM) is huge. With limited entry of personnel in isolation area, the lactation support and counseling get hampered. The limited staff is expected to look after other COVID positive patients in the isolation area and thus, would not be instrumental in providing lactation support to mothers. Often there is very less support from other family members in the current scenario because of lockdown imposed movement restrictions as well as for maintaining physical and social distancing. Personal protective equipment (PPE) for family members may not be feasible in resource limited settings.

Most of the facilities are not equipped with separate breast pumps for the isolation area. Appropriate disinfection of breast pumps in isolation areas is another concern. In many facilities, there are common isolation areas for male and female patients that jeopardises the privacy of mothers. Even if the mother manages to express breast milk, the safe transport of EBM to the baby is questionable. Further, COVID positive mothers remain admitted for a longer duration and the baby is usually discharged with alternative caregiver. Keeping the baby in hospital premise till mother's discharge is not safe as that would put the baby at risk of acquiring healthcare associated infections as well as COVID from the hospital environment. This entire process interrupts and negatively affects breastfeeding. The psychological impact of COVID on mothers cannot be undermined and may have detrimental effect on breastfeeding because of heightened anxiety and fear, both because of disease as well as separation from her baby. With the pandemic swelling up, facilities catering to out-born babies also resort to use formula milk (where donor human milk is not available) because of restricted entry of mothers till their COVID status is declared negative. Donor human milk (DHM) has its own challenges. Not all facilities enjoy the benefits of human milk banks. Although the demand has increased, the supply of donors is expected to reduce because of decreased number of donors owing to restricted movement and early discharge of mothers from facilities. We know that the virus is expected to be destroyed by pasteurisation but the risk of droplet transmission from infected donors remains. With rampant spread of virus reaching the level of community spread in certain areas, universal screening of asymptomatic donors for COVID infection may be resorted to.

Optimising Newborn Nutrition in COVID Era

To attain some equipoise, the need of the hour is to jointly focus upon the areas which would ensure optimal nutrition for the baby and maximise breast milk availability, keeping in consideration various logistic issues as mentioned above. The facilities should have clear demarcation and separate areas for keeping neonates of COVID suspect, positive and negative mothers. The mothers of all babies being admitted to out-born nurseries may be screened for COVID infection so that they may be allowed entry to NICU for breastfeeding or providing expressed breast milk (EBM), once they are declared negative. Facilities where rooming in is feasible, should encourage breastfeeding wherever possible. In facilities where it is not feasible to give EBM or DHM, mothers separated from their babies should be encouraged to express their breast milk every 2-3 hours and discard, so as to establish and maintain milk supply for later continuation. Mothers can be provided lactation support and counseling by distribution of pamphlets and by means of social media, so that they can resume the same once their health permits and they are discharged. The challenges, as mentioned above need to be addressed for effective implementation and sustenance of breastfeeding. As transmission of virus through respiratory droplets during the period of breast feeding remains the primary concern, proper counseling regarding infection preventive measures should be done before discharge. When the baby is being discharged early with alternative caregiver, it is of utmost importance to edify them regarding droplet and contact precautions at home, so as to prevent the baby from being infected by other means. Post discharge support can be provided by scheduled telephonic surveillance in these high-risk mother baby dyads. It is imperative to note here that if mothers are unable to breastfeed or chose not to breastfeed, it becomes the prime duty of healthcare provider to educate mother and other family members, regarding ways to provide safe, affordable and feasible alternative feeding to the newborn. This would ensure proper hygiene, dilution and method of giving formula milk, which is equally prudent.

To conclude, while the importance of various immune components in breast milk and protective benefits of breastfeeding in COVID times cannot be underestimated, it is the need of the hour to rapidly generate more evidence on feasibility, sustainability and logistics of breastfeeding in COVID era; and also role of

breastfeeding in vertical transmission of SARS-CoV-2 virus. This would require large population studies on existing isolation and breastfeeding practices to determine its practicability and estimate the risk of COVID 19 in breastfed versus non- breastfed babies, standardisation of human milk collection and storage protocols for SARS-CoV-2 research and validation of analytical methods for detection of COVID specific immune components in human milk. At the facility level, it remains equally prudent to provide counselling support to mothers by innovative methods, to allay their fears and anxieties and provide them with education regarding safe alternative feeding. There is also a need to follow up these babies for long term impact of separation on early childhood growth and development.

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स्वास्थ्य और जनसंख्याः
परिप्रेक्ष्य और मुद्दे, 43(4): –153-157/2020

कोविड–19 युग में स्तनपानः एक परिप्रेक्ष्य

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सारांश

कोविड–19 हाल ही के दिनों में सार्वजनिक स्वास्थ्य के एक मुद्दे के रूप में उभरा है। दुनिया भर में कोविड–19 का स्तनपान पर पड़ने वाला प्रभाव वैश्विक परिदृश्य को देखते हुए एक अध्ययन का विषय है। स्तनपान, सुरक्षात्मक लाभों सहित अति आवश्यक है, लेकिन महामारी के दौरान इसके सुरक्षात्मक उपाय चुनौतीपूर्ण हैं। महामारी के दौरान स्तनपान करना और विशेष स्तनपान जारी रखना एक बड़ी चुनौती है जबकि मानव–दुग्ध–दाता (ह्यूमन मिल्क डोनर) के लिए स्वयं में यह एक बड़ी चुनौती है। इस बिंदु पर, स्वास्थ्य सेवा प्रदाताओं की प्रमुख जिम्मेदारी बन जाती है कि वे सभी नवजात शिशुओं के लिए स्तनपान की उपलब्धता को बढ़ाने का समाधान निकालें। इसके अतिरिक्त, यह कोविड युग में स्तनपान की व्यवहार्यता, स्थिरता और पूर्ति बनाये रखने के लिए समय की आवश्यकता भी है।

मुख्य शब्दः कोविड–19, स्तनपान, मानव–दुग्ध–दाता (ह्यूमन मिल्क डोनर) ।

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Impact of Lockdown on Doubling of Cases of COVID-19: A Comparative Study of India with Developed Countries

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Abstract

In December 2019, the novel coronavirus was recognized as the cause of a cluster of pneumonia cases in Wuhan city in Hubei Province of China. Subsequently it spread to the whole of China and then to elsewhere in the world making it a global health emergency. In February 2020, the World Health Organization (WHO) designated the disease COVID-19, which stands for coronavirus disease 2019, a public health emergency. On 11 March 2020, WHO Director General characterized COVID-19 as a pandemic. The current paper is written by using electronic search of available data on internet, and daily newspapers were also referred for the information and data. Currently, there is no treatment for COVID-19 infection. Only supportive care is needed. Several antivirals and other treatments have been used for COVID-19 outbreak but the efficacy of these drugs has not been established. The only solution to control the spread of coronavirus is to break the cycle of transmission through social distancing. Therefore, lockdown was enforced in the countries to keep the people away from each other to control and contain the spread. The lockdown means imposing curfew in the countries all over or cities except for essential items. The whole point of social distancing or lockdown is to make doubling time longer and longer. The doubling time is dynamic and it shows the impact of interventions on the growth of the epidemic. The comparison of India with other developing countries on the impact of lockdown on doubling of cases shows that though western countries like USA, France, Italy, etc. who have best medical facilities and manpower could not take a strong action like lockdown early resulting in immense suffering and more challenging to minimize or contain the spread. Whereas, with the lockdown, India was able to bring down the cases much before the situation otherwise would have been become out of hand. The analysis suggests that if you don't get in early and the outbreaks grow, they get very big and very quickly; then managing it is a massive task. Though lockdown will not eliminate the disease but it certainly helps in containing the transmission of cases i.e. flattening of the curve; and helps the country to handle the situation with limited health resources without a big surge of cases.

Key words: COVID-19, Incubation, Doubling, Lockdown, Growth rate, Vaccine.

Introduction

Until recently, most people have never heard of coronaviruses. But the diseases have been identified about 50 years back that cause in humans and animals. A group of virologist in 1968 were the first one to recognize the coronaviruses. The 'corona' word has many different meanings. But virologist had sun in mind when they gave the name of coronaviruses. They actually compared "the characteristic 'fringe' of projections" on the outside of the virus with the solar corona[1].

There are about 40 different varieties of Coronaviruses. The size of the coronavirus is about 120 nanometers in diameter and are single-stranded RNA viruses. Coronaviruses are highly diverse since they are susceptible to mutation and recombination. The coronaviruses generally can be found in bats and wild birds. They further spread to other animals and from there onwards to humans. The COVID-19 which has been caused by the virus have been thought to originated in bats.

In December, 2019, novel coronavirus, previously designated 2019-nCoV, was recognized as the cause of a cluster of pneumonia cases in Wuhan city in Hubei Province of China. Subsequently it spread to whole of China and then to elsewhere in the world and became a global health emergency. In February 2020, the World Health Organization (WHO) designated the disease COVID-19, which stands for coronavirus disease 2019[2]. On 11 March, WHO Director General characterized COVID-19 as a pandemic.

Incubation Period

Public health experts have stated that one of the issues that has contributed to spread of COVID-19 virus is its two week incubation period. During incubation period, a person may have the virus, but may not display any symptoms of it, but can still spread it to others. Therefore it makes difficult for people to know who has the virus and when they should take actions to protect themselves from becoming infected. This has created an extra sense of concern that the virus could quietly continue to spread[3].

Symptoms of the Illness

People infected with the COVID-19 may experience mild cold or flu-like symptoms in two to four days. Although the symptoms can vary from person to person, and can typically include fever, sneezing, runny nose, coughing, fatigue and sore throat[3].

Treatment and Prevention

Currently there is no treatment for Covid-19 infection. Only supportive care is needed. Several antivirals and other treatments have been used for Covid-19 outbreak, but the efficacy of these drugs has not been established.

According to healthcare experts one of the simplest things people can do to protect themselves from the COVID-19 virus is to wash their hands regularly with soap and water after making contact with people who could potentially have it[3]. It is recommended to wash hands for at least 20 seconds before touching your eyes, nose, mouth or food. Also use of mask has also been seen as a good practice in prevention of spread of Covid-19.

Also there should be careful disposal of materials infected with nasal secretions. Surface disinfectants are also an important in infection control, since coronaviruses appear to survive for one or more days after drying on surfaces such as stainless steel, plastic, or cloth.

The steps which can be seen as a preventive measures for the spread of Covid-19 are:

i) Spending at least 20 seconds washing their hands as often as possible using soap and water.
ii) Make sure your hands are washed before touching the mouth, eyes or nose.
iii) When people are sick with the virus, avoid close contact with them.
iv) If you are sick with the virus, stay home.
v) Clean and disinfect object and surfaces that are touched frequently.

The only solution to control the spread of coronavirus is to break the cycle of transmission through social distancing. Therefore, lockdown has to be enforced in the countries to keep people away from each other and control the spread[6].

What is lockdown?

The lockdown means imposing the curfew in the county or city with the following restrictions:

i) Ban on people from stepping out of their homes
ii) All services and shops closed except pharmacies, hospitals, banks, grocery shops and other essential services
iii) Closure of commercial, public and private establishments (only work-from-home allowed)
iv) Suspension of all educational, training, research institutions
v) Closure of all places of worship
vi) Suspension of all non-essential public and private transport
vii) Prohibition of all social, political, sports, entertainment, academic, cultural, religious activities[21].

The whole point of social distancing or lockdown is to make doubling time longer and longer.

What is doubling time of cases?

In simple words, how many days does it takes for the number of coronavirus cases to double. The shorter the time frame, faster the growth and steeper the curve. While a one or two days difference in doubling time doesn't seems much but it can have a massive effect on how many patients are flooding the health facilities potentially overwhelming medical systems[9].

COVID-19 infections, like many other viruses, grow exponentially. Fixed rate exponential growth means that the number of cases doubles in a defined amount of time. If there are 100 cases on day-1, and the doubling period is four days then on day-5 there will be approximately 200 cases, and on day-10, there will be 400 cases, and so on. This is exponential growth, with a longer doubling period representing slower growth. The doubling time is dynamic and it shows the impact of interventions on growth of epidemic[11].

When we talk of 'flattening the curve', it means lengthening the doubling period. For the maintenance of capacity of the health sector it is crucial and very important to flatten the curve, or slow down the rate of growth of new infections. Increasing the doubling period can be achieved through official policies of the

government and social behaviours. These range from simple social distancing practices through to more aggressive approaches like lockdown of all non-essential activities, and the expectation of stay-at-home policies. Reducing the opportunity for transmission of infections aims to lower the growth rate. Changes in the doubling period states that the policies which have been implemented by the government are effective[11].

The doubling time in a disease outbreak is not constant and for the outbreak of COVID-19 it has changed in recent weeks and will continue to change with time[10].

Methodology

The current paper has been written by using electronic search of available data on internet and also daily newspapers were referred for the information and data for COVID-19.

Data Analysis

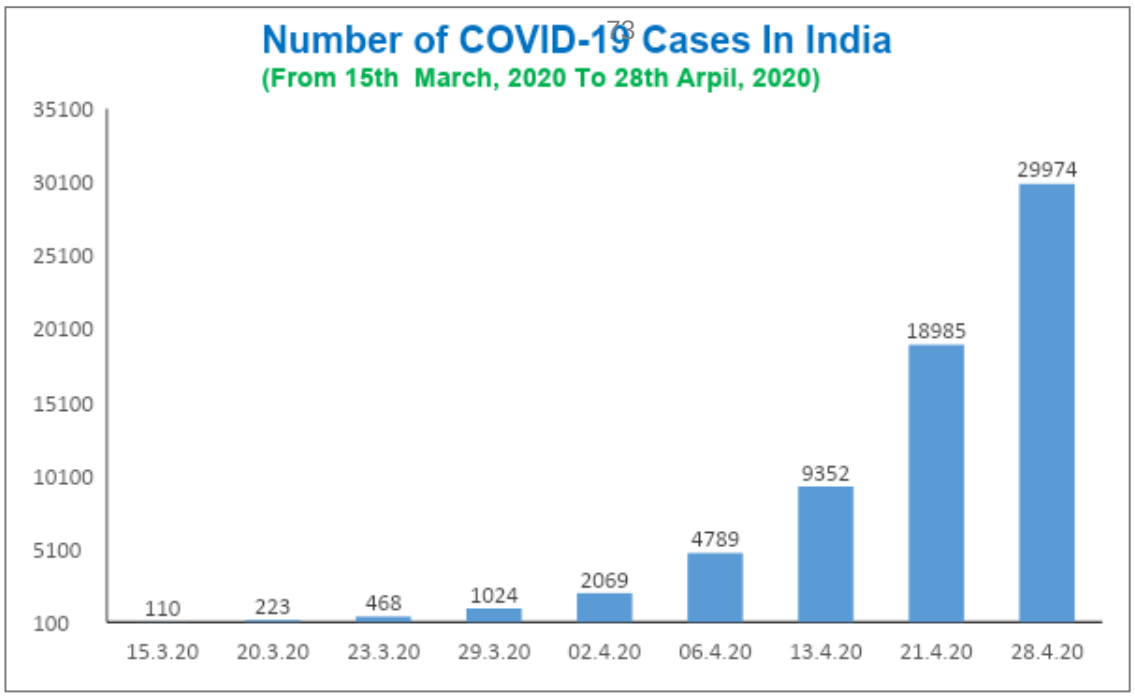
The paper has tried to analyse the secondary data of India, USA, France, Italy, England and Spain with respect to number of COVID-19 cases when these countries reached 100 cases and thereafter number of days it took in doubling of these cases. Also analysis has been done to see the situation of doubling of cases before and after the lockdown has been imposed in the respective country.

India

Date	Number of Covid-19 cases	Number of days in which doubling of cases occurring	Lockdown date
15.3.20	110		**24 March 2020**
20.3.20	223	5 days	
23.3.20	468	3 days	
29.3.20	1024	6 days	
02.4.20	2069	5 days	
06.4.20	4789	4 days	
13.4.20	9352	7 days	
21.4.20	18985	8 days	
28.4.20	29974*	> 7 days	

*Since cases were not doubled till 28.4.20 therefore greater than sign has been put before the number of days

It can be seen from the above table that in India Number of +ve cases of Covid-19 on 15.3.2020 were 110. The cases doubled in 5 days and subsequently in 3 days. On 24 March 2020, our Hon'ble Prime Minister Shri Narendra Modiji took a courageous decision for complete lockdown in the country so that spread of Covid-19 could be contained. It is the largest COVID-19 national lockdown in the world[5]. If we look at the above table that after lockdown i.e. from 24 March 2020, the lockdown started giving fruitful results[4]. However, from 13 April onwards i.e. 19 days since the lockdown began, the growth rate of infection began to decline, with cases doubling every in almost seven days and next to 8 days[6]. And now it is happening almost in 10 days from every three days— which was the situation before the lockdown. Before we call the lockdown a complete success, India needs to stop seeing fresh cases of Covid-19 for at least 15 days given that the virus has an approximately two-week incubation period[8].



Lockdown from 24 March 2020

5 3 6 5 4 7 8 >7 (Nearly 10 Days) (Days in which doubling of cases are occurring)

Italy

Date	Number of Covid-19 cases	Number of days in which doubling of cases occurring	Lockdown date
23.2.20	150		**09 March 2020**
25.2.20	322	2 days	
27.2.20	650	2 days	
1.3.20	1694	3 days	
5.3.20	3858	4 days	
8.3.20	7375	3 days	
12.3.20	15113	4 days	
17.3.20	31506	5 days	
23.3.20	63927	6 days	
5.4.20	128948	13 days	
28.4.20	201505*	>23 days	

* Since cases were not doubled till 28.4.20 therefore greater than sign has been put before the number of days

The above table shows that on 23 February 2020, Italy had 150 number of Covid-19 cases. The doubling of cases in Italy was almost between 2 to 4 days for almost 15 days that is till 12 March 2020. On 31 January 2020, the Italian government suspended all flights to and from China and declared a state of emergency for a duration of six months. The government also introduced thermal scanners on international passengers arriving at Italian airports. Though Italy was the first EU country to take this kind of precautionary measure but still could not contain the spread of Covid-19. On 9th March Italy's Prime Minster took a decision to keep more than 60 million people in quarantine. On 11th March 2020, government prohibited nearly all commercial activity except for supermarkets and pharmacies. On 21st March, the Italian government closed all non-essential businesses and industries, and restricted movement of people[15]. So if we look at the above, it is clear that practically complete lockdown was imposed on 21st March, 2020. The complete lockdown started giving results in doubling of COVID-19 cases. Thereafter the doubling of cases occurred in 6 days, then after 13 days and now it is more than 23 days.

Lockdown from 09 March 2020

2 2 3 4 3 4 5 6 13 >23
(Days in which doubling of cases are occurring)

France

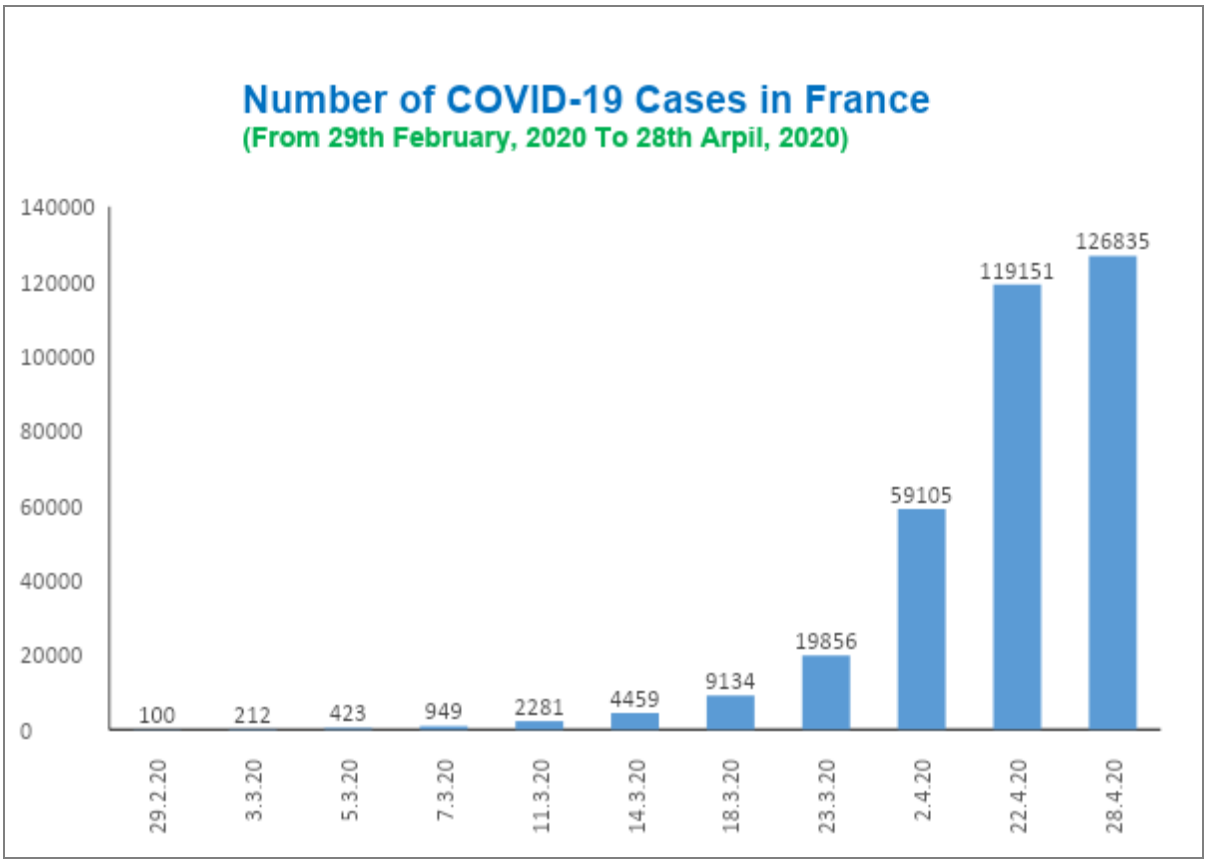
Date	Number of Covid-19 cases	Number of days in which doubling of cases occurring	Lockdown date
29.2.20	100		**17 March 2020**
3.3.20	212	4 Days	
5.3.20	423	2 Days	
7.3.20	949	2 Days	
11.3.20	2281	4 Days	
14.3.20	4459	3 Days	
18.3.20	9134	4 Days	
23.3.20	19856	5 Days	
2.4.20	59105	10 Days	
22.4.20	119151	20 Days	
28.4.20	126835*	> 6 days	

* Since cases were not doubled till 28.4.20 therefore greater than sign has been put before the number of days

In France, the first 100 cases were reported on 29 February 2020 and almost from there onwards, the cases were doubling between 2 to 4 days for almost 20 days. On 12 March 2020, French President announced that all schools and all universities would closed down. The next day, Prime Minister banned gatherings of more than 100 people, not including public transport. The following day, the prime minister ordered the closure of all non-essential public places, including restaurants, cafés, cinemas and nightclubs, effective at midnight. On 16 March 2020, government announced mandatory home confinement from 17 March 2020[16]. Therefore the complete lockdown in France came from 17 March 2020. If we look at the above table from 17 March 2020, the doubling of cases started taking more days as was before the lockdown. The next doubling of cases took 10 days, and then 20 days and now more than 20 days.

Lockdown from 17 March 2020

4 2 2 4 3 4 5 10 20 >20 (Days in which doubling of cases are occurring)



Spain

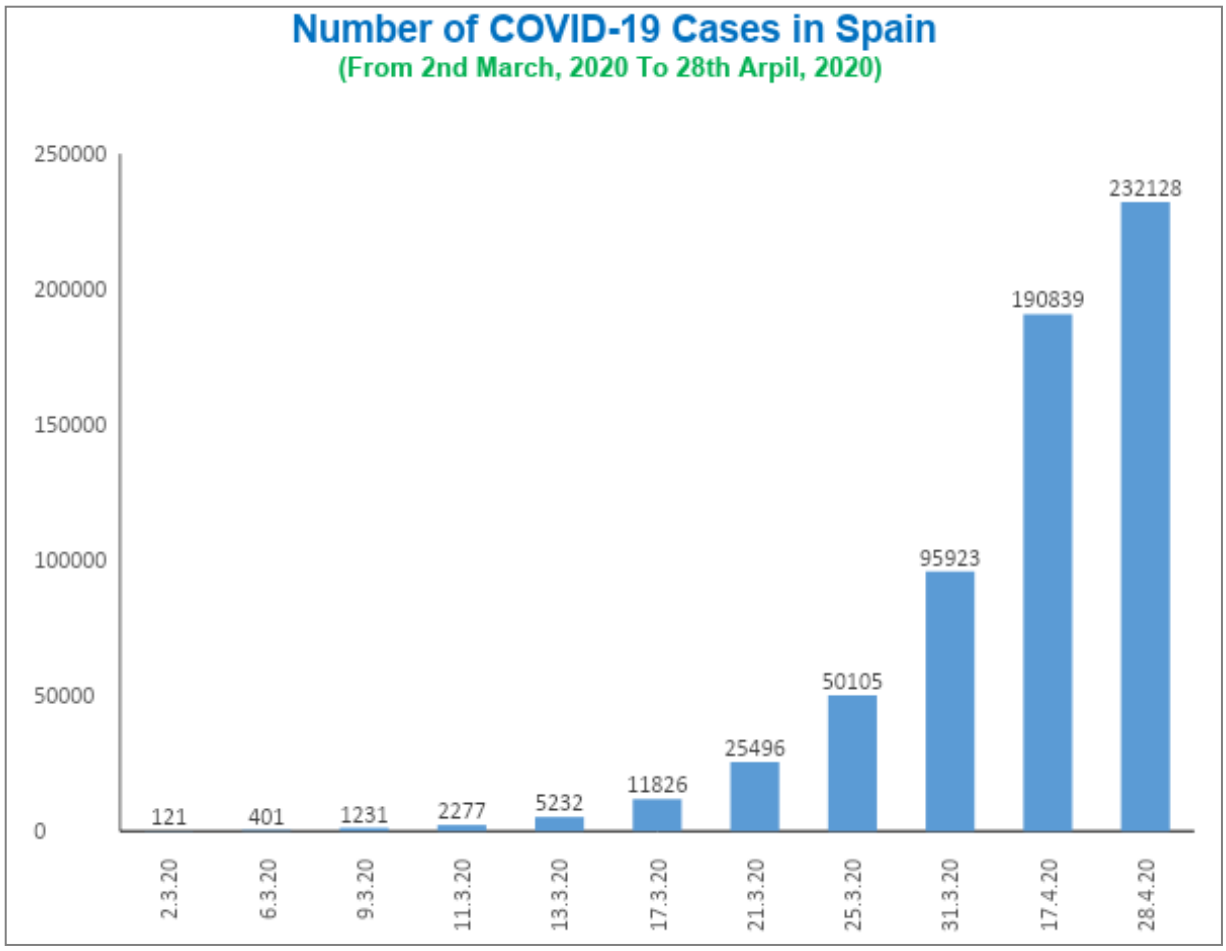
Date	Number of Covid-19 cases	Number of days in which doubling of cases occurring	Lockdown date
2.3.20	121		**15 March 2020**
6.3.20	401	4 Days	
9.3.20	1231	3 Days	
11.3.20	2277	2 Days	
13.3.20	5232	2 Days	
17.3.20	11826	4 Days	
21.3.20	25496	4 Days	
25.3.20	50105	4 Days	
31.3.20	95923	6 Days	
17.4.20	190839	17 Days	
28.4.20	232128*	> 11 Days	

*Since cases were not doubled till 28.4.20 therefore greater than sign has been put before the number of days

Lockdown from 15 March 2020

4 3 2 2 4 4 4 6 17 >11
(Days in which doubling of cases are occurring)

The first 100 cases were reported on 2 March 2020 in Spain. Almost from there onwards the cases started doubling in 2 to 4 days for almost 23 days. In Spain the state of alarm and national lockdown was announced on 14 March 2020[14]. After about 10 days the lockdown seemed started giving results. The cases started doubling in 6 days, then in 17 days and now almost more 17 days.



United Kingdom

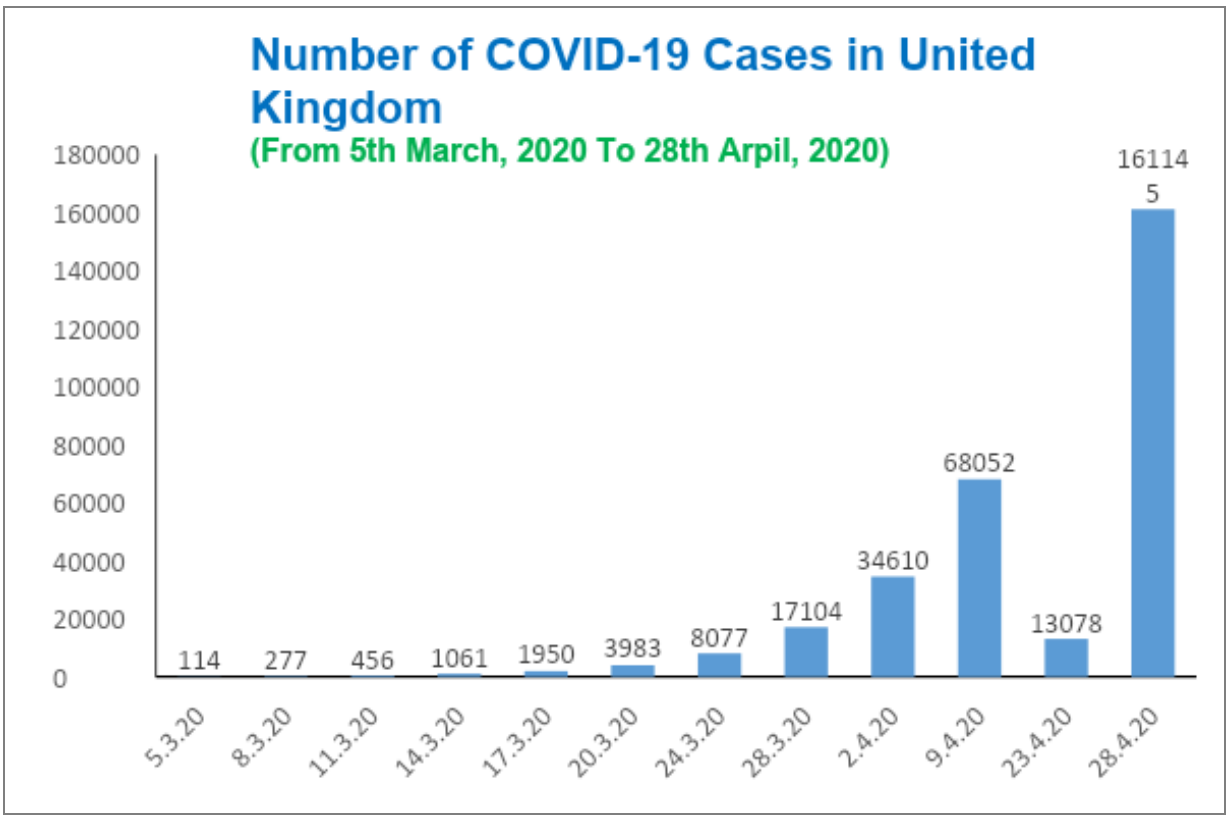
Date	Number of Covid-19 cases	Number of days in which doubling of cases occurring	Lockdown date
5.3.20	114		**23 March 2020**
8.3.20	277	3 Days	
11.3.20	456	3 Days	
14.3.20	1061	3 Days	
17.3.20	1950	3 Days	
20.3.20	3983	3 Days	
24.3.20	8077	4 Days	
28.3.20	17104	4 Days	
2.4.20	34610	5 Days	
9.4.20	68052	7 Days	
23.4.20	13078	14 Days	
28.4.20	161145*	>15 days	

*Since cases were not doubled till 28.4.20 therefore greater than sign has been put before the number of days

Lockdown from 23 March 2020

3 3 3 3 3 4 4 5 7 14 >15
(Days in which doubling of cases are occurring)

In England, first 100 cases were reported on 5 March 2020. Almost for 23 days, the doubling of cases of COVID-19 occurred almost in 3-4 days. On 20 March 2020, all schools, restaurants, pubs, clubs, and indoor leisure facilities were ordered to shut, with some exceptions. On 23th March, the government imposed a lockdown on the whole population, banning all "non-essential" travel and contact with people outside one's home, and shutting almost all businesses, venues, facilities and places of worship[18]. After a one week of complete lockdown, the cases started doubling in every 5 days, 7 days and then 14 days and now more than 15 days.



The first 100 cases reported in United States of America were on 4.3.2020. And from there onwards, the doubling of cases was almost between 2-4 days till 30.3.2020 i.e. for about 26 days. This may be because those even cases were doubling every 2 days still the complete lockdown was not imposed by USA govt. On March 16, the White House advised against any gatherings of more than ten people. Since 19 March 2020, the government advised the U.S. citizens to avoid all international travel. Travel restrictions on most foreign nationals who had recently traveled to Iran or 28 European countries were implemented in March. State and local responses to the outbreak have included prohibitions and cancellation of large-scale gatherings (including cultural events, exhibitions, and sporting events), restrictions on commerce and movement, and the closure of schools and other educational institutions. From 19 March 2020, the more

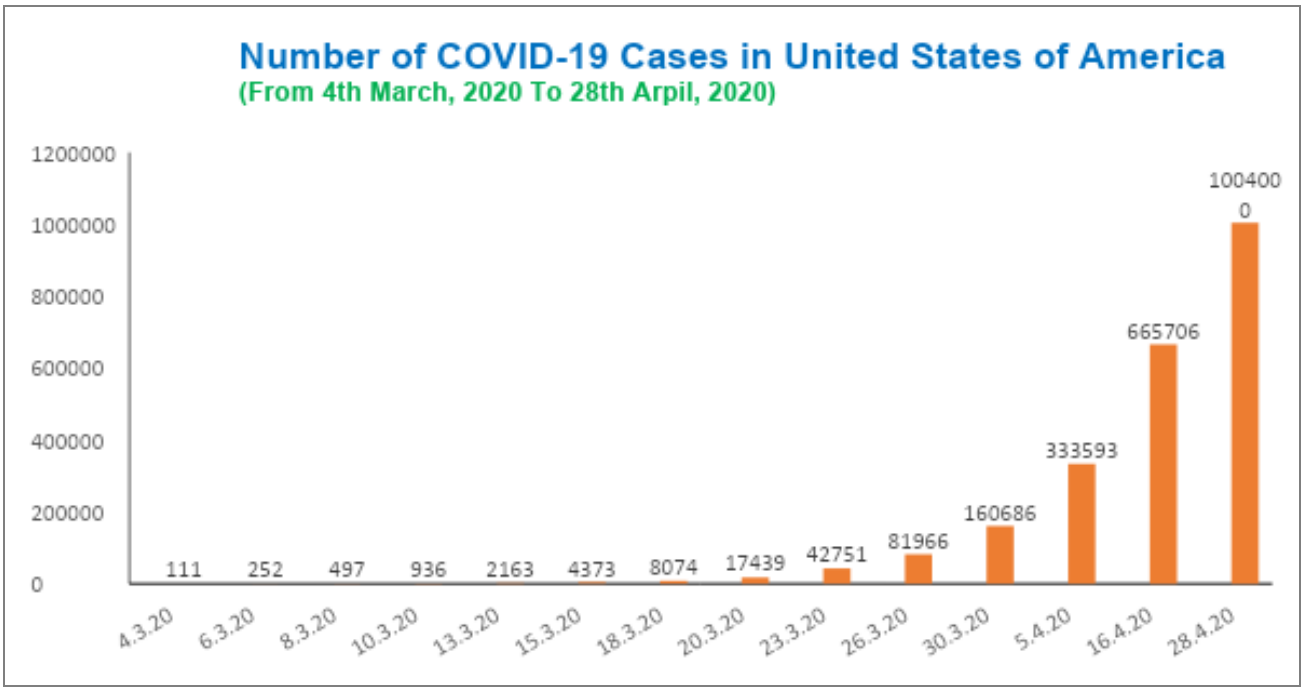
restrictions started giving better results though not very encouraging[19]. After 10 days of partial restrictions i.e. from 30 March 2020, the cases started doubling in every 4 days, 6 days and then in 11 days and now in more than 12 days which suggests if USA has also implemented complete lockdown the situation would have been different.

United States of America

Date	Number of Covid-19 cases	Number of days in which doubling of cases occurring	Lockdown date
4.3.20	111		**14 March 2020***
6.3.20	252	2 Days	
8.3.20	497	2 Days	
10.3.20	936	2 Days	
13.3.20	2163	3 Days	
15.3.20	4373	2 Days	
18.3.20	8074	3 Days	
20.3.20	17439	2 Days	
23.3.20	42751	3 Days	
26.3.20	81966	3 Days	
30.3.20	160686	4 Days	
5.4.20	333593	6 Days	
16.4.20	665706	11 Days	
28.4.20	1004000**	> 12 Days	

* Partial Lockdown

**Since cases were not doubled till 28.4.20 therefore greater than sign has been put before the number of days



Partial Lockdown from 19 March 2020

2 2 2 3 2 3 2 3 3 4 6 11 >12 (Days in which doubling of cases are occurring)

Discussion

With much of the worst performing countries far above on a logarithmic scale, India seems to be avoiding the fate that has gripped much of the western world. By the lockdown, India was able to bring down the cases much before the situation otherwise would have been become out of hand. The above analysis suggests that if you don't get in early and the outbreaks grow, they get very big and very quickly, then managing them is a massive task. Though lockdown will not eliminate the disease but it helps in containing the transmission of cases i.e. flattening of curve and helps the country to handle the situation with limited health resources without a big surge of cases.

Conclusion

The lockdown ensures reduces opportunities of transmission. The lockdown in India came very early when a relatively small number of cases were there of Covid-19. It gave the opportunity to come to terms with the reality of this enemy. It gave time to develop capacities at the local level and preparing medical staff, equipment and sorting out hospitals. Before we call the lockdown a complete success, countries need to stop seeing fresh cases of Covid-19 for at least 15 days given that the virus has an approximately two-week incubation period. Longer doubling time produce a smaller, flatter surge, but it also mean that the public must continue social distancing to maintain that trajectory.

The lockdown comes with lot of anger, frustration and criticism. India's courageous government took this step and not waited till when the virus is more wide spread. Though western countries like USA, France,

Italy, etc who all are developed countries and have best medical facilities and manpower could not take the kind of strong action early on of lockdown and what we see that they have to struggle with immense suffering.

Recommendations

There is no evidence to suggest that the coronavirus disease will disappear. The people may have to consider new norms for the future. Declaring a lockdown when there was relatively a small number of cases in India gave the country time to come to terms with the new virus.

Currently there is no drug approved for treating COVID-19 as a therapy. Also there is no vaccine which can lead to immunity against the Covid-19 infection. Though Human trials of an eagerly-awaited vaccine, developed by the prestigious Oxford University against the novel coronavirus began in the UK, with scientists giving it an 80 per cent chance of success but still it will take about 5-6 months more to be available in the market until then, physical distancing is recommended as it has been shown to slow the spread of the disease.

Countries can begin easing restrictions in areas that show a lower incidence of cases. The WHO is developing new strategic advice for countries considering lifting restrictions. As per the WHO countries easing lockdowns should meet the following criteria:

- The transmission is controlled.
- Health system capacities are in place to detect, test, isolate and treat every COVID-19 case and trace every contact.
- Outbreak risks are minimized in special settings like health facilities and nursing homes.
- Preventive measures are in place in workplaces, schools and other places where it's essential for people to go.
- Importation risks can be managed.
- Communities are fully educated, engaged and empowered to adjust to the "new norm".

As per WHO, countries seeing their numbers stabilize should not believe the worst is over. "Now is the time for vigilance". Measures such as physical distancing and hand washing will need to stay in place even after lockdowns are lifted. Change our behaviors for the foreseeable future is the key[20].

Once the restrictions are eased, the capacity at health systems has to be increased. As we come out of these lockdown situations, we may see a jump in cases. Therefore it is government's preparedness to see that hospitals have protective equipment in place and intensive care beds in reasonable number are also available on standby otherwise we will go back to the situation where were we before the lockdown and effect of lockdown will be wasted.

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परिप्रेक्ष्य और मुद्दे, 43(4):–158-172/2020

कोविड–19 संक्रमण की संख्या के दोहरीकरण पर लॉकडाउन का प्रभाव : विकसित देशों के साथ भारत का तुलनात्मक अध्ययन

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सारांश

दिसंबर 2019 में, चीन के हुबेई प्रांत में वुहान शहर में नॉवेल कोरोनवायरस को निमोनिया के मामलों के एक समूह के कारण के रूप में मान्यता दी गई। तत्पश्चात यह संक्रमण पूरे चीन में फैल गया, उसके उपरांत यह संक्रमण विश्व के अन्य स्थानों में भी फैल गया तथा वैश्विक स्वास्थ्य आपातकाल घोषित कर दिया गया। फरवरी 2020 में, विश्व स्वास्थ्य संगठन द्वारा जन स्वास्थ्य आपात स्थिति, कोरोना वायरस रोग 2019 को कोविड–19 नाम से चिन्हित किया गया है। वर्तमान शोध पत्र में सूचना एवं आंकड़ों के लिए इंटरनेट पर उपलब्ध आंकड़ों तथा दैनिक समाचार पत्रों की सहायता ली गई है। वर्तमान में, कोविड–19 संक्रमण का कोई इलाज नहीं है। कोविड–19 संक्रमण के दौरान सिर्फ सहायक देखभाल की आवश्यकता होती है। कोविड–19 संक्रमण हेतु कई एंटीवायरल दवाओं तथा अन्य उपचारों का उपयोग किया गया है परंतु इन दवाओं की प्रभावकारिता स्थापित नहीं हुई है। कोरोनावायरस के प्रसार को नियंत्रित करने के लिए एकमात्र उपाय सामाजिक दूरी (सोशल डिस्टेंसिंग) है। सामाजिक दूरी के माध्यम से कोरोनावायरस संचरण के चक्र को तोड़ा जा सकता है। इसलिए, लोगों को एक दूसरे से दूर रखने तथा प्रसार को नियंत्रित करने के लिए देशों में लॉकडाउन लागू किया गया था। लॉकडाउन का अर्थ है कि आवश्यक वस्तुओं के सिवाय, सभी देशों या शहरों में कर्फ्यू लगाना। सोशल डिस्टेंसिंग या लॉकडाउन मुख्य रूप से दोहरीकरण के समय को बढ़ाता है। कोरोनावायरस के संदर्भ दोहरीकरण का समय गतिशील है तथा दोहरीकरण समय में वृद्धि हस्तक्षेपों/प्रयासों के प्रभाव को दर्शाता है। भारत तथा अन्य विकासशील देशों में कोविड–19 संक्रमण की संख्या की तुलना से लॉकडाउन के प्रभाव से पता चलता है। अमेरिका, फ्रांस, इटली आदि जैसे पश्चिमी देश, जिनके पास अच्छी चिकित्सा सुविधाएं तथा मानव सांसधन है, वे लॉकडाउन जैसी मजबूत कार्यवाही जल्दी नहीं कर सके, जिसके फलस्वरूप कोविड–19 के प्रसार को कम करने या नियंत्रित करने के लिए उन्हें अधिक चुनौती का सामना करना पड़ा। तालाबंदी के परिणामस्वरूप भारत, कोविड–19 की संख्या को कम करने तथा स्थिति को संभालने में सफल रहा अन्यथा स्थिति को संभालना मुश्किल हो जाता है। विश्लेषण दर्शाता है कि शीघ्र कार्यवाही नहीं किए जाने की स्थिति में संक्रमितों की संख्या में काफी वृद्धि होती है; तो स्थिति को संभालना अत्यधिक कठिन कार्य हो जाता है। यद्यपि लॉकडाउन से रोग का उन्मूलन नहीं होगा तथापि यह निश्चित रूप से कोविड–19 संक्रमण की संख्या को कम करने में सहायक है अर्थात वक्र का समतलन करने; तथा सीमित स्वास्थ्य संसाधनों के साथ संख्या में बड़ी वृद्धि हुए बिना स्थिति को संभालने में सहायक है।

प्रमुख शब्द: कोविड–19, ऊष्मायन (इन्क्यबेशन), दोहरीकरण, तालाबंदी, विकास दर, वैक्सीन।

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What Makes Kerala to Stand Top in Preventing COVID-19?

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Abstract

After the first report of COVID-19 from Wuhan, China, the Government of India reviewed and initiated itws multi-sectoral measures for the mitigation of this emerging public health crisis. In India, Kerala was the first state to be affected by COVID-19, and the first case was detected in Thrissur district on 30 January 2020. The first three COVID-19 confirmed cases in India were medical students who returned to Kerala from Wuhan, China. The objective of this article is to study the initiatives and the precautionary measures taken by the Kerala state government in controlling and reducing COVID-19 cases and deaths to be at the top amongst the states. The data used in the analysis were extracted from various sources. The data from the day when the first case was confirmed in the area until 30 April 2020 were considered for study. Various initiatives were taken to control COVID-19 in Kerala. The state implemented several strategies such as surveillance, contract tracing, quarantine comfort, testing strategies, route maps, uninterrupted treatment services, mobilising community, focussed approach, mid-day meal delivery, checking rail and road entry points which contributed to the effective management and control COVID-19 in Kerala.

Key words: COVID-19, Corona, Initiatives, Kerala, Pandemic, Management.

World Health Organization's (WHO) first situation report on Corona virus disease 2019, from 31 December 2019 through 3 January 2020, a total of 44 cases patients with pneumonia were reported and most of these cases were commonly exposed to the Huanan wholesale market in Wuhan,China[1]. China reported the outbreak to the WHO on 7th January 2020, that the new type of virus was identified as corona virus (2019-nCoV)[2]. The confirmed cases of COVID-19 were suddenly exported through Wuhan city initially Thailand, Japan, South Korea, soon spreading to Europe, USA and has now spread to over 200 countries worldwide. According to WHO, 85,403 cases of corona virus disease 2019 (COVID-19) were reported globally, as of February 29, 2020, including 79,394 cases (2838 deaths) from China and 6009 cases (86 deaths) from 53 other countries/territories/areas[3]. WHO declares the disease as a pandemic on 11 March 2020[4].

After the first report of COVID-19 from Wuhan, China, the Government of India reviewed and initiated multi-sectoral measures for the mitigation of this emerging public health crisis. These include point-of-entry surveillance at 21 international airports, enhanced State-level surveillance programmes and preparedness for handling clinical cases in designated hospitals. Till date, the Integrated Disease Surveillance Programme (IDSP), a national health programme, Government of India, has collected samples from symptomatic travellers in liaison with the State-level Viral Research and Diagnostic Laboratories (VRDLs), Department of Health Research. These VRDLs respond for timely diagnosis during outbreaks[5]. The WHO and other international governments and agencies abroad have recognized the effective and bold measures initiated by the Indian Government including Find, Isolate, Test, Treat and Trace measures. The WHO representative to India described India's efforts as timely, comprehensive and robust[6]. Along with several initiations by the state and local governments and authorities to address the issue surrounding COVID–19 spread, the nationwide 'Janata curfew' on March 22, 2020 followed by a nationwide 21–day lockdown to further extension of the lockdown to phase two until April 14, 2020 have received positive reviews nationally and globally.

The prevalence of COVID-19 varies from country to country. Till 29 February 2020, only three cases were reported in India[7]. In the beginning, the numbers remain nearly constant until early March but since then, the outbreak spread rapidly in almost all parts of the country. As on 31 March 2020, there were 1397 COVID-19 positive cases were reported and it have reached 33610 on 30th April, 2020 according to Ministry of Health and Family Welfare, Government of India. The first corona death in India was reported on 12 March 2020 in Karnataka. On 31 March 2020 the number of deaths due to COVID-19 became 35 and again rises to 1075 after one month (30 April 2020)[8].

But within a few weeks the nationwide number had increased, with cities including Mumbai showing thousands of cases and several hospitals shutting down in panic. Over the same time, Kerala, relatively prosperous state on the southern tip of the subcontinent start to "flatten the curve". In view of this, the present paper is an attempt to study the initiatives and precautionary measures taken by Kerala state government in controlling and reducing COVID-19 cases and deaths to reach top among the states.

Data and Methodology

The data used in the analysis were extracted from various sources. Majority of the data were extracted from various federal and government websites, which have been updating regularly. Nonetheless, in cases where official statistics were not available, other source including newspaper articles were also used to

complete the time series data. The data from the day when the first case was confirmed in the area until 30 April 2020 were considered for study.

Profile of Kerala State

Kerala is popular for tourism; the state also tags along for the best human development indicators in the country, even matching that of the Scandinavian countries. Kerala may be a small state (38,863 square kilometres), it represents only 1.18 percent of total area of India, but its population of 35 million makes it India's eighth most densely populated state with 860 per square KM according to 2011 census[9]. Highest sex ratio with 1084 (per 1000 males) was reported by Kerala. The state also have lowest infant mortality rate (10), Maternal Mortality Ratio (MMR) of 46, TFR of 1.8 and birth rate of 14.2 according to SRS 2017[10]. Life expectancy of male and female is 74.2 and 78.1 respectively during 2016-20[11]. Kerala have the highest literacy rate of 94 percent in India[9].

Kerala have around 2.9 beds for every thousand population. Italy has 3.2 beds, and the United States has 2.2 beds per thousand. World Health Organisation stipulates only one doctor per 1,000. India's national average is one doctor for 2,000 people. Kerala has 1.5 hospitals per 1,000 square metre[12].

COVID-19 status in Kerala

Kerala was the first state reported COVID-19 case in Thrissur district on 30 January 2020 in India[13]. The first three COVID-19 confirmed cases in India were medical students who returned to Kerala from Wuhan, China. When they confirmed positive, all the three and their family members were send to home quarantine and provided essential foods and services at home. All the three were recovered later. This is not the first time the state of Kerala is faced a similar situation. The Nipah virus outbreak in late May 2018 was centric to the northern districts of Kozhikode and Malappuram[14]. The virus had no particular vaccine or cure, and protection. Moreover, this was a challenging situation for India's well performing state in terms of medical awareness and infrastructure. The state government along with health department was very alerts and fought with the resources it had, giving importance to its clampdown[15]. After successfully defeating the Nipah virus, Kerala has utilized this experience in activating state machinery, mobilising community and launching awareness campaigns against COVID-19 spread after a rather bumpy start.

Ways Kerala is fighting against COVID-19

Social distancing and other precautions: The use of face masks was promoted from January 30. Schools and colleges were closed on March 10, and all religious groups were told to cancel gatherings to encourage social distancing. For school children who rely on free meals, food was delivered to their homes. When work from home became the norm, internet service providers were asked to improve bandwidth.

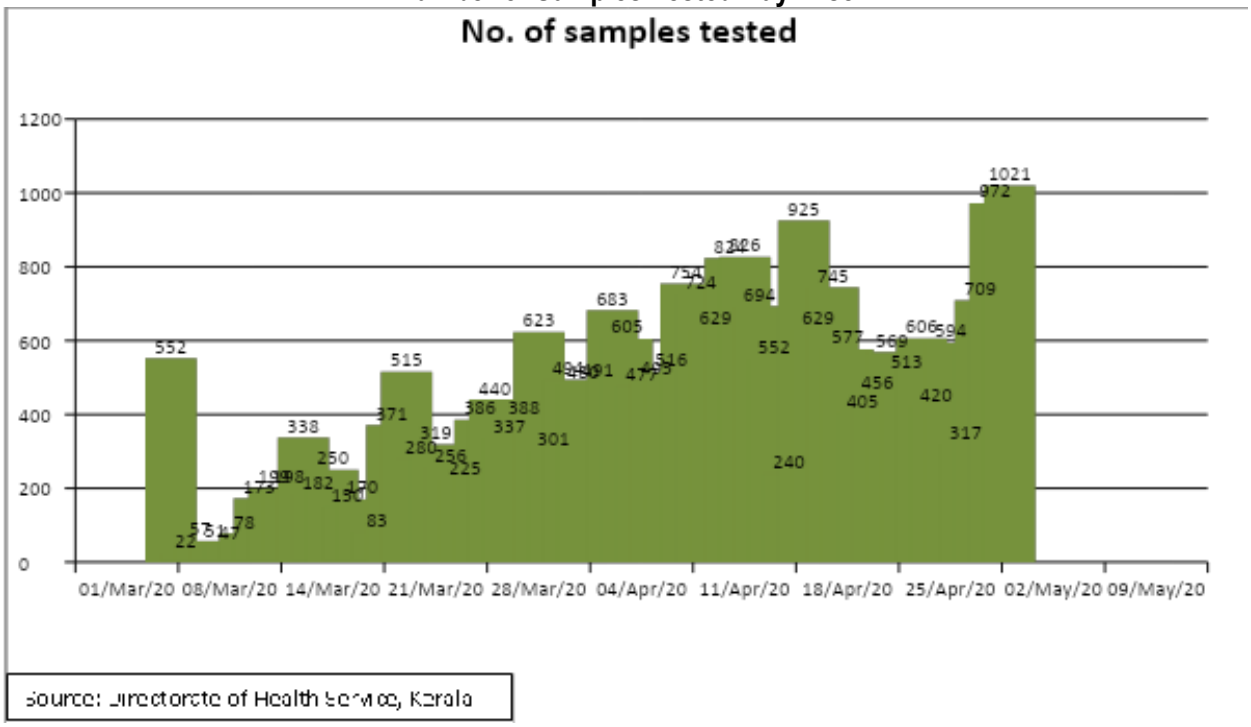
Contract Tracing: With previous experience of virus containment at hand, the state health department initiated a massive tracking exercise to trace a person who came in contact with newly infected people. At panchayat level, ASHA and 'Kudumbashree' workers have been asked to track if any people in their respective areas have come from abroad. Officials traced those who returned to Kerala from infected areas and isolated them even if they had minor symptoms. Some others were home quarantined. Trained health workers were deployed to assist them.

Route Maps: District authorities were prepared route maps of the infected people, which involves tracking very point from when the patient landed in India or came in contact with an infected person, upto when they were admitted to a hospital. The information gathered included place and time.

Testing: The National Institute of Virology, Pune, helped set up a facility in Alappuzha to speed up testing. The government also launched 12 testing labs for early identification of COVID-19 patients. More testing centres were opened later. Kerala was far ahead of any other Indian states in tests per million while having lower than mean percentage of positive. At one point Kerala, Maharashtra and Tamil Nadu had comparable number of cases between 300 and 400. Infact, Kerala took the lead in testing from the very beginning and has fallen a bit behind only now after its curve has begun to flatten while cases have continued to flare up in other parts of our country. Roughly1 in 5 individuals were tested by Kerala[16].

Fig 1

Number of Samples Tested Day-wise



Testing Criteria released on 6 March 2020 stated that symptomatic individuals with travel history will be tested as well as their close contacts. On 6th March, the day testing criteria was declared for the first time, Hardeep Puri, Union Minister for Civil aviation tweeted that Universal Screening had started at all International Airports. On 6 March 2020, Kerala also declared that it will universally screen all international passengers and newspaper reports indicating that this was implemented at Kerala's 4 International Airports. On 10thMarch Kerala declared that they will screen all domestic passengers coming in at the airports in the state. On 15th March Kerala began screening all railways and buses coming from outside the state and putting people with symptoms in quarantine[16]. No other state Government appears to have taken all these measures so proactively, as it is above and beyond what was recommended by the Central Government.

Quarantine Comfort: Centre's period of quarantine was 14 days, while Kerala was quarantining people for 28 days. People who had returned from Wuhan and other Chinese territories were told to quarantine at home for 28 days. All contacts were tracked and asked to self-isolate at home. Today, anyone entering the state has to undergo a mandatory 28-day quarantine.

Isolation Wards: Isolation wards were setup in medical colleges, general and district hospitals. Around 635 corona care centres were created in hostels,[88] educational institutions and unoccupied buildings. Besides that, around 125,000 rooms were kept aside to accommodate suspected cases.

Focus on Mental Health: The state opened multiple call centres to keep check on the mental health of those who are home quarantined. A live counseling hotline is being used to provide stress relief to the affected people. The mental health division is in constant contact with patients and giving them good psychological support.

Focused Approach: On February 18, Kerala constituted three high-level committees and experts groups to advise the government on COVID-19. Among their members were special virologists, disaster management experts, software professionals, hospital administrators, former civil servants and retired defense personnel. Also set up a special monitoring group headed by Secretary to the Chief Minister and officer on Special duty. State chief secretary was directed to coordinate with various departments and the centre[17].

Mobilising Communities: Lessons learned from the management of Nipah out break that government could not manage the response alone. Kerala's robust panchayat raj system and urban local bodies mobilised support for the contract tracing and support to affected families. Non-government organizations arranged for supplies including protective gear. Opinion leaders, religious leaders, media, civil society organizations were all co-opted into responding to the threat. This led to the community trusting government and coming forward to provide the needful information, volunteering to provide resources and following directions of the government even it was painful for them[18].

Mid-day Meal Delivery: As the government announced on March 10 that all classes, including at madrasas, anganwadi centres and private tutorial institutions, would remain closed till the end of the month, the CM assured that the government would home-deliver the mid-day meals provided at anganwadi centres across the state. The move has received widespread praise. Taking a cue from this, the Karnataka government said it would deliver groceries to the homes of children studying in anganwadis while they remain shut this week[19].

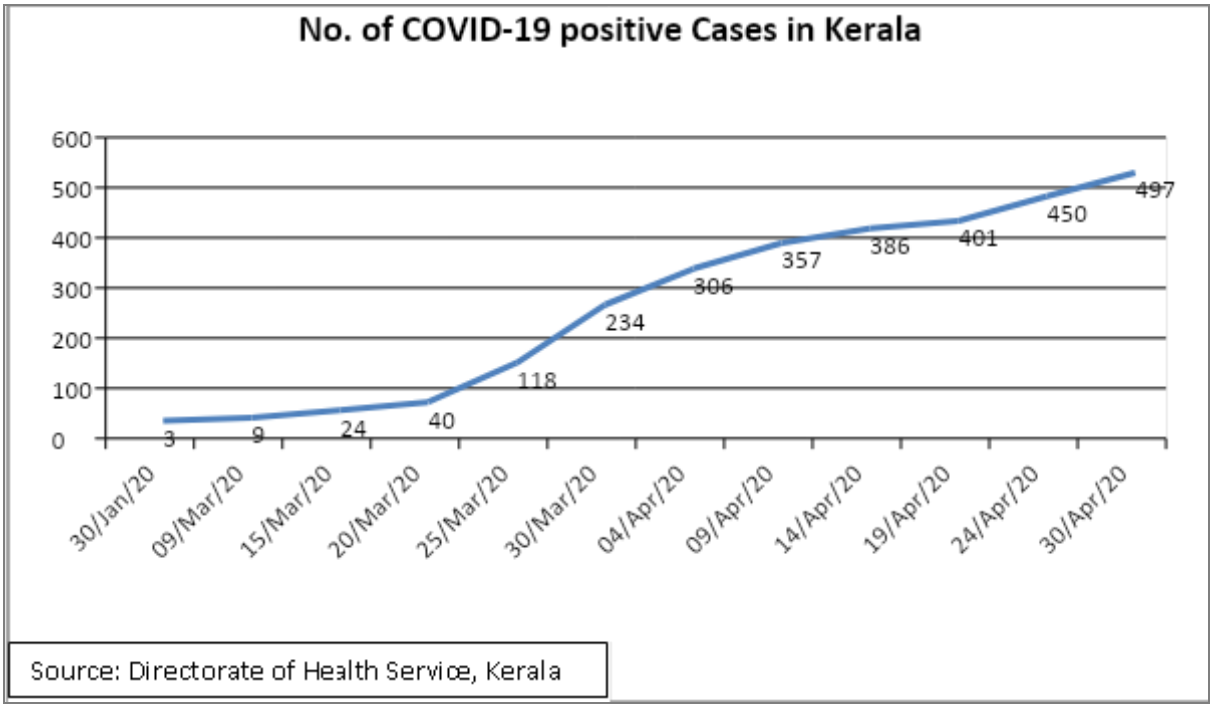
Checking Rail and Road Entry Points: Kerala government launched intensified medical check-ups at 24 spots bordering Tamil Nadu and Karnataka for people entering the state by rail and road. A special team monitors all the passengers of inter-state trains at the first station inside Kerala borders. The team comprises of one paramedical staff, a police man and a local volunteer and they can examine two train bogies at a time and examine all passengers. The train passengers would also get an SMS alert, saying they would beneficiaries checked at the first station the train touches after entering Kerala.[19] The state government has also identified 24 points in the border road areas of Kerala from north to south and a separate team, headed by a Deputy Superintendent of police (Dy. SP) monitor those who travel by vehicles.

Break the Chain: The health department of Kerala launched a "breaking the chain" campaign to encourage hand sanitizing among people in order to prevent the spread of corona virus. Sanitizing among people in order to prevent the spread of corona virus. There are chances of the virus being spread through our hands. Sanitizing our hands will break the chain and prevent the spread of the virus. The campaign promotes use of hand sanitisers or washes the hands with soap and maintains personal hygiene[19].

Data Transparency on COVID-19: Except Kerala and Tamil Nadu, no other major states affected by Covid-19 have released regular reports from the beginning providing comprehensive data which can beneficiaries easily accessible through the website. Delhi has released reports from the day the city reported its first case on 4th March. Rajasthan saw its first case on 14th March. Madhya Pradesh, understandably, has begun releasing reports giving testing numbers only from 30th March on wards. Detailed reporting began from 16th March. Reporting for all India data at the Ministry level started only from 6th March[16]. While in Kerala, the Directorate of Health Services publishing daily corona bulletin is available in their website with all the details from 25February 2020 onwards.

Fig 2

November of COVID-19 Positive Cases in Kerala till April 30



Another issue is that of language. Gujarat and Madhya Pradesh only provide reports in their State's official language: Guajarati and Hindi respectively. Maharashtra's reports are erratic; sometimes they are posted in both Marathi and English and sometimes in either one of the two languages. Tamil Nadu, West Bengal, Delhi, Rajasthan and the Ministry give reports in English only. Kerala stands out again, giving reports in both Malayalam and English always[16].

Table 1

Number of Cases, Active Cases, Recoveries and Death of COVID-19 in Kerala District-wise till 30 April 2020

District	Active cases	Recoveries	Deaths	Total cases
Kannur	42	72	0	114
Kottayam	17	3	0	20
Idukki	14	10	0	24
Kollam	12	8	0	20
Kasaragod	8	171	0	179
Palakkad	2	11	0	13
Ernakulam	1	22	1	24
Malappuram	2	21	1	24
Thiruvananthapuram	2	14	1	17
Pathanamthitta	1	16	0	17
Kozhikode	1	23	0	24
Thrissur	0	13	0	13
Alappuzha	0	5	0	5
Wayanad	0	3	0	3
Total (all 14 districts)	**102**	**392**	**3**	**497**

Source: Directorate of Health Services, Kerala, Various Daily corona Bullettins[20]

The table 1 indicates that out of 497 reported COVID-19 cases, 392 patients were recovered and 102 are still active and only 3 deaths reported on 30 April 2020 in the state of Kerala. Kerala have the best recovery rate in the country with 79 percent according to the Ministry of Health family Welfare, followed by Tamil Nadu and Telangana with 52 and 42 percent respectively[21].

Other Initiatives: Sanitizer production in the state by Kerala State Drugs and Pharmaceuticals limited, Increasing internet connectivity by 30-40 per cent to the people who are quarantined or need to work from home, awareness among migrant workers through awareness campaign in their local languages, visits of government officials to the patients in the isolated wards, daily press conference and updates of COVID-19 daily, prisons manufacturing masks and make it available in low cost, batting and prepping for foreign arrivals etc activities helped Kerala to stands on top of fight against COVID-19 in India.

Conclusion

Preparing route map to trace the places those infected visited before being identified as positive proved to beneficiaries highly successful when maps are widely circulated on social media. Looking at the map, it became possible for people to maintain social distance and contact health officials if they happened to beneficiaries in that locality with the infected people. The media also shares the experiences of people who have been quarantine, self-isolation and even completed treatment as recorded in their own words, thereby creating a rich source of content for people to reflect upon. These proactive attempts have proven to beneficiaries crucial in Kerala's effort to flatten the curve. The success in Kerala could prove instructive for the Indian government, which has largely shut down the country to stop the spread of the contagion but

continuous to see the curve turned upward. The US Publication noted "proactive measures adopted by Kerala such as early detection of cases and broad social support measures can beneficiaries a model for the rest of the country[22]".

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स्वास्थ्य और जनसंख्याः
परिप्रेक्ष्य और मुद्दे, 43(4):–173-184/2020

ऐसे कौन से बिन्दु हैं जो कोविड–19 की रोकथाम में केरल को शीर्ष स्थान प्रदान करते हैं ?

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सारांश

चीन के वुहान से कोविड–19 से प्राप्त पहली रिपोर्ट के पश्चात, भारत सरकार ने इस उभरते हुए जन स्वास्थ्य संकट के शमन हेतु बहु–क्षेत्रीय प्रयासों की समीक्षा तथा पहल की। भारत में केरल कोविड–19 से प्रभावित होने वाला प्रथम राज्य था तथा कोविड–19 से संक्रमित पहला व्यक्ति त्रिशूर जिले में 30 जनवरी 2020 को पाया गया था। भारत में पहले तीन कोविड–19 पुष्ट मामले मेडिकल छात्र थे, जो चीन के वुहान से केरल लौटे थे। इस लेख का उद्देश्य कोविड–19 मामलों एवं मृत्यु को नियंत्रित करने तथा कम करने में केरल, राज्य सरकार द्वारा की गई पहलों एवं एहतियाती प्रयासों का अध्ययन करना है, जिसके कारण राज्यों में केरल शीर्ष स्थान पर है। विश्लेषण में प्रयोग हुए डेटा को विभिन्न स्रोतों से लिया गया है। अध्ययन हेतु पहले मामले की पुष्टि के दिन से लेकर 30 अप्रैल 2020 तक के आंकड़े लिए गए। केरल में कोविड–19 को नियंत्रित करने के लिए कई पहलें की गईं। राज्य ने निगरानी, संपर्क अनुरेखण, क्वारंटाइन सुविधा, परीक्षण नीति, मार्ग मानचित्र, निर्बाध उपचार सेवाएं, सामुदायिक लामबंदी, केंद्रित दृष्टिकोण, मध्याह्न भोजन वितरण, रेल एवं सड़क प्रविष्टि बिंदुओं पर जाँच आदि कई रणनीतियाँ लागू कीं, जिनसे केरल में कोविड–19 के प्रभावी प्रबंधन एवं नियंत्रण में योगदान मिला।

प्रमुख शब्दः कोविड–19, कोरोना, पहल, केरल, महामारी, प्रबंधन।

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THE NATIONAL INSTITUTE OF HEALTH AND FAMILY WELFARE

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