

# **Personalized Medicine: The Changing Landscape of Healthcare**

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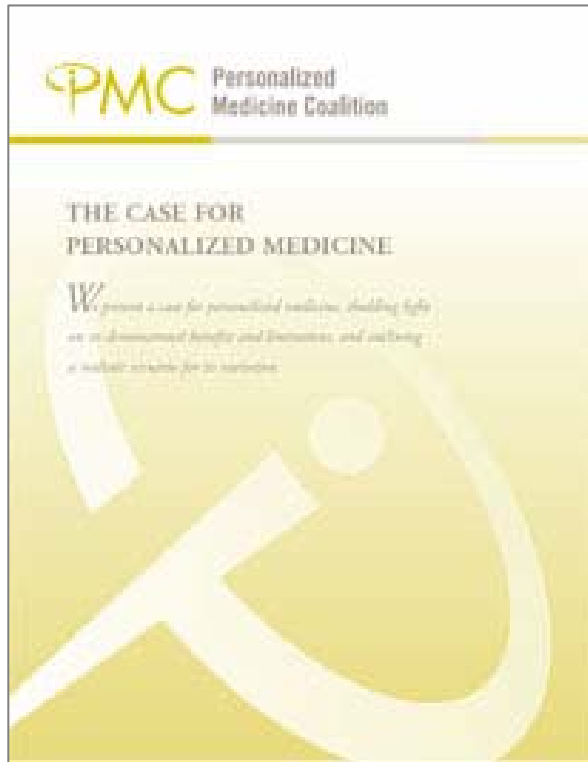
## Learning Objectives

- List the advantages for a personalized medicine approach to healthcare
- Illustrate how personalized medicine impacts therapeutic drug management.
- Understand the regulatory issues of personalized medicine reimbursement
- Explain the role of the Personalized Medicine Coalition as a motivator for change.

# Personalized Medicine:

## What is it?

# What is Personalized Medicine?



By using molecular analysis to achieve optimum medical outcomes in the management of a patient's disease or disease predisposition, personalized medicine promises to introduce a new standard of healthcare.

# What Are the Potential Benefits of Personalized Medicine?



Advocates of personalized medicine stress its potential to:

- Detect disease at an earlier stage, when it is easier to treat effectively
- Enable the selection of optimal therapy and reduce trial-and error prescribing
- Reduce adverse drug reactions
- Increase patient compliance with therapy
- Improve the selection of targets for drug discovery
- Reduce the time, cost, and failure rate of clinical trials
- Revive drugs that failed clinical trials or were withdrawn from the market
- Avoid withdrawal of marketed drugs
- Shift the emphasis in medicine from reaction to prevention
- Reduce the overall cost of healthcare

# What is Personalized Medicine?



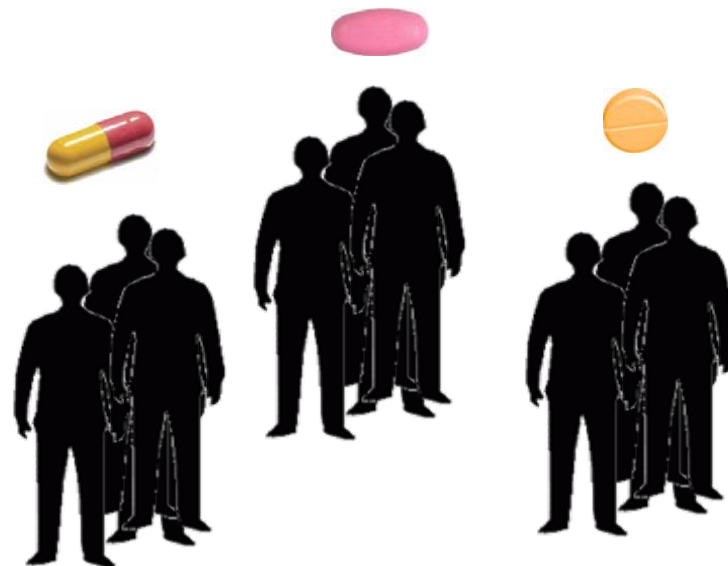
## Current Practice



One size fits all

Trial and error

## Personalized Medicine



The **right treatment** for  
the **right person** at the  
**right time**

# Major Drugs Ineffective for Many...



**Hypertension Drugs 10-30%**

ACE Inhibitors



**Heart Failure Drugs 15-25%**

Beta Blockers



**Anti Depressants 20-50%**



**Cholesterol Drugs 30-70%**

Statins



**Asthma Drugs 40-70%**

Beta-2-agonists



# ...And Harmful to Some



- 100,000 deaths per year
- Just in hospitals: about 6.7% of patients (2.2 million) experience serious adverse drug reactions



Serious adverse drug reactions in even smaller percentages of treated populations have led to the withdrawal of several drugs from the market

**Zelnorm**

**Vioxx**

**Cylert**

“Are good drugs going to the wrong people?”

**Rezulin**

**Baycol**

**Lotronex\***

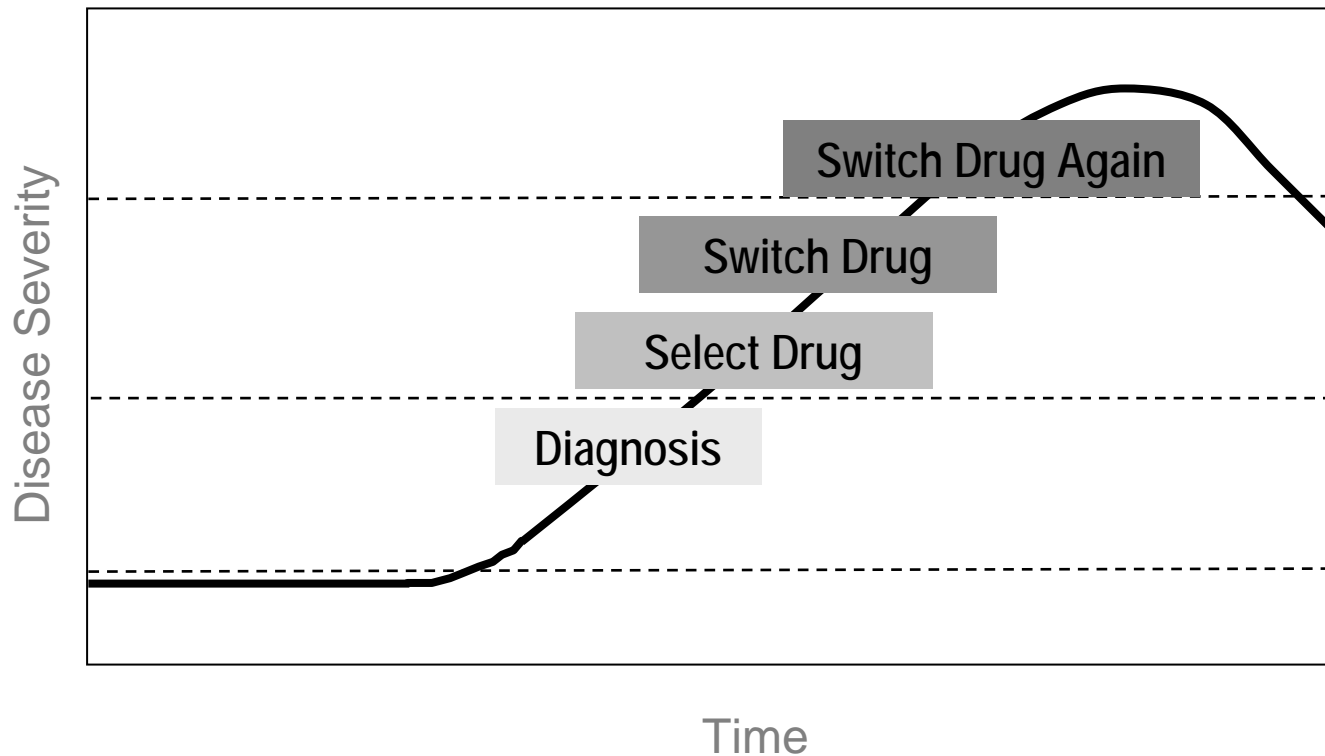
\*Reintroduced in 2002 after a very strong campaign from patients who saw it as an important drug that should be made available again, even with restrictions.



# The Old Paradigm: Treatment of Disease



## Reactive Medical Care

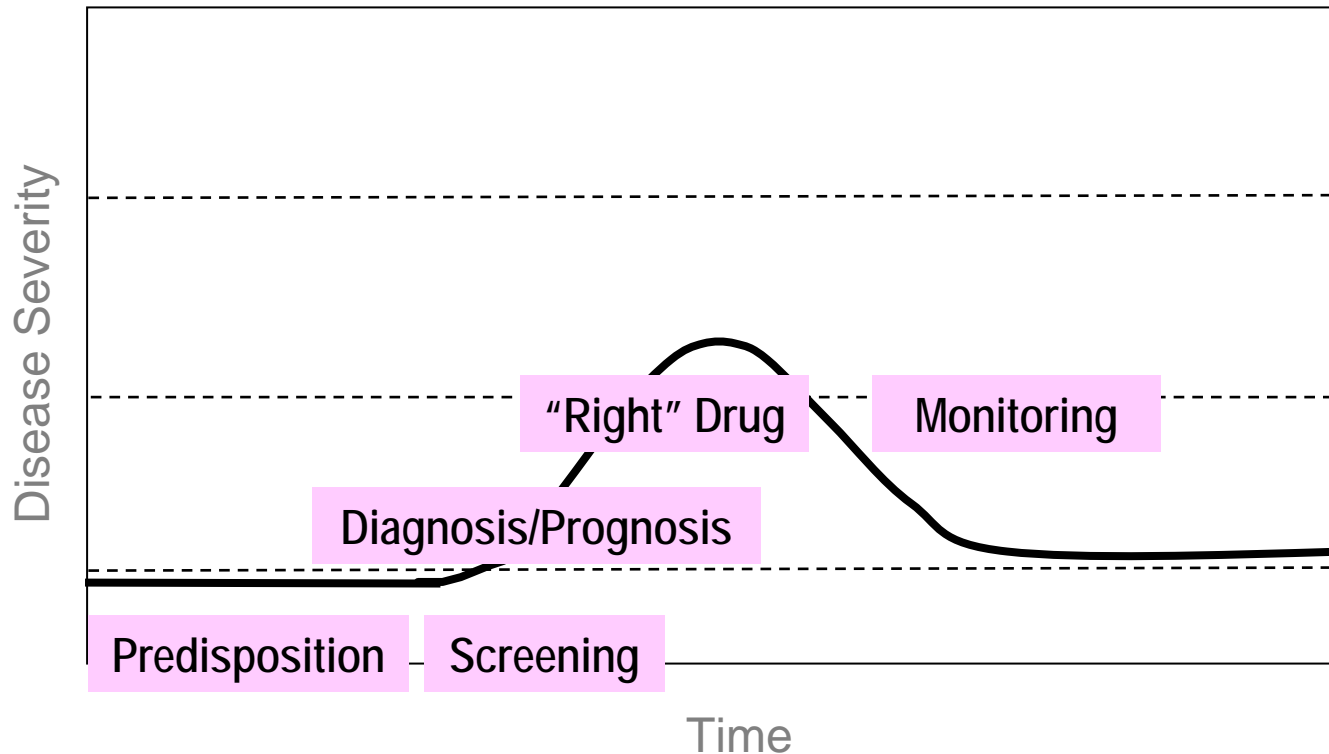


*Diagnose Disease; Treat Symptoms; Costly, Trial and Error Treatment*

# Personalized Medicine Paradigm: Health Management



## Efficient Medical Care

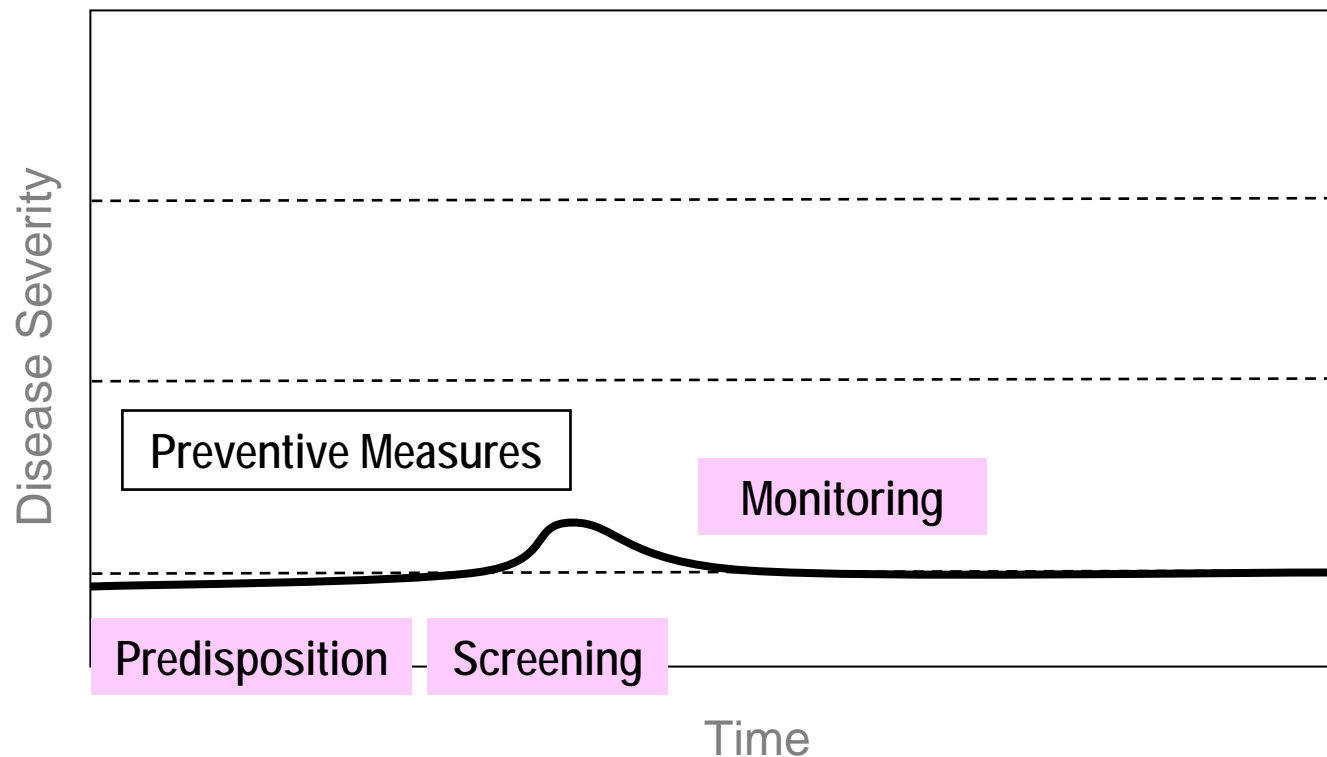


*Health Management; Molecular Screening; Early Detection;  
Rapid Effective Treatment; Improved Quality of Care*

# Personalized Medicine Paradigm: Moving Healthcare Upstream



## Preventive Medical Care



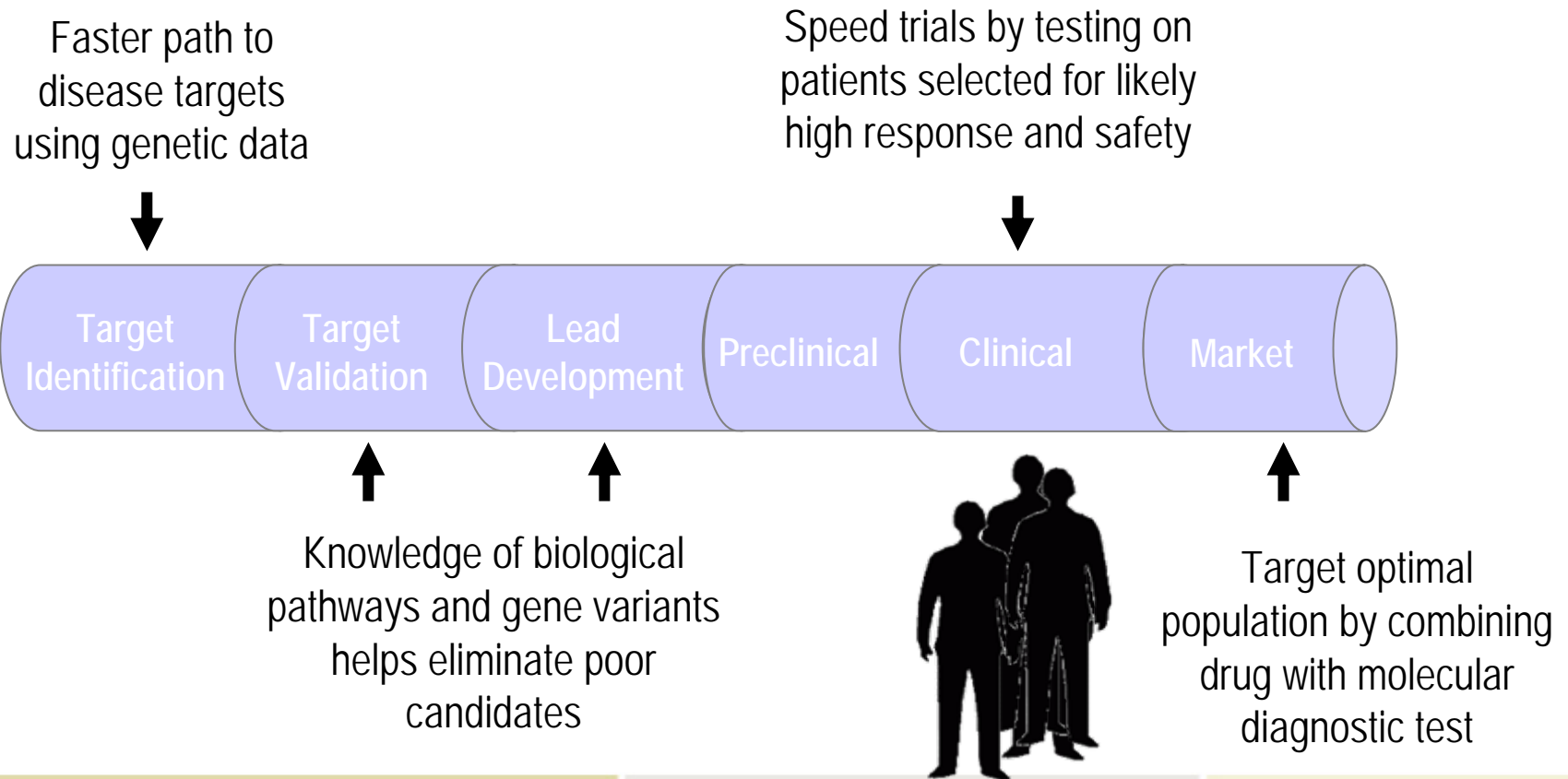
*Predisposition Guides Prevention; Treat the Molecular Markers vs. Symptoms and Disease; Healthcare Cost Reduction*

# Personalized Medicine In Research & Development



## Safer, More Effective Drugs

Identify disease targets, speed clinical trials, and advance more drugs that are safe and effective for specific populations



# What Drives the Movement to Personalized Medicine?



## Consumer Demand for:



### **Safer, More Effective Drugs**

End of one-size-fits-all drugs. New drugs will be safe and effective for specific populations.



### **Faster Time to a Cure**

Using genomic information to find disease targets. Speedier clinical trials based on high responder population.



### **Cost-Effective Healthcare**

Reduced costs, due to avoidance of futile treatments and improved clinical outcomes.

# The Blockbuster Model is “Broken”



*"The challenge for us as an industry ... is to move more from a blockbuster model to a targeted model. We need a better value proposition than today."*

Sidney Taurel

Chairman, President and CEO

Eli Lilly and Company

# It's Already Here... In the Media



*January 3*

**Test Could Gauge Risk in Patients with Lung Cancer**



*March 18*

**“Genetics and Diabetes:  
New Research on DNA Testing May Lead to  
New Therapies”**

**The New York Times**

*February 7*

**“Test to Predict Breast Cancer Relapse is Approved”**

**The Boston Globe**

*May 21*

**“Genome-wide Association Research  
Speeds Discoveries”**



*February 14*

**“Kaiser Wants 2 Million Enrollees to Enter Genetic Research Program “**

**The New York Times**

*June 19*

**“On the Horizon, Personalized Depression Drugs”**

# It's Already Here ... in Emerging Treatments



<b>Variable Target</b>	<b>Therapy/Prevention</b>	<b>Disease</b>
Alpha-adducin	ACE inhibitors	Hypertension
CETP	HMG-CoA reductase inhibitors	Atherosclerosis
CYP2C9/VKORC1	Warfarin	Coagulation disorders
Transcriptional profiles	Chemotherapy protocols	Non-Hodgkin's lymphoma
Transcriptional profiles	Chemotherapy protocols	AML Leukemia
OncoVue® (117 loci)	Surveillance	Sporadic breast cancer
KRAS mutation	Tyrosine kinase inhibitors	Lung cancer drug resistance



# It's Already Here ... in Clinical Practice



Variable Target	Therapy/Prevention	Disease
BCR-abl; c-KIT	Gleevec/Imatinib	Cancer/Chronic myelogenous leukemia
BRCA1/2	Surveillance; tamoxifen; prophylactic surgery	Breast and ovarian cancer
EGFR	Tarceva, Iressa	Lung cancer
Estrogen receptor	Tamoxifen	Breast cancer
HER-2/neu receptor	Herceptin/Trastuzumab	Breast cancer
PML-RAR alpha	Tretinoin/All trans retinoic acid	Acute Myelocytic Leukemia
<i>p16</i> gene/CDKN2A	Surveillance	Melanoma
TPMT	Mercaptopurine	Acute Lymphocytic Leukemia
TruGene®-HIV 1 Genotyping	Anti-retroviral drugs	HIV virus drug resistance

# It's Already Here ... in Clinical Practice (cont'd)



<b>Variable Target</b>	<b>Therapy/Prevention</b>	<b>Disease</b>
Oncotype DX: 16 gene profile	Chemotherapy protocols	Breast cancer recurrence
MammaPrint 70-gene profile	Aduvant chemotherapy	Breast cancer recurrence
Familion® 5-gene profile	Pharma/Lifestyle prevention	Cardiac rhythm abnormalities/side effects
AlloMap® gene profile	Immunosuppressive drugs	Heart transplant rejection
Amplichip® CYP2D6/2D19	~25% of prescribed drugs	Various diseases – drug metabolism
UGT1A1	Camptosar® (irinotecan)	Colon cancer
Sprycel (dasatinib)	BCR-Abl	Gleevec resistance

# **Personalized Medicine: How Will It Affect Healthcare?**

# Changing Role of the Patient

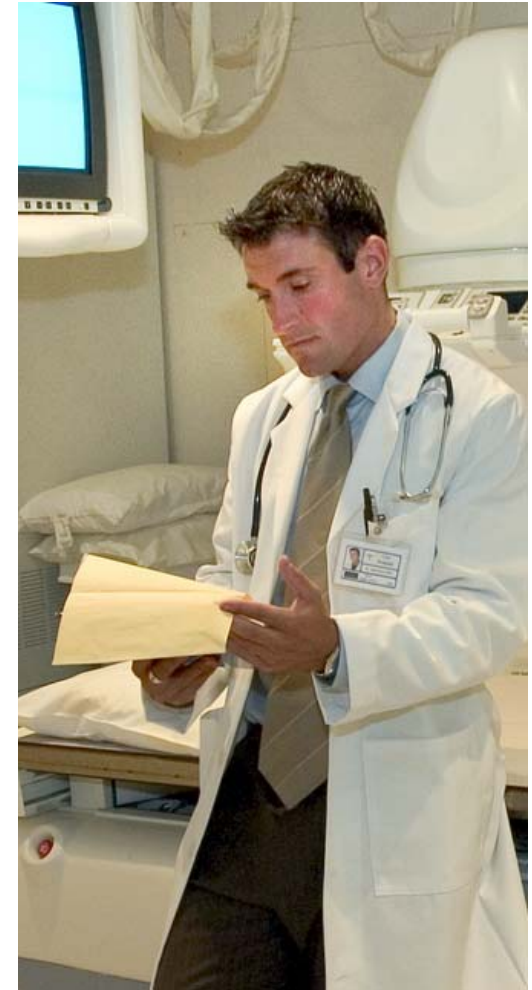


- Greater knowledge of one's genetic risks
- Actionable lifestyle and nutrition Rx for reducing risk of disease
- Greater control and patient-centered access to medical records
- Treatment decisions will be improved by an educated patient
- Genetic information affects every aspect of the individual's life



# Changing Role of the Healthcare Provider

- Physician as manager, rather than repository of medical knowledge
- Greater reliance on IT for decision support
- Increased use of molecular tests
- Highly networked medical care
- Healthcare management based on pro-active treatment and longer term outcomes
- New ethical and legal issues/quandaries



# New Business Strategies for Pharma

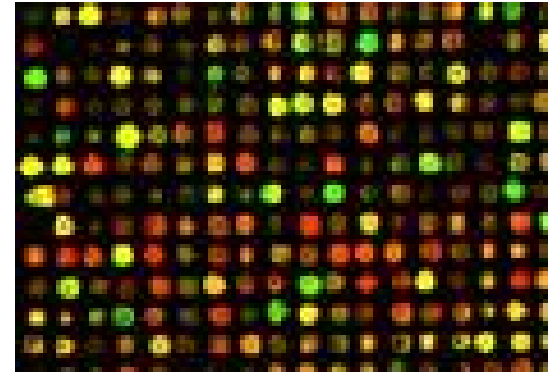
- Uncertain economics of drug development and commercialization
- Regulatory mandates could disrupt development budgets and market plans
- “Personalization” of drugs may affect product lifecycle
- Changing paradigm for marketing and sales of pharmaceutical products. Greater focus on patient education emphasizing proactive care, prevention, and targeted treatments.



# New Business Strategies for Clinical Laboratories



- Increase emphasis on proactive testing for pre-symptomatic individuals
- Educate physicians and patients to capitalize on new genetic/molecular tests
- Promote standardization of analytical genomic/proteomic technologies, sample collection, handling and storage
- Work with diagnostics developers to establish outcomes evidence for emerging tests



# **Personalized Medicine Coalition:**

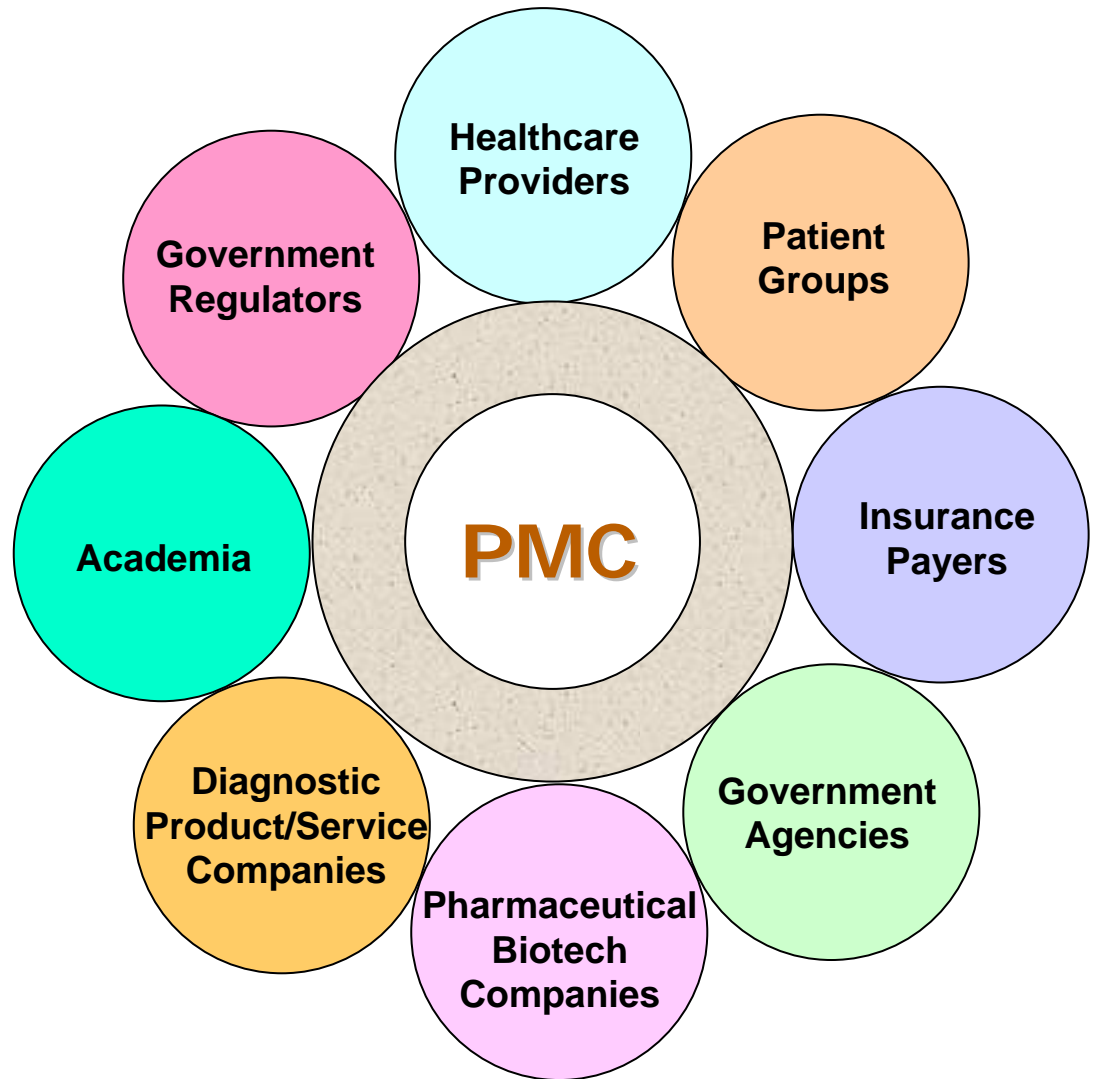
# **An Agent of Change**



# What is the PMC?

## Convening Stakeholders and Aligning Objectives

The Personalized Medicine Coalition (PMC), representing a broad spectrum of academic, industrial, patient, provider, and payer communities, seeks to advance the understanding and adoption of personalized medicine concepts and products for the benefit of patients.



# Addressing Public Policy Issues



The potential impact of Personalized Medicine is very broad and far-reaching. There are an array of issues facing us:

- Intellectual property
- Regulatory oversight
- Reimbursement
- Privacy / Ethics
- Healthcare insurance
- Patient education
- Physician education
- Hospital system infrastructure
- R&D incentives

# Major Policy Initiatives



- **Genetic privacy** – building confidence among the public to ensure widespread acceptance of genetics in medical care
- **Regulation** – paving the way for market approval of personalized medicine drugs and diagnostics
- **Reimbursement** – ensuring coverage of predictive diagnostics, and targeted treatments for a new paradigm of healthcare
- **R&D Business Incentives** – creating incentives for R&D to generate a stream of linked diagnostics and therapeutics
- **Investment** – increasing government funding for basic and translational research

# Genetic Privacy and Protection



According to polls conducted on genetic privacy:

- 93% of Americans believe that if someone has had a genetic test, their employer should not be able to use the information in hiring or promotion, and their insurer should not use the information to reduce benefits or increase prices (Genetics and Public Policy Center, Johns Hopkins University, 2007)
- 76% of Americans think Congress should protect genetic information (Genetics and Public Policy Center, Johns Hopkins University, 2007, Research!America, 2006)

Genetics Information Non-discrimination Act (GINA) passes US House by a vote of 420-3 (April 25, 2007)

# Genetic Privacy and Protection



**Encourage use of genetic services and participation in clinical trials.**

- Support passage of the Genetic Information Non-discrimination Act (GINA)
- Define patient and healthcare worker access and control of electronic medical records
- Ensure protections against insurer and employer discrimination are enforceable
- Monitor public attitudes toward genetic testing to measure progress

# Regulation



**Create a more predictable regulatory environment that keeps pace with scientific advances and evolving business models.**

- Ensure new regulations encourage innovation. Support the US FDA Guidance on voluntary PGx data submissions
- Advocate for continued guidance on Rx/Dx co-development
- Advocate for guidance on voluntary post-approval surveillance of drugs, when genetic information on ADRs and efficacy emerge
- Promote global regulatory harmonization on the FDA model of PGx data submissions

# Reimbursement - Diagnostics



**Place reimbursement on a sound economic footing. Diagnostics comprise 5% of hospital costs, yet leverage 70% of healthcare decisions.**

- Increase level of reimbursement for molecular diagnostic tests under the physician fee schedule vs. laboratory fee schedule
- Create incentives for insurance industry to reimburse preventive testing and treatments
- Support new formulary models that incorporate concepts of genetic segmentation on safety and efficacy, and preventive treatment
- Shift from focus on short-term healthcare and unit costs, to long-term costs and outcomes
- Demonstrate and communicate savings in doctor visits, length of hospital stay and other medical procedures

# R&D Business Incentives



**Encourage industry to develop personalized medicine products through incentives in regulation, patenting and other areas of government policy.**

Encourage industry to develop personalized medicine products by establishing public policies that:

- Credit companion diagnostics R&D
- Authorize funds for companion diagnostic development
- Streamline the FDA approval process for companion diagnostics
- Accelerate the reimbursement of companion diagnostics



# Investment



**Invest in proteomics, genomics, imaging and other technologies that are essential to meet the need for validated biomarkers.**

- Support full funding of NIH
- Support programs in basic research
- Support programs that translate basic research into clinical therapeutics, diagnostics and methods for prevention

# PMC Member Organizations



## Research and Educational Institutions

AACC (American Association of Clinical Chemistry)	The George Washington University Medical Center
American Institute for Medical and Biological Engineering (AIMBE)	Harvard-Partners Center for Genetics and Genomics
American Society of Human Genetics (ASHG)	Hudson-Alpha Institute for Biotechnology
Bentley College	Institute for Genomics & Systems Biology, The University of Chicago and Argonne National Laboratory
The Brain Institute at the University of Utah	Karolinska Institute
Center for Molecular Medicine	Marshfield Clinic
Cincinnati Children's Hospital Medical Center	Mayo Clinic
Cleveland Clinic Genomic Medicine Institute	National Coalition for Health Professional Education in Genetics (NCHPEG)
The Critical Path Institute (C-Path)	The Ohio State University Medical Center
Duke University	National Jewish Medical and Research Center
Genetics, Ethics & Policy Consulting	PENN Medicine
	Vanderbilt University Medical Center

## Health Insurance

Aetna  
WellPoint

## Industry & Trade Associations

American Clinical Laboratory Assoc.  
PhRMA

## Emerging Biotech/Pharma

Perlegen Sciences, Inc  
Xanthus Life Sciences, Inc.

## Consumer Genetic Testing

DNA Direct, Inc.

## Strategic Partners

Boston Healthcare Associates, Inc.  
Center for Medicine in the Public Interest  
Clear Point Health  
Defined Health  
Diaceutics  
Feinstein Kean Healthcare  
Genomic Healthcare Strategies  
IDA Ireland  
KFDunn Life Sciences, a division of Aloysius Butler & Clark  
Nixon Peabody LLP  
PAREXEL International  
Personalized Medicine Partners, LLC  
Pri-Med Institute  
Wilson Sonsini Goodrich & Rosati

## Venture Capital

Boston Millennia Partners  
Burrill & Company  
Kleiner, Perkins, Caufield & Byers  
MDV-Mohr Davidow Ventures  
Pappas Ventures  
Stephens Investment Management

# PMC Member Organizations



## Diagnostics

Aureon Laboratories, Inc.  
Aviir  
BG Medicine  
Bio Research Support, Inc.  
The Brain Resource Company Limited  
dnaprint genomics, inc.  
DNA Vision SA  
Exagen Diagnostics, Inc.  
Expression Analysis, Inc.  
Genomas, Inc.  
Genomic Health, Inc.  
Gentris Corporation  
Lipomics Technologies, Inc.  
Monogram Biosciences  
Nanosphere, Inc.  
NeuroMark  
Pathway Diagnostics  
PGx Health (a division of Clinical Data, Inc.)  
TheraGenetics Ltd.  
XDx, Inc.

## IT/Informatics

IBM Healthcare and Life Sciences  
Lead Horse Technologies  
Mirixa  
Saffron Technology, Inc.  
Theranos, Inc.

## Clinical Laboratories

Kimball Genetics, Inc.  
LabCorp  
Quest Diagnostics

## Patient Advocacy Groups

Alliance for Aging Research  
*FasterCures*  
Sarcoma Foundation of America

## Agency Partners

Centers for Disease Control and Prevention  
Centers for Medicare and Medicaid Services  
National Cancer Institute  
National Human Genome Research Institute  
U.S. Food and Drug Administration

## Research Tools

Affymetrix, Inc.  
Aplera Corporation  
Applied Biosystems  
Celera  
Gene Logic  
GenVault Corp.  
HistoRx  
Illumina, Inc.  
Luminex Corporation  
Nanogen, Inc.  
Osmetech Molecular Diagnostics  
Qiagen, Inc.

## Large Biotech/Pharma

Abbott Molecular Inc.  
AstraZeneca Pharmaceuticals  
Eli Lilly and Company  
Genzyme Corporation  
Johnson & Johnson  
Pharmaceutical Research & Development LLC  
Millennium Pharmaceuticals, Inc.  
Pfizer, Inc.

# Personalized Medicine Coalition



*The Personalized Medicine Coalition, representing a broad spectrum of academic, industrial, patient, provider, and payer communities, seeks to advance the understanding and adoption of personalized medicine concepts and products for the benefit of patients.*

# The Personalized Medicine Coalition

*To learn more, visit:*

***[www.PersonalizedMedicineCoalition.org](http://www.PersonalizedMedicineCoalition.org)***

# Personalized Medicine Review

(Choose the best answer)

- What are benefits of Personalized Medicine?
  1. Treatment tailored to individual's genetics
  2. One physician for each patient
  3. Each individual has sequenced DNA
- What is the estimated number of deaths due to adverse drug reactions?
  1. 5 million per year
  2. 100,000 per year
  3. 1,000 per year
- Why would genetic characterization prior to therapy reduce the time to disease response to treatment?
  1. Drugs would be more effective
  2. Drugs would be used only for the genotype for which they were designed
  3. Optimum dosage could be assigned.
- Why would genetic characterization reduce the incidence of adverse events?
  1. Drugs would be less toxic
  2. Drugs would be used only for the genotype for which they were designed
  3. Pharmaceutical companies would be required to market safer drugs.

# Personalized Medicine Review

(the best answer)

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