



Covid-19 Impact on Telemedicine

Ankit Singh^{1*}, Ajeya Jha² and Shankar Purbey³

¹*Symbiosis Institute of Health Sciences, Symbiosis International (Deemed University), Pune, Maharashtra, India.*

²*Sikkim Manipal Institute of Technology, Sikkim Manipal University, Majhitar, Sikkim, India.*

³*Development Management Institute, Patna, Bihar, India.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

In healthcare, the delivery has become challenging as the affected patients need to be cured, and at the same time, other patients and communities need to be protected. The traditional healthcare delivery modes need to be revised as it has a higher probability of human contact and transmission of infections. This study aims to review the existing work in the literature related to care delivery in the COVID 19 era and to suggest alternative modes and practices to reduce the transmission of infection and to improve the accessibility of healthcare to the population. This research was conducted through a comprehensive review of research articles available in the research databases "PubMed" and "Science Direct" searched with the keywords "Coronavirus" and "COVID-19" till March 19, 2020. This conceptual study analysis the best practices for adoption by the government to contain COVID 19. At the same time, it also analyses the conceptual model proposed in a study done in Taiwan. Moreover, the current study proposes a new healthcare delivery model with the integration of Telemedicine, Healthcare, and Institutional Care. This study

*Corresponding author: E-mail: ankit@sihspune.org;

concludes that at the primary level of healthcare, the Use of Telemedicine should be considered and promoted, similarly at the secondary level of care, Home healthcare should be the preferred mode, and last, at the tertiary level of healthcare requires hospitalization should be preferred.

Keywords: Telemedicine; home healthcare; hospitalization; bio-safety level-6; COVID-19.

1. INTRODUCTION

Currently, the whole world is combating COVID 19 (Corona Virus Disease 2019), which has originated in China. Even technologically advanced and economically developed nations are finding it very difficult to curb the spread of this deadly virus; for example, as of May 22, 2020, as per the WHO website, around 3,23,412 patients have died throughout the world. The situation is much more serious for underdeveloped countries where the resources to tackle this deadly virus spread are very limited. The risk factor for transmission of this disease is very high. This category includes Indian, Brazil, Mexico, etc. However, India is admired throughout the world for timely actions, which have enabled them to reduce the number of infected cases. Still, these numbers are in rise. The total number of cases is above 1,17,500, with 3583 deaths.

The pandemic has made the world to focus less on other severe diseases where people are much worried and staying back at home and avoiding the regular check up. This condition makes the persons to be more prone to infections and seriousness of the diseases is taking up their own effect like cancer, hepatitis, diabetes, pregnant women's, Thyroid, blood pressure and so on. The prevailing situation causes tension among the people and the care takers at home to provide an alternate source to overcome these issues. Telemedicine was then introduced to the existing issue where doctors can be called via telephones and to provide clinical services for the patients.

2. LITERATURE REVIEW

Recently the Oxford University has developed a response tracker, which is widely appreciated. The Oxford response tracker developed by Oxford University consists of the information about key eleven Indicators of government responses which are:

- School closure;
- Workplace closures;
- Public event cancellation;

- Public transport closure;
- Public information campaigns;
- Restriction on internal movement;
- International travel controls;
- Fiscal measures;
- Monetary measures;
- Emergency investment in healthcare;
- Investment in vaccines.

The Indian Citizens that their government has scored a 100 on these Indicators. Overall, all key themes highlighted in these seven indicators are quarantine, social distancing, up-grading healthcare facilities, Surveillance, and Economic measures for helping the poor and sustaining the nation's economy [1]. However, the authors believe that despite the speedier response of many nations' governments, some more situations are much needed. This condition can change how the world as a unit used to function [2]. Many new normal are going to become a norm, and the world leaders and the persons holding decision-making positions should think about it. The healthcare services and how healthcare delivery should be fine-tuned in these difficult times [3].

2.1 Description of Major Healthcare Related Themes to Combat Corona Virus 2019

The key areas where all the administrative body of the locality needs to focus upon include these focus areas as mentioned above.

2.2 Government Response

The community depends on the government for the direction and actionable points in emergency and pandemic times. This is because the government is better equipped with information and can implement the decisions taken [4]. Despite the government's proactiveness and the due considerations to the seriousness of the situation can bring encouraging results, this can be seen in the "Bhilwara District" of the Indian state Rajasthan hotspot in March month, and presently there are no new cases. Similarly, India's Kerala state has also shown the world the

best practices that should be adopted in these situations [5]. In both these admired models, the common action points were a mass campaign to educate people about social distancing and hand hygiene, intense contact tracing, total lockdown, Use of technology such as geographical information system to track the location of patients in-home quarantine, in addition to that with the help of an app the monitoring was done for people under home quarantine, the total lockdown of the district, and use of drugs such as Hydroxy-chloroquine, Tamiflu and HIV drugs for the treatment of the patients, setting up of isolation wards in the hospitals and quarantine centers in the outskirts of the city, moreover, in the state of Kerala, the mandatory home quarantine duration was of 28 days. In contrast, the other Indian states had kept this to 14 days [6].

2.3 Social Distancing

Based on the local news, it won't be wrong to say that compliance with the social distancing norm is related to education and the attitude towards the infection's risk threat [7]. Primarily education is important then comes the role of attitude. This is also demonstrated in low compliance in some geographical areas and communities where the education level is less in India [8].

2.4 Home Quarantine

Home quarantine is suggested to those people who have a risk of being exposed to the infection but are not sick. This is the widely adopted measure for preventing the coronavirus spread [9].

2.4.1 Hand hygiene and sanitation cum fumigation

Prevention is always better than cure. The community can also play their role in safeguarding themselves against the risk of transmission by adopting sanitization and the most effective measure for cross-infection prevention [10]. Moreover, the local administration has to carry out fumigation activities in all areas, especially in the hotspots [11].

2.5 Quarantine Centers

Quarantine centers, in case the number of suspected cases increases home quarantine is not enough as it puts the other family members

also at risk, then the local authorities have to identify the appropriate place which should be ideally in a non-busy area and if possible, in the outskirts of the city [12].

2.6 Isolation Units

In India, initially, the isolation wards were created only in the government hospitals, but local administration has asked the private hospitals also to set up an adequate number of isolation wards [13]. The peculiar isolation ward requirements are positive pressure in the room, barrier nursing, Use of disposable linen and cutlery, and adequate provision of Personal Protective Equipment (PPE's) [14].

2.7 Up gradation of Intensive Care Units

Normally, in a tertiary care hospital, the number of Intensive Care beds is around 5 – 10% of the total beds [15]. Moreover, currently, India has a total of 44,000 ventilators for the 1.3 billion ICU beds and is located in the medical colleges and private hospitals in metropolitan areas [16].

2.8 Risk of transmission to Frontline Healthcare Workers

The frontline workers are at a high risk of infection from the corona virus-infected patients. In India alone to date, around 90 healthcare workers are infected with COVID 19 [17].

2.9 Innovative Usage of Technology at Rescue

Use of drones for sanitizing, surveillance, and monitoring lockdown, use of mobile apps to disseminate health education and information regarding preventive practices [18]. Moreover, hospitals have started to use robots for medication transportation and administration and ventilator monitoring in the isolation wards [19]. However, in some Indian cities, disinfection and sanitation tunnels are getting installed, but their effectiveness is still questionable.

2.10 Prophylaxis

Recently, it has been accepted throughout the world that the drug Hydroxy-chloroquine, a low-cost drug with some side-effects, is effective against the COVID 19 post-exposure prophylaxis.

2.11 High-Risk Group

High-risk groups include children, persons above 60 years of age, and persons with other comorbid situations such as diabetes, hypertension, chronic kidney disease, and other respiratory illnesses.

2.12 Measures to Prevent a Panic Visit to Hospitals Resulting in Increased Load

Most of the governments have taken measures such as requesting citizens not to overload the health institutions for minor illness and to visit a hospital in India only in case of emergency as the patients visiting the hospital will have a higher risk of healthcare-associated infection and on top of that it will overburden the already stressed healthcare workforce which is busy in providing service to the corona infected patients.

2.13 Vaccine Development

The most effective cure cannot be attained for coronavirus until a vaccine can be developed for this and the health agencies and various multinational companies are in the different stages of developing a vaccine for this, but to date, there is no vaccine for coronavirus in any part of the world [20].

3. METHODS

The review article is based on a comprehensive literature review of research articles related to healthcare delivery in the Coronavirus pandemic and COVID-19 situation. Hence, the research articles related to healthcare delivery in the COVID-19 situation were considered for the review analysis. The research databases "PubMed" and "Science Direct" were explored for the articles confirming healthcare delivery objectives in the COVID-19 situation. "COVID-19" AND "Healthcare Delivery," and this search was done until March 19, 2020. Around 18 research articles were found. Out of 18 research articles, seven articles were discarded as they were not conforming to the set objectives. The Remaining 12 articles were considered for the review.

4. RESULTS

The key themes identified for the healthcare delivery in the Coronavirus pandemic was "Telemedicine, "Teleconsultation, "Gatekeeper method for reducing the patient load on tertiary

care hospitals, "Use of Technology, "Internet of things, "Walk in Clinics," and "Community Screening Centers."

4.1 The Strategic role that Homes Healthcare and Telemedicine Can Play in the Containment of the Corona Virus

"An array of health and social support services provided to clients in their homes" is how home care is defined. Home care can be defined as "an array of health and social support services provided to clients in their residence." The goal, contents, and outcomes of home care are shown in Fig. 1. The goal, contents, and outcomes of home care are shown in Fig. 1.

Moreover, Telemedicine is an umbrella term used to refer to remote delivery of healthcare and health information. It has a strong reliance on telecommunications and information technology. Its services range from clinical services to continuing medical education and preventive health. Its most salient characteristic is that it doesn't include the patient and the physician's physical confrontation. However, in a recent study, a Taiwanese primary healthcare model is said to be effective in reducing the Corona Virus Spread. In this model, the four tiers of the primary healthcare system are discussed. The four tiers are shown in Fig. 2.

- i) Walk-in Clinics: Treatment service for chronic diseases, mental care, and long-term care.
- ii) Community Healthcare Groups prepared clinics: For patients with fever, cough, upper respiratory symptoms can monitor isolated cases with video conference.
- iii) Community Screening Stations: Healthcare centers with diagnostic facilities such as X-ray machines and quarantine facilities.
- iv) Medical Centers: Tertiary care centers, Hub for the Community screening stations.

However, we feel that in this model, the first three tiers can be well handled with the help of home healthcare and Telemedicine, For instance just the Walk-in Clinics of Taiwan, In Indian capital New Delhi, there are mohalla clinics which were also functional in the initial stage of the corona spurge in India but later on it was found that some of the physicians working in the Mohalla clinic got infected and they become the source of infection for many other patients. Moreover, they came in contact with around 900

people, and it was a challenging task for the administration to do the contact tracing of these 900 people as some of these people were from other states. Hence it won't be wise to allow people to come to a commonplace even for the treatment. Then the question arises as to what should be done? Even preventive and curative care for minor illnesses couldn't be completely stopped. The answer is Telemedicine which can be used for consultation and screening of the patient and the home health workers can play an assisting role only when intervention is required.

Hence the first level of screening can be done in a video call in case the physicians suspect an infected case. The sample for RT-PCR, a diagnostic test for confirmation of 2019 novel coronavirus; can be collected from the home itself with the help of home healthcare workers, and the reports can be received within two days in case the case comes positive all the family members should be tested and sent to quarantine centers moreover with the help of contact tracing the exposed persons can be screened.

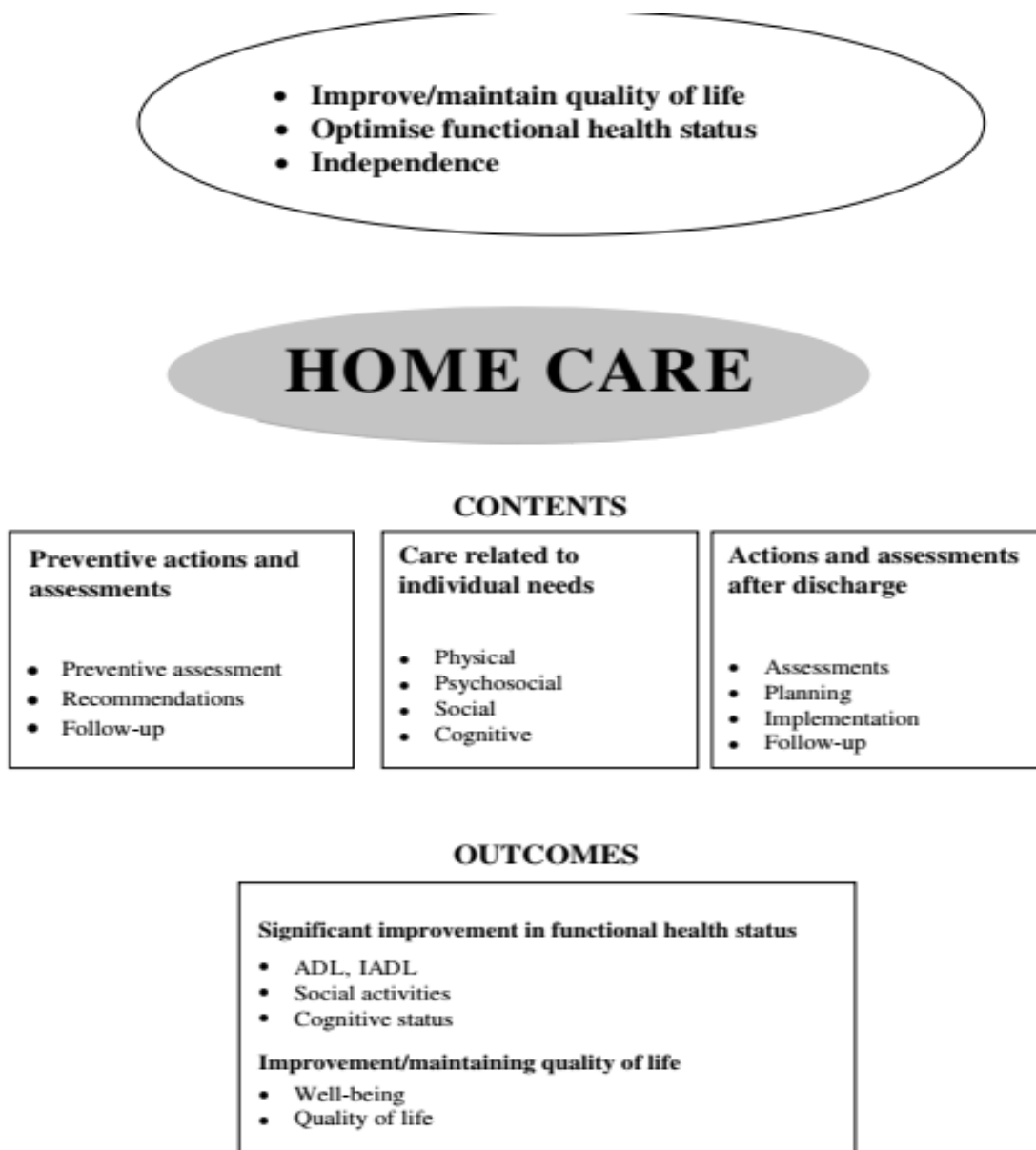


Fig. 1. Objectives, contents, and outcomes of home care [21]

However, the third tier of care is not that relevant for corona infected patients as the screening and confirmation with the help of Telemedicine and home healthcare can be done at the secondary level. Moreover, as there is no drug available to target coronavirus, the treatment modality is shifted towards symptomatic treatment with respiratory support, which can be delivered at the Intensive care units at the tertiary care hospitals. However, in-home healthcare also there is a provision for converting a home into Intensive care units, but since the number of life-supporting devices is already limited hence centralization of resources at the tertiary care hospitals will be a better choice. Furthermore, to test this model in a pilot mode, this can be used for those localities which is a hotspot, and the demographic distributions of old age people are more, like old age people at high risk of this disease and in the absence of young family members in times of lockdown, they will be finding it difficult to cope with the activities of

daily living and arranging the essentials for survival. Home Healthcare workers can play a crucial role in improving their situations. In the end, home healthcare workers can also play a vital role in the capacity building of the family caregivers for disease management of chronic diseases and educating them about the modes of seeking help through online mode in times of medical emergency before rushing to the hospital.

4.2 Suggested Model

Considering the weaknesses of the Taiwanese Primary care model, a refined model is designed with the primary focus on the safety of healthcare workers. This model also categorizes the healthcare requirements at three levels primary, secondary and tertiary, and it also suggests the appropriate model of care delivery process in a flow chart. Fig. 3 Staggered Model for Healthcare Delivery in COVID 19 Era, Here.

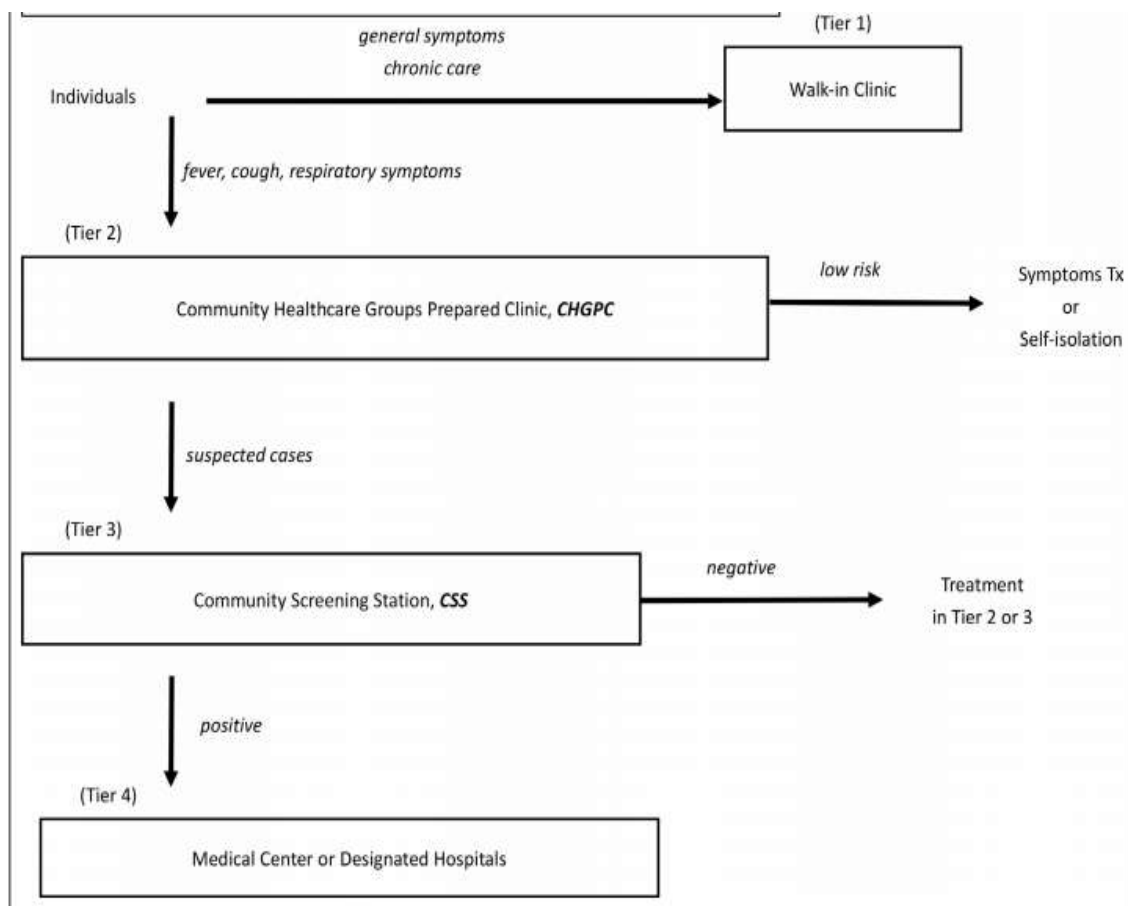


Fig. 2. The innovative model of tiered primary healthcare
 Source: (Chang & Chiu, 2020)

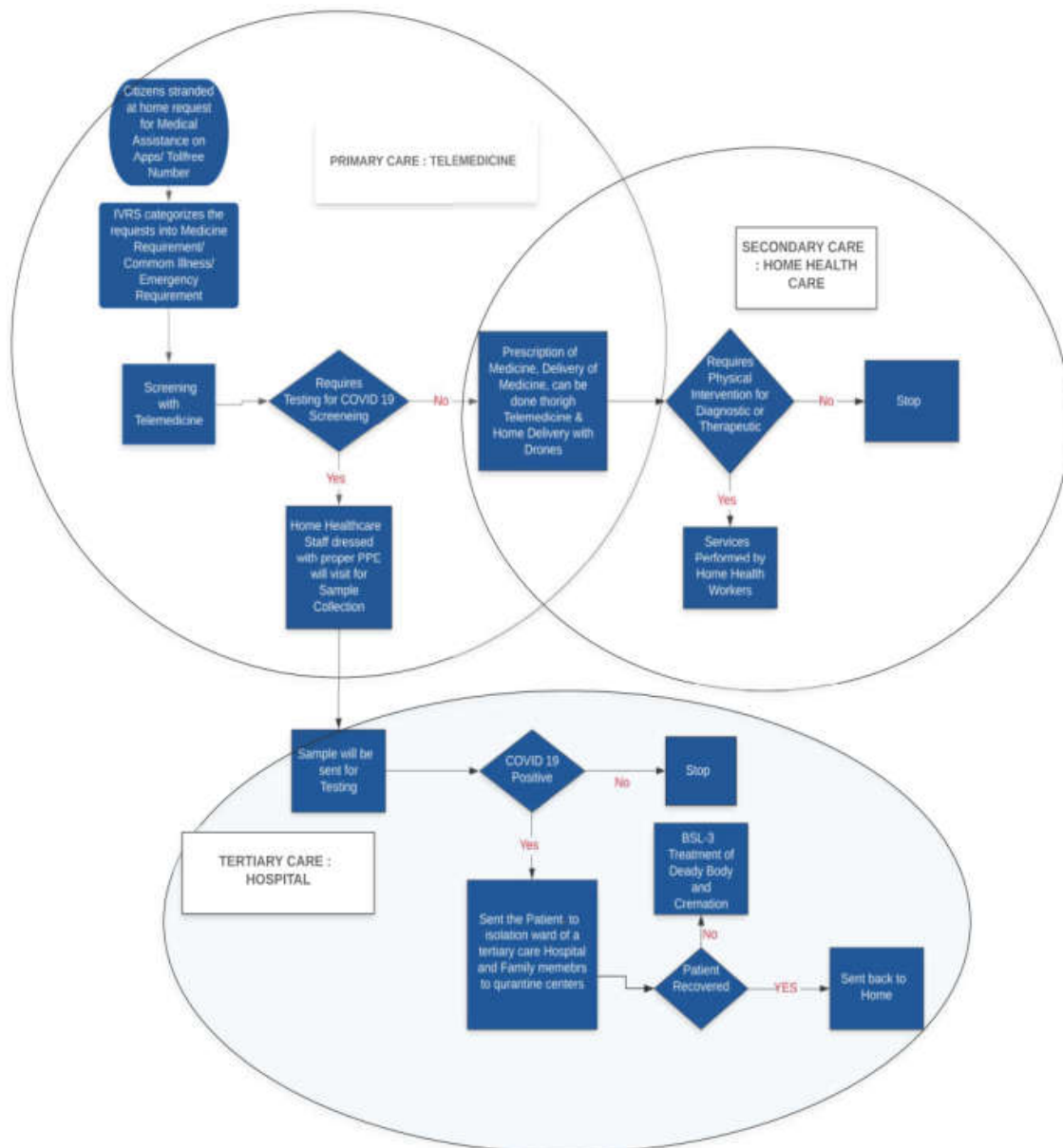


Fig. 3. Staggered model for healthcare delivery in COVID-19 era
 Source: (Chang & Chiu, 2020)

5. DISCUSSION

The model discussed in the earlier section proposes that the preferred mode of care delivery for primary care should be "Telemedicine" for patients and citizens living in the COVID-19 affected regions. The patient can send the request with the help of mobile apps or the toll-free numbers provided by the agencies. In the next step, the IVRS (Interactive Voice

Response System) can categorize the requests into medicine requests, illness confirmation requests, or requests for emergency services. Similar thoughts are also reflected in published studies where authors have supported the Use of Telemedicine for the primary level of care as it will reduce the caregiver burden and protect the healthcare workers from the risk of exposure. In addition to that, some of the authors have also highlighted the negligence towards Telemedicine

even in developed countries such as Italy, where it was not included as a model of care delivery under the National Health Service. The same situation prevails in India, where also the regulatory framework for implementation and Usage of Telemedicine is very weak. Recently the regulatory body of India, i.e., the Medical Council of India, released Telemedicine practice guidelines for the medical practitioners; however, in the future, many more such initiatives will be required. Furthermore, some of the authors do not limit the Usage of Telemedicine in the primary level of care but also promote its application in secondary and tertiary levels of care, with a wide range of services from Tele-Consultation and Forward Triage to Tele-Radiology and Tele-ICU. There are also some barriers to the adoption of Telemedicine that need to be addressed, for example, clarity about the legal issues involved in teleconsultation, the payment mechanism as some of the insurance companies don't cover the teleconsultation and this also affects the accessibility of care. However, initially, the healthcare system of developing countries should start with the application of Telemedicine in the primary level of care as the resource and training requirements will be less and the initial level of screening can be done with the help of video calls between the patient and the physician, same is also advised for palliative care, and in case the physician feels the patient should go for COVID 19 testing, the home health staff with proper personal protective equipment will visit the patient's house for sample collection. This will prevent the unnecessary traveling of the suspect corona infected patients, which can become a source of infection for many others in his journey to the nearest health screening center. On the contrary, in case the testing for corona is not required, but only medicines are required, the same can be delivered with the help of drones or home delivery in sanitized boxes while maintaining social distance. However, in the secondary level of care also the home health workers can play a vital role in case the patient requires a diagnosis or a physical intervention. Moreover, at the tertiary level of care, the hospitals have to pitch in, and if the results of the test sample collected by the home health workers come positive, the patients and the family members should be asked to remain in home quarantine or can be sent to community quarantine centers. Institutional care is advised for only those patients who can't be serviced with Telemedicine or home healthcare, and the same is proposed

for patients suffering from neurological diseases or patients requiring emergency surgery. Lastly, when the patient recovers, he should be sent to the home and can be asked for blood donation as some of the countries are supporting plasma therapy for the treatment of COVID-19, but the same is not yet endorsed. In case the patient dies due to Corona Infection, then it becomes very important to treat the dead body of the patient at the Bio-Safety Level- 3, which means the bodies should be packed intact in leak-proof plastic and cremated.

6. CONCLUSION

This study proposes a new model of health care delivery in a staggered manner with the help of Telemedicine and home healthcare. This new model will not only prevent the community transmission of the coronavirus but will also facilitate the healthcare delivery to those individuals who are stranded at their homes due to lockdown and are afraid to visit the nearest healthcare centers. COVID-19 pandemic has significantly affected various service sectors such as education, where the adoption of technological solutions is on the rise, and blended learning with a mix of online and offline is promoted. On the same note, this study also suggests a blended model of care delivery with the adoption of technology-fueled modes such as Telemedicine, Home Healthcare, and Institutional Care. Similarly, in mortuary procedures, the aerosol-generating procedures should be avoided, and the body should be kept in the mortuary at a temperature range of 4-6 degrees Celsius. In the future, healthcare delivery will be focused on these three areas depending upon the patient's needs and conditions.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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