

Telehealth and Digital Technology: Challenges and Opportunities in Cancer Care

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Abstracts: Telehealth describes the deployment of remote technology as a means to afford healthcare services to individuals who face challenges in accessing adequate healthcare. The efficacy of telemedicine has been well established to be comparable to in-person care, resulting in enhanced accessibility and reduced expenses, while also garnering substantial satisfaction among patients and healthcare providers, particularly in the case of chronic diseases including cancer. This review is conducted to offer a full study of the implementation and utilization of telehealth and digital technology in the oncology practice aiming to explain the updates in trends, barriers, and opportunities in cancer care delivery using digital health.

Keywords: Telehealth, Oncology, Cancer Care, Digital Health.

1. THE HISTORICAL APPLICATION OF TELEHEALTH

The historical context of telehealth is a topic of academic interest and analysis. Over several decades, telehealth has taken on various manifestations in response to the prevailing technology capabilities. The first documented publication on telehealth dates back to 1906, when an article was published describing the transmission of electrocardiogram data through telephone lines [1,2].

During the beginning of the 1960s, the National Aeronautics and Space Administration (NASA) incorporated the concept of telemedicine as a significant component within its space missions. The implementation of telehealth devices in spacecraft and spacesuits was initiated to facilitate the monitoring and communication with rocketeers in space. In 1964, the Nebraska Psychiatric Institute established a bidirectional communication system with clinicians at Norfolk State Hospital, located at a distance of 112 miles, via television cables. In order to provide services to patients who were at the airport, Boston's Logan International Airport built internal medical facilities that were connected to Massachusetts General Hospital in 1967. The meetings were held via microwave audio and video hookups. [3]. Kenneth Bird established a telemedicine clinic at Massachusetts General Hospital in 1967 as well. At Boston's Logan International Airport, about three miles from the hospital, this clinic provided occupational and emergency health care to both workers and travelers. Seven telehealth efforts in various states received funding approval from the US Department of Health, Education, and Welfare in 1972. These programs were later extended, and the following year saw the funding of an additional two projects. With the development of the Internet and information technology, the area of telehealth has made considerable strides in recent decades. Additionally, these advancements are a result of computers, laptops, and mobile phones being widely accessible and available. [4].

2. CANCER CARE CHALLENGES

Cancer continues to be the primary cause of death in the United States and most of the countries worldwide, despite decreasing mortality rates. Cancer patients residing in underdeveloped nations and areas typically exhibit characteristics such as advanced age, presence of comorbidities, and overall inferior health status. Moreover, this group demonstrates a higher incidence of lifestyle risk elements that influence the complexity of their survival, including smoking, insufficient physical activity, and obesity [5,6].

Geographic disparities are significantly influenced by the availability of healthcare services. Rural regions exhibit a diminished presence of physicians at the county level, which is particularly notable in terms of the scarcity of specialized medical practitioners such as radiation oncologists. According to a study, a minority of medical oncologists, namely less than 3%, were found to be practicing in rural locations [7]. The presence of individuals in underdeveloped regions has been linked to increased instances of unmet healthcare needs and limited availability of social work, palliative care, and hospice services are examples of supportive care services for cancer survivors. [8,9]. The issue of access to healthcare is worsened by the rising number of hospital closures in recent years [10]. The presence of inadequate local health services necessitates patients to travel longer distances to receive necessary care. Patients must drive longer and farther for medical care due to a lack of local health providers; the average travel time is 50 to 100 minutes according to a Onega et al study on different countries [11]. Moreover, poverty gives rise to significant obstacles in transportation, hence posing a formidable task for impoverished individuals residing in rural areas to afford the cost of gasoline required for accessing healthcare services. In addition, it is worth noting that a significant number of rural households, specifically over 1.6 million, lack access to private automobiles [5]. Consequently, this poses a substantial obstacle when it comes to commuting to medical appointments. The utilization of web-based needs assessments has enabled the investigation of unaddressed requirements among rural cancer survivors, the identification of persistent survivorship concerns, and the suggestion of employing technology to enhance patient education and support as well as facilitate communication between healthcare providers [12]. The utilization of digital health technologies has the potential to address the healthcare demands of patients, providers, and healthcare systems by facilitating the implementation of distance-based care solutions including cancer diagnostics, teleconsultations, and patient care [13-15].

On the other side, in terms of healthiness structure, the United States, where 75% of its hospitals utilize electronic health record systems, and the United Kingdom have lately undertaken disastrous e-health programs, are typical examples of using digital health technology [16]

3. DIGITAL TRANSFORMATION IN HEALTHCARE

Digital transformation involves the utilization of digital technology advancements for the betterment of society and the healthcare sector. The utilization of digital technology is crucial for healthcare systems to implement creative solutions that enhance healthcare delivery and address medical challenges. The digital revolution in healthcare encompasses the integration of the internet, digital technology, and their impact on novel therapeutics and optimal approaches to enhance health management protocols. The use of robust quality control measures for the management of extensive datasets has the potential to enhance the overall welfare of patients and mitigate the financial burden associated with healthcare services. Digital technology will have a significant impact on medical education, leading experts to explore novel methods for training individuals. In this manner, practitioners will be presented with novel prospects [16,17].

The process of digital transformation is a continuous endeavor that has the potential to generate favorable prospects within the health sector, contingent upon the availability of requisite infrastructure and training. According to Regulation (EU) 2021/694, a legislative act On April 29, 2021, the European Parliament and the Council adopted a resolution that formed the Digital Europe Program and revoked Decision (EU) 2015/2240. According to the regulation, digital transformation refers to the use of technology to speed up the transformation of businesses and services. The Internet of Things (IoT) digital platform, cloud computing, and artificial intelligence (AI) are some of the technologies that significantly aid in digital transformation. The areas of society that are simultaneously affected significantly include telecommunications, financial services, and healthcare. [17].

Digital health can also play a role in innovation in health and healthcare-provided services, as it facilitates the participation of the patients and relatives in the process of providing health care [18].

Telehealth and digital health have a number of different, frequently overlapping formal and informal definitions. Using "digital technologies in health, such as the Internet of things" and "computing platforms, software, 1964

connectivity, and sensors for healthcare and related uses" are the formal definitions of digital health [19]. The US Health Resources and Services Administration has given telehealth a definition that reads, "the utilization of traditional as well as electronic information and technologies of telecommunications to promote distant clinical care, professional linked to health education, patient education, public health, and health administration." [20]. Although this definition is inclusive of digital health, Telehealth term is often used more narrowly to describe interactions between healthcare providers and patients.

Incorporating telephone evaluation live video engagement utilizing a private gadget, and conference calls at a selected healthcare facility, telehealth involves all spoken and written interaction [21]. Although video link interactions needing a visit to a local institution may seem more convenient, telemedicine utilizing private gadgets at home is not suitable for individuals who are unsure of or unfamiliar with the equipment or who have inadequate internet connectivity. Additionally, telemedicine visits that use a video link to connect a hospital offering tertiary care to a rural healthcare facility enable an in-person evaluation by the medical staff of the nearby center. [22].

4. DIGITAL HEALTH (TELEHEALTH) IN CANCER CARE

Because the quality of the cancer care necessitates a multidisciplinary team approach, Interprofessional care can be facilitated by telecommunications technology. Teleoncology is highly suited for service aggregation. At their most basic level, most tele oncology sessions consist of a real-time videoconference with the patient and a store-forward transfer of the lab, scans, and pathology data for later review. In order to improve access to high-quality care as a combination of in-person care (i.e., the clinical services on-site) and tele consultative care, some authors showed the effectiveness of combining teleradiology, telepathology, and tele oncology in the treatment of certain types of cancers. This had already been accomplished for tele diabetes care. [23].

4.1. TELE GENETICS IN CANCER CARE

Based on previous involvement with tele genetics in pediatric populations, the Arizona Telemedicine Program and others have begun offering tele genetic services to urban and rural populations. The expansion of telemedicine services was supported by substantial research on phone consultations for genetics care. The strategy effectively identifies genetic carriers and produces high patient satisfaction [23,24]

4.2. TELE-ONCOLOGY; RECENT INNOVATIONS

Teleoncology services are investigating remote chemotherapy administration supervision. Except for palpation, all aspects of a physical exam assessment can be conducted virtually, despite certain restrictions. Training is essential for success in the virtual physical exam. The incapacity to palpate can be remedied through discussion and dialogue with the referring physician regarding physical examination outcomes. Some programs just use the locally conducted physical examination. Mobile, residential-based, and mobile technologies may be used for medical monitoring, which could involve wound treatment, symptom control, and palliative care [25,26]. (See the section below about mobile apps for cancer treatment).

The practice of teleoncology should adhere to in-person professional standards, including the integration of comprehensive documentation into the patient's electronic health record. Utilizing the finest technology you can afford, in conjunction with technological advancements, depreciation, and cost efficiencies, will keep your activities on the cutting edge as technology evolves. Consider your current in-person procedures as you develop tele oncology clinical procedures. Creating standardized procedures will facilitate use, reduce errors, and enhance patient care [26].

4.3. TELEPATHOLOGY

Historically, The actual presence of microscopists and the microscopy equipment used to image the glass slides was necessary for the microscopic study of cells on glass slides in pathology. Telepathology, which enables a distance inspection of microscopic pictures and effectively decouples the physical necessity, challenges this paradigm. of microscopic examination experts from the glass slide which is used in diagnosis and remote

consultation of several types of ordinary or immune-stained slides [27-29].

Telepathology for rapid on-site evaluation (ROSE) is one such pathology application. In minimally invasive procedures, ROSE with cytology preparations serves a pivotal role. Obtaining precise diagnoses frequently necessitates additional immunohistochemical testing. Similarly, cytologic specimens must contain sufficient tissue for molecular analysis. Obtaining precise The importance of ROSE in providing prompt responses on evaluating minimally invasive specimens through offering diagnoses and enough tissue for genetic analyses is highlighted [27,30].

ROSE has historically been carried out by pathologists or cytotechnologists who had to travel to the surgery location. The maximum number of ROSE operations that can be carried out is decided by the on-site cytotechnologists and pathologists. Cytotechnologists and pathologists are not always available on-site. If the injury is virtually unreachable, doing ROSE in challenging situations can take hours. Such tasks take up time, which reduces your availability. Pathologists or cytotechnologists are so occupied with such difficult procedures that they are no longer available for other procedures. Due to the speed of ROSE, synchronized real-time telecytology tackles all of these problems [26–27].

5. MOBILE CANCER TREATMENT APPLICATIONS

Mobile health, or mHealth, continues to be developing quickly as an essential tool for cancer care, from palliative care to cancer prevention. mHealth strives to help patients stay healthy while staying near their homes and leading their lives, taking into account that cancer patients want to remain healthy and reduce the time they spend in ambulatory and inpatient medical settings. Mobile, movable, and home-based technology can be employed for home health follow-up in alongside wound treatment, handling symptoms, and palliative care [31].

Vital signs can be continually or intermittently monitored through wearable technology. Skin sensors can detect temperature constantly or sporadically and can help identify neutropenic fever early on. It is possible to do irregular weight checks, with the clinical team receiving the data right away.

Examples of mHealth technology include texting and message programs that offer patients ongoing interaction, support, and coaching. Smartphone applications are frequently linked to mHealth technology [32]. Smartphone applications have been used to improve medication adherence, wellness activities, and lifestyle modification. These assistive technologies might also be created specifically for certain demographics, such as the elderly. Mobile device attachments can give doctors tools to help in patient care. These treatments encompass everything from iPad-based group counseling sessions for cancer patients in their 20s and 30s to using smartphone digital images to evaluate the cervix following abnormal screening. [26,33].

Barriers to successful adoption often included technical problems for patients and a lack of broadband access. In a longitudinal care setting, like cancer care, where patients interact with their clinician more than once, it is much easier for them to do so if they can successfully download the app or use the web platform and get past any technical problems.

CONCLUSIONS

Technology has a huge potential to enhance healthcare. Combining in-person and online choices is a possible method for providing cancer care services. For the benefit of the patient, clinicians can collaborate digitally to give both the important multidisciplinary care and the required interprofessional care. Telecommunications technology enables patients to receive more therapy at home as the point of care moves beyond the hospital and the doctor's office. Regarding both budget savings and patient satisfaction, teleoncology has been demonstrated to be somewhat comparable to in-person care, like other telemedicine therapies.

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