Personalized medicine is the future sustainable knowledge for human well-being

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Abstract

Purpose – The purpose of this paper is to provide a viewpoint on the subject of personalized medicine and its impact on human well-being.
Design/methodology/approach – The paper takes the form of a viewpoint.
Findings – The paper concludes that personalized medicine can help in the elimination of redundant treatments, decreasing side effects, prevention of disease and earlier intervention.
Originality/value – This is a viewpoint piece.

Keywords Research, Personalized medicine, Molecular level

Paper type Viewpoint

Personalized medicine

Background

In 1898, William Stewart Haisted, considered the Father of American surgery, developed an innovative approach to the treatment of breast cancer: the radical mastectomy. A century later, the Food and Drug Administration approved an even more radical innovation: a biological compound called "rastuzumab," which binds to the cells of some cancerous tumors, triggers the body's defense system to attack them and may prevent the cells from replicating.

Trastuzumab, better known by its brand name, Herceptin, was one of the first drugs to leverage the power of genetics to treat disease. It is prescribed only for patients whose genetic tests reveal an over-expression of the protein HER2 due to a gene mutation – an indicator of an aggressive form of cancer that is responsive to treatment by the drug. Unlike chemotherapy drugs, which attack any cell that is replicating rapidly, including healthy cells, Herceptin is customized to target only those cells associated with disease. As a result, the drug has none of the side effects associated with chemotherapy, such as hair loss and digestive problems.

Over the past decade, advanced research into genomics – the study of an organism's genes – and proteomics – the study of the proteins that genes create or "express" – has accelerated our understanding of individual differences in genetic makeup, opening the door to a more personalized approach to health care. "If you want to understand a disease, genetics gives you the opportunity to shine a bright light into the darkness of our ignorance so we can provide better ways to prevent and treat" says Dr Francis Collins, the former Director of the National Center for Human Genome Research within the National Institutes of Health who is now the Director of the NIH.

Since Genentech's Herceptin and companion HER2 test were approved in 1998, they have been joined by a growing roster of "targeted" diagnostics and therapeutics that are tailored to the genetic makeup of the individual.

The science of genomics and proteomics has the potential to personalize health care, enabling providers to match drugs to patients based on their genetic profiles, identify

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who is susceptible to which health conditions and determine how a given patient will respond to a particular therapy, a field known as "pharmacogenomics." That could eliminate unnecessary treatments, minimize the potential for adverse events and ultimately, improve patient outcomes. Also, developing a vaccine produced from a patient's one's own tissues have taken the personalized medicine to a new height in the present scenario.

Thus, the concept of pharmacogenomics deals with the genetic variation among the masses, and uses the genetic data to select the right drugs to treat disease in a given patient. Furthermore, using a patient's own tissues for developing a vaccine is in itself a novel strategy to provide a protection to the society especially with the prevalent genes. Taken together, personalized medicine enables doctors to match drugs to patients and to develop drugs and vaccines match society with particularly expressed genes.

Recent scientific discoveries have enabled a new view of disease that focuses on interactions at the molecular level, which differ from one person to the next. "Take into account that your genome and mine differ by 6 million nucleotides (which is the basic unit of organic acids found in all living cells). Then, therefore, we're susceptible to all sorts of combinations of diseases" says Dr Leroy Hood, Co-founder of the Institute for Systems Biology and pioneer in personalized medicine. "We have to treat you differently than we treat me and everybody else. How we create an era of highly personalized medicine will depend entirely on new diagnostic, therapeutic and ultimately […] preventive techniques."

Personalized medicine is a unique approach to medical practice in which the individual aspects of a patient are directly considered to guide treatment planning, including his or her genetic makeup, key biomarkers, prior treatment history, environmental factors and behavioral preferences. This approach can be used to optimize pharmaceutical treatments and overall care of individuals and a society that share specific genes targeted by newly developed drugs.

Others point out that we will never be able to predict perfectly the many types of medical responses possible among individuals, and that personalized medicine will need to emphasize the use of diagnostic skills and tests to guide selection of the treatment that is most likely to be optimal for each patient. The latter group includes Dr Raymond Woosley, President and CEO of the Critical Path Institute (C-Path), a collaboration of government, industry and academia whose goal is to accelerate the development and commercialization of targeted diagnostics and therapeutics. "I don't think personalized medicine means that we'll have a different specific treatment for every individual" says Woosley, "but that there are characteristics of each individual that can be better defined and incorporated into disease management once a diagnosis is made."

One area of personalized medicine that shows early promise is molecular diagnostics – tests used to identify proteins and other biomarkers of disease, or disease susceptibility. "One of the innovation areas with the highest impact will be the whole field of early and correct diagnoses" says Mars di Bartolomeo, Luxembourg Minister of Health. "More than anything else, we need objectivity and medical efficiency within therapy. By nature, this need will lead us to the approach of personalized medicine."

Molecular diagnostics, which include imaging and lab tests, are used to guide treatment decisions and create prevention strategies. They can predict which patients are likely to have an adverse reaction to a drug and help a physician decide whether to use a particular drug, patient by patient. That can lead to better health outcomes and could prevent black box warnings or recalls for drugs that may be highly effective for a large population but can have severe – even fatal – adverse reactions for a small subset of patients.

Considering what has been mentioned above, personalized medicine is emphasizing the ways in which diseases risks are unique and different based on the predispositions written into genome at birth combined with lifestyle and environment; treatments are then tailored to the unique findings related to the person to create personalized diets, nutritional supplements plans, exercise necessary and medicinal recommendations. It is the new integrative concept in health care that enables to predict individual predisposition before onset of disease, to provide targeted preventive measures and create personalized treatment algorithms tailored to the person. The expected outcomes are conducive to more effective population screening, prevention in early childhood, identification of the persons at risk, stratification of patients for the optimal therapy planning, prediction and reduction of adverse drug or drug-disease interactions relying on emerging technologies, such as pharmacogenetics, pathology-specific molecular patterns, subcellular imaging, disease modeling and individual patient profiles.

Several reasons have contributed to giving rise to the personalized approach:

(1) worldwide, it is estimated that 97 percent of health care systems resources are spent on disease; only the remaining 3 percent are on health;

(2) as per the rising pattern of expenditures on health over the years, it is clear that the existing systems are not sustainable;

(3) pharmaceutical companies may be pathologizing normal conditions in order to provide a bigger market for their drugs;

(4) wellness is the key to understanding human potential and to better understand diseases because it let us look at the very earliest transition of diseases and figure out how to reverse them from the beginning;

(5) the need to shift the focus from studying diseased persons to detect the factors that contribute to keeping people healthy;

(6) progression scenario in the progression of common non-communicable diseases;

(7) delayed interventional approaches to conventional medicine;

(8) problematic ethical aspects of several treatments as well as inadequate communication among professional groups and policy maker;

(9) traditional medicine focuses on the disease, not the person, one-size-fits-all-approach and on one-way communication; and

(10) the need to provide the: right treatment to the right person at the right time.

Thus, personalized medicine can help in elimination of redundant treatments, decreasing side effects of drugs, prevention and prediction of disease and earlier intervention and reduction of health care costs.

Towards establishing a personalized medicine practice, the following is highly recommended:

(1) The need for urgent and necessary launch of the National Genome Project which will contribute to the welfare and development of the society and particularly in the provision of appropriate and effective treatment especially in the early stages of life, in order to avoid the emergence of genetic and complexity diseases later in life.

(2) Providing effective treatment according to genetic makeup to reach positive results for the treatment of patients. Early intervention for treatment through an accurate understanding of the genome of the person and the common diseases in the community will in turn leads to saving time and costs of very expensive therapies.

It will also reduce the burden on state budgets through the early detection of disease-related genome.

(3) The development of professional competence in this important specialty. It is necessary to develop national occupational skills capable of building the National Genome Project, and the continuity of the work, and scientifically consolidate these competencies.

(4) National Genome Project requires cooperation and coordination between the relevant parties, especially between the official bodies to harmonize regulations and coordination within the National Genome Project.

(5) Build and enhance the international cooperation with specialized international expertise and research centers, in building and sustaining the National Genome Project.

(6) To create effective national participation and development of an integrated plan for awareness and education about the National Genome Project because of its paramount interest and importance to the health of the individual and society.

About the author

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