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P4 Medicine: A Futuristic Approach to Health and Disease

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Abstract: *In today's age of innovation and rapid technological advancement, there are variety of modern medical diagnostics, "omics" data, bioinformatics computing softwares, devices, biological tools and drugs available globally. System biology and digital revolution are further transforming P0 medicine (Physician centered, paternalistic, autocratic) model to P3 and P4 medicine model. P4 medicine paradigm of healthcare is Predictive, Preventive, Personalized, Participatory healthcare proposition. It is predictive as the genetic risks for many diseases are identified, signs of illness are recognized at cellular level before it manifests. The effects of disease are known and planned for in advance. It is preventive as the people are supplied with diagnostic tools to identify the initial symptoms of disease when it can be adjustable and can be reversed back to its normal. It can be made personalized by putting efforts on the discrete personal care rather than all inhabitants in one go and hence stop it for further spread. It is participatory as the patients are fully well-versed about their health reports and hence they are better equipped to create their own health care assessments and take final decisions. The ultimate objectives of P4 medicine are to improve health care, reduce cost of healthcare and stimulate innovation and creation of new collaborations.*

Keywords: *P4 medicine, omics data, system biology, wellness*

I. INTRODUCTION

P4 medicine is an interdisciplinary approach to medicine which aims to engage people from computer science, basic science researchers and clinicians for the integration of information from different levels of genetic information, cell organs, individuals, populations and environment. The 4 P's in P4 Medicine stands for the Predictive, Preventive, Personalized and Participatory treatment. Perturbations that occur through genetic mutations, environmental influences or both can be studied by making blood as a diagnostic space differentiating the wellbeing and disease. It engages dense, dynamic data clouds to study the personal health and sickness and assess individual's genetic information and environmental influences on fitness of an individual. This envisions drug trials that are personalized by studying the genomics, proteomics and metabolomics of the individual.

The revelation of medicine that is having the idea of p4 medicine was first endorsed by Leroy Hood (Fig 1) and other medicine researchers during 2000 (1) Its two major objectives are to quantify wellness and demystify disease. P4 medicine is the clinical face of systems medicines which use body fluid - blood as a investigative substance for watching wellbeing and sickness in the person. P4 medicine provides new futuristic approaches to drug target discovery and drives intense economic, policy and social changes.(2)

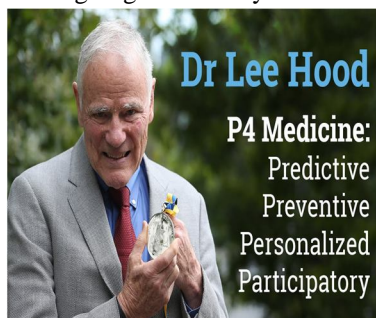


Fig 1 Dr Lee Hood

The earlier medicinal chemistry dealt with the introduction of new therapeutic agents with the sound knowledge of organic chemistry, biochemistry and pharmacology. It helped to improve the beneficial effects of drugs and minimize the undesirable side effects. Presently medicine has been looked upon at molecular level and as an approach to understand the use of treatment of disease through the use of biologics, omics, databases and structured methodologies. By using highly fast and developed computer cloud technologies, it permit one to search new magnitudes of persistent patient's data space, changing investigative tools to handle and interpret indefinite amount of data and facts with high precision.(Fig 2)

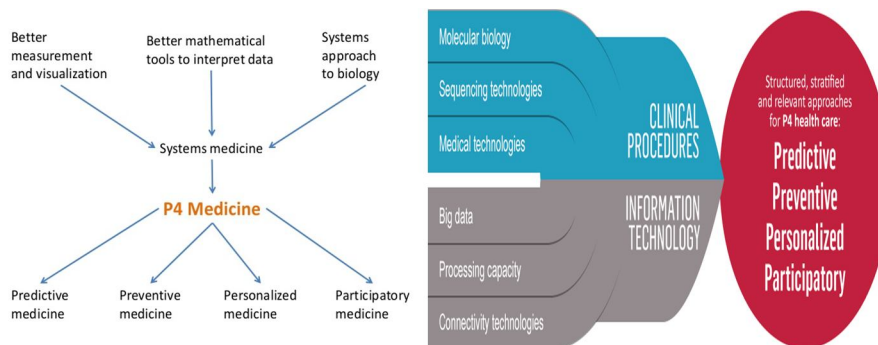


Fig 2: The P4 Model

A. Predictive Medicine

Envisaging abnormal functions and identifying disease pre-cursors permits one for pro-active mediations to understand the fundamental mechanisms before warning sign appear. Predictive medicine is required to make the outline for disease prohibition when a threat appear physical by the patient, expecting an increased possibility for adverse effects. All attempts must be taken to avoid the various risk factors, reversing the conditions of the patients the to the normal condition of health. This need the immediate attention by a group of health care specialists to take care of these healthy people in asymptomatic phase , to identify the safety of these patients with upcoming abnormality, inhibiting the advancement of the disease at the least and preferably looking for the possibility of reversion. (3)

B. Preventive Medicine

Averting diseases at the earliest requires a deeper study of its origin, development and spread of the enduring disease. This can be managed by applying advanced information technologies, medicinal tools, diagnostic approaches that can stop the unwellness in starting Stage A and guarantees the non manifestation of risk factors for chronic disease to occur. (4)

C. Personalized Medicine

Causes of differences between individuals is due to independent assortment, due to genetic changes and during reproduction (through meiosis) and various mutational events. We are all dissimilar and our genomes, micro- and macro environments are also different. Diseases need to be classified with reference to the genetic material present in each individual, even the identical twins born by same mother have this difference as having different finger prints (Fig 3) . The people themselves will own the responsibility of their health, unwellness and observation of medical reports and treatments to get back to their healthy state at the earliest.

Left Index Fingerprints from Identical Twins



Fig 3 The Personalized Medicine

In p4 system, the data of each individual will be compiled at one place through cloud computing which will record the medical reports, medical record, health documents – like blood reports, genomic analysis, proteomic analysis, allergy tests, lifestyle data, complete details of RNA transcripts under different situations, and gut microbiota analysis covering various inflammatory bowel conditions like painful swelling and redness etc.

This data will be readily available with a copy given to each individual for its emergent action. The individual's various life style diseases like hypertension, obesity, type II diabetes etc can be compiled with blood reports and the instruction to reverse the disease, about the life style changes, diet change and medical interventions to prevent the inception of disease. The study of biological systems and medicine take a holistic network management approach starting from cellular level → tissue level → organism level → population level. This involves a multidisciplinary collaboration from physicist, biologist, chemists, mathematicians, engineering inputs and computational expert (3,4)

D. Participatory

The medical care team and especially physicians follow conservative approach towards unwellness. In order to be P4 medicine to be successful the better-quality data assembly through self-monitoring will become an important factors. The individual must have a better understanding about ones own health. The patients data can be shared through networks for the better understanding of the disease. All this work is still in progress with continuous research and development in this area to make the treatment of this unwellness effective with the help of doctors, nurses, counsellors and paramedical staff.

II. THE P4 MODEL

The idea of health, and best state of health, may be a model-changing idea for reframing the health care sector. Within the future, medical care should shift its focus to promoting a state of health, from one person to community of residents. In addition unwellness to health alterations and learning a way to reverse common diseases at their earliest attainable stage. Within the approaching years, we have a tendency to predict that the flexibility be raised to outline true human health in a more refined manner through advancements in various scientific fields as well as liquid analysis. In instances wherever risk factors or an actual chronic unwellness designation has manifested, the main target should device a protocol to reverse the symptoms of a specific individual to a state of health and fitness depending on once genomic analysis (Fig 4)

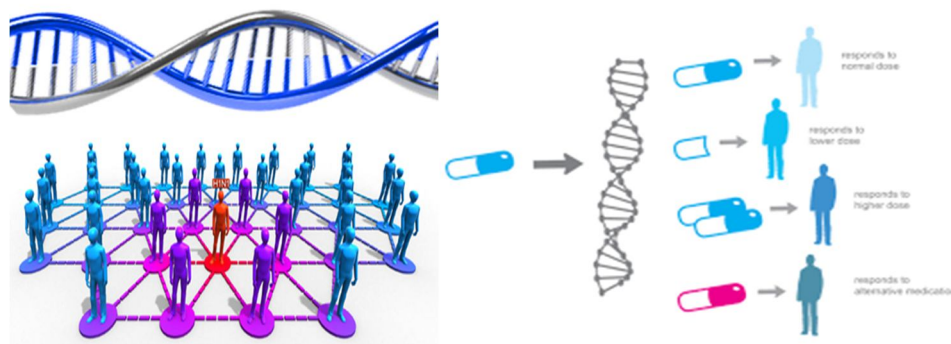


Fig 4: The p4 medicine

III. STAGES OF HEALTH AND DISEASE

A. Stages of Health

Stage A indicates a person is in good physical state. People in Stage A emulate healthy life style with wholesome diet, and regular physical activity. They maintain good health and all their lab reports are within the normal ranges. It is during this stage that individuals are having high immunity and can adapt to the stressors in the surrounding and potential threats and maintain/sustain their physiological state and promote survival. Stage B marks the initiation of detectable phenomena related to prolonged chronic unwellness. Conventional symptoms are raised blood pressure, sugar levels and other disturbances in their lab reports. Symptoms of chronic illnesses starts appearing as vital signs for chronic unwellness risk, and fatigue load. People in this stage if engaged at proper time can revert to stage A. In stage C the appearance of chronic unwellness start appearing through the strain needed for daily routine activities like climbing up the stair falls in symptoms of Stage C. The symptoms start going beyond the reach of person like consistent fatigue, as time passes the stage D is reached. In Stage D after the diagnosis of chronic disease, the management of the unwellness has to become more combative and responsive in medical care. This will involve hospitalization of the patient for various invasive and surgical procedures. Treating a full blown chronic disease, such as coronary artery disease or cancer, requires affluent interventions and require lot of expenditure. Any unwellness are often viewed as network perturbations (5-6),

B. Stages of Unwellness

The first stage of unwellness, is fatigue as a results of worldly sin like uptake of plenty of sweet food, lack of peace and instability in living conditions. The second stage of unwellness, is pain that is because of poor circulation and clogged capillaries and not enough supply of gas at cellular level The third stage, is contagious diseases. This stage could be a results of the excess of body fluids because of excessive consumption of sugar, sweeteners, fruits, spices, alcohol, harmful medication and medicines, normal and refined foods. Herpes and AIDS are a complicated style of this stage of unwellness.. The fourth stage, is that the weakness of the involuntary systema nervosum, that controls the secretion of hormones and therefore the organ start getting effected. Then the productions with thyroid, exocrine gland and kidneys / adrenal glands get influenced. Once the endocrine secretion is perturbed, the functioning of the organs is further disturbed. The fifth stage is that the unwellness of cells and organs i.e cancer. Our blood should have a pH value around seven. This acidity level is unbroken consistent and correct with the graceful functioning of organs, particularly kidneys, that separate out excess acids. Once the kidneys become weak, the blood begins to diminish alkalinity. If the pH scale reaches 6.0, then the cells die. However, between pH scale 6.0 - 7.0, rather than dying, cells begin and alter their cistron structure to survive within the acidic atmosphere. This can be the standard value of cancer cells. The predominant reason for this exacerbation is artificial chemicals in foods like preservatives, dyes, flavorings agents, softeners, antioxidants notable to be cancerous. Even what are supposed to be “safe” chemicals will become extraordinarily dangerous once combined with other “safe” chemicals. Therefore, it's suggested to avoid all foods containing such chemicals particularly cancer patients. The sixth stage, is psychological which involve emotional issues, dementia praecox, nervous breakdown, etc. This psychological condition is caused by the imbalance of the physiological / physical conditions. The seventh stage , is spiritual. It's delineated as a state of lack of feeling forever, non-appreciation and non-faith within the order that exists within the Universe.

C. Stages of Symptoms

In stage I the person is aware that something is wrong in the form of physical or sensation and a limitation in normal functioning but does not suspect any diagnosis. This is manifested in the form of fever, muscle aches, malaise, and headache as physical aspects. Perception of having Flu, worry on consequence of illness as emotional aspects. In stage II the symptoms persists and become severe they are not able to perform normal duties and role expectations. If symptoms persist despite home remedies and require emergency care the person is motivated to seek professional health services and this is stage III of symptoms

D. Blood and Haematological Agents

Blood is the connective tissue whose matrix is in solution form known as Plasma. Plasma contains blood cell like RBC,WBC and platelets which remain suspended. Solid portion of plasma contain proteins, hormones, antibodies, enzymes, non protein nitrogenous substance- urea, uric acid, ammonia, creatine, xanthine and fats- phospholipids, cholesterol, pentose and glucose. The gaseous part contain the respiratory gases- oxygen and carbon dioxide. The inorganic part has sodium chloride, calcium, potassium, bicarbonate, iodine, iron etc. Blood contain the personalized information of the patient and is source of dynamic vital information of several organs and cancerous cell.

COPD is a heterogeneous unwellness with varied breathing manifestation comprising several phenotypes driven by different pathways. These different phenotypes often differentiated using biomarkers and it helps pinpoint patients that is the basis of personalized drugs. In the Global Initiative For Asthma (GINA),the approach is to manage the medical treatment of respiratory illness. For active personalized drugs in respiratory illness , it is vital to be able to constitution and the condition in a unique way for each patients. There is an additional needs to be accurate availability of predictive and responsive biomarkers. To study the variation at cellular level a number of studies have been carried on gene modules, various biomarkers, liquid biopsy for lung cancer and other deformities (7,8) Genomic analysis structure people into subclasses with diverse responses to medicines, medications different disease threats and other clinically relevant features. Diseases such as various types of carcinoma like breast cancer, prostate cancer, crohn's unwellness which were assumed to be a single diseases, are being stratified into clinically relevant subclasses based on molecular, genetic, and cellular network interfaces (9-11). The stratifications facilitate in lot of flawless diagnoses and efficient mediations supporting the underlying sources of the unwellness. Concentrating on the causes instead of the symptoms of unwellness can modify imposition to occur much earlier in the illness process, in several cases inhibiting unwellness from arising within the major place. The medication developed using these computational models will be radically simpler, more effective and cheaper for pharmaceutical companies. Moreover, cheap and mainstream nanosensor technology to measure various analytes longitudinally is on its way (12).

In the near future, these technologies may well serve to alert people in period to any unsound alteration from healthy baseline measurements so as to prevent clinical complications such as organ failure, heart attacks (13), prion unwellness (14), liver injury (15), cancer repetition (16), polygenic disorder (17) or respiratory illness attacks (18). This theme is anticipated to be particularly powerful once combined with individualized genomic information, additionally as different biosensors continuously tracking essential variables, such as exhaled breath (19), urine (20), imaging (21) and/or ambient pathogens or allergens (22- 24). The term ‘precision medicine’ (25) is a way in which the medicine is descriptive of once unwellness, stratification of diseases and treatment supported with genetic, molecular and cellular markers of a patients in coming future (Fig 5)

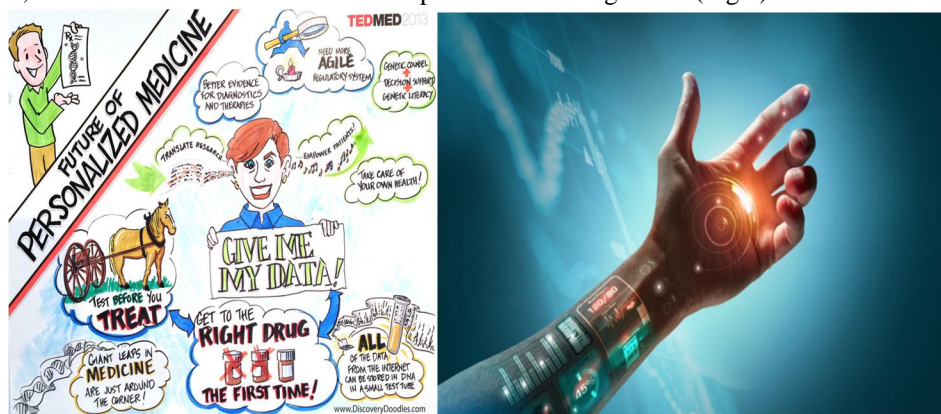


Fig 5 Future Medicine

New delicate assessment/examination procedure are presently offered for the popularity of circulating tumour deoxyribonucleic acid (ctDNA) and circulating tumor cells (CTC). There's a demand for calibration of pre investigatory issues and cross-platform analysis observation values. Liquid biopsies are measure being evaluated for treatment choice, for observance of unwellness reaction and resistance, for watching token residual infection, and for cancer designation. Multiple analysis is current to judge the clinical application of bureau and ct DNA in several settings (treatment versus resistant, adjuvant versus metastatic) and for various treatment modalities (systemic medical care, surgery, radiation therapy)(26)

IV. CONCLUSIONS

P4 medication is sort of totally different from conventional drugs. It is proactive rather than reactive. It focuses on the individual instead of populations. It focuses on health, as well as unwellness. It employs personal, dense computational analysis, dynamic information on clouds to review health and unwellness, and assess individual's genetic and environmental influences on health. It envisions drug trials that are personalized and customizes disease-prevention strategies. It will cut back the time, cost, and failure rate of pharmaceutical clinical trials, eliminates trial-and-error inefficiencies that inflate health care prices and undermine patient care.

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