

Populomics: Understanding & Addressing Complex Health Challenges

Population Health & Care Coordination Colloquium

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US “Health” System

Basic and Clinical Sciences

Social and Population Sciences

Geographic and Environmental Sciences

Current Converging Trends

- Prevalence of Chronic Disease
- Burgeoning of the Senior population
- Increasing Longevity
- Rising Healthcare Costs
- Minorities, immigrants & underserved

Early work

- Edwin Chadwick (1840), British statistician
 - Liverpool class based mortality differentials
- Rudolph Virchow (1849) German physician
 - diseases of the populace > defects in society
- Louis Villerme French physician
 - improve school and work conditions to reduce class differences in mortality

Early work

- Titmuss and Logan
 - British regional class-based infant mortality trends increased from 1910 to 1950
 -
- British government (1942)
 - Policy initiatives to address the “five giants”
 - Want, Disease, Ignorance, Squalor and Idleness”

Early work

The Black Report

- 1977 – Working Group on Health Inequalities established
- Causes of Inequalities
 - Artifact
 - Natural Selection
 - Occupational class/Wealth
 - Cultural/Behavioral

Early models

The Acheson Report

- 1997 British government commissioned a follow up study
 - Chair – Sir Donald Acheson
 - Inequalities Remain
 - Scientific evidence supports a socioeconomic explanation

US Experience

- The Surgeon Generals Report 1983
 - *SG Task Force 1984*
- Harvard Medical Practice Studies
- John Wennberg
- Agency for Healthcare Research & Quality
 - NHQR and NHDR Reports (2002)

Growing Recognition

Sociobehavioral and environmental factors are increasingly recognized as important determinants of health AND healthcare outcomes

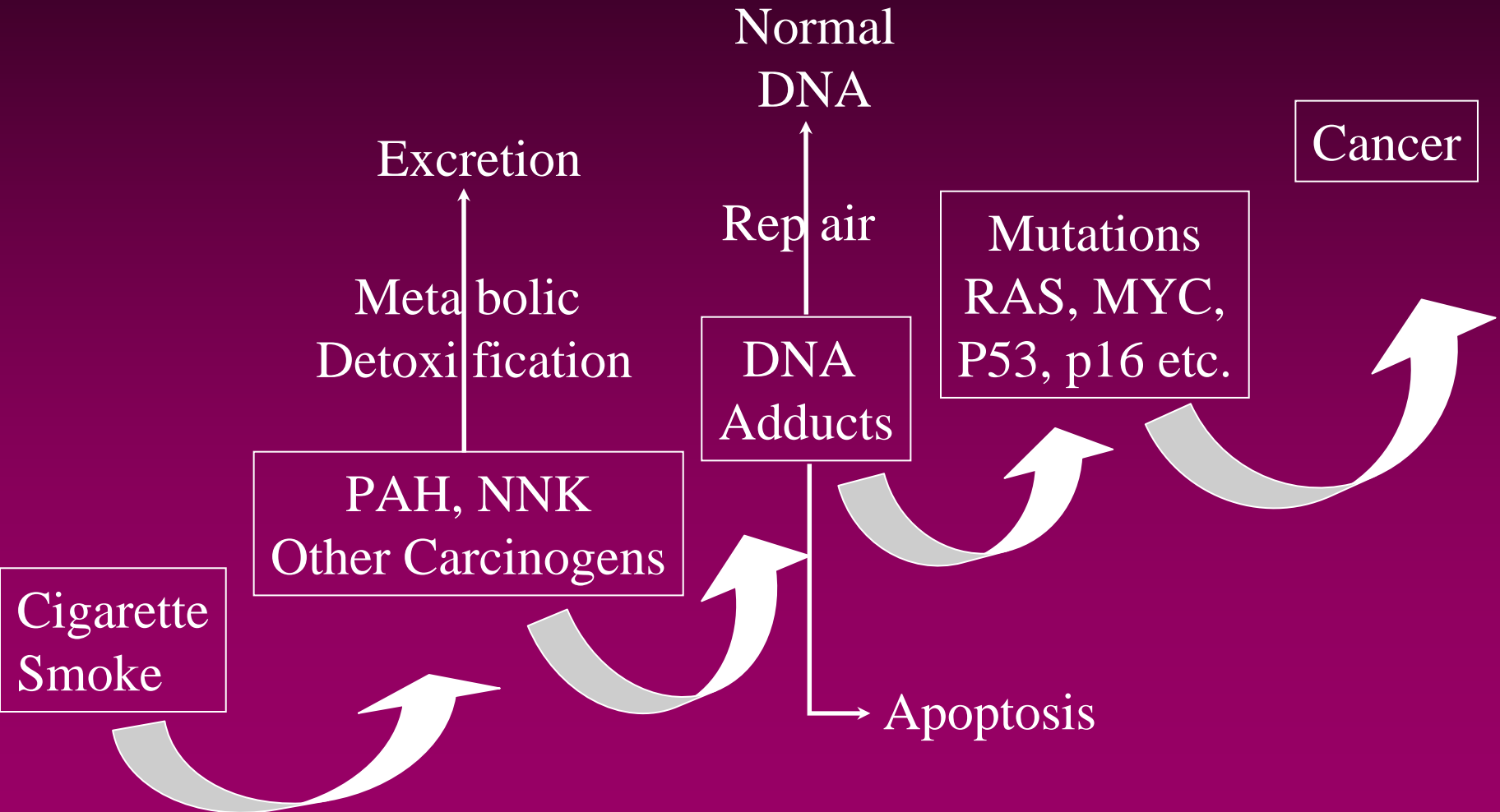
Actual Causes of Death

- Smoking
- Poor Diet
- Inactivity
- Alcohol
- Infections
- Poisons
- Auto Accidents
- Guns

Health research in the 21st century

Disease causation in general and health disparities in particular, result from *complex interactions* of many factors that simultaneously and often cooperatively act across more than one level of influence, over time.

Lung Cancer



Technology and Disease Pathogenesis

Information Technology based approaches offer significant promise in helping to gain a more robust and comprehensive characterization of disease and disparities pathogenesis.

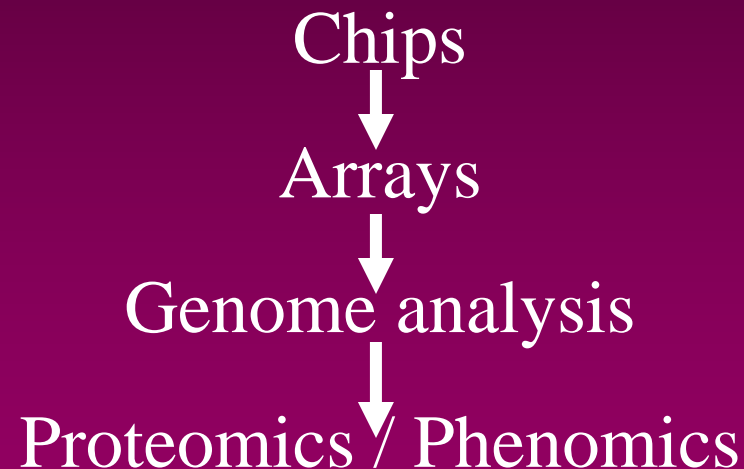
Health research in the 21st century

Recent advances in the computer and information sciences have led to methodologic and analytic revolutions in the molecular and clinical sciences

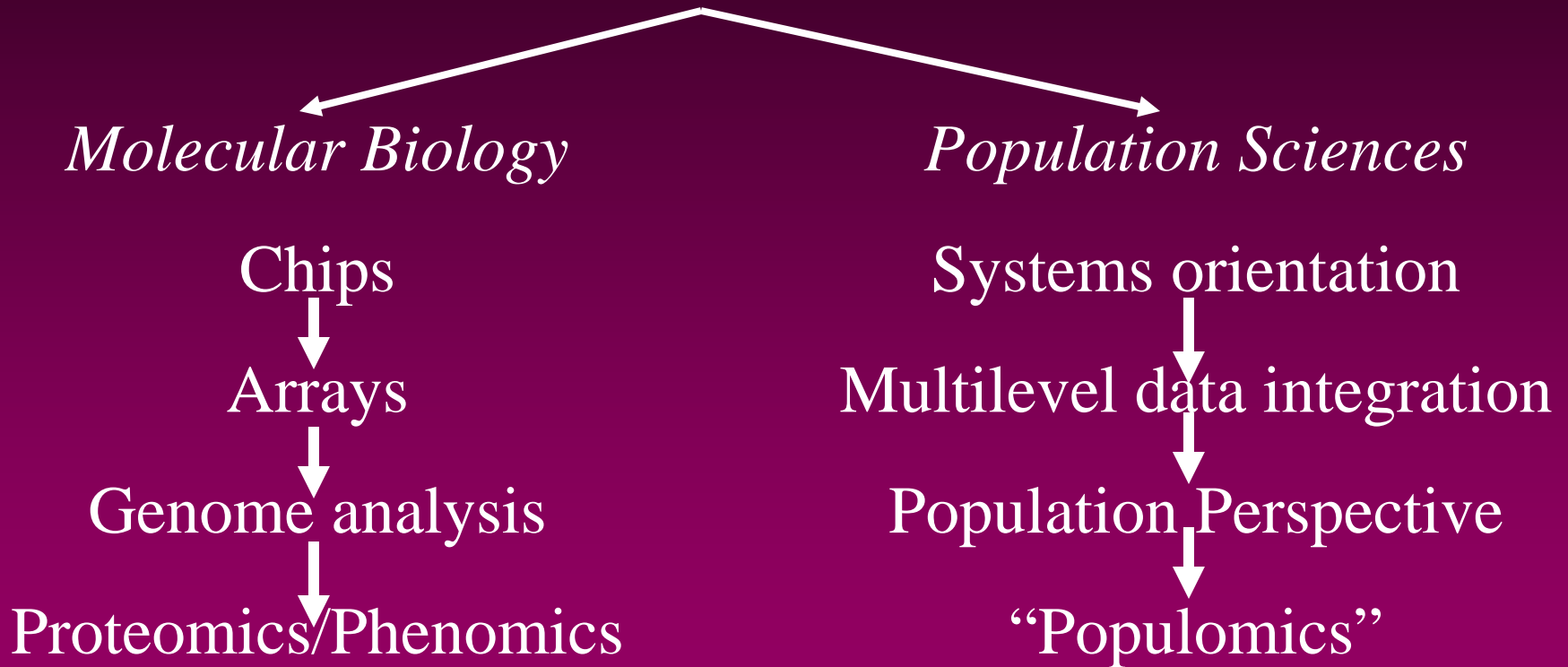
NEJM 2006

Information Technology Revolution

Molecular Biology



Information Technology Revolution



Gibbons, *J Med Internet Res* 2005;7(5):e50)

Gibbons, *Stud Health Tech Inform* 2008;137:147-62

Requirements

- Large studies
- Knowledge integration
- New nomenclature
- Traditional and nontraditional Informatics
- New research and evaluative methodologies
- Systems Integrative perspective

Scientific Challenge

- Work across systems
 - » Define timing, scope, intensity and relevance of interactions between determinants
 - » Define groups of critical factors operative at the population level

Populomics

"An emerging discipline focused on population level, transdisciplinary, integrative disease/risk characterization, interdiction and mitigation that relies heavily on innovations in computer and information technologies.

J Med Intern Res Gibbons 2005

Stud Health Tech Inform Gibbons 2008

Populomics

Population level transdisciplinary
systems integrative science

Benefits

- Population level hypothesis testing with precision currently not possible
 - » Better understanding of pathogenesis and outcomes
 - » Scientific insights approximating reality
 - » Improved prognostication/predictive value
 - » Better clinical interventions therapies and drug development

A new “Basic” Population Research model

Single etiologies or conditions might be less important than a given group of factors that work together, to influence discreet biomolecular mechanisms, resulting in a given outcome

A new “Basic” Population Research model

“Socio-Behavioral Phenotypes”

Groups of individual, environmental and
Population level factors that predictably coexist and
are thought or known to act cooperatively
to influence discrete health outcomes
among specified populations

A new “Basic” Population Research model

“Causal profiles”

Sociobehavioral Phenotypes linked with
underlying biophysiologic and
molecular mechanisms

A new “Basic” Population Research model

PheGe Analysis

Next generation GWAS that begin at the population based phenotypic level, which then seeks to elucidate the underlying biophysiological and molecular mechanisms

A new “Basic” Population Research model

At the population level

One or more “causal profiles” may
be responsible for a given outcome.

A new “Basic” Population Research model

These “Causal profiles” might be more accurate predictors of health and disease outcomes than contemporary social or biologic constructs, particularly at the population level.

A new “Basic” Population Research model

Populovigilance

A science of collecting, monitoring and evaluating data from defined Populations, on the adverse effects of disparate care, environmental hazards, behavior and policies, specifically to 1) identify hazards and/or sentinel events associated with the existence of disparities and to 2) prevent harm to patients and individuals among the target subpopulations

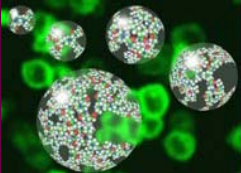
A new “Basic” Population Research model

Disparities Harm Reduction Research

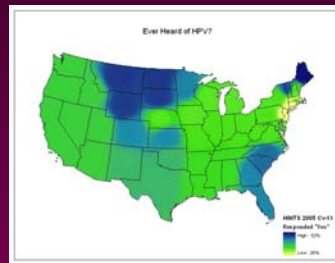
Transdisciplinary research with a primary focus of identifying and evaluating strategies designed to mitigate the adverse health effects associated with a defined disparity and target population.

Adding "Populomics" to the "Grid"

Nanotechnology

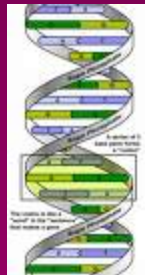


Populomics*

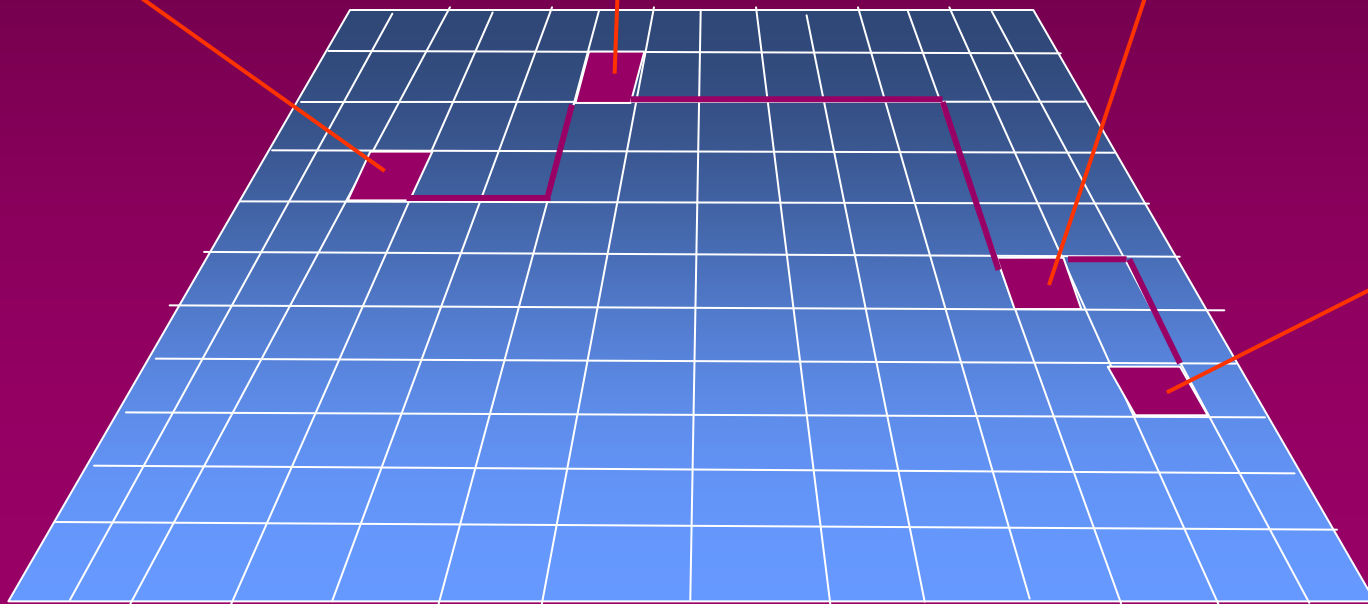


Focus

Proteomics



Genomics



Technology and Disparities

The role of technology is not limited to improving our understanding of the etiology and pathogenesis of disease.

Technology may be used also as an interventional tool providing decision & behavioral support.

Clinical technology

EMR's, EHR's

CPOE

e-consultation

Telemedicine

Remote monitoring

Intelligent Devices

Sensor Technology

Limitations

700,000 Physicians

2.6 million Nurses

5200 Hospitals & Clinics

Vs

362 million people

Beyond “Pills and Procedures”

RFID

Web 2.0/3.0

Health Gaming

“On Demand”

m/p/u Computing

Mesh networks

WiMax

Nanotechnology

Consumer Health Informatics

Any electronic tool, technology or electronic application that is designed to interact directly with consumers, with or without the presence of a healthcare professional, that provides or uses individualized (personal) information and provides the consumer with individualized assistance, to help the patient better manage their health or healthcare.

Consumer Health Informatics

Can such tools improve clinical outcomes?

Types of CHI Tools evaluated

- Interactive web-based applications
- Educational websites
- Non-web-based computer feedback applications
- Interactive computer programs
- Personal monitoring devices
- Health-risk assessments
- Patient decision aids delivered via
 - » cell phones, PDAs, laptops, CD ROMs
- Text messaging
- Discussion/chat groups.

SER of Impact of CHI

- Preliminary evidence suggests that CHI applications can improve certain adult clinical and intermediate health outcomes (mental health and smoking cessation)
- Effective interventions often employ tailored content, personalized messages and appropriate, ongoing behavioral feedback

SER of Impact of CHI

- The role of CHI applications among children, priority populations, on healthcare processes or economics has not been adequately evaluated
- Many personal and systems level utilization barriers exist
- Knowledge gaps include the health impact of social networking technologies, CHI impact on Disparities, the role of CHI in acute disease management and primary, secondary or tertiary disease prevention

Digital Disparities

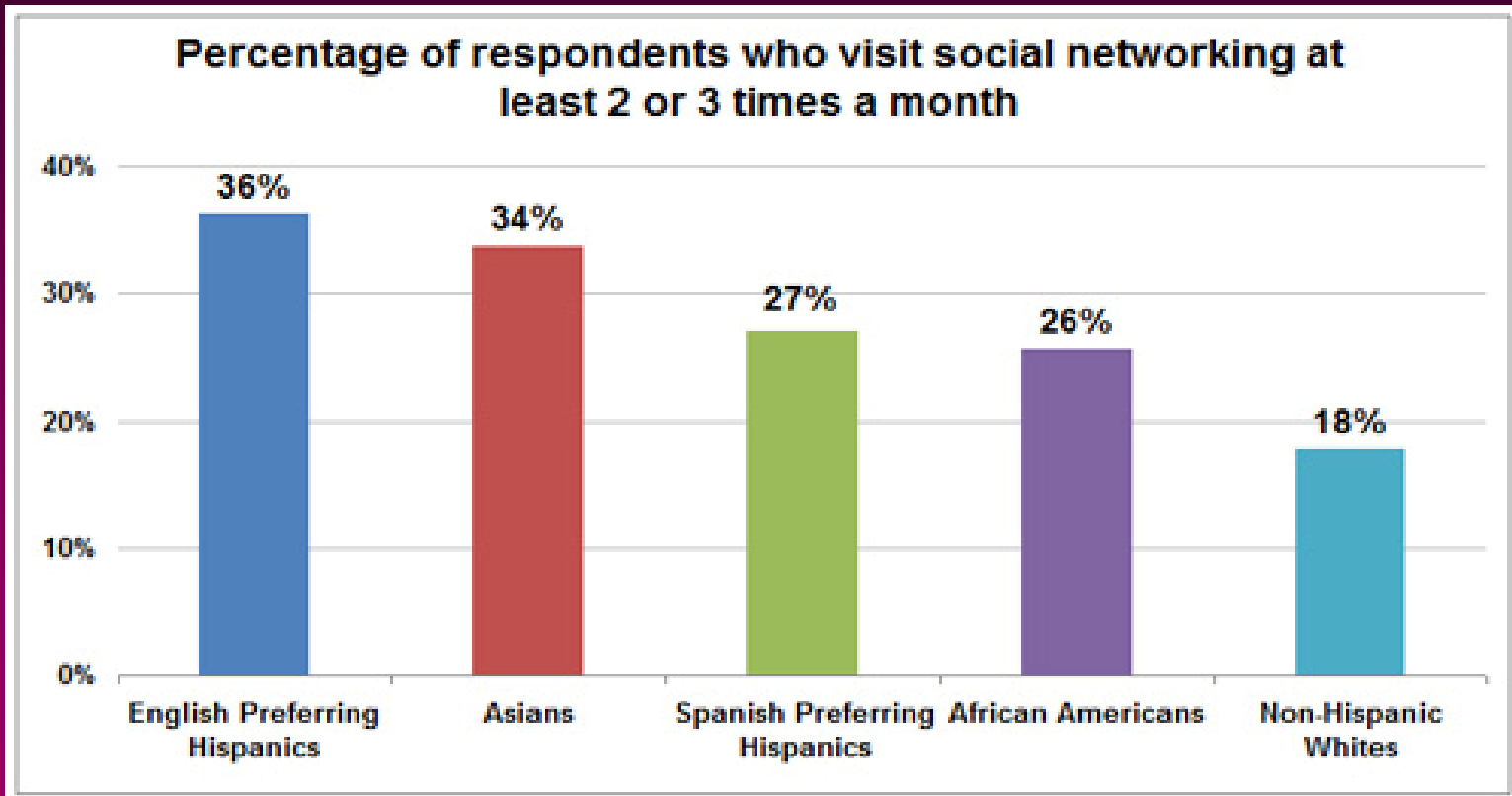
Early evidence suggests differential access, utilization patterns and preferences regarding technology among population subgroups.

The Digital Divide is changing

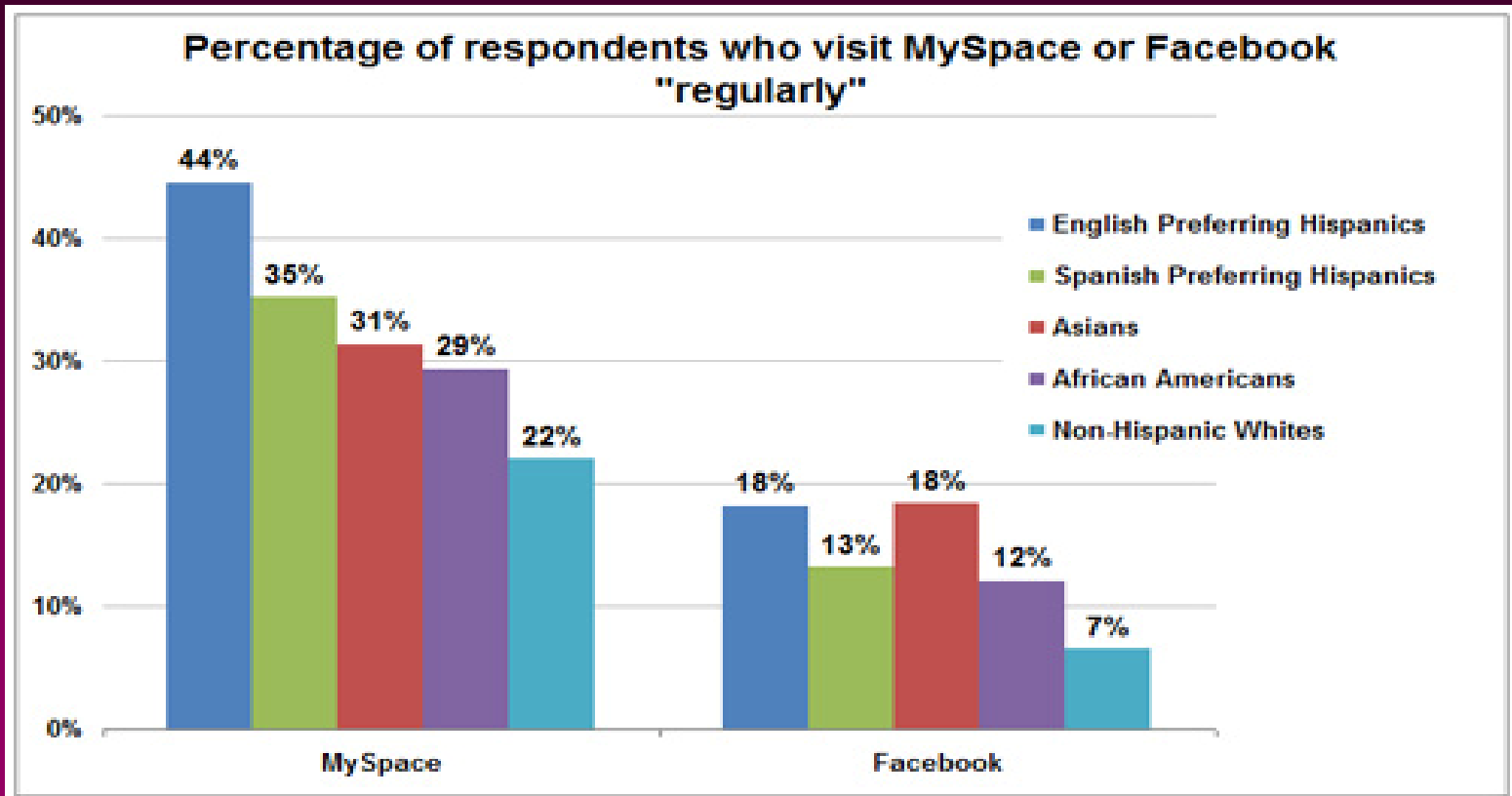
Digital Disparities

Unless these differences and their implications are understood in greater detail, these realities may lead to differential health benefits from technology enabled interventions and as such may result in an increase in Disparities

Social Media and Population Health



Social Media and Population Health



Beyond Improving Access and Quality

- Minority patients stress the value of being able to “tell their story and be heard”.
- They also emphasize the importance of information sharing rather than decision-making sharing.
- They often believe there is an acceptable role for non-adherence as a mechanism to express control and act on treatment preferences when inequitable experiences exist.

Peek M. et al Patient Education and Counseling 72 (2008) 450-458

Rose L, et al J Adv Nurs. 2000 Sep;32(3):587-94

*Capitman J et al CPDT for R/E minorities; Evidence report and evidence-based recommendations.
1500-00-0031, DHHS 2003*

Patient related opportunities and SM

- Improve shared decision making
- Enhance patient engagement
- Promote adherence

- Groupon
- Nike+iPod – Physical activity & Fitness
- Qwitter, Quitnet, Habitchanger – Smoking cessation
- Whrrl, Yelp – Healthy diet and nutrition
- Foursquare, GyPsii, Plazes – other health or healthcare oriented activities

Provider & System related opportunities and SM

- Improve information sharing and patient centered collaborative care
- Obtain important nonclinical information - ODL's
- Enhance Cultural Competency (crowdsourcing)
- Enhance access to health care services
 - Patients like me
 - Second Life
- “Patient Centered” Medical Home Integration
- “Accountable” Care organization Integration

Technology, Health & Disparities

Across the Health and Care Continuum

- Harm Reduction
- Prevention/Wellness
- Screening
- Diagnosis
- Medical Treatment
- Self care/ Self Management
- Survivorship

The Future of Disparities

- In this world
 - » Clinicians and researchers know and understand how all social, environmental and biological factors that collectively contribute to ill health
 - » Health risks are managed before they become diseases and before patients ever need to go to the hospital

The Future of Disparities

- In this world
 - » Health interventions are delivered via a variety of formats (in person, web, game console, TV, cell phone, PDA's etc)
 - » The efficacy of traditional interventions is enhanced via technological adjuncts to treatment or care

The Future of Disparities

- In this world
 - » “Clinical” interventions can be delivered anywhere and at any time as needed.
 - » A variety of intervention genres enable exquisite customization and tailoring

The Future of Disparities

- In this world
 - » healthcare is proactive not reactive
 - » Patients don't delay seeking care
 - » Medical errors rarely made
 - » Health information is always accessible in both provider and patient centric forms

The Populomics Potential

Over time there exists real potential to make significant impact towards the goals of

- 1) Understanding Health, Disease & Disparities
- 2) Enhancing patient centeredness & responsiveness
- 3) Improving HC quality AND outcomes
- 4) Eliminating disparities & population health challenges.

eHealth Solutions for Healthcare Disparities

Edited by Michael Christopher Gibbons, MD, MPH
Johns Hopkins Urban Health Institute, Baltimore

Paralleling emerging trends in cyber-health technology, concerns are mounting about racial, ethnic, disparities in health care utilization and outcomes. *eHealth Solutions for Health Care Disparities* brings these concerns together, challenging readers to use, promote, and develop new technology-based methods for closing these gaps. Edited by a leading urban health advocate and featuring 16 expert contributors, the book examines cyber-strategies with the greatest potential toward effective, equitable care, improved service delivery and better health outcomes for all.

Chapters go well beyond the possibilities of the Electronic Medical Record to discuss emerging roles for information technology in promoting healthful behavior changes (e.g., nutrition, weight loss, smoking cessation), disease prevention (e.g., cancer, HIV), and healthcare utilization, patient education and medicine compliance. The rise of e-Patients and the transformation of the doctor-patient relationship are also discussed. Opportunities for Web based products and interventions are explored in terms of tracking disparities, improving healthcare utilization and health outcomes, reducing disparities and monitoring trends among patients, whether they have Internet capabilities or not.

Among the book's highlights:

- Why health care gaps still exist: individual, provider, and systemic factors.
- What information technology can bring to health care services.
- Current strategies in eHealth, public health informatics, and medical informatics.
- Technological disparities, and what can be done to reduce them.
- New paradigms in disparity research.
- The potential for eHealth in health care policy.

For public health professionals, health care administrators and informaticians as well as graduate students in health behaviors, health promotion, and social epidemiology, *eHealth Solutions for Health Care Disparities* is a road map for an increasingly digital future.

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