International Journal of Health Research and Innovation, Vol. xx, No. xx, 2021,
ISSN: 2051-5057 (print version), 2051-5065 (online)
Scientific Press International Limited

ACCELERATED INNOVATION IN THE ERA OF COVID-19

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Abstract

Healthcare innovations including vaccine development, expansion of testing capacity, production of healthcare supplies, growth of telehealth around the world have all been accelerated due to the coronavirus disease (COVID) - 19 pandemic. Telemedicine and virtual healthcare have become some of the front runners of this exponential transformation in 2020.
This article will explore the healthcare and commercial elements of telemedicine in the United States during the COVID-19 pandemic, evaluate the unmet clinical need and highlight the enablers and limitations of this innovation with reference to various theories of innovation including the diffusion of innovation theory, Schumpeter's theory of innovation and Rogers' theory of innovation.

Keywords: Innovation, COVID-19

1. Background

The coronavirus disease pandemic has rapidly changed the pattern of healthcare delivery around the world. Healthcare innovation was accelerated in an unprecedented fashion, changing of the pace of innovation and fast-tracking the transitions between the stages of invention, commercialization, adoption and diffusion as described by Schumpeter's theory of innovation [1].

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Article Info: *Received:* February 5, 2021. *Revised:* March 2, 2021.
Published online: ….. .., 2021.

In the United States, telemedicine was first utilized by National Aeronautics and Space Association (NASA) during Project Mercury in 1960, to remotely monitor the astronauts by their physicians. NASA demonstrated that this innovation of utilizing telecommunications to invent a new interface between doctors and patients was possible [2]. Since then telemedicine has had a gradual but steady increase around the US. A national survey of physicians in 2016 showed the utilization of telemedicine was about 15.4% [3]. A recent study in New York highlighted the rapid adoption of telemedicine during the COVID-19 pandemic with a decline in office visits by 80% and an increase in telemedicine visits by 683% [4]. This mass migration was facilitated by changes in reimbursement policies and economic impact driven by the global pandemic. This is supported by the profit and growth-oriented approach of the Schumpeterian trilogy of invention, innovation and diffusion [5].

2. Unmet Clinical Need

In March 2020, COVID-19 was declared a global pandemic by the World Health Organization (WHO) [6]. With no vaccines available at the time, the only known mitigation strategies were social distancing, quarantining and face masking. This meant that patients and providers began delaying care and cancelling non-emergent care. The United States reported a 42% decline in emergency

room visits [7]. The largest US health care system, Mayo Clinic, reported a 78% decrease in in- person visits from mid-March to mid-April [8]. In addition to the public health issue created by the COVID-19 pandemic, the ripple effects of the lack of access for other health conditions as well as the significant economic impact to one of the largest industries in the nation was projected and felt very quickly. This created the perfect storm to accelerate telemedicine, a safe alternative to in-person healthcare, by breaking down the existing barriers at an unprecedented speed. By mid- April, Mayo Clinic had reported a 10,880% increase in video appointments. Before the pandemic, only 300 of their providers had utilized telemedicine to provide care, by July 2020, this number had risen to 6500[8].

3. Description of the Innovation

According to Bessant et al, “innovation represents the core renewal process in any organization and unless it changes what it offers the world (product/service innovation) and the ways in which it creates and delivers those offerings (process innovation) it risks its survival and growth

prospects" [9]. The US healthcare system was forced to be innovative by the COVID-19 crisis given the real economic and public health threats the pandemic generated.

Telemedicine refers to use of electronic, audio and video technology to provide remote services for patients [10]. The modes of delivery as well as breath of services provided through telemedicine are vast. Services can be provided live, through interactive video-conferencing, over the phone, asynchronously using recorded information or through a one-way patient monitoring service amongst others. Services provided include urgent care, emergency triage, office visits, remote diagnosis and treatment of certain conditions, home monitoring as well as collaborative care amongst providers. Other non-physician services include rehabilitation, physiotherapy, behavioral therapy and psychotherapy as well as services by social workers, pharmacists, nurses and other allied professionals.

Telemedicine has disrupted the traditional methods of providing care and transformed the physician-patient relationship by providing innovative ways of extending the relationship well beyond the in-person visit [11]. In this context of telemedicine as an innovation, it is important to recognize that neither the technology nor the health care service was new, rather it was a new way of applying existing tools for better delivery of service. This was emphasized by Barlow's definition of innovation as application of an existing idea in a new context [12]. Here, the modification of the business model or process for delivering the healthcare service and increasing access is considered a disruptive innovation.

4. Enablers

4.1. Improving Access

Adoption of telemedicine made care accessible to patients who have difficulty accessing care due to distance or disability by eliminating the need for transportation. This was a significant enabler during a pandemic for high-risk populations, such as seniors and those with chronic medical conditions. It also meant that patients were able to receive care while still maintaining social distance [13].

Beyond the pandemic, telemedicine also improves access to care for patients in remote locations or those with socioeconomic constraints that may preclude them from in-person visits [14].

4.2 Cost

The United States has the highest level of healthcare costs in the world with an expenditure of $3.6 trillion in 2018 that amounts to approximately 18% of gross domestic product (GDP) [15], [16]. These costs do not translate to better access to quality of care when compared to other Organization for Economic Co-operation and Development (OECD) countries [17].

Prior studies have shown that use of telemedicine saves costs both for the patient and the healthcare system [18–20]. A prospective study compared the cost of telemedicine office-visits to in-patient visits and estimated a cost savings ranging from $19–$121 per visit [21].

4.3 Minimize infection risk

While telemedicine cannot completely replace traditional in-person hospital visits due to the need for clinical examination and administrating of medications or services, there are many scenarios where physical contact is not essential and therefore can help mitigate risks of infection during a pandemic [22].

Beyond the COVID-19 pandemic, it can also help during other epidemics or pandemics by minimizing unnecessary hospital visits and exposures.

4.4 Convenience

In the 1930s, 40% of physician-patient contact occurred from the home. Over time, many factors led to the decline of this practice including relatively low reimbursements, decline in general medical practitioners and emergence of specialty practice at larger academic centers [23]. Telemedicine will serve as a second-generation house-call, allowing patients access to their physicians from the comfort of their home, albeit virtually [24].

Additionally, telemedicine is time-saving for both the patients and caregivers. A study examined the time spent during in-office visits and showed that for a 30-minute visit, the patient and caregivers spent up to 4 hours in travel and wait time. There was no significant difference in the duration of time spent with the physician for telemedicine and in-person visits (35 minutes v. 48 minutes; $p=0.71$). However, the amount of visit time spent without the physician was significantly lower for telemedicine visits versus in-person visits (18 minutes v. 207 minutes; $p < 0.001$) [25]. Telemedicine can also increase convenience and flexibility for the provider, allowing physicians to work from home [26].

5. Limitations

5.1 Reimbursements

One of the major barriers in adoption of telemedicine in the US was the restrictions in reimbursement by The Centers for Medicare & Medicaid Services (CMS) and other private insurers. There were no clear guidelines across states for reimbursements and polices were inconsistent [27]. This was a barrier for healthcare systems to expand their telemedicine services. In 1999, a survey of telemedicine providers reported that 43% of responding telemedicine networks saw reimbursement as a barrier to long-term sustainability [28]. At the start of the pandemic, CMS issued a waiver allowing Medicare to pay for office, hospital, and other visits delivered via telemedicine covering a range of providers including doctors, nurse practitioners, clinical psychologists, and licensed clinical social workers.

Prior to this waiver, there was a restriction for Medicare reimbursements limited to when the patient was in a designated rural area and when they left their home and go to a clinic, hospital, or certain other types of medical facilities for the service [29].
Following these policy changes, there was a rapid increase in telemedicine utilization from a reported 13,000 Medicare beneficiaries in 2019 nearly 1.7 million beneficiaries by mid-April 2020 [30]. Although private insurers largely followed suit with the CMS changes, some have scaled back reimbursements due to significantly increased utilization and in turn, costs for insurers. Post- pandemic, reimbursements will likely remain, however may be at lower rate compared to inpatient visits since they can be delivered at a lower cost [31].

5.2 Licensing

Another major barrier to telemedicine is the state-based licensure system in the US, where physicians are limited to providing care only in the states they are licensed [32]. States that had policies that required out-of-state providers to have special licenses when delivering telemedicine services to patients within the state made providers less likely to offer the service [33]. At the start of the pandemic, licensure restrictions were relaxed to allow providers to engage in telemedicine. Emergency licensure agreements also allowed providers to obtain licenses faster removing another obstacle to telemedicine [34].

5.3 Access to technology

The change in policies regarding reimbursements and licensure lead to a reciprocal rise in health care systems rapidly transitioning to telemedicine. However, there were other barriers on the patient-front including technology literacy and lack of access to Wi-FI or smart phones/computers due to socioeconomic barriers [35]. This further widened the existing digital divide and increased disparities in care already brought to the forefront by pandemic. In an analysis of Medicare beneficiaries, 50.1% of those with income of 100% below the federal poverty level lacked digital access compared with 11.5% of those with income 400% above the federal poverty level ($P < .001$). This study also showed that the proportion of Medicare beneficiaries with access to technology was lower among those who were 85 or older, were widowed, had a high school education or less, were Black or Hispanic, received Medicaid, or had a disability [36]. Another study also explored factors that led to decreased utilization of telemedicine. The investigators reviewed 3,000 adult cardiology patients who were scheduled for a telemedicine visit between mid-March and mid-April 2020 to identify factors associated with a noncompleted visit. They found that one of the factors that was most strongly associated with lower telemedicine use was non- English language speakers, others included female sex and lower household income [37].

5.4 Liability

A major limitation of telemedicine is the uncertainty of medical malpractice liability especially in a highly litigious society. Because of ambiguities with regard to the legal status of telemedicine within and between states, some experts suggest that an extended insurance coverage should be implemented in all states to protect the careers of health care providers [14]. Telemedicine raises issues not only regarding a physician liability but also a potential of liability for other service providers such as pharmacists and nurses who accept prescriptions from an out-of-state physician [38].

5.5 Privacy and security

One of the leading causes for concern with telemedicine is the risk for data breach and provider's ability to ensure that federal privacy and security rules are met. During the pandemic, the United States Department of Health and Human Services (HHS) temporarily relaxed regulations under the Health Insurance Portability and Accountability Act (HIPPA) allowing physicians to communicate with patients on various video-conferencing platforms, including *Zoom, Apple FaceTime, Facebook Messenger video chat, Google Hangouts video, and Skype* [39]. This nationwide regulation created a unified framework for data exchange that was effective during the pandemic

but will need to be reviewed to ensure patient safety especially in an era of cyber- insecurity.

6. Implementation Strategy

In considering an implementation strategy it is important to weigh the barriers to this innovation against the benefits it brings. The COVID-19 pandemic brought world economies to a scratching halt due to wide spread lockdowns that were instituted to mitigate the spread of virus. In addition, healthcare systems were stretched to an elastic limit with overflowing emergency departments and inadequate intensive care units. It was evident that immediate and decisive action was needed to rescue the both the economy and the health system from collapse. A disruptive Innovation as defined by Barlow was needed to challenge the current model of health care delivery to counter the effects of the pandemic [12].

Using Rogers' diffusion of innovation theory, the elements of the innovation can be examined to identify strategies for rapid implementation of telemedicine. Rogers identified five characteristics of an innovation that account for the rate of adoption. These are relative advantage, compatibility, complexity, trialability and observability of the innovation [40].

With regards to adoption of telemedicine during the pandemic, there was a clear relative advantage to early adopters when compared to the status quo and the risk of infection that came with traditional in-person visits. This was a convincing advantage and expedited the adoption of telemedicine.

Telemedicine was relatively compatible with the new reality of lockdown, allowing patients access to their physicians from the comfort of their homes. For a large proportion of the population that were technologically literate, telemedicine was not complex. However as described above, for a part of the population, especially the elderly and those with poor tech literacy, the complexity of learning a new skill became a barrier to adoption of telemedicine. Trialability and observability were fairly acceptable with regards to adoption of telemedicine [8].

7. Economics

In the United States, the cost of healthcare is remarkably high when compared to other developed nations [16]. A key factor for adoption of any healthcare innovation in the US is the economic implication measured against the health outcomes.

According to Schumpeter's theory of disruptive innovation, in order to achieve a new level of efficiency, outdated processes had to be destroyed and replaced by innovative models [1]. Schumpeter argued that "innovation is more realistically analyzed as an ordinary business activity than as the extraordinary efforts of new firms or new men; that invention and innovation are subject to costs and result in revenues like any other business activity; and that both are carried out in competitive struggle by firms which are at once producers and innovators". Schumpeterian theory of economic development and innovation validates the accelerated adoption of telemedicine in the US once barriers to reimbursements and liability were taken down.

8. Policy

Research has shown that existing government policies and regulations can encourage or deter innovation [41]. In the case of telemedicine, despite initial emergence in the 1930s, adoption was stagnant due to stringent policies and regulations that hinder reimbursements. A rapid change in governmental policies during a pandemic created an accelerated rate of adoption [29], [30]. Ashford argued that government policies can significant impact three main contributors of innovation: the willingness to change, the capacity to change, and the opportunity to change. The change in policies as well as effects of the COVID-19 pandemic created an opportunity as well as willingness to change in a system with already a capacity to change [42].

9. Conclusion

Adoption of telemedicine in the United States has had a profound effect on the healthcare system as well as the nation's economy as the country was pushed to extremis from the overwhelming and rippling effects of the pandemic. Various theories of innovation including the diffusion of innovation theory, Schumpeter's theory of innovation and Rogers' theory of innovation highlighted the healthcare and commercial properties of telemedicine that lead to its rapid adoption. These

theories can be studied further to inform policies that can ensure sustainability of telemedicine beyond the COVID-19 pandemic.

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