

IMPACT OF TECHNOLOGICAL INNOVATIONS ON HEALTHCARE SERVICE DELIVERY IN US: MEDICARE AND MEDICAID AS FACILITATORS

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Abstract

The feats brought to place by information and communication technology (ICT) in various facets of the 21st century society are evident in the healthcare sector too. This study examines the impact of technological innovations (TIs) on the healthcare systems of the US, focusing on the role played by Medicare and Medicaid in fostering healthcare service delivery in the US. Drawing evidence from extant studies, the paper demonstrates that TIs have been significantly impacting healthcare service delivery in the US. It also shows that Medicare and Medicaid have been playing a crucial role in fostering and sustaining adoption and implementation of TIs in healthcare service delivery in the US. The study concludes that TIs have been revolutionizing healthcare service delivery in the country. Stakeholders in the sector are charged to increase technology adoption and educate the masses on best practices and how to access and utilize available digital healthcare services.

Keywords: Technological innovations, Impact, Healthcare, Medicare, Medicaid

Introduction

The impact of technological innovations (TIs) on healthcare systems as well as healthcare service delivery across the globe and in the US in particular cannot be overemphasized (Islam, 2021; Litwin, 2020). There are different kinds of innovation, depending on context and scope focus. These include technological, social, service, business, process, open, disruptive or radical, sustaining, incremental, and product innovations. Dwelling on open innovation, Hossain et al. (2016) emphasize the need for researchers to deploy newer and better approaches to measuring open innovation, appropriateness in enabling open innovation, and the integration of open innovation into existing theories of management and economics.

Also, Hossain's et al. (2016) opinion implies that there is need for more research on this theme. The present study is an attempt in that direction. It follows that innovations have to be improved through research, measurement and evaluation, newer and better approaches, and significant integration of theories, practices and systems. Nations, organizations, groups and individuals alike benefit hugely from these innovations, either directly or indirectly. Podemska-Mikluch (2018) explains the impact of Medicare on the innovations in the healthcare systems of the US, thereby educating the public on the role of Medicare in fostering technological innovations in US' healthcare systems.

The present study combines Medicare and Medicaid in its engagement with the impact of TIs on health service delivery in the US. Its focus is on TIs as healthcare innovation. The study aims at assessing the impact of technological innovation on healthcare service delivery in the US, focusing on Medicare and Medicaid. It seeks to show the extent to which Medicare and Medicaid have contributed to introducing and fostering healthcare innovation in the US.

Healthcare Innovation as an Offshoot of Technological Innovation

Healthcare innovation refers to the introduction of new models, ideas and/or systems into healthcare systems in order to revolutionize, digitalize, and improve them for efficiency,

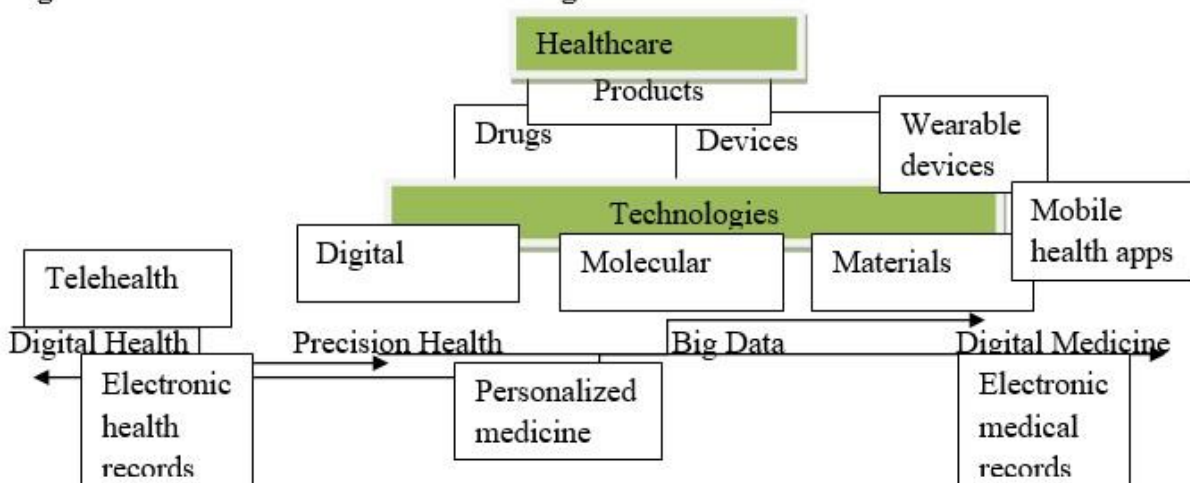
quality, safe and optimal diagnostic results, and affordability and accessibility of healthcare services (Einspruch & Omachonu, 2010). Advanced technologies, such as AI and smart technologies, are offshoots of Information and Communication Technology (ICT). Although their impacts are in the strict sense those of ICT, there are some that are peculiar to them, which are more monumental.

As Okafor (2010) and Robert (2017) have noted, ICT has had consistent impacts on different facets of life and the society. Adebisi (2009) has described ICT as the application of technical, advanced, computerized and scientific technologies to various processes of producing, transmitting, consuming, storing and providing information. Ravi (2012) has noted that technologies, particularly those of the new media, include internet, portals, mobile phones, multi-media, portals, gaming, multi-media and animations, among others, which have been impacting millions of users in over 200 countries.

The impact obtains in areas such as communication, creativity, cognition, education, culture, education, management, public administration, polity and governance, and various other formal endeavors. For Anjugu (2013), technology includes blogs, picture sharing, music sharing, crowd sourcing, e-mail, instant messaging, and voice record. As Ad-Car et al. (2011) have agreed, the aforementioned technologies greatly impact healthcare delivery, guaranteeing professionalism, quality, patient safety, efficiency, optimization, informed decisions, patient satisfaction, and effective disease control and prevention.

As it is commonly said, “Health is wealth.” Bearing this reality in mind, many governments across the globe alongside their agencies in the health sector consistently make appreciable efforts to optimize, digitalize, advance, improve and transform their health systems (NHS, 2018; Romanelli, 2016). Healthcare systems are of great national and international values. They are critical to every society. Thus, every nation makes concerted efforts to better its healthcare systems. To that end, a good number of nations pursue and realize technological innovations in their healthcare systems. Examples of TIs in healthcare systems include big data, precision medicine, artificial pancreas, smart inhaler, medicines for rheumatoid arthritis, and cancer medicines. The diagram below represents ITs in the health sector:

Fig. 1: Healthcare Services and Technologies



Source: Author, 2022

Healthcare innovation is of top priority to nations like the United States of America (USA), the United Kingdom (UK), Canada, Australia, France, Germany, and many other developed countries. This statement does not imply that it is not of top priority to developing nations. Rather, the point is that while most developed nations give top priority to their healthcare systems, most of the developing nations give little or no priority to their healthcare systems. Governments' efforts, priorities, leadership qualities and competences, etc. differ generally. Most of the governments of developing nations do not have their people at heart. They do not have the willingness to take the health of the masses seriously. They are rather concerned with amassing wealth and struggling to remain in power till death.

The foregoing is upheld by Larnyo et al. (2018), who indicate that governments of all nations of the globe face the challenges of attaining and sustaining improvement, performance, efficiency, quality, and digitalization in the public sector. The struggle is high in the US, where the government is committed to improving public health and increasing access to healthcare resources. These factors constitute the goals pursued consistently and realized significantly by Medicare and Medicaid, two giant health bodies in the US. In the health sector, technological innovation involves the use of modern scientific and digitalized information and communication technology to render medical healthcare services in improved, seamless, online and hybrid ways.

Impact of Advanced Technologies on Healthcare Systems

The core objectives of TIs in the health sector are to improve services, ensure efficiency, quality and productivity, establish practices, migrate from traditional to modern systems and ways of operation, and sustainably digitalize all activities, practices and services in the sector. A study indicates that TIs have reduced medical errors, revolutionized communication, increased research and development, fostered high quality and standards, and made diagnoses and treatment seamless and easy, faster and efficient (Braimer, 2018). Similarly, Lucero (2017) proves from reviewed extant literatures that TIs have the huge potential of improving healthcare services, promoting quality healthcare delivery, and creating more efficient healthcare delivery systems. With them in place, healthcare service delivery has become more effective, accessible, productive, cost-effective, seamless and easy, optimized, and qualitative. Studies, such as Bhatia (2021) and AlQudah et al. (2021), affirm the highlighted impacts of TIs on the health sector of every nation, wherever they obtain. In addition, with optimization, the following feats obtain: healthcare systems become digitalized, AI-driven systems and diagnoses, supporting independent healthy living, hastening the adoption of advanced technologies, and aligning oversight with accelerating digital transformation. As Sheikh et al. (2021) demonstrate, with the current recorded impact of TIs on healthcare systems and service delivery in the US, there is a bright, promising and more prosperous future ahead. There are other related studies on the impact of TI on the healthcare systems of different nations. Several of them will be presented thematically in what follows hereafter.

Ross et al. (2016) show that advanced technologies have brought to place an appreciate volume of TIs in various healthcare systems of society, specifically mentioning 3D printing, wearable technology, IoT, pharmacogenomics and genome sequencing. Their findings reflect the claims of the present study, thereby justifying the viewpoint that technology has been revolutionizing health systems with different kinds of innovations. Similarly, Pepito and Locsin (2019) indicate that TIs have transformed healthcare services, influenced healthcare practices, and changed the attitude of professionals, policymakers and medical practitioners. Thus, it is quite factual that

advanced technologies are greatly impacting the healthcare systems of the US and other nations of the world.

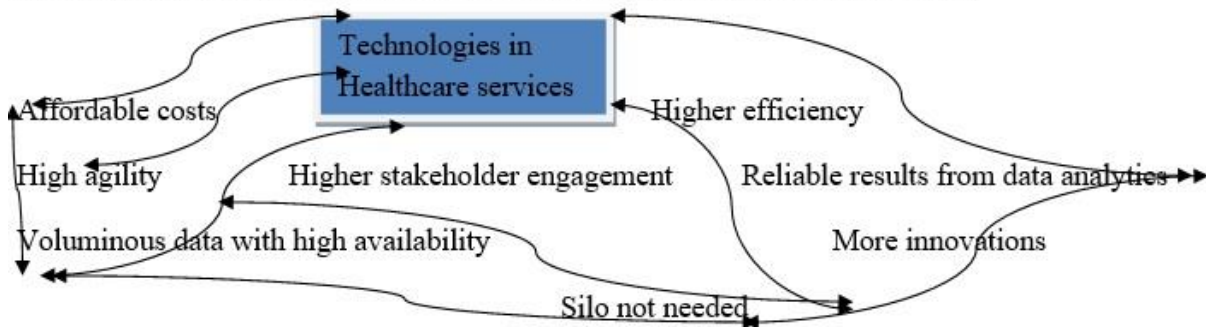
Rantala et al. (2018) revealed that technological innovations have transformed businesses that have significantly integrated advanced technologies into their activities. Although their study does not focus on TI in healthcare systems, it upholds the findings in the area of TI in healthcare systems. Besides, there is no doubt that the technological innovations in businesses are beneficial to the healthcare systems of nations. Businesses include companies producing and trading in various kinds of medical and social care facilities and products. These include drugs, medical gadgets, laboratory equipment, and critical infrastructure in the health sector. Once these are influenced by the innovations in businesses, it is quite true that technological innovations have been influencing healthcare systems in various regards, both directly and indirectly.

Heart and Kalderon (2017) observe that the increasing cost of healthcare services and resources makes it imperative to develop technological measures for addressing the challenges and reduce the spread of chronic diseases. Their observation implies that TIs in the healthcare sector help address the challenges confronting the sector. With technological innovations in the sector, chronic diseases get reduced appreciably. Also, the cost of healthcare resources and services get reduced with the presence of TIs in the sector. These, among others, are impacts of TIs on the healthcare systems of the US as well as other nations of the world. In their case study on the NHS UK, Windrum et al. (2016) prove that the integration of technologies into the NHS has led to the attainment of technological innovations, reformations, improved and quality healthcare services, and seamless access to healthcare services and resources. Despite being a study on TI in the healthcare system of a country other than the US, its findings serve as a backbone to the present one. They justify the claim of the present study that Medicare and Medicaid of the US have been contributing to TI in the health systems of the US.

Larnyo et al. (2018) are of the view that it is only when an innovation is rooted in sustainability that it can stand the test of time. Sustainability considerations include social, environmental and financial factors, research and development (R & D), and commercialization. Innovations apply to and are needed in these areas. Clearly, the study supports the Innovation Diffusion Theory. Innovation Diffusion Theory (IDT), propounded by Rogers (1962), explains how, why and the extent to which an innovation is adopted in society. Rogers (1962) has identified five categories of adopters thus: “innovators, early adopters, early majority, late majority, and laggards” (p. 150). Based on these categories, Medicare and Medicaid are innovators.

He added that innovations get diffused through the following stages: awareness, interest, evaluation, and trial and adoption (Roger, 1962). Medicare and Medicaid have undergone these stages in the adoption of TIs. An agent, like the media, the school, Medicare, Medicaid, or what have you, influences the adoption of an innovation– technological innovation. According to AlQudah et al. (2021), the theories of technology acceptance have various valuable practical implications, since they have potentials for the acceptance of technology in the health sector and open opportunities for research and development. Thus, IDT has valuable practical implications for the present study and the adoption of TIs in the healthcare systems of the US and other nations. Healthcare service delivery in the US has got revolutionized by TIs. The value of TIs in the health sector is concisely represented in the diagram below:

Fig. 2: Major Impacts of Technological Innovations in Healthcare Systems



Source: Author, 2022

Medicare and Medicaid in Technology Innovations

The efforts to implement and make available to the citizenry technological innovations in the healthcare systems of the US informed the formation of The Centers for Medicare & Medicaid Services' Innovation Center. The Center was established by section 1115A of the Social Security Act and section 3021 of the Affordable Care Act. Under section 1115A, since 2012, the activities of the Innovation Center are expected to be reported by the Secretary of Health and Human Services to Congress. There is no doubt that the formation of the innovation center was driven by the quest for better medical service delivery, affordability of healthcare resources and services, seamless access to medical care and resources, etc. As at October, 2022, there were 41,500,000 beneficiaries of Medicare and Medicaid, including individuals having private insurance in multi-payer model tests (The Center for Medicare and Medicaid Innovation, 2022).

The source also reported that 314,000 healthcare providers had plans to participate in the payment arrangements and optimized service delivery models and initiatives (The Center for Medicare and Medicaid Innovation, 2022). From the foregoing, it is quite justifiable that Medicare and Medicaid have teams charged with the responsibilities of fostering TIs in the healthcare systems of the US. By uncovering this reality about Medicare and Medicaid, the study has contributed to knowledge about the strategic roles of these medical systems in the US that significantly impact the health of the citizenry. The desire to improve patient care remains the driving force behind the concerted efforts made by Medicare and Medicaid, among other health systems in the US, to optimize and reform the healthcare systems of the US (Shortell & Wu, n.d.). Consequent upon their efforts, the following have been in place:

- (i) Patient-centered medical services targeted at remote access from anywhere,
- (ii) Accountability in service delivery, and
- (iii) Cost reduction, following easy accessibility and payment reduction arrangements.

The results of the integration include improvement, efficiency, easiness, productivity, creativity, optimization, adequacy, patient care satisfaction, high level of ethical professionalism, safety, accessing health services with insignificant challenges, and prevention of chronic diseases. With TIs, the following health technological systems have been introduced into the sector:

- (i) Telemedicine
- (ii) Mobile health Apps
- (iii) Electronic health records
- (iv) Health information exchange
- (v) Remote monitoring

- (vi) Picture archiving and communication
- (vii) E-prescription
- (viii) Artificial intelligence
- (ix) Robotics
- (x) Virtual reality
- (xi) Block chain
- (xii) Wearable devices.

Given the foregoing, this study is novel by virtue of exploring the impact of TI on healthcare service delivery in the US, focusing on the contributions of Medicare and Medicaid. In doing so, it draws evidence from some extant studies. It demonstrates that the technological innovations, introduced by Medicare and Medicaid into the healthcare systems of the US, have been impacting the systems, patient care, professional service delivery, individual health and wellbeing at an appreciable extent. The study proves its claim that Medicare and Medicaid have initiators of TIs on the basis of their commitment to technology integration, optimization, quality, effectiveness, patient satisfaction and wellbeing, among others (The Center for Medicare and Medicaid Innovation, 2022).

Challenges of Technological Innovations Adoption

In spite of the growing interest in technological innovations that impact and revolutionize healthcare systems and other spheres of society, many systems of society are yet to duly key into the developments. This study avers that the integration of AI and other advanced technologies into different sectors of society is still currently insignificant. Thus, it is essential to examine the extent to which healthcare innovation obtains in the US as regards the integration of AI-driven healthcare systems. Studies identify reasons for the low integration of AI technologies to include AI safety and fairness concerns, infringing on human rights, violating ethics, threatening data security, invasion of the privacy of individuals, and technological unemployment putting out human employees (Yigit et al., 2018). Also, since AI requires voluminous data for high results (Cudzik & Radziszewski, 2018), its adoption is constrained by this factor– data volume. The higher the data, the better the results produced by AI (Lukovich, 2023).

Again, the adoption of these technologies revolutionizing health systems and other spheres remains constrained by some conventional and cyber challenges. As Nwode (2022) and Asogwa and Asogwa (2014) note, advanced technologies proffer both opportunities and challenges. Studies, such as Mohammadzadeh et al. (2023), Hutchings (2020), British Medical Association (2019), Castle-Clarke (2018), and Barmier (2018), share a common viewpoint on the following challenges of adopting advanced technologies in health systems for TIs:

- (i) Resistance to innovations by healthcare professionals
- (ii) Financial or funding constraints alongside poor budgeting,
- (iii) Ethical issues of data security and privacy,
- (iv) Poor or low training and support to personnel,
- (v) Shortage of resources or resources,
- (vi) Stakeholder differences
- (vii) Inadequate communication
- (viii) Inadequate monitoring and evaluation,
- (ix) The complexities of compliance with regulations
- (x) Issues of collaboration arising from the integration of clinical workflows
- (xi) Organizational structure and internal leadership lapses

- (xii) Internal conflicts
- (xiii) External factors

Long et al. (2016) admonish that the adoption of innovation should be guided by conscious design of appropriate innovation for contextual suitability and usability. This means that stakeholders have to consciously design TIs in healthcare systems and other systems of society needing technology integration. The design requires strategic planning and management, and reliance on advanced technologies. According to European Union (2019), performance extent is one crucial consideration for the adoption of advanced technologies for health systems. This means that prior to and upon adoption of technologies, stakeholders ought to make critical evaluations of the technologies for adoption in relation to the context of adoption. One reason is to test for and prove compatibility. Another reason is to be sure the technologies for adoption are innovative, problem-solving, result-oriented, affordable, maintainable and sustainable.

Some studies consider adoption and implementation of technology to be challenging. The attitude of medical practitioners and clinical staff, the routine care system, and the overall culture in health care organization affect or constrain adoption and implementation (Ude-Akpeh, 2020). Since healthcare sector is associated with people's life and health, it is somehow dangerous to experiment new innovations, unlike in other sectors. There are other challenges. These include over reliance on machines, experiencing technical challenges while using machines, knowledge inhibition, poor technical-know-how, and reducing creativity in the employees of health systems making use of the technologies. More so, leadership lapses, including unaccountability, corruption, mismanagement, lack of the requisite leadership qualities and competence, and behavioral factors, are identified to be challenges to the adoption of technological innovations.

There are also issues of ethical governance, moral irresponsibility, unaccountability, lack of transparency, privacy and data invasion, disruption of human welfare, ethical, moral and legal violations, and job redundancy, dismissal and unemployment. Nwode et al. (2019) observe that ICT exert adverse effects on users, leaving negative effects on their cultures, perception and behavior. Apart from the aforementioned challenges, it is observed that when digital interventions in healthcare service are confined to a particular setting, it is difficult to assess the impact and make generalizations based on the results (European Union, 2019).

Similarly, Ogwo's (2016) study observes that values are affected by technologies and social networking sites– social media. These also affect adoption and implementation of advanced technologies for healthcare service delivery, as they influence the attitude of the individual towards the technologies. Consequently, the attainment of TIs is hampered. In addition, Maghsoudi's et al. (2015) study reveals that there exist differences between public and private sector organizations in managing technological innovation, with the major ones being budget constraints, organizational objectives, decision-making, and incentive strategies and other like conditions. This study posits that the differences obtain in the private and public sector healthcare organizations of the US.

Conclusion

From all indications, the study has demonstrated that technological innovations are obtained significantly in US health systems. It attributes the developments to Medicare and Medicaid, as the major influencers of adoption and implementation of TIs in the healthcare systems of the US. Although other agencies in the health sector of the US are also involved in introducing

and fostering the innovations, the study focuses on Medicare and Medicaid. It establishes that Medicare and Medicaid are deeply involved in the pursuit of TIs, which actually leads to the attainment of the innovations at a significant extent. The study has also identified prospects and challenges of adopting TIs in the health sector generally and in that of the US in particular. Considering the feats and the best practices obtained in the health sector of the US under the auspices of the Medicare and Medicaid's Innovation Center, with its mandates, the study submits that TIs has had a significant impact on healthcare service delivery and patient care in the country, while Medicare and Medicaid have been contributing enormously to the realization and sustenance of TIs in the healthcare systems of the US.

By exploring the impact of TIs in relation to the crucial role played by Medicare and Medicaid in ensuring the attainment of the innovations, the study contributes to the evaluation of digital healthcare services. These services generally include assessment, enacting context-based policies, establishing guidelines, rules, regulations and priorities, making use of viable measures, and optimization of decision-making. The study contributes to these areas both now and in the nearest future, as it triggers deserving attention to them and engender more studies on the impact of technological innovations and the contributions of Medicare and Medicaid to introducing, fostering and sustaining the innovations. The study has reformation, development and policy implications and national relevance to the US and other nations in general. To adequately mitigate the identified challenges, stakeholders should adequately, consistently and expertly deploy the aforementioned conventional and technology-based mechanisms for remedies. Increased collaboration is also a panacea.

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