Cost-effective Telemedicine System to combat COVID-19 in India: A proposed Model

Debanjana Ghosh (✉ debanjanaghosh92@gmail.com)

University of Engineering & Management <https://orcid.org/0000-0003-2422-6453>

Piyali Mukherjee

University of Engineering & Management

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Abstract

The telemedicine system has documented its concept quite a long time ago. Even though, it only got materialized a decade ago mainly owing to lack of channelization of knowledge and its usefulness. The proper and systematic use of this, can be a boon for a lot of countries' healthcare system in the present era. The recent fear, the COVID-19 which has been declared a pandemic by WHO, has massively broken the structure of the prevailing healthcare system and the only possible and even better alternative that has been realized by many countries is the Telemedicine. A country like India with extremely high population and with a low per-capita income, is still fighting such an infectious disease without proper approach. Telemedicine can thus be a new light for India but no implementation models have been reported so far. This paper proposes a model and the means to incorporate telemedicine in the existing healthcare system to combat COVID-19. The model aims at creating both cost-effective and time-efficient solution to treat patients while maintaining proper distribution of resources.

Introduction

A disease can turn to pandemic without any prior notice and becomes the cause of vulnerability to mankind. Such disasters happened in the past and is also likely to take place in future. The rapid spread of Coronavirus or COVID-19 in the present era is one such burning example. As people are gaining knowledge about this pandemic with every passing day, awareness to combat such situation by preventive measures is also being practiced. Telemedicine, though not a very new concept in context of health-care systems [1] is still gaining attention in recent times as it aims to provide proper care to patients with the aid of telecommunication technologies in a very effective way [2,3]. In spite of being a potential candidate to treat several infectious diseases with ease, lack of knowledge about its usefulness is still a major hindrance. With the emergence of COVID-19, people are getting familiar with it and its advantages in healthcare treatments [4].

India being a developing country with a population of nearly 1.366 billion [5], among which 73 million people are below the poverty line [6] and a huge percentage of the population don't earn enough so as to support lucrative healthcare packages for treatments. Due to this extreme poverty that a country like India suffers from, it is needless to say healthcare still stands at the primary onset of human demands.

Setbacks such as limited number of health workers and the uneven distribution of existing healthcare professionals are the thrust issues that are very much prevalent [7]. This is mainly attributed to poor communication systems, sub-standard living conditions and associated problems. Owing to this, the number of health workers providing service to rural areas get lowered which results in unbalanced distribution of manpower and very unpromising infrastructure. On the contrary, the facilities in the urban sector is plenty with favorable healthcare solutions. It is a notable fact that the rural population of India is 0.895 billion which is almost three-fourth of the total population [8] that mainly comprises of the underprivileged people whose basic healthcare is not met.

It has been documented that a huge percentage of healthcare cost is borne by an individual's income [9]. The privatized health care sector imposes a good out-of-pocket expense to provide modern amenities to the patients. This extra expense becomes unaffordable for the middle-class families to whom treatment becomes a luxury. Though Government has taken some radical steps for investment to better the infrastructure [10], yet proper planning is required to materialize it. Telemedicine is thus a better alternative and finds scope for implementation in a technologically developing country like India. Proper incorporation of this will definitely lead to a greater development in the entire healthcare system of the country yet no researches reported in literature, proposed any implementation models. This paper thus proposes a model and the means to incorporate telemedicine in the existing healthcare system to combat COVID-19. The model aims at creating a cost-effective solution to treat patients in a time-efficient way while maintaining proper distribution of resources.

Formulation Of Work

The motivation for taking up this work underlines the fact that cost-effective healthcare solutions can be the only alternative to develop the mainframe of a poverty-stricken developing country like India. Owing to several reasons, the present system is failing to provide complete healthcare to all corners of the country. The socio-economic condition enables the affluent class of the society to avail all possible healthcare benefits and often tend to use it unwisely, while the people with lower economic income tend to suffer from serious health issues with the economic crisis being a major hindrance for treatments. To add to it, the situation even worsens when it comes to a pandemic like the COVID-19.

The aim of the paper is to propose possible solutions to improve the existing healthcare facilities that can be availed by all sections of the society and in turn make the country more prepared to fight any future infectious pandemic and epidemic. The proposed model targets to reach all nooks and corners, and hence, based on progressiveness, infrastructure and socio-economic conditions, the country may be divided into three sectors namely, the rural area, the semi-urban area and the urban area. In this paper, three models have been proposed that may be implemented to fight against the infectious COVID-19. The models propose to use telemedicine system in addition to the existing point-of-care system depending on a case-to-case basis.

The vision behind these models are:

- Providing cost effective solution in case of crisis,
- Equal distribution of both healthcare providers and equipment throughout the country,
- Time-efficient approach to provide attention to every patients,
- Enabling minimum spreading of the disease.

With this vision, the paper is structured as follows. In Section III, the detailed model proposition has been described for the rural area, the semi-urban area and the urban area separately. Section IV provides a brief conclusion of the entire proposed method.

Proposed Models And Execution Steps

It is a notable fact that no implementation models for Telemedicine systems to combat COVID-19 has been documented so far. This led to the design of a proposed model and the execution steps for implementation of the same. To enable this, the country is thought of to comprise three main sectors: (1) Rural Area, (2) Semi-Urban Area and (3) Urban Area.

(1) Rural Area Model:

Present Scenario:

The present healthcare system in the rural area is far inferior than desired. There are hardly a couple of dispensaries with utmost a single healthcare unit. In some villages the scenario is even worse with no medical facility at all. In case of critical emergencies, the patients have to travel for hours to reach a health-center, while a significant number of people restrict themselves to quack drugs owing to their inability to bear transportation or treatment costs. The poverty and illiteracy also results in enhanced belief in charms or superstitions. In the present situation of COVID-19, the scenario has even worsened. Lack of proper information, fear due to less knowledge and spread of rumors, lead the infected patient completely abandoned which confirms the death of the person without any treatment. Besides they sometimes ignore the government cautions completely which causes the rapid spread of diseases. To overcome this, a proposed model implementing Telemedicine system is presented (Fig. 1).

Proposed Model:

- This model is expected to comprise only one healthcare center with internet facility in every village consisting of a small team of health-workers. They should be properly trained in handling technology for the use of telemedicine.
- A proper listing of the symptoms of COVID-19 proposed by researchers is required to be communicated with the residents.
- A healthcare worker may be assigned to check the patients, having any non-infectious symptoms at their home, to reduce their chances of being affected.
- An individual who is experiencing any of the stated symptoms has to inform to the center.
- The patient can be diagnosed by a doctor from a distant hospital via video-conferencing. The doctor will address all the problems reported by the patient and may pose query for cross-checking.
- In case of a non-viral disease showing similar symptoms to coronavirus, the doctor may prove instrumental in deciding that after cross-questioning, and decides the severity of the patient's condition which may lead to two possible outcomes:

Case 1: Patients with high percentage of doubt would be quarantined. Test sample will be collected and sent to labs. They would be isolated and treated until the test results arrive. Now, if the person's test turns positive and have a severe condition, he/she will be sent to the hospital while for moderate condition can

be treated by the health-workers with the aid of doctor's consultation via telemedicine. Once they get completely cured, they may be released.

Case 2: Patients diagnosed with some other disease by doctor's experience will be kept in isolation at the center. They will be treated with prescribed medicine by the doctor. Their conditions should be consulted regularly via telemedicine. Doctor can change/update the treatment depending on patient's condition. After complete recovery the person will be released after consultation with the doctor.

Advantages of the proposed model:

- The system will formulate distribution of resources according to the need.
- Everyone facing the symptoms need not rush to the hospital which will decrease the chances of rapid spreading.
- Patients with moderate condition can be treated locally which will save huge cost as well as resources.
- Doctors can give advice to these patients via telemedicine while treating the critical patients physically, which will resolve the manpower problem.

(2) Semi-Urban Area Model:

Present Scenario:

Healthcare system in semi-urban area is in an organized condition consisting of one or two moderately structured hospitals and some pharmacies. A few private chambers operated by individual doctors are also available. Most citizens are literate and have moderate level of income to avail the cost of medical facilities. During pandemic or treatment of infectious diseases, situation gets difficult without proper communication hierarchy. People with symptoms are driven by sudden surge of fear and rush to the local hospitals. Hospitals face complications due to their limited infrastructure. Another setback is the prioritization of patients which may cause the sever patient to be deprived from their needs. Additionally, fear drives expenditure as people start spending to gather medicine beyond their need in advance. This causes unequal distribution of resources where one stores beyond necessities while the others get deprived of the basic necessities.

Proposed Model:

- Spreading the correct information among the citizens about the disease is the first step which will reduce fear, panic and lack of knowledge and will also improve the awareness about the symptoms.
- A single point-of-service (POS) facility may be constructed with the equipment to provide telemedicine service.
- Everyone should be advised not to avail any private facilities or hospitals at the first go and should neither self-diagnose to take medicines.

- Patients having symptoms other than that of coronavirus may avail private consultation to avoid chances of being affected.
- Patient having symptoms of COVID-19 should first report to the POS facility, where they will be checked by doctors via video-conferencing and will be questioned to take further decision. Doctor with their expertise will judge the disease and treat accordingly.
- This will lead to two further cases.

Case1: Patient, diagnosed with high chance of COVID-19, would be kept quarantined and sample will be tested. In case of positive result, he/she will be sent to the hospital and treated on emergency basis for severe conditions. Patients having moderate condition would be kept in hospital's quarantine facility for further treatment.

Case2: Patients having similar symptoms but not diagnosed with coronavirus may be kept in isolation in that POS center. They will be treated by healthcare workers in consultation with doctor via telemedicine and be released upon complete cure.

- Person having a facility to avail telemedicine from their residence may do so via appointment through POS and be diagnosed with any of the above mentioned cases.

Advantages of the proposed model:

- Unnecessary expenditure on treatments will reduce while increasing cost-effective distribution of resources.
- Patients may be diagnosed from the comfort of their home which will reduce chances of inducing or spreading the disease.
- Doctors can treat patients simultaneously via offline and online solely on the basis of their need.

(3) Urban Area Model:

Present Scenario:

Healthcare facilities in urban area is quite promising. Enormous number of private and government hospitals in addition to a lot of private chambers are widespread and some of which are highly equipped with cutting-edge healthcare facilities. The urban area comprising mainly of the affluent society enables them access and availability to any or all possible healthcare services. In case of any infectious disease, like COVID-19, all rush to the hospitals for testing irrespective of their level of emergency and results in greater exposure to being contaminated. People also spend uselessly for some high-end facilities which are highly chargeable, and results in economic gap. In addition to this, the critical patients are often ignored and are forced to shift to different hospitals due unavailability of services.

Proposed Model:

- Assuming that a huge percentage of citizens have all the facilities to avail telemedicine from their home, yet they should be made aware about the symptoms of COVID-19.
- Most of the hospitals already have telemedicine facilities, otherwise they may construct a User Interface (UI).
- People having non-coronavirus symptoms should visit doctors privately, while those having similar symptoms should connect themselves to desired hospitals through common UI.

Case1: If the doctor diagnoses a high chance of COVID-19 then a healthcare worker will be sent to collect the sample. If the result is positive with serious condition then he/she should be admitted to the hospital and treated. If the condition is moderate even being positive, then he/she may be home-quarantined and treated via telemedicine. Medications can be delivered to the patient by local pharmacies.

Case2: If doctors conclude that the patient's symptoms are due to other disease then he/she may also be treated via telemedicine from home. A time to time update must be sent to the doctor about that patient's recovery.

For some people who cannot avail the facility of telemedicine from home, may visit a local facility with minimum requirements that will be constructed temporarily to avail telemedicine consultation.

Accordingly the stated cases may occur and appropriate measures may be taken.

Advantages of the proposed model:

- The proper utilization of telemedicine will ensure the right distribution of resources while decreasing the initial rush.
- As the numbers of doctors are limited, it will ensure that the critical patients will get the proper treatment.
- Use of telemedicine will decrease the requirements of doctors to be present physically, hence some will be transferred to the semi-urban or rural area to attend the patient in need, maintaining even distribution of manpower.
- Above all, the expenditure of both the patients and the hospitals will decrease, making it cost-effective.

Conclusion

Technology is indeed a great friend for human when used effectively. It can be a better alternative in addition to the existing healthcare facilities for a wider horizon of people having different socio-economic standards. It is a moving step forward in both medicine and technology. The proposed model is now mainly targeted for combating COVID-19 but can also further be extended to treat any sort of infectious diseases. The present healthcare system has always been in support for the affluent society, but implementation of these models via telemedicine will not deprive the metropolitan area, but at the same time will be dedicated to all other areas as well with the same manpower. Though the initial cost involved

in its implementation will be a little higher but interpolating it in terms of future prospective, the amount stands very insignificant compared to existing system. Once the new system is established, the associated cost and time will never have to be compromised. In India there are still many places which are lacking proper internet connectivity. Government and Telecommunication Industries should take a joint initiative to fill those gaps and construct an efficient structure of telemedicine for the overall benefit of the nation.

Declarations

There is no conflict of interests.

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Figures

Figure 1

Proposed Model of Telemedicine Service in rural area

Figure 3

Proposed Model of Telemedicine Service in urban area