Chapter 6
Toxicogenomics and Pharmacogenomics Research in Health Disparities

Surendra Prakash Gupta
https://orcid.org/0000-0002-4873-6346
Shri Vaishnav Vidhyapeeth Viswavidhayalaya, India

Ankur Bhardwaj
https://orcid.org/0000-0003-0687-8810
Shri Vaishnav Vidhyapeeth Vishwavidyalaya, India

ABSTRACT

In recent years, the fields of toxicogenomics and pharmacogenomics have become increasingly popular as scientists attempt to understand the intricate interactions between genetic variables, environmental exposures, and how these factors affect health outcomes like the onset of diseases and the efficacy of medical treatments. This method has grown in significance for comprehending and resolving health inequalities. Significant racial and ethnic differences in drug response are revealed by combining genetic ancestry and pharmacogenomic data, which can help address health disparities and guide personalized medicine. These fields leverage genetic data to tailor medical treatments, aiming to reduce adverse drug reactions and improve therapeutic efficacy. Understanding these mechanisms are crucial to developing more personalized and effective treatments that account for individual genetic differences and their impact on how people respond to medications. The important developments in the field of omics to comprehend and reduce health disparities are covered in this chapter.

DOI: 10.4018/979-8-3373-5796-6.ch006

1. INTRODUCTION

1.1 Definition of Toxicogenomics (TGx) and Pharmacogenomics (PGx)

TGx and PGx are essential for comprehending and tackling health disparities among at risk populations by customizing medical interventions based on genetic profiles, which enhances health outcomes and fosters health equity. These disciplines examine genetic differences that affect drug efficacy and toxicity, which can differ markedly among various racial and ethnic groups. By integrating these insights into clinical practice, healthcare providers can better address the unique needs of diverse populations, potentially reducing health disparities.

TGx, which integrates toxicology with genomics, has become an essential instrument in health disparities research, providing critical understanding of how environmental factors and genetic predispositions interact to affect health outcomes at both individual and population levels. Through the integration of genomic technologies, conventional drug assessment methodologies, and advanced data analysis techniques, these fields have the potential to significantly impact how new therapeutics are discovered and how clinical populations are understood.

Developments in biological sciences have shed light on both intrinsic and extrinsic elements that influence health and disease, underscoring the necessity for a more holistic and unified approach to research in biomedicine. Numerous factors contribute to the observed differences in health and disease indicators among and within populations, including genetic diversity, geographic context, cultural and psychological influences, behavioral patterns, and the unequal access to resources. These factors interact in complex ways, creating disparities in health outcomes that require multifaceted interventions and a deeper understanding of the underlying mechanisms. A more comprehensive approach that considers the interplay of genetic, environmental, and socioeconomic determinants is crucial for addressing these persistent health disparities and improving the overall well-being of diverse populations (Royal et al., 2021). The Japanese Toxicogenomics Project (TGP) collaborated with the National Institute of Health Sciences, the National Institute of Biomedical Innovation (NIBIO), and numerous pharmaceutical companies to assemble a large array of transcriptome databases. The goal of this project was to develop a toxicogenomics approach, a framework for assessing the safety and toxicity of substances, including drug candidates using the data gathered (Uehara et al., 2010). The initial version of Toxygates, an integrated platform for toxicogenomics data analysis, was released to the general public (Nyström-Persson et al., 2017).