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SHORT COMMUNICATION

P4 medicine: The current understanding

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ABSTRACT

Introduction:

The concept of "precision medicine" has gained significant popularity in recent years, driven by both scientific and political viewpoints. It is a novel healthcare paradigm that employs multidimensional data and machine-learning algorithms to develop public health initiatives. Phenotyping is an integral component of precision medicine approaches and focuses on meticulously examining the health status of each individual. Precision medicine uses vast amounts of biological data for personalised treatments, including genomics, transcriptomics, epigenomics, proteomics, metabolomics, and pharmacogenomics, thus helping predictive medicine and diagnostics by aiming to provide patients with treatments tailored to their biological and clinical attributes.

Conclusion:

Precision medicine is revolutionising medical treatment, requiring a comprehensive approach involving scientific, clinical, and policy initiatives. Successful implementation requires strong global leadership and unwavering determination to ensure its correct integration into the realms of healthcare and society.

Keywords

Approach, data, genome, information, medicine, precision, technology

Introduction

Precision medicine, also called personalised, stratified, or P4 medicine, represents a novel paradigm in the healthcare landscape and aims to encourage a holistic medical approach by utilising an extensive network of health and illness information and individual profiles based on "omics" data. The term "omics" refers to the comprehensive analysis of biological molecules from different areas of molecular biology utilising high-throughput technologies, involving the molecular characterisation and quantification of these molecules.

P4 stands for predictive, preventive, personalised, and participatory medicine. It refers to a novel healthcare paradigm that employs multidimensional data and machine-learning algorithms to develop public health initiatives and oversee the well-being of the population, explicitly promoting well-being and healthy ageing. [1] P4 shows significant potential for alleviating the impact of chronic diseases through technology and enhanced comprehension of human interaction, evidence-based therapies, and the fundamental mechanisms of chronic diseases. According to the US National Human Genome Research Institute, precision medicine is defined as "Precision medicine (generally considered analogous to personalized medicine or individualized medicine) is an innovative approach that uses information about an individual's genomic, environmental, and lifestyle information to guide decisions related to their medical management. Precision medicine aims to provide a more precise approach for the prevention, diagnosis, and treatment of disease." [2] It primarily encompasses advancements driven by technology rather than prioritising the theoretical aspect. P4 medicine relies heavily on the widespread implementation of digital technology, which includes data collection through internet browsing and smartphone usage, as well as the storage and processing capabilities for genome sequencing in clinical practices. Additionally, algorithms play a crucial role in developing and applying P4 medicine.

Phenotyping, a significant aspect of the P4 concept, focuses on thoroughly analysing each person's health condition. This involves the assessment of biochemical (such as serological tests) and physiological (such as heart rate and blood pressure) measurements, heredity (including the genome and microbiome), and the evaluation of exposure to risk factors (such as pollutants, occupational variables, and biological agents). Currently, only a limited number of extensive databases, such as the UK Biobank, provide access to this type of information. These databases offer a valuable source of genetic data, enabling researchers to conduct crucial epidemiological and clinical research investigations. [3] Precision medicine uses vast amounts of biological data for personalised treatments, including genomics, transcriptomics, epigenomics, proteomics, metabolomics, and pharmacogenomics. This approach is designed for predictive medicine and diagnostics, aiming to provide patients with treatments tailored to their biological and clinical attributes. Precision medicine has seen significant advancements in oncology, with 144 medications available, including 107 targeted therapies and 37 specific immunotherapies. [4] These therapies are primarily used for advanced stages of cancer or those with chronic myeloid leukaemia, lung and breast cancer, and metastatic melanoma. [5]

Artificial intelligence (AI) and machine learning (ML) can efficiently analyse large amounts of data using the bioinformatics system, gradually becoming an integral part of precision medicine. Both AI and ML can combine and transform large volumes of data, known as big data, into effective diagnostic and therapeutic solutions. [6] The most effective approach for storing, processing, and analysing data is to utilise these strategies. Additionally, they can effectively address all statistical obstacles with greater efficiency than conventional approaches. Data mining and noise reduction in data are specialised approaches that AI and ML offer. By employing clinical, diagnostic, and therapeutic algorithms in the form of flowcharts, these strategies enable clinicians to make prompt and diverse decisions. These technologies can be effectively used to create predictive and prognostic models.

The COVID-19 pandemic was a lesson for the world to embrace precision medicine. The geospatial tracking of populations has facilitated the management of disease outbreaks at all levels during the pandemic. This tracking provides real-time information on the occurrence of infection, its spread, risk factors, mortality rates, contact tracing, the impact of lockdowns, and the supply of vaccines. [7] Telemedicine and AI in radiology during the pandemic underscored the magnitude of digitalization and the increasing significance of precision medicine.

Conclusion

Precision medicine represents the forefront of medical treatment, utilising various advanced instruments to revolutionise medicine in the following years. To fully harness the transformative capabilities of precision medicine, a comprehensive approach encompassing scientific, clinical, and policy initiatives is necessary. The successful implementation of P4 necessitates strong global leadership and unwavering determination to ensure its correct integration into the realms of healthcare and society.

Abbreviations

Artificial intelligence (AI), machine learning (ML)

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