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# Network Science in Clinical Trials: a patient-centered approach

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## Abstract

There has been a paradigm shift in translational oncology with the advent of novel molecular diagnostic tools in the clinic. However, several challenges are associated with the integration of these sophisticated tools into clinical oncology and daily practice. High-throughput profiling at the DNA, RNA and protein levels (omics) generate a massive amount of data. The analysis and interpretation of these is non-trivial but will allow a more thorough understanding of cancer. Linear modelling of the data as it is often used today is likely to limit our understanding of cancer as a complex disease, and at times under-performs to capture a phenotype of interest. Network science and systems biology-based approaches, using machine learning and network science principles, that integrate multiple data sources, can uncover complex changes in a biological system. This approach will integrate a large number of potential biomarkers in preclinical studies to better inform therapeutic decisions and ultimately make substantial progress towards precision medicine. It will however require development of a new generation of clinical trials. Beyond discussing the challenges of high-throughput technologies, this review will develop a framework on how to implement a network science approach in new clinical trial designs in order to advance cancer care.

## 1. INTRODUCTION

In preclinical and clinical cancer research there is an increasing use of molecular throughput-technologies enabling us to leverage large quantities of molecular data. This is enhancing our knowledge of deregulated oncogenic pathways due to alterations at the genomic, transcriptomic

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