

# Chapter 67

## The Role of Genetic Data Analysis for Precision Therapy in Cancer: Personalized Medicine Concept in Cancer Treatment

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### ABSTRACT

*Cancer has been known as a devastating disease that takes thousands of lives every year. And since this is a heterogenous disease, standard treatments, like chemotherapy, radiation, and chemo-radio therapy, are effective in specific patient population subset only. Genetic differences play a very crucial role in defining cancer susceptibility and also in determining the drug's efficacy by affecting regulation, expression, and activity of drug metabolizing enzymes, drug transporters, and drug receptors. This genetic variability of the disease lends itself to the emerging field of precision or personalized medicine. There are some specific ways of acquiring data for precision or personalized medicine approach like genome wide association scan (GWAS). This is basically identification and scanning of biomarkers throughout the complete DNA/genome of several individuals to study any type of genetic variations which are linked with any form of cancer.*

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## **INTRODUCTION**

The term ‘oncology’ has been derived from two words onco and logy where “onco” defines excessive mass and “logy” is study. Oncology deals with cancer treatment and understanding the genetic predisposition leading to DNA variation and then to the disease ultimately. People probably think of cancer treatment as a modern practice but that is not a true fact as it has its root in ancient Greek. Among manuscript the initial description of this disease and its treatment is mentioned in the book of Edwin Smith Papyrus, back in 3000 BC and described it as “incurable” but with the time it changes. In fact, cancer survival among several years has been increased because of less exposure to life style related habits (like consumption of tobacco/smoking and alcohol) and advancements in the screening methods and treatment regimens (Blackadar, 2019; Jarrell et al., 2020).

The introduction of immunotherapy has driven the cancer care field towards individualization of therapeutic guidelines which ultimately led to basics of personalized medicine approach or precision medicine approach, which is often called precision and personalized medicine (PPM), which is actually customization of therapeutic protocol as per the patient (Kruger et al., 2019; Jarrell et al., 2020). Over the past few decades, it has become apparent that the physiology of cancer is different in different patients and that could be the probably be a reason for difference in the treatment outcome in these patients even after following the same treatment regimen. Therefore, the conventional cancer therapy regimens have been unsuccessful, costly and causes unwanted side effects for patients. A more effective model is based on PPM in order to adjust the conventional and more traditional approach. This viewpoint promotes the creation of personalized therapies for each particular cancer subtype, which utilizes calculation and information related to genetic predisposition and genetic variation data of patients for better and more reliable methods of treatment (Jarrell et al., 2020).

Different forms of cancer have been treated through conventional and more traditional methods for several decades which includes chemotherapy, radiation and surgery. This approach of common treatment protocol for all patients in most of the cases led to deterioration and hazardous damage of healthy, non-malignant tissues and organs as well. The personalized approach or precision medicine approach based on individualization of treatment regimen as per tissues, genetic variations and individual events/factors significant to specific cancer physiology. It helps in determining the appropriate treatment method as per specific malignancy and guides for the novel & targeted treatment protocol which either do not led to any hazards to the healthy tissues/organs or it shall be the minimum harm. Thus, this approach of treatment is more appropriate and safer as compared to others. Moreover, improvements and advancements in the identification of pathways and biomarkers related to cancer, precise and more effective approaches of patient data analysis (Big data); and more accurate high-throughput screening methods will surely lay down a strong base for precision and personalized medicine approach (Jarrell et al., 2020; Fan et al., 2020).

## **EPIDEMIOLOGY OF CANCER**

### **Genetic Factors**

It is a well-known fact that almost all the cancer-causing agents leads to variations in the genetic content. Furthermore, it has been studied by several researchers across the world that variations in the somatic

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