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Personalized Medicine: A Future Ahead for Human Health

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Abstract

Personalized medicine means creatingprecise treatment plans for individuals based on pharmacogenetic and pharmacogenomics data. The practicalities of personalized medicine can be examined by adopting various methods including single nucleotide polymorphism genotyping. In future perspectives, the molecular diagnostics will playkey role in the improvement of personalized medicine, by combination of treatment and diagnosis. In present scenario, there are many examples of personalized medicine, like selecting patients for cancer treatment based on genotype to avoid non-responders or side effects. Self-treatment is economically viable because it reduces drug development costs by shortening the time to drug development. Incorporating pharmacogenomics into clinical trials reduces the likelihood of clinical trial failure and leads to safer, more effective treatments for specific patients. Some of the advantages and challenges of developing personalized medicine are reviewed.The concept of personalized medicine was not new at the time, but it was made possible in the 1990s by advances in DNA sequencing technology, including automation and amplification. The advent of personalized medicine has accelerated the development of health information technology, which involves the electronic processing and storage of patient information. Advances in these areas, especially the use of electronic health records (EHRs) that store patients' medical histories, medications, test results, and demographic information, are important for integrating data from genetic and genomic studies into clinical settings.

Keywords: Cancer; Drug development; Personalized medicine; Tuberculosis.

INTRODUCTION

Early medical practices involved the peoples of Babylon, China, Egypt, and India. The invention of the microscope was a result of enlarged understanding. Before the 19th century, humoral theory (also known as humoral theory) was thought to explain the cause of disease, but it was gradually replaced by the disease theory, which led to a complete treatment that could cure many diseases. Army doctors provided advanced medical and surgical care. Public health measures

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were developed, especially in the 19thcentury, as the rapid growth of cities necessitated sanitation.[2] In the early 20th century, advanced research centres were established, often attached to larger hospitals. In the mid-20th century, new treatments such as antibiotics emerged. These advances, combined with developments in chemistry, genetics, and electricity, led to the emergence of modern medicine. Medicine became more professional in the 20th century, with women entering new professions such as nursing (from the 1870s) and medicine (especially after 1970).[3]

In medical advancement a decade passed always result into incorporation of advance technologies in medicine field. The human genome project during 1990s is one of the key factor towards the personalized medicine. The Human Genome Project (HGP; 1990–2003), had sequenced more than 3 billion pairs of human genomes and made them available to scientists worldwide. Similarly, the global HapMap project (2002–2010) identified genes that predispose people to disease and gave researchers the information they needed to connect the genes to specific diseases and disorders. These advances reflect the effects of treatments over the years, such as drugs that are more effective in some patients and adverse side effects in others. The progress of pharmacogenetics and pharmacogenomics has contributed to improvements in understanding the molecular factors that influence a person's genetic tendency to disease and treatment; studying the genetic reasons behind people's differences in response to drugs; and learning the many variables that affect the effects of drugs.

A person's genetic makeup. about disease and treatment by manipulating the response to drug therapy or using information from pharmacogenetics and pharmacogenomics, researchers have developed more objective and accurate tests to diagnose disease and predict people's pain response to medication. In some cases, researchers have discovered that the development or outcome of certain diseases can be altered by using genetic and other molecular information to guide diagnosis and treatment. [1]

Role in disease prevention, diagnosis, and treatment

Personalized medicine is having many applications which can be helpful in prevention, diagnosis, and treatment. For example, doctors can use family medical history information to assess a patient's risk of disease. In some cases, family history can be used to determine whether a patient should undergo genetic testing. A prediction can be made based on the data, to determine whether the person would specifically benefit from a vaccine. For example, in people with a family history of Lynch syndrome, a common cause of colon cancer, genetic testing can help identify the mutation that causes the disease. Frequent and regular screening for evidence of changes in the colon for people with the mutation can lead to early detection of the disease, which can be lifesaving. Similarly, tests that can detect mutations in multiple genes at once could help diagnose breast, ovarian, and prostate cancers in early stages. A type of treatment that uses drugs to target specific molecules that help cancer grow and spread. The first successful treatment involves the antibody imatinib, designed to treat chronic myeloid leukaemia (CML) patients who carry the BCR-ABL tyrosine kinase, a protein produced by a cytogenetic abnormality in the Philadelphia chromosome. It was observed that the Imatinib effectively reverses the cancer-causing effects by blocking the growth of CML cells with mutated kinases.[1]

Another example of personalized medicine used for treatment is the use of genotyping to identify different enzymes that alter a patient's sensitivity to the anticoagulant warfarin. Information about changes in enzymes that metabolize warfarin can be used to help decide which drug a patient should take to achieve the desired effect.[1]

Challenges and Decisions

Personalized medicine faces major challenges. For example, In the HGP sequence of the human genome, each human genome has approximately three to five million variants. Therefore, disease-modifying or therapeutic responses to genetic modification require careful analysis and translation across multiple disciplines. Furthermore, genomes are geographically and ethnically diverse and are influenced by the environment. Therefore, individual differences found in a population based on race or geography may have a significant impact on disease in other cultures. For example, the structure of electronic medical records impacts their use. Access to and analysis of genomic data in electronic medical records will be limited by the presentation of genomic test results in the context of the analysis tab. There should be no raw data or information about the patient's lifestyle, behaviour, etc. that is critical to the research. Of particular concern is that historically most genomic studies have focused on populations of European descent

and ethnic and racial minorities. This inconsistency in representation may impact the process used to inform drug selection and dosing decisions, leading to poor clinical outcomes and poor outcomes for patients with genetic and lifestyle differences from those in the study population. There are increasing concerns about privacy and security generally associated with the use of electronic health records. For example, flaws in electronic health records can lead to the disclosure of personal and health information as well as medical information. Self-medication is expensive and therefore may not be available to patients without health insurance, and the cost of self-medication may be lower in countries where medical services are less available. Genomics is one of several omics branches of biological science that focus on the structure, function, and heredity of an organism's genome (its entire genetic material). Genetic Proteins

A significant part of genomics is determining the sequence of molecules that make up the deoxyribonucleic acid (DNA) content of the human genome. Genomic DNA sequences are found in one or more sets of chromosomes, in every cell of the body. Chromosomes can also be described as containing the genetic material that is the basic unit of reproduction. Genes are transcripts, which are regions of chromosomes that produce ribonucleic acid (RNA) messages that can be easily translated into protein molecules. Chromosome crossover events are part of recombination. In this process, a region of one chromosome is exchanged for a region of another chromosome, resulting in a unique combination of chromosomes that divide into haploid daughter cells. The chromosomes of each species are unique in number and size and contain the entire genome and all the DNA between them. Although the word "genome" was not used until the 1920s, the existence of genomes has been known since the 19th century, when chromosomes were first discovered as chromosomes that could be seen under a microscope. Genetic maps of chromosomes were drawn in the 20th century after their initial discovery, because most chromosomes are distributed by a process called chiasm, a process that is revealed by testing during the normal recombination and production of cells (gametes). The genes that can be localized by chromosomal exchange are usually those that have been shown to alter phenotype (as viewed by the body's genetics) and are only a small fraction of the total genes in the genome. The discipline of genomics emerged with the advent of technology that could determine the complete nucleotide sequence of the genome (a significant fraction of millions of nucleotide pairs).

Sequencing and bioinformatic analysis of genomes

DNA extraction: The DNA extraction process is necessary to isolate DNA molecules from cells or tissues. The isolation of pure DNA requires several steps, including the use of proteases to remove proteins from the DNA, which are used in subsequent procedures such as cloning or sequencing. Replication and expansion in cells. This allows more DNA to be cloned and extracted from the cells. The DNA is then sequenced and analysed in more detail using bioinformatics techniques. In an attempt to determine the sequence of a genome, genomic DNA is first extracted from a diseased brain sample and then broken into many random pieces. These fragments are cloned into DNA vectors that can carry large amounts of DNA. Since all the DNA needed for synthesis and further testing is several times the total DNA in the bacterial genome, each cloned fragment is copied individually in the brain in living organisms, which proliferate rapidly and form many more clones in it. The cloned DNA is then extracted from the cloned organism and fed into a sequencer. The sequence data is stored in the computer. Once enough sequences have been obtained from many different clones, the computer uses the overlapping sequences to join them together. The result is a sequenced genome that is then stored in a public database. The need for these detailed analyses has given rise to the field of bioinformatics, where computers analyses DNA sequences to find genes using methods based on genetic features, such as nucleotide triplets called start and stop codon stems, DNA segments, or DNA sequences that extend the DNA sequence. Genes are known to be important in size and in regulating neighbouring genes. Once candidate genes are identified, they must be copied to increase functional capacity. These explanations are often based on information about the function of similar genes in other organisms, analysis made possible by the evolutionary conservation of genes, and function due to the genetics of disease. However, there are still some genes whose role remains undetermined after annotation; with further research, these functions are becoming increasingly clear.

CONCLUSION

Doctors know that many patients they treat with drugs will not be effective. Many patients know this, and this may be why some do not take them. The basic idea behind stepwise medicine is that we can be smarter about identifying patients

who will benefit. Long-term expectations are slowly becoming reality, but reforming healthcare, creating regulatory frameworks, and finding business models that support quality care are challenging.[3-4]

In the "14 Grand Challenges of Engineering" established by the National Academy of Engineering (NAE), self-healing medicine is considered important and looks to the future to "completely eliminate concerns about personal health" and thereby meet the challenge of "developing better medicine".[5-6]

In personalized medicine, diagnosis is often used to select appropriate and recommended treatments based on the patient's genetics or molecular or cellular characteristics. Important role (e.g. genetic testing).[7-8] Image analysis, nanoparticle-based theranostics,[9-10] among them.

If the personalized medication adopted on larger scale the Public Health scenario will change to more healthy peoples. Customization is the current need in medication sector for well being and early diagnosis of diseases.

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