Chapter 11
Leveraging Big Data and Advanced Technologies for Enhanced Sustainability in Healthcare:
An IPO Model Approach

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ABSTRACT

The convergence of big data and technology is transforming the collection, processing, and application of information in the healthcare industry. It is now crucial to comprehend and manage the enormous amounts of data that are constantly produced from various sources, including wearable technology, medical imaging, and electronic health records (EHRs). This chapter examines the five main characteristics of big data that healthcare companies may use to improve sustainability in patient care and operational efficiency, i.e. Volume, velocity, variety, Veracity and Variability. These elements are integrated into a comprehensive IPO (Input, Process, Output) model, illustrating how they function as input and process components that leads to substantiality. Based on earlier literature and real world scenario, the chapter

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highlights the importance of cutting-edge technologies in managing the complexity of healthcare data and improving delivery and operational effectiveness.

INTRODUCTION

The contemporary healthcare sector relies more on big data and advanced technologies. Data is generated in huge quantity on a daily basis from various sources in the healthcare sector, including electronic health records (EHRs), medical imaging, genetic information, and wearable sensors. Effectively managing and using this data has the potential to significantly enhance the quality of patient care, streamline operations, and enable evidence-based decision-making. This chapter examines the use of big data and emerging technologies to improve sustainability in the healthcare sector via the implementation of a complete Input-Process-Output (IPO) model. The IPO model provides a structured framework for understanding the flow of data inside healthcare systems. The input component of the model comprises several types of data, including structured, semi-structured, and unstructured data, which are collected. Examples of such data include patient records, laboratory results, medical images, and data obtained from wearable devices. The process component encompasses the techniques and technologies used to standardize, analyze, and interpret the data, including data cleansing, validation, and interoperability frameworks. The output component emphasizes the practical insights obtained from the data, which may be used to influence clinical choices, enhance operations, and ultimately enhance patient outcomes.

The chapter explores the five dimensions of big data in healthcare, namely Volume, Velocity, Variety, Veracity, and Variability. Every dimension poses a distinct difficulty and opportunity when it comes to handling healthcare data. Volume refers to the large amount of data created, which requires storage solutions that can be easily expanded and strong techniques for combining different sets of data. Velocity refers to the pace at which data is produced and processed, highlighting the need of instantaneous analytics and decision-making. Diversity emphasizes the many types of data, requiring sophisticated methods to manage organized, semi-structured, and unstructured data. Veracity is dedicated to assuring the precision and dependability of data, which is crucial for efficient patient care and research. Variability pertains to the ever-changing characteristics of data, which are impacted by variables such as patient demographics and seasonal patterns.

This chapter demonstrates the interplay of these factors inside the IPO model to generate enduring results in the healthcare sector. We illustrate the actual use of data analysis insights in healthcare delivery by providing examples, showing how these insights may lead to quantifiable changes. The primary objective is to provide