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# Personalized Medicine: A Novel Way to Drug Delivery System

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**ABSTRACT:**
Personalized medicine (PM) is a rapidly growing field of healthcare and medicine. The advantage of a personalized medicine is the availability of each person's unique genetic and genomic print. The healthcare that incorporates personalized medicine provides coordinated, continuous patient-specific data. The goal of personalized medicine is to promote health wellness, satisfaction, and to increase the likelihood of a successful disease prevention, detection and treatment. The individualization of medicine and healthcare appears to be following a general societal trend. The terms "personalized medicine" and "personal health" are used to describe this process. Here it must be emphasized that personalized medicine is not limited to pharmacogenomics, but that the spectrum of personalized medicine is much broader. Applications range from individualized diagnostics, patient-specific pharmacological therapy, therapy with individual prostheses and implants to therapy approaches using autologous cells, and from patient model-based therapy in the operating room, electronic patient records through to the individual care of patients in their home environment with the use of technical systems and services. Although in some areas practical solutions have already been found, most applications will not be fully developed for many years to come. Medical and information technology are essential to personalized medicine and personal health.
**Keywords**: Personalized medicine, Pharmacogenomics, Pharmacology, Technology

## I. INTRODUCTION:

From the ancient times to promising future. It aims at confronting every obstacleon prevention, diagnosis, and treatment of diseases by targeting each patientindividually[1].

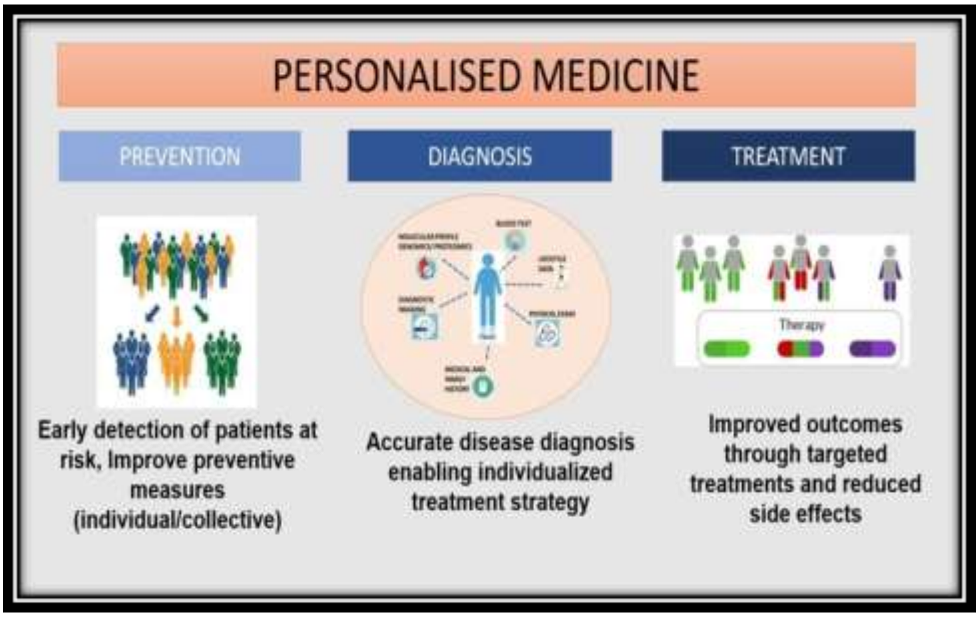


**Figure 1: Personalized Medicine**

1. More than 100 years ago, a renowned Canadian physician, William Osler,quotedthat,–Ifitwerenotforthegreatvariabilityamongindividuals,medicine might as well be a science, not an art.Over the past century, most therapeuticstrategiesweredevelopedbasedonrandomizedclinicaltrialsandappliedfor "statisticallyaveragepatient".Althoughmedicinemaycontinuetoremainanart, the 21st century bringsa newhope with successof; for example, the –human genome‖projecttotakeconsiderationofgeneticvariabilityanddeliverpersonalizedtherapysolutions[2].

2. Personalized medicine (PM) has the potential to tailor therapy with the bestresponse and highest safety margin to ensure better patient care. By enabling eachpatient to receive earlier diagnoses, risk assessments, and optimal treatments, PMholdspromise forimprovinghealth carewhile alsolowering costs.

3. We are now able to bring out best treatment options for a particular individualleading to better therapeutic outcomes and decreased adverse effects. It also hasthe potential to identifythediseaseat an earlierstage[3].

4. Itessentiallymeans usingthe rightdrugfor the rightpatient [4].

5.Among 14 Grand Challenges for Engineering, initiative sponsored by NationalAcademy of Engineering (NAE), personalized medicine has been identified as akey and prospective approach to –achieve optimal individual health decisions‖, thereforeovercomingthechallengeof–Engineer better medicines‖[5].

**A. DevelopmentofConcept**

Inpersonalizedmedicine,diagnostictestingisoftenemployedforselectingappropriateandoptimaltherapiesbasedonthecontextof a patient'sgeneticcontent or other molecular or cellular analysis. The use of genetic information hasplayedamajorroleincertainaspectsofpersonalizedmedicine(e.g.pharmacogenomics), and the theory was first coined in the context of genetics,though it has since broadened to encompass all sorts of personalization measures,[includingtheuseofproteomics,imaginganalysis,nanoparticle-basedtheranostics, amongothers [6].

**B. BasicofPersonalizedMedicine**

The concepts of personalised medicine can be applied to new and transformativeapproaches to health care. Personalised health care is based on the dynamics ofsystems biology and uses predictive tools to evaluate health risks and to designpersonalised health plans to help patients mitigate risks, prevent disease and totreat it with precision when it occurs. The concepts of personalised health care arereceiving increasing acceptance with the Veterans Administration committing topersonalised,proactivepatient driven careforallveterans [7].

**C. PersonalizedMedicinetheAbilitytoOffer**

1) Theright drug
2) Totherightpatient
3) Fortherightdisease
4) Attherighttime
5) Withtherightdose[8].

## II. PHARMACOGENOMICS

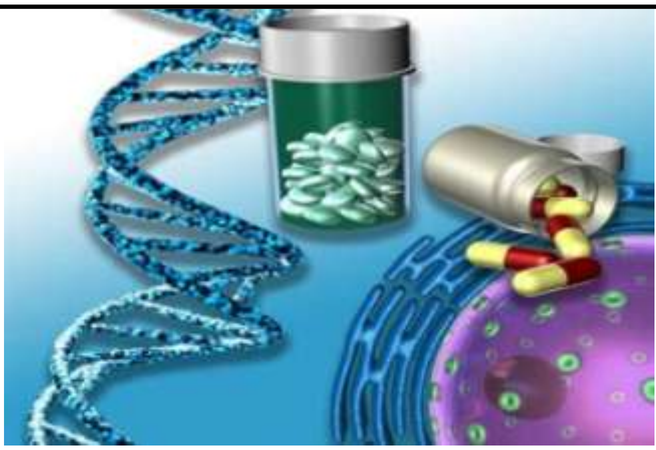

**Figure3:Pharmacogenomics**

**a. Definition**
Thestudyofhowgenesaffectaperson‘sresponsetodru gs

**b. Whatis…?GenomicSequencing**
A laboratory method that is used to determine the entire genetic makeup of aspecific organism or cell type. This method can be used to find changes in areas ofthe genome. These changes may help scientists understand how specific diseases,suchascancer,form.Resultsofgenomicseque ncingmayalsobeusedtodiagnose and treat disease[9].

**c. GeneticTest**
1) CYP450genotypetest:-
To determinehow quickly and effectively these agentsareeliminate fromthe body
2) Thiopurinemethytranferasetest:-
To treat theleukemiaand autoimmunedisorders [10].

## III. IMPLEMENTING PERSONALIZED MEDICINE

Althoughthereisincreasingevidencetosupp orttheimplementationofpharmacogenetics in certain clinical scenarios, the adoption of this approach hasbeenlimited.Theadventofpreemptiveandinexpen sivetestingofcriticalpharmacogenetics variants may overcome barriers to adoption. We describe thedesign of a customized array built for the personalized-medicine programs of theUniversity of Florida and Stanford University. We selected key variants for thearray using the clinicalannotations of the Pharmacogenomics Knowledgebase(PharmGKB), and we included variants in drug metabolism and transporter genesalongwith other pharmacogeneticallyimportantvariants[11].

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# IV. PERSONALIZEDMEDICINEFORDISEASE

### 4.1 CancerManagement

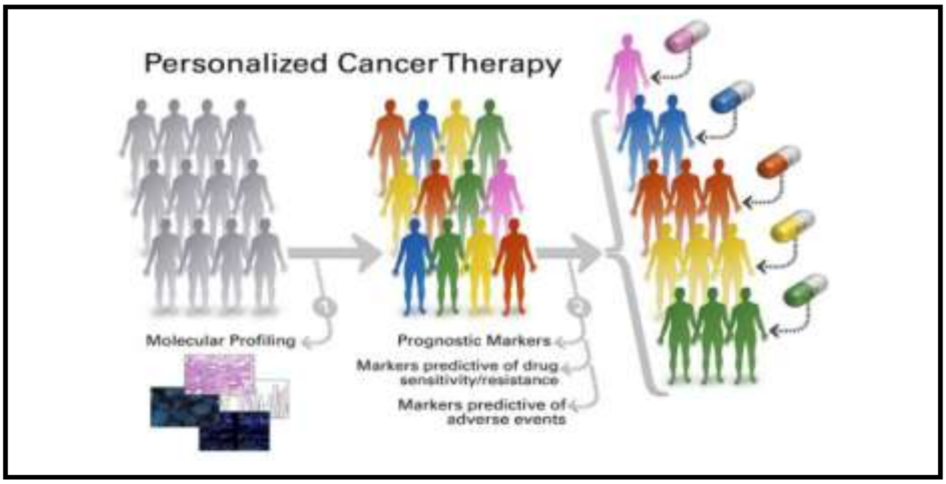


**Figure4:Personalized CancerTherapy**

Oncology is a primary section of medicine consisting of various cancer phases,measured in centimeters in most cases, and types with regard to their anatomy andpathology. Cancer genetics is a subgroup falling under the category of oncologythat is focusing on genes and is associated with inherited cancer risk (Mansour &Schwarz,2008).Thereisalimitednumberofcancerousdisordersinwhichhomogeneity separates in an autosomal dominant fashion, leading to considerablyhigher risk for certain cancers types. It is considered that inherited cancer geneticsfactors explain only about 5-10% of all cancers cases. Nevertheless, other geneticmodifications with more indirect effects associated to cancer risk may triggerdetailed cancer risk valuation to patients who are not associated with a familyhistory(Yan, 2008).Examples ofpersonalizedcancer management [12].

### 4.2 RenalCarcinoma

Kidney, or renal, tumors are often discovered at an early stage and are frequentlytreated with partial nephrectomy, a surgical procedure in which the tumor and partof the kidney are removed. However, some patients, including those with chronickidneydisease, arepoorcandidates for surgery.

–Theremaybeclear-cutriskswithanoperationinthesepatients,‖saidstudy lead author Stella K. Kang, M.D., M.S., assistant professor of radiology and populationhealthatNYULangoneHealthinNewYork City.–Patientsmayhavesignificant heart disease or other comorbidities, or a limited life expectancy for some otherreason‖[13].

# V. PATIENT NEED FOR PERSONALIZED MEDICINES

The current set-up of conventional pharmaceuticalmanufacturing isbased onmass production of selected dosage strengths. This creates challenges especiallyfortreatmentofchronicdiseasesincludingcardiovasculardiseases,type2diabetesaswellasbraindisorders.Manyofthediseasetreatmentsrequiremultiple doses to be delivered to the patient based on severity of the disease,lifestylechanges,co-administrationof other medication,aswellasgoing offmedication. Furthermore, different subgroups of patients such as, pediatrics andgeriatricswould require age-approaches [14].

### 5.1 Additive Manu facturing(AM) as a Digital Technology for Personalized Drug Delivery Systems(PDDS)

To overcome the challenges of the currently marketed drug products, innovativesolutionswithimprovedfunctionalitiesare needed.Onesuchinnovationispersonalized drug delivery systems (PDDS) defined in this review as solid dosageforms, containing the patient-tailored precise dose of a single or multiple APIs andpossessing customized appearance that can aid in drug identification, swallowability, release and

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monitoring of the treatment. Additive manufacturing (AM),basedondifferenttwo-dimensional(2D)andthree-dimensional(3D)printing techniques,hasrecentlyemergedasanewtechnologyforPDDSduetoitsversatilepossibilities of producingon-demandflexibledoses[15].

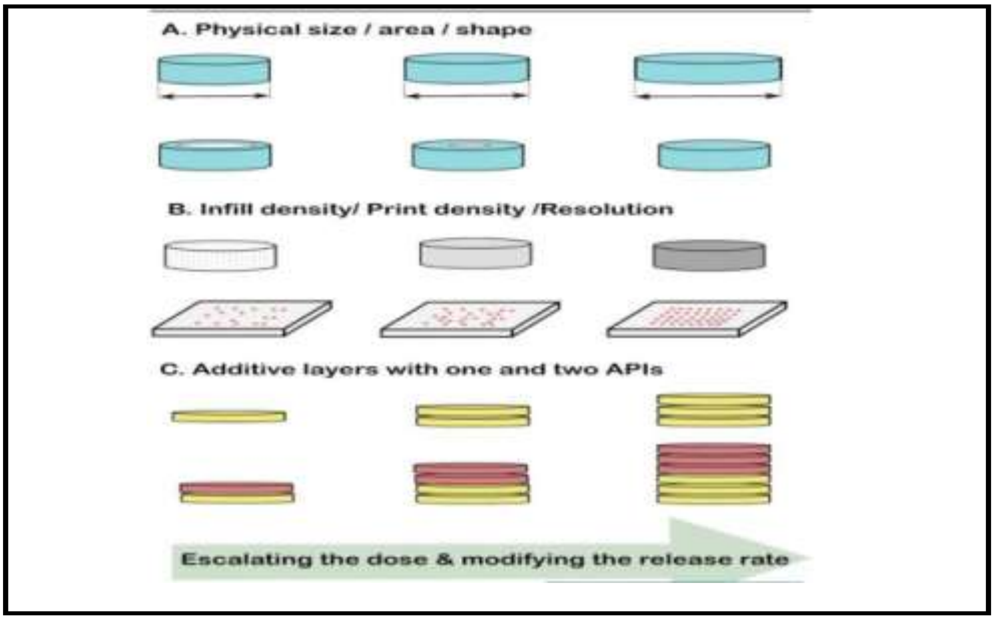


**Figure5:APIofPersonalizedMedicine**

### 5.2 StandardSmartphone

Over the past decade, 85% of the European an mobile d US phone users had asmartphone. A smartphone, its sensors and associated mobile applications can beused as a tool for gathering quality data for medical research, or regular healthcarepractice, as data can be gathered from the subjects unobtrusively for long periodsoftime,inalaboratory,aswellasinasubject‘snaturalenvironments.Thesmartphone can also become a ―sensor for medication adherence‖– either by actingasareminderorengagementservicetotakethemedicineoravoiddouble dosing,orrelyingonsmartphonesensors–quantifyinghumanstatesandbehaviours related to adherence or tracking symptoms (or lack of those) in theindividual‘s daily life environment. It is also used as processing and displayingtool with a sharingpossibilityto track thedrugintake[16].

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**Figure6:Digital Heath Care System of Personalized Medicine**

**5.3 DigitalTherapeutics**

1) They rely on some existing hardware (wearable and/or smartphone) and, areproviding,amongothers,game-basedandquestionnaire-baseddiagnostictoolsandsuggestions fortreatment and,potentially, feedback


**Figure7:DigitalTherapeutics**

Loop-drivenalterationinthetreatmentregime.Inthelongterm,digitaltherapeutics aim to have the potential to make patient‗s life drug-free for certainconditions

2) They come into play and gain user acceptance as ―theillusionthatalltherapy mustbedeliveredin-personisnowfading‖.InOctober2020,theDigitalHealthcareAct(DVG)officiallygranteddoctorsinGermany permissiontoprescribe insured health apps to their patients for the first time. Currently, ten appshave been approved; amongst which there are for example are (1) Kalmeda® app,which aims to help with tinnitus and (2) Velibra®, a therapy program for anxietydisorders[17].

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### 5.4 Apps Used for Health Care

Bluster®Neurorehabilitatio
n Clam®EndeavorRx™
Kalmeda®PainDrainer®

## VI. POTENTIAL OF 3D PRINTING IN PERSONALIZED MEDICINE

One of the major potentialsof 3D printing inthe pharmaceuticalsector isitsability to tailor the dosage forms to individuals. This can be done by fabricatingadequate dosage forms, adjusting the doses, combining them or by varying thereleaseprofiles of thedosageforms accordingtotheneed of patients.

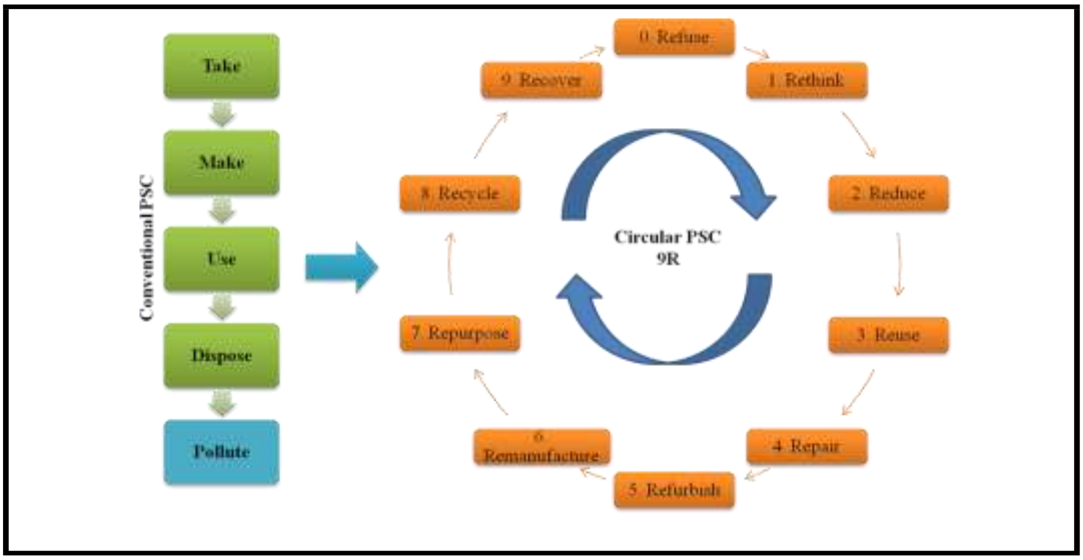
Dose PersonalizedIn ODF formulations, this can be easily done by modulatingthe amount of liquid API dispensed on the film. ODFs can also be subjected tochangesin shapeand dimension to individualizetreatments[18].

## VII. PHARMACEUTICAL SUPPLY CHAIN(PSC)

### 7.1 ConventionalSupplyChainModel

ThePharmaceuticalSupplyChain(PSC)isquitecomplexandwithspecialcharacteristics, whichare typically not seen in supply chains for other consumergoods. These special characteristics include the need for higher security, completetraceability and secured record keeping, especially if records contain sensitiveinformation. A study by McKinsey & Company found that in the United States,supply chain accounts for nearly 25% ($230 billion) of pharmaceutical cost. Thisfact alone is indicative of the complex nature of the conventional PSC model andengagement ofmultiplestakeholders(Fig.3).It involvestheflowof raw materials to pharmaceutical manufacturers, followed by a flow of finished pharmaceuticalproductsthroughthechainofwholesalersanddistributors,retailers,and,ultimatelytoend-userspatients and healthcareprofessionals.

Figure8:ConventionalSupplyChainModel



The ultimate goal of the series of regulations enforced in the PSC is to achieveunit-level traceability by 2023, where unit is defined as a single sealable entity. Asealable unit can be the primary package with multiple dosage units, e.g., a blisterpackage with tablets or, or a primary package with a single dosage unit, e.g., anoral film [19].

### 7.2 DiagnosisandIntervention

Having the ability to look at a patient on an individual basis will allow for a moreaccuratediagnosisandspecifictreatmentplan.Genotypingistheprocessofobtainingan individual‘sDNAsequencebyusing biological assays[20].

### 7.3PersonalizedMedicine MatchingTreatmentstoYourGenes

You‘re one of a kind. It‘s not just your eyes, smile, and personality. Your health,riskfordisease,andthewaysyourespondtomedicinesarealsounique.Medicines that work well for some people may not help you at all. They mighteven cause problems. Wouldn‘t it be nice if treatments and preventive care couldbedesigned just foryou?
Thecarefulmatchingofyourbiologytoyourmentalcare isknownaspersonalized medicine. Its already being used by healthcare provider nationwide[21].

### 7.4 PersonalizedMedicineandDrugSafety

By matching the drug to the right patient, a consequence of personalized medicineis improved drug safety. There is, however, a limit to which drug safety can bedesignedintoamoleculebasedonphysicochemicalandpharmacokineticconsiderations. Consequently, additional interventions are required. They includedesigningtargeted drug-deliverysystemstagged forthe targetcellscells[22].

### 7.5 Method

In order for physicians to know if a mutation is connected to a certain disease,researchersoftendoastudycalleda‒genome-wideassociationstudy‖(GWAS). A GWAS study will look at one disease, and then sequence the genome of manypatients with that particular disease to look for shared mutations in the genome.Mutationsthatare determined tobe related toadisease by aGWASstudy canthen be used to diagnose that disease in future patients, by looking at their genomesequence to find that same mutation. The first GWAS, conducted in 2005, studiedpatients with age-related macular degeneration (ARMD). It found two differentmutations, each containing only a variation in only one nucleotide (called singlenucleotidepolymorphisms, or SNPs),which wereassociated with ARMD[23].

### 7.6 TissueEngineeringforDrugDiscoveryand PersonalizedMedicine

During the past century, animal models have provided a wealth of knowledge andunderstanding of the mechanism of human disease and therapy and played a vitalrole in medicine and drug discovery. However, the use of these models in researchand industry remains the focus of intense ethical debate and brought further intofocusbygovernmentagenciesandresearchbodies whohaveendorsedtheimplementation of the 3R‘s initiative aimed at the Replacement, Reduction, andRefinementofanimalsinallareasofresearch.Coupledtothis,thelackoftranslationalresearchoftenfoundin animalmodelsthathaveledtoseveralexamples where toxicity and damage have not been found in animal models andefficacy either over or underestimated has led to costly and sometimes fatal drugfailuresduringhumanclinical studies[24].

## VIII. WHAT IS PRECISION MEDICINE?

Precisionmedicineaimstocustomizehealthcare,withdecisionsandtreatments tailored to each individual in every way possible. Pharmacogenomics ispartofprecision medicine.

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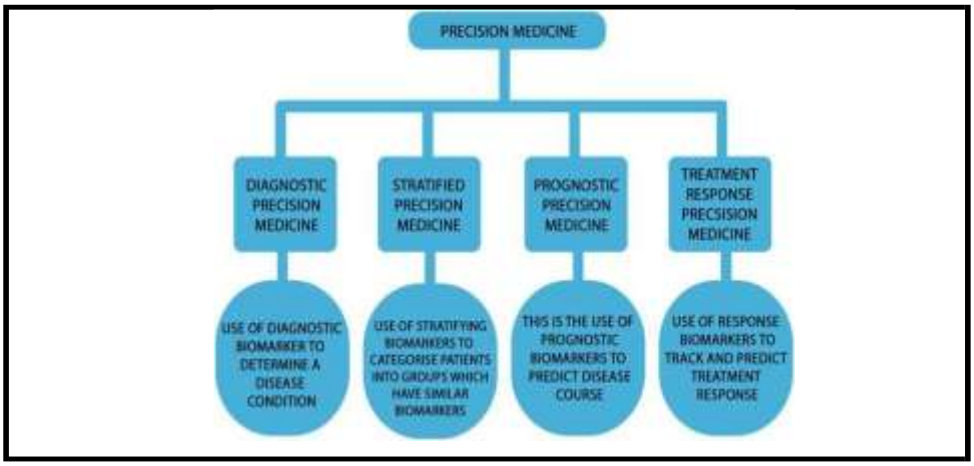


**Figure9:Precision Medicine**

Although genomic testing is still a relatively new development in drug treatment,thisfieldisrapidlyexpanding.Currently,morethan200drugshavelabelinformationregardingpharmacogenomicsbiomarkers—somemeasurableoridentifiable genetic information that can be used to individualize the use of a drug[25].

## IX. THE GREAT PROMISE PERSONALIZED MEDICINE

Apatientisdiagnosedwithnon-small-celllungcancer.ADNAtestcosting$1,000 reveals the subtype of his cancer. The test indicates that the most effectivetreatment will be an oral drug rather than Chemotherapy. Thus, through genetictesting of the tumor, the patient is treated more effectively and with a Longersurvivalbenefit.

A woman with atrial fibrillation, a heart condition, is prescribed the widely usedblood-thinningdrugWarfarin.A$350genetictestisperformed,lookingforvariations in two specific genes that affect the Body's metabolism and response tothedrug.Combinedwithotherfactors,thetestindicatesaproperDosagerangefor her. Thus, with a test that looks at her genetic profile, she is prevented fromsuffering uncontrolled bleeding or life-threatening blood clots and risk of strokethatcan accompanythe useof this Powerful drug.

These are examples of personalized medicine in practice. Of course, physicianshavealwaysbeenalerttoVariationsbetween patients.Buttheterm–personalized medicine‖ reflects the growth of scientific Understanding and medical tools thatcanhelpindividualizecareatanewlevel.Suchtools canhelpmatchTreatmentsto individual genetic variations, or differentiate between subtypes of disease. Andthat can help take the guesswork out of medicine, making healthcare decisionsmoreprecise and effective, oftenatLower cost.
Theopportunityofpersonalizedmedicinestemsfromadvancesinmolecularbiology,especiallytheExplosion ofnewknowledgeofthehumangenome.Itis already working for patients with some conditions, and it has the potential totransformtheeffectiveness of medicalcarein theimmediatefuture.For example, most drugs prescribed in the United States are effective for fewerthan 60 percent of treated Patients. This is not because of shortcomings of thedrugs,butratherbecauseeachofusisbiologicallyUnique.Thetoolsofpersonalized medicine can help direct the right treatment to the right patient. ThePotentialimprovements inhealth aswell assavings inhealth costsarevast.

Likewise, our conception of disease needs to be more precise in order to betterindividualize care. For Example, when we refer to asthma, it is a respiratorydisease butthereare many varieties.FromaTreatmentperspective,they aredifferent diseases, but we are just at the cusp of identifying them Accurately andproviding the right treatment on the first encounter. We refer to breast cancer, yetin reality There is no such single disease. Rather, cancers of different kinds mayarise in breast tissue. One result is that most women who are treated with painfulandexpensivechemotherapiesarereceivingtreatmentsThatareactuallyineffectivefortheircondition.

Withpersonalizedmedicine,wecanimprovethe current paradigm. The explosive growth of scientific Discoveries at the molecularlevel, accompanied by advances in technology and analytical capabilities, Bringthe promise of greater precision and effectiveness in medicine. Over time, weshould be able to Prescribe medicines with foreknowledge as to their effectivenessfor individual patients and disease Subtypes. Over time, increased knowledge ofgenetics and molecular biology should also enable us to detect Disease beforesymptoms appear, making possible earlier treatment and even preemption of thedisease. Personalized medicine, as promising and as transformative as it is, cannotbe implemented if it is going to Result in a great increase in healthcare costs. Butthe practice of personalized medicine can be an Important part of achievinghigher value in healthcare. In the case of warfarin, for example, adverse eventsRelatedtodosageproblemsmakethisdrugaleadingcauseofdrug-relatedemergency room episodes. More accurate dosing, enabled by a relatively low-costgenetic test, might save as much as $1 billion per Year while delivering better-qualitycare and better health[26].

## X. CHALLENGES

As personalized medicine is practiced more widely, a number of challenges arise.The current approaches to intellectual property rights, reimbursement policies,patient privacy, data biases and confidentiality as well as regulatory oversight willhave to be redefined and restructured to accommodate the changes personalizedmedicinewill bringto healthcare [27].

### 10.1 Benefits

1. Shifttheemphasisinmedicine fromreactiontoprevention
2. Predictsusceptibilitytodisease
3. Improvediseasedetection
4. Preemptdiseaseprogression
5. Customizedisease-preventionstrategies
6. Prescribemoreeffectivedrugs
7. Avoidprescribingdrugswithpredictableside effects
8. Reducethetime, cost,andfailurerateofpharmaceuticalclinicaltrials
9. Eliminate trial-and-error inefficiencies that inflate health care costs and underminepatient care[28].

### 10.2.TheUseofPharmacogeneticsInformationisCentraltotheConceptofPersonalizedMedicine

Understanding pharmacogenetic differences in drug response and tolerability hasbeeninvestigatedmainlythroughthestudyofpharmacokineticandpharmacodynamic processes. The hope and promise of pharmacogenetic testinghaveledtothecommercialavailability ofseveraltestingproducts.Withtheexception of the relationship between certain types of adverse drug reactions andimmune response genes such as the human leukocyte antigen, a growing body ofresearch has not yet established the clinical utility of pharmacogenetics testing.Variance in findings from pharmacogenetics studies conducted to date may be duetoepistasis(gene-geneandgene-environmentinteractions),epigenetics(non-DNA sequence-related heredity), or other genetic factors, which have been largelyunexploredin pharmacogenetics research[29].

## XI. PSYCHIATRIC PATIENTS

Tendtoexhibitsignificantinterindividualvariability intheirresponsestopsychoactive, as well as an irregular clinical course. For these (and other) reasons,increasing numbers of psychiatrists are turning to genotyping for help in selectingthe psychopharmacologic agents best suited to an individual patient‘s distinctivemetaboliccharacteristicsandclinicalpresentation.Fortunately,routinegenotyping is already available for gene variations that code for proteins involvedinneurotransmission,andfordrug-metabolizingenzymesinvolvedintheelimination of many medications. Thus, genotyping-based personalized psychiatryis now in sight. Increasing numbers of clinically useful DNA microarrays are inthe development stage, including a simplified procedure for genotyping patientsfor CYP2D6, which metabolizes a high proportion of the currently prescribedantidepressantsandantipsychotics.Ithasbeenpointedoutthatpsychiatricdisease israrelyaconsequenceofanabnormalityinasinglegene,butreflectstheperturbations of complex intracellular networks in the brain. Thus, analysis offunctionalneuronalnetworksisbecominganessentialcomponentofdrugdevelopmentstrategies.Theintegrateduseoftechnologiessuchaselectroencephalography,magnetoencephalography,functionalmagneticresonance imaging (fMRI), and diffusion tensor imaging (DTI), in combinationwithpharmacogenetics,promisestotransformourunderstandingofthemechanisms of psychiatric disorders and their treatment. The concept of networkmedicine envisions a time to come when drugs will be used to target a neuralnetworkratherthansimplycomponentswithinthenetwork.Personalizedmedicine in psychiatry is still at an early stage, but it has a very promising future[30].

## XII. THE DEVELOPMENT AND PROSPECTS OF CONVENTIONAL THERAPEUTIC DRUGMONITORING

Thedevelopmentandprospectsofconventionaltherapeuticdrugmonitoring (TDM) and pharmacogenetic testing as aids in personalized treatmentwithantidepressantsandantipsychoticsaredescribed.Ourownexperienceisdiscussed in relation to international guidelines for rational TDM. Emphasis is puton the usefulness of TDM combined with genotyping of cytochrome P450 2D6(CYP2D6),thekeyenzymeinvolvedinthepolymorphicmetabolismofthemajorityofantidepressants(bothtricyclicsandselectiveserotoninreuptakeinhibitors) and antipsychotic drugs. This combination of methods is particularlyuseful in verifying concentration-dependent adverse drug reactions (ADRs) due topoormetabolism, anddiagnosingpharmacokinetic reasons(ultrarapidmetabolism(UM))fordrugfailure. ThisisbecauseADRsmaymimicthepsychiatric illness itself and therapeutic failure due to UM may be mistaken for poor compliance with the prescription [31].

## XIII. ADVANTAGES AND DISADVANTAGES OF PERSONALIZED MEDICINE

**13.1Advantages**

- Increasesthechancesofadoctortousethepatient's geneticandmolecularinformation.
- Enhancesthe abilityto predictthebesttreatmentforaspecificpatient
- Itimprovesthe abilitytounderstand theunderlyingmechanismsofthedisease.
- Ithelps in preventing,diagnosingand treatingarangeofdiseases [36].

**13.2 Disadvantages**

- Despitenumerousbenefitsofpersonalizedmedicine,aspreviously described,there are alsomany drawbacks which could prevent it from becoming the futureofhealthcare.
- A major concern of the increased use of personalized medicine is the ethical issueof patient privacy. For example, there are concerns that some may not use thisinformation in an ethical way, such as insurance companies who may not offercertainpolicies to thosewith geneticpredisposition.
- Therearealsootherethicalconcerns,suchasincidentalfindings[37].

## XIV. BRIEFHISTORYOFPERSONALIZEDMEDICINES

By the 20th century, clinicians had developed a kind of personalized approach tothetreatmentsofpatients.Forinstance,aftertheriseof bloodtransfusions,knowledge accumulated that indicated that individuals differ in blood groups. Itwasalsonotedthatgroupingsuchpeopleresultedinsuccessfulbloodtransfusions.The doctorslater advancedinthedocumentationof individuals'relations to diseases depending on their families' histories. This was done indiseasesthat seemed tobe passed fromgeneration to generation.

The personalized medicine became more concrete at the beginning of the 21stcentury with the solidification of the Human Genome Project. This project took anew approach that connected the genetic makeup of individuals and their health.Thisenabled thedoctorstoconductgenetic mapping. Genetic mapping revealsthat 99.1% of an individual's genetic makeup is identical. The rest is varied by thedifferences that exist in the species of human beings. This explains why differentindividualsresponddifferentlytodifferentmedications,hencenecessitatingtailoringthe medication to an individual based ontheirvariations[38].

## XV. INTHEFIELDOF4PMEDICINE

That is Predictive, Personalized, Preventive and Participatory.It is clear thatpersonalized medicine is still at its infancy and its huge potential has yet to beunlocked.ClaimedissupportingkeyHealthcareplayersinaddressingthepromisingfieldofpersonalizedandprecisionmedicineandpromotingtheirdevelopment,from R&Dto market accessandadoption[39].

## XVI. KEY TECHNOLOGY ADVANCED, MAKING PERSONALIZED MEDICINE POSSIBLE AND FASTER PACE OF GROWTH, INCLUDING;

Newtoolstodecodethehumangenomemorerapidlyandaccuratelyusingphysically smaller yet more powerful machines. Large-scale studies and samplerepositories that help link genetic variations to disease across multiple countriesand continents. Health information technology (HIT) that fosters the integration ofresearch and clinicaldata, which isalready growing faster inthe U.S.as a resultof aggressive government incentivesfor adoption. Explorationsof–personal genomics‖ anddirect-to-consumergenetictestingandhowthefieldaffectsPM.

Information about ground-breaking policy, legislation, and government initiativesin place and in development to support PM, including the Genetic InformationNon-discrimination Act (GINA), passed in 2008, and proposed changes to healthplan reimbursement policies. Real-world examples of hospitals, regional healthcaresystems,andeducationalinstitutionspromotingclinicaladoptionofPMthroughresearch,clinicalpractice,and medicaleducation reform[40].

## XVII. CONCLUSION

As the new trend of Personalized Medicine has the potential to fulfil the requirement to improvehealth outcomes by reducing healthcare costs, drug-development costs and time.Now we can see people are more involving in this revolution in the healthcaresystemwillonly bepossibletoachieveby equalcontributionofpatientandconsumersinparticipatinginclinicaltrials,entrepreneursandinnovatorstodevelop smart tools and analyze the genetic information, regulators by educatingconsumersandproviders,andsupportessentialrevolutionsinpolicyandregulation, physicians to understand the disease at the molecular level, academicresearchers by accompanying innovative research to uncover new insights at themolecular basis of disease and supporting target-based drug development, So thenew trend ofPersonalized Medicine is increasingdaybyday.

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