Healthcare System Strengthening During COVID-19 Pandemic through Artificial Intelligence Enabled Virtual Out-Patient Clinics

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Abstract

Healthcare professionals play a vital role in a community's response to a pandemic. The timely and efficient provision of healthcare services to the affected population is the most crucial step in the management of any pandemic. In the wake of the COVID-19 pandemic there is tremendous pressure on the healthcare system and routine OPDs are closed. Under such circumstances artificial intelligence enabled virtual outpatient clinics could prove to be a boon. This study adopts a case based approach and examines the available international and Indian evidence on the working and acceptability of virtual outpatient clinics with a view to assess their suitability to deal with the COVID-19 pandemic in India. An examination of the preliminary data available on virtual outpatient clinics and the demographics of the people who have availed their services reveal the acceptance of virtual outpatient clinics both from the perspective of the provider and patient. Thus, virtual outpatient clinics could be of vital help to India in dealing with the COVID-19 pandemic situation.

Keywords: *Virtual OPD, e-Clinic, Health care professional, Pandemic, COVID-19, Artificial intelligence*

Introduction

During any pandemic, the functioning of a society or community is seriously disrupted over a relatively short period of time [1]. This disruption involves extensive human, economic, material and/or environmental loss. The impact of a pandemic usually exceeds the ability of the affected community or society to cope with the help of its own resources [2]. Although multiple sectors play an important role in pandemic management, health professionals play a vital role in pandemic preparedness and response [3]. Timely and efficient provision of health-care services to the pandemic-affected population is one of the highest priorities in overall pandemic management [2].

Whenever any pandemic accelerates, e.g., the corona virus disease 2019 (COVID-19), it is commonly observed that health care systems face tremendous workload in terms of infectious patients seeking testing and care. During such public health emergencies, besides logistics, a shortage of trained personnel takes place. During this COVID-19 pandemic, government of India is doing its level best to minimize the impact of COVID-19. Multiple stringent measures, such as nation wide lockdown, social distancing, closing of out-patient services in hospitals, postponement of elective surgeries, creating dedicated COVID-19 treatment hospitals etc. have already been taken to face the problem at hand. It may be noted that one-third of the existing health staff is working overtime on rotation basis and many more have electively opted to help treat and prevent the spread of COVID-19. These healthcare professionals are working day and night to minimize the impact of COVID-19 [4].

As most of the routine OPDs are closed, it is very difficult for the patients to consult their doctors [5]. In this scenario, artificial intelligence enabled virtual OPDs (VOPDs) can be a boon to the Indian population. Within this context, the present article discusses the benefits and present situation with respect to VOPDs in India and abroad. Based on the available preliminary evidence on VOPDs in the international and Indian context, this article assesses the suitability of VOPDs for dealing with the current pandemic in India.

The rest of the article is structured as follows. The next section of this article underscores the study methodology. Subsequent sections highlight the conceptual framework, advantages of VOPDs and the available international and Indian data on VOPDs to make a case for their use to strengthen the Indian healthcare system during the COVID-19 pandemic. The article ends with a discussion on the ethical issues related to VOPDs.

Method

This article makes use of the available evidence on VOPDs to assess their suitability to deal with the current pandemic in India. Preliminary data available on VOPDs was examined in the case of three countries: England, Sweden and India with key focus on the demographics of the people who have availed the services of VOPDs in these countries. Based on the examination of this data, it was assessed whether VOPDs should be used to strengthen the Indian healthcare during the COVID-19 pandemic.

This article has adopted a case based approach to justify the objective of this article. The use of this approach is recommended in under researched areas, [6,7] such as the present topic of VOPDs.

Conceptual Framework: Artificial Intelligence (AI): A Strategic Tool to Save Lives Amidst the COVID19 Pandemic

A pneumonia of unknown cause was reported to the WHO office in China on the 31st of December 2019. On 11th of February 2020, the WHO named the disease COVID 19 (coronavirus disease of 2019). COVID 19 has currently claimed 194470 lives, directly impacted 2786743 people and indirectly impacted the lives of people living in 213 countries. In India, the disease has claimed 722 lives and has affected 23502 people directly as we write this article. Globally and nationally the disease has negatively impacted both lives and livelihoods.

Substantial and diverse efforts are being made to combat the negative impacts of COVD 19 not just on the lives and livelihoods of people, but also on other key aspects of international and national development. But what drives these efforts across countries and institutions is none other than a mighty strategic tool called Artificial Intelligence (AI).

According to the encyclopedia Britannica, "AI is the capability of a computer program to perform tasks or reasoning processes that we usually associate with intelligence in a human being." Epidemiologically, AI is the backbone of the simulations and sophisticated mathematical modeling that has the potential to inform policies on the lockdown globally. Political discussions and debates to combat the pandemic have moved to virtual forums. Be it politicians, policy makers, experts, providers of health care or patients themselves, it is AI that is today connecting everyone across scientific, political and social disciplines. AI is being extensively used to integrate work and take all kinds of decisions.

However, the million-dollar question to reflect upon is whether the users of AI are aware of its immense potentials. For example, Deloitte's recent Global Mobile Consumer Survey on the awareness of AI among smartphone users showed that only 9-12% used voice search and voice assistants in their smartphones. The survey further found that about 65% of smartphone users utilize at least one application in their smartphone that works through AI. The situation is very similar when it comes to optimizing the use of AI in health and social care, especially in situations such as the current pandemic. While AI has been extensively used to combat the current pandemic, the benefits of AI have not been realized optimally. There are two key reasons for this. The first one is the lack of awareness and the second one is lack of acceptance. Many people lack the awareness and skills required to harness the benefits of AI. Yet others find it difficult to accept that machines can replace human minds and in some cases even make them redundant.

AI has vast potential that is not just restricted to data and information systems. The current situation reveals the different ways in which AI could be used across sectors. Today, without AI, professionals cannot work from home, education and knowledge cannot reach students enrolled in

academic institutions, even assessment, testing, treatment and continuum of care is not possible for sick people. Therefore, the need of the hour is not just to change the behavior of the general public for reducing the transmission rate of COVID 19, but also the behavior of the politicians and policy makers to invest in AI for transforming the existing health and social care system of India. Optimizing the use of AI in the heath care sector is of utmost importance.

AI is uniquely placed to radically transform the way health care services are delivered. It has two key benefits: improved accessibility and cost-effective delivery of service. AI could be the answer to the problem of shortage of health care workforce during the current pandemic. Under the current circumstances, the health care needs of the country are increasing and complex to say the least. AI has the capability to help comprehend these needs and the dynamic interplay of factors that influence the spread and treatment of COVID 19. In addition, the attempts to control and treat COVID 19 patients across the world are generating an ever-increasing amount of data. Here too, AI can help make sense of this data and improve the pace of biomedical innovations, hasten the process of diagnosis and enhance access to treatment.

AI must be understood in its complete scientific sense and used strategically to save lives. For this, the contribution of the heath care sector/professionals must be purposefully sought. It must be clearly defined how AI can be scaled up in heath and social care systems. It is important to take stock of individual components of the healthcare system of the country and define aspirations for these components that fit with larger strategic goal of the system.

Advantages of Artificial Intelligence Enabled Virtual OPDs

The existing problems related to lack of access to OPD care for a major proportion of population could be solved to some extent by virtual OPD care services. In virtual OPD care services patients consult with a healthcare professional with the help of phone, text, video or email. Virtual OPDs are believed to offer several benefits over the conventional physical OPDs, especially where accessibility and cost is concerned [8]. Furthermore, if effectively integrated into the current healthcare systems and virtual payment modes, virtual OPD services could bring about a sustainable revolution in healthcare management [8]. Because of their numerous above-discussed benefits, use of VOPDs is recommended to manage the healthcare related problems caused by the existing pandemic, per se COVID-19.

Despite the numerous documented benefits of VOPDs, data on service quality delivered and impact on clinical outcomes is limited in the Indian as well as international context. Given this consideration, the next section of this article captures and critically examines the international and Indian data related to VOPDs.

Findings

VOPDs – A Critical Examination of Available Evidence

This section provides an insight into the available research and data on VOPDs/virtual clinics. This section is divided into two sub sections. The first sub section briefly outlines the international research in the context of VOPDs/virtual clinics. The second sub section provides a snapshot of the same data and information in the Indian context. With a view to assess the acceptance of VOPDs/virtual clinics in the international as well as the Indian context, the key demographics of the patients who avail the services of VOPDs/virtual clinics are provided in both the sub sections.

VOPDs/Virtual Clinics – International Evidence

In the international context, a study on virtual primary care conducted in England revealed that 53 per cent and 89 per cent of the patients who availed virtual health care services were male and between the ages of 18 and 39 years respectively. Only one per cent of those who availed the services were over 65 years [8]. In another study conducted in Sweden, it was found that metropolitan residents and children were the main users of virtual clinics. The study further found that patients over the age of

65, patients with chronic ailments and rural residents were among the minorities who availed consultation services provided by virtual clinics [9]. All the patients who availed the services of virtual clinics had a rural background. The highest education level of the patients was middle school (10 per cent) followed by primary school (21 per cent) and 69 per cent of the patients were illiterate. The study further found that osteoarthritis, lower backaches, allergic problems (bronchial asthma) and skin problems were the major problems affecting the patients in the study region, and more than two-third of the patients chewed tobacco. As such, poor dental hygiene was also commonly seen among the patients. The e-clinics examined under the study referred about six patients with truisms or poorly healing mouth ulcers to higher centers for oral cancer screenings. Patients suspected to have tuberculosis were sent to nearby dispensaries for diagnosis and treatment [9].

The evidence available in the international context suggests that patients, especially the ones living in rural areas avail the services of VOPDs/virtual clinics even in the case of serious life threatening diseases/disorders. Further, patients of all age groups and both genders avail the services of VOPDs/virtual clinics. These facts establish the acceptability of VOPDs/virtual clinics in the international context.

VOPDs/Virtual Clinics – Indian Evidence

In India the AI enabled Virtual OPD (VOPD)/e-mitra clinic is a social business model innovated by Jiyyo Innovations, a Chandigarh based start-up. Jiyyo e-mitra clinic aims to reach rural and interior parts of India and provide primary as well as specialist healthcare services by connecting local practitioners, health workers and patients with qualified allopathic and specialist doctors in cities through video calls. Jiyyo has changed the scenario of telemedicine and made it available to areas with poor infrastructure. In this case there is no need of costly equipment. A simple smartphone is the primary requirement. Additional devices such as screen and printer can be added so that patients can see the doctors, communicate with them regarding their health problems and get authentic and printed prescriptions similar to the ones provide during face-to-face interactions [10].

Initial findings of this e-clinic (based on last six months' data) reveal that general physicians provided consultations to most of the patients. However, in some cases specialized and super specialized consultations including pediatrics, orthopedics, dermatology, urology, nephrology, cardiology, neurosurgery etc. were also provided. This e-clinic also provided neurosurgery consultations to two paraplegic patients. Further, the authors analyzed the data of five centers. The total number of consultations provided by these centers was 800. Out of the 800 patients who availed the services, 157 patients belonged to the age group of 60 years and above [10]. Each of these 157 patients willingly participated and completed the entire consultation session. This illustrates the acceptability of the e-mitra clinic system/VOPD. Also, the printed prescriptions revealed particulars of diagnosis, offered treatment and details of advanced or complex cases referred for further diagnosis [10]. These details highlighted the efficacy and feasibility of the VOPD model in the context of rural India.

The preliminary evidence available on e-mitra indicates the acceptability and feasibility of virtual OPDs in rural India. Virtual OPDs may improve access to qualified healthcare providers for a massive population. The patients requiring advanced tests for diagnosis or referral to higher centers may also be routed through virtual OPDs. Further virtual OPDs may also be helpful in popularizing preventive and therapeutic measures regarding chronic health related bad habits such as use of tobacco, use of steroids, alcoholism etc. These problems are pervasive among the rural population of the country. Virtual OPDs could help address them at the grass root level. It is the understanding of the authors that continuous counseling provided through virtual OPDs could inoculate and promote healthy lifestyle habits among the rural masses.

Conclusion

To conclude we can say that the existing evidence shows that e-clinics are increasingly becoming popular. This may help alleviate the burden of primary care centers by offering remotely available virtual services without compromising access to qualified providers. The acceptability of e-

clinics is good, both from the perspective of the provider as well as the recipient of the service. This implies the potential sustainability and future possibility of expansion of such services over a wider geographical area. The patient turnover of e-clinics is growing and the increasing re-visits suggest that most of the patients are satisfied with the services provided. Thus, e-clinics can contribute to addressing inequity issues in the provision and access of healthcare services in India. We expect this e-clinic concept to be of vital help in a pandemic situation like COVID-19.

Ethical Considerations

Despite promising prospects for improving primary care in rural areas, it is essential to evaluate the ethical issues related to VOPD systems. For any medical service delivered through digital platforms, informed choice of patients and technology literacy plays a vital role. In a country like India, the quality of care should be placed at the heart of digital revolution [11] in primary care, so that the health rights of individuals and population at large are safeguarded. VOPDs should be further developed upholding ethical and clinical values. This can go a long way in dealing with crises such as pandemics as well as normal situations in a humanitarian way.

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