


# Chapter 5

## Emerging Technologies in Radiotherapy: Advances in Health Literacy and Healthcare Practice

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### **ABSTRACT**

*Radiation therapy (or radiation oncology) plays a crucial role in the treatment of cancer, requiring advanced medical practices and strong health literacy on the part of healthcare professionals. This chapter aims to explore with a literature review how emerging technologies can be integrated into radiation therapy to improve patient health literacy and the effectiveness of medical practice. The application of technologies such as virtual reality, artificial intelligence, and digital communication in radiotherapy highlights their implications for professional education attitude, patient education and treatment, and the development of optimization of radiotherapy treatment protocols. Nowadays, knowledge has become a crucial tool to meet the challenges of an increasingly digitized society. Staying up-to-date and understanding emerging technologies can be key to navigating this landscape. The ability to learn and adapt quickly has also become a valuable skill during constant change in a global society.*

### **INTRODUCTION**

The World Health Organization (WHO) notes that approximately 50% of all cancer patients require radiation therapy at some stage of their illness, and up to 60% could benefit from it. An estimated 40% of cancer patients can expect a normal life expectancy or cure following treatment, with radiation therapy contributing to up to 18% of these cures. Radiation therapy is increasingly crucial in managing cancer (Boejen & Grau, 2011) and is essential for the aim of curing various early-stage cancers. It also plays a significant role in palliative care, reducing pain or symptoms in locally advanced malignancies and

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metastatic diseases. Key treatment modalities in cancer management include surgery, radiation therapy, and chemotherapy. Radiation therapy, which uses ionizing radiation alone or in combination with other therapies, can be an independent oncological specialty or integrated into broader clinical oncology practices (Benstead et al., 2019).

It is estimated that the annual global incidence of new cancer cases is 19,292,789, projected to rise to around 23 million by 2030 (Sung et al., 2021). The estimated increase in cancer cases in low-middle-income and low-income countries is expected to be significantly higher than the global average, at 80%-90% (Laskar et al., 2022). Common cancers with high radiation therapy utilization rates include breast, cervical, head and neck, lung, and prostate cancer. By 2030, the shortfall in teletherapy machines globally is expected to exceed 10,000 units. However, the distribution of these machines is uneven worldwide, with stark disparities among high-income countries, high-middle-income countries, low-middle-income countries, and low-income countries. For instance, North America has nearly 2,600 radiation therapy centers, dominated by the United States, while other regions like South America, Europe, Africa, and Asia have varying numbers of centers (Laskar et al., 2022). The chapter emphasizes the need for innovative, cost-effective research tailored to local requirements to maximize the benefits of existing radiation therapy facilities.

## **MAIN FOCUS OF THE CHAPTER**

The primary focus of this chapter is to delve into the recent technological advancements in health literacy, particularly within the field of radiotherapy. This exploration begins with a historical overview (Hewitt, 1973), tracing the evolution of digital health technologies and their impact on health literacy (Arif et al., 2024; Miranda, 2024; Tomé et al., 2024) from their inception to the present day. This historical context sets the stage for a comprehensive analysis of contemporary digital health technologies used in radiotherapy, evaluating their potential, feasibility, and effectiveness in various settings. The unique contribution of this chapter lies in its multidimensional approach, which combines innovative research methods, novel theoretical frameworks, and fresh insights to assess these technologies. This approach not only offers a deeper understanding of current tools and practices but also sheds light on their practical implications for patients, students, and professionals in the field. By addressing current trends, debates, and developments, the chapter also situates itself at the forefront of scholarly discussion in the field. It not only informs readers of the latest technological advancements but also encourages critical reflection on the future trajectory of health literacy in radiotherapy, making a significant contribution to the ongoing dialogue in healthcare technology and practice (Erisen & Uludag, 2024; Tariq, 2024a; Toit & Goosen, 2024).

## **HISTORICAL EVOLUTION OF RADIOTHERAPY**

Before the discovery of ionizing particle beams, medicine had limited options for treating diseases, both malignant and benign. This changed dramatically with Wilhelm Conrad Röntgen's discovery of X-rays in 1895. Even before fully understanding X-rays' physical properties and biological effects, Emil Herman Grubbe used them to treat a breast cancer patient just a year after their discovery (Gianfaldoni et al., 2017). From 1930 to 1950, significant scientific progress was made in treating deep cancers. This

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