## Advances in artificial intelligence-based microbiome studies have potential implications in economic precision medicine regimens.

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Each human harbours around 100 trillion symbiotic microbes known as the microbiome. Humans share 99.9% of DNA with a diversity of 90% in their microbiota with contributing factors being diet, lifestyle, age, environmental exposures, genetics, antibiotic use, etc. Physiological conditions of the human body appear to be linked with microbes which are unique to each individual. Hence microbiome-based data can be aimed to promote precision medicine. Artificial Intelligence (AI) and Machine Learning (ML) have brought unprecedented progress in big data including the microbiomes. AI-based predictions have been successfully used in many aspects of scientific research with ML being the most critical part with different training datasets. Thus microbiome analysis to enforce precision medicine with the help of AI/ML is worth exploring.

Figure 1. Workflow of AI-based microbiome analysis towards precision medicine.
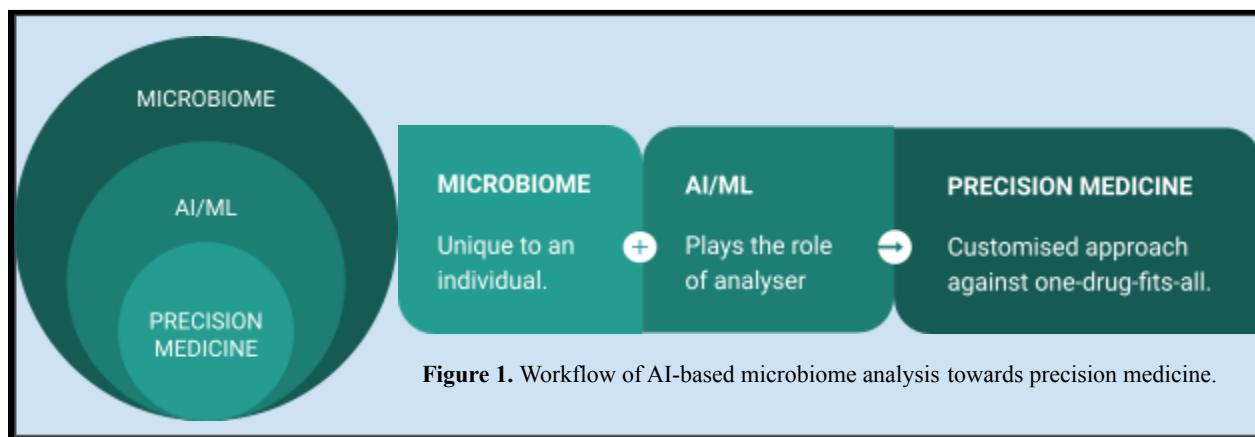
Microbes are omnipresent and humans are no exception to it. There are ten times more microbes in the body than there are human cells, residing in various parts of the body. They account for 1.5 kilograms of body weight (1). Human genes are around 20,000-25,000 whereas there are 200 million or more microbial genes with immense genetic diversity. Therefore microbiome is recognised as an integral component in human development, health and disease (2). Crucial advances have indicated that gut microbiota is involved in basic biological processes which include modulating the metabolic phenotype, regulating epithelial development and influencing innate immunity. Human microbiota is associated with major chronic diseases like obesity,diabetes mellitus, atherosclerosis, inflammatory bowel disease, liver diseases, gastrointestinal cancers, autoimmune diseases and so on (3). However, microbiome is unique to an individual like fingerprints, consequently fostering precision medicine. To cite one significant current scenario, in several ways gut microbiota has been implicated in cancer as specific microbes are known to promote cancer development and influence therapies' tolerability, efficacy and safety. As a potential application this microbiome based

big data derived from omics techniques is aimed at promoting precision medicine in cancer (4). There is continuous progress with regard to identification of possible diagnostic,therapeutic and preventive measures for various diseases.

Coming to the importance of precision medicine also known as personalized medicine, which is an emerging approach to accurately predict strategies for preventing and treating diseases as it takes into account individual variability in genes, lifestyle and environment.In other words, it is tailor made. This approach gives more priority to the differences between individuals in contrast to the one-drug-fits-all model hence will show great efficiency (5). This new frontier combines genomics,big data analytics and population health making it impactful and precise (6).

The prime role of making sense of microbiome data to lead to precision medicine is poised by AI/ML. It splendidly presents us with deeper analysis of large datasets helping us increase our understanding by leaps and bounds and also to arrive at novel amusing conclusions. AI/ML can channel patient-centric medication through integration of multi-modal data from the individual by reducing time,cost and burden. It is right to say that the convergence of AI and precision medicine is promising in revolutionising healthcare (7, 8).

AI/ML is currently used for accurately and quickly detecting bacteria. Furthermore for predicting pathogenesis.It proved its ability of early diagnosis of diseases by finding patterns in data. This is applicable in case of microbiome data as well. Microbiome, AI/ML and precision medicine are interwoven giving prominent outcomes. There is still a lot to uncover and requires further research nonetheless progression in healthcare holds utmost

significance on that account it is quest worthy. Altogether they will render great advancements to mankind as delved further. As science and technology is all about pushing the limits so looking at the future a plausible prediction pops up, a machine which will be able to diagnose and give recommendations based on patient charts after applying algorithms to big data obtained from the individual's microbiome, thereby enabling precision medicine economically. Our inhouse microbiome analysis will use ML/AI protocols in the near future. All the data from our analysis will be published in the future issues of TCABSE-J.

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