Genomics and Public Health: CDC Update: 2003

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Director,

Office of Genomics and Disease Prevention

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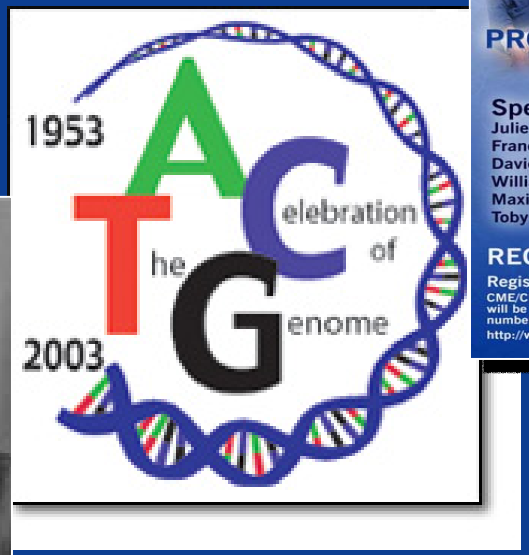
2003
Year of the Human Genome

- DNA 50th Anniversary
- Human Genome Sequence



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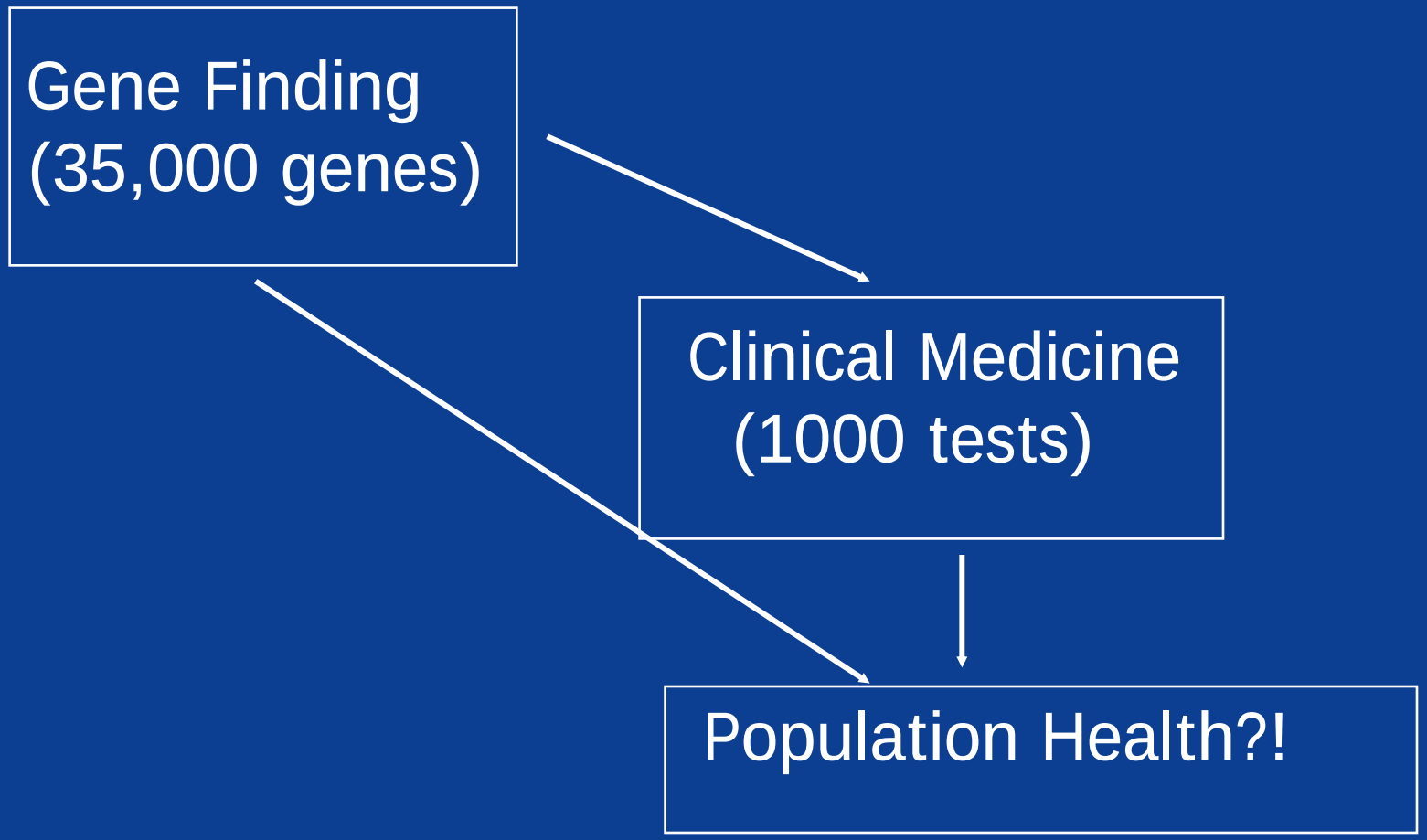
"DNA Changed the World: Now What?"

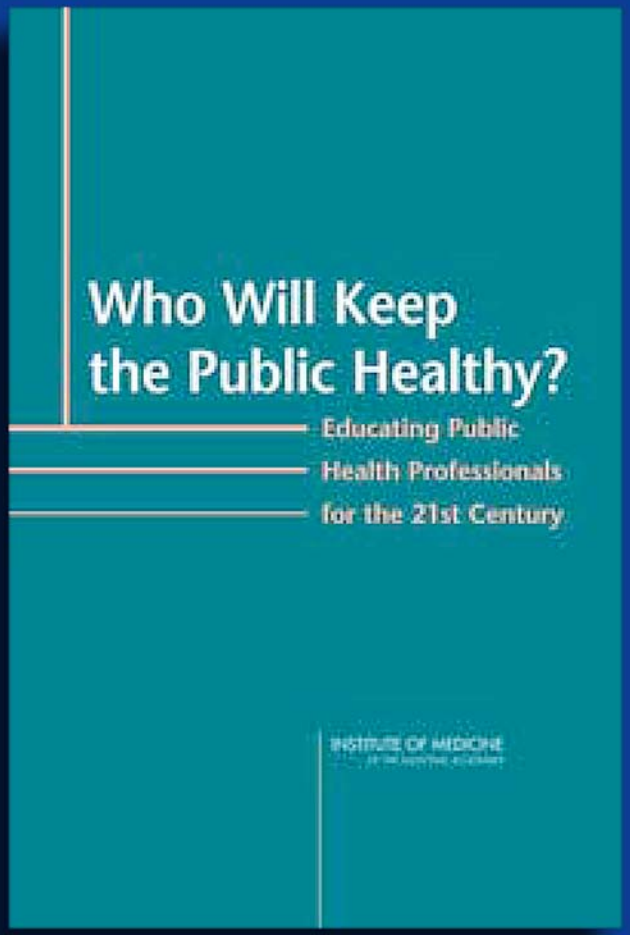
NY Times, February 25, 2003



Who Will Keep the Public Healthy?
Public health in the 21st Century

Crucial Public Health Areas

- Informatics
- ***Genomics***
- Communication
- Cultural competence
- Community-based research
- Global health
- Policy and law
- Public health ethics



(Institute of Medicine, 2002)

Say ACGT!!!
Genetic Test Developers are Forging Ahead…

From Gene Discovery to Medicine and Public Health: How Do We Get From Here to There?

Urgent Need for Public Health to Translate Research into Health Benefits !!

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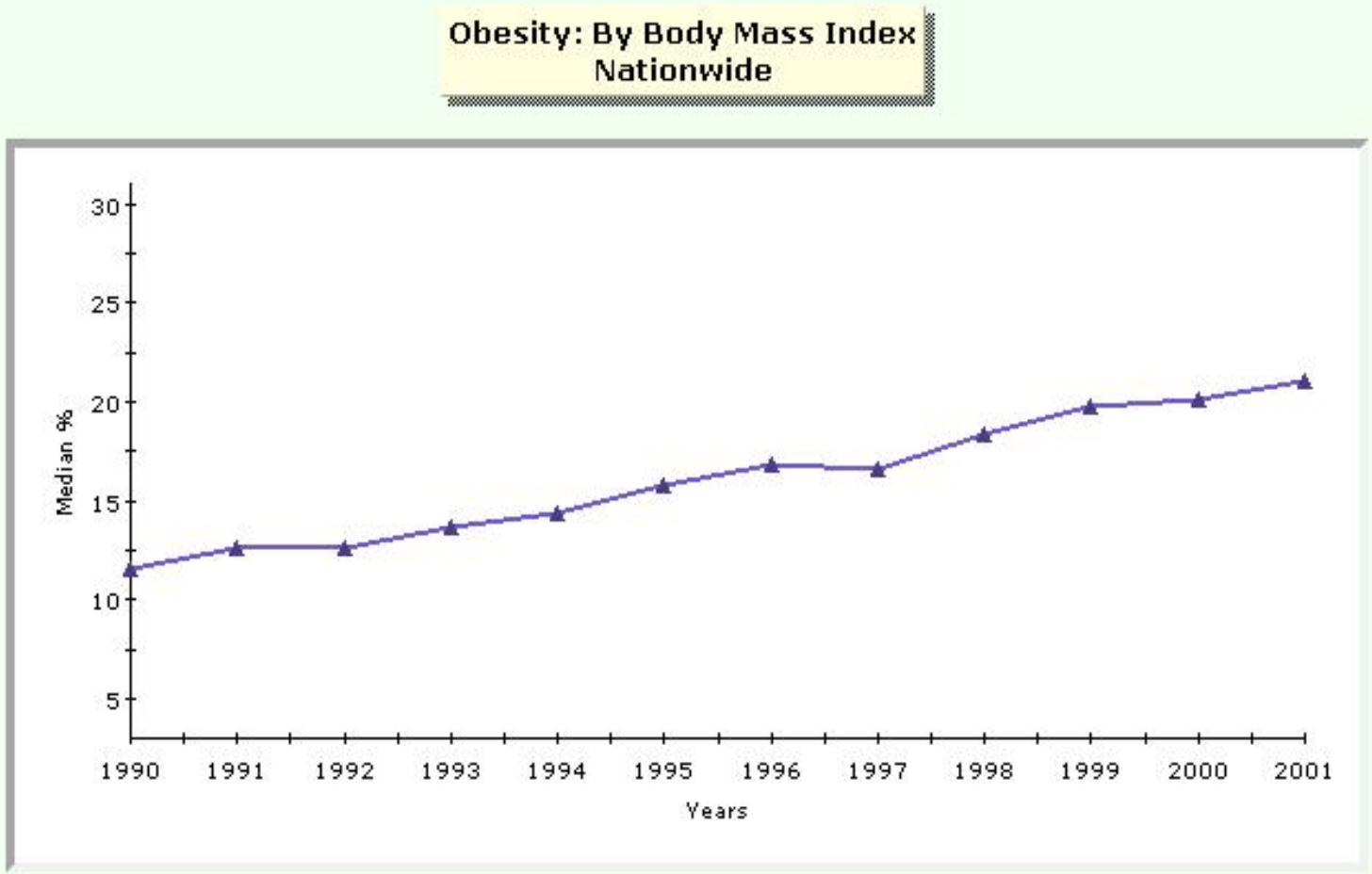
From Research To Prevention

Obesity



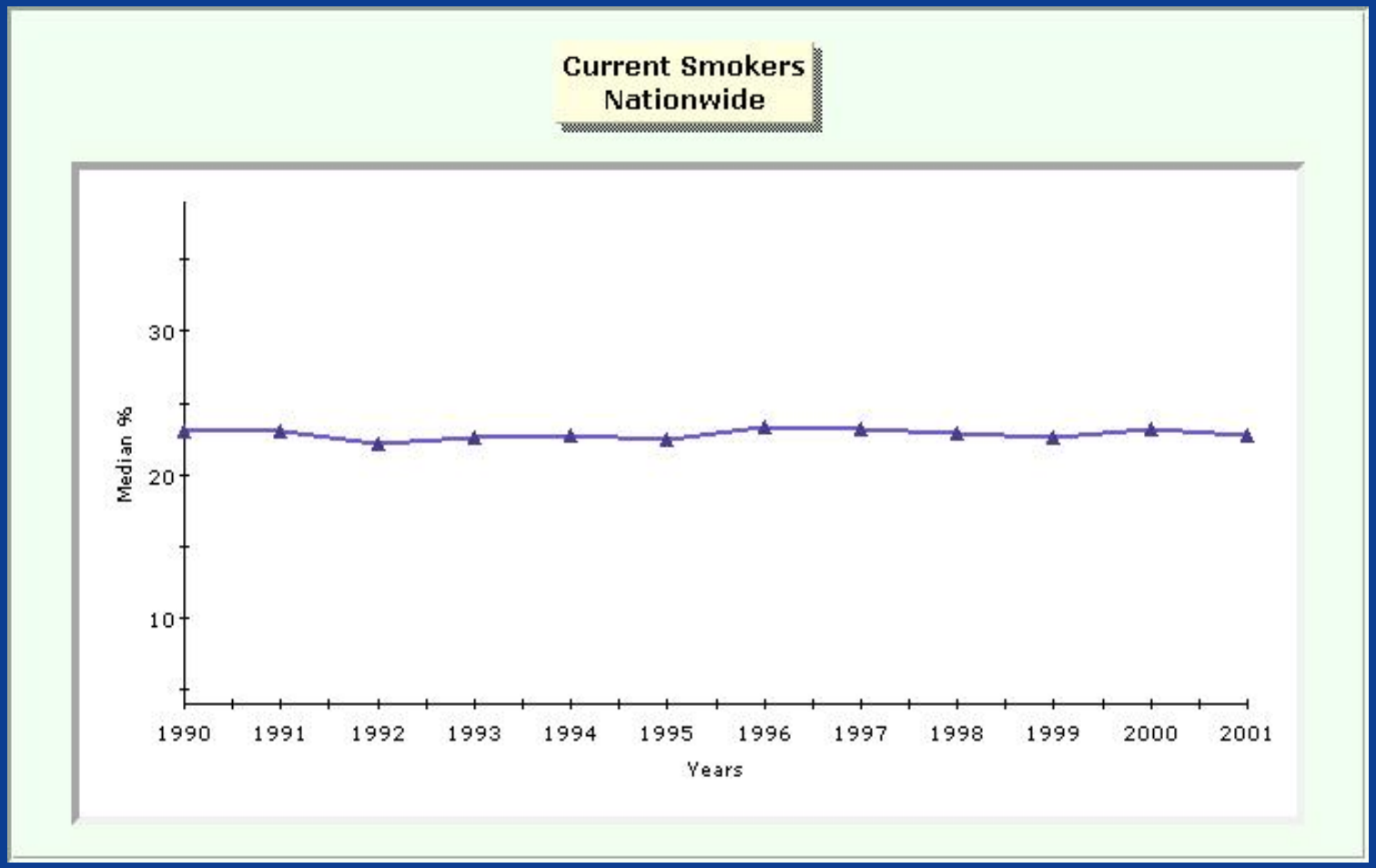
From Research To Prevention

Exercise

- only 25% of adults engage in recommended physical activity levels

From Research To Prevention

Smoking



”Clinical Research to Clinical Practice — Lost in Translation?”

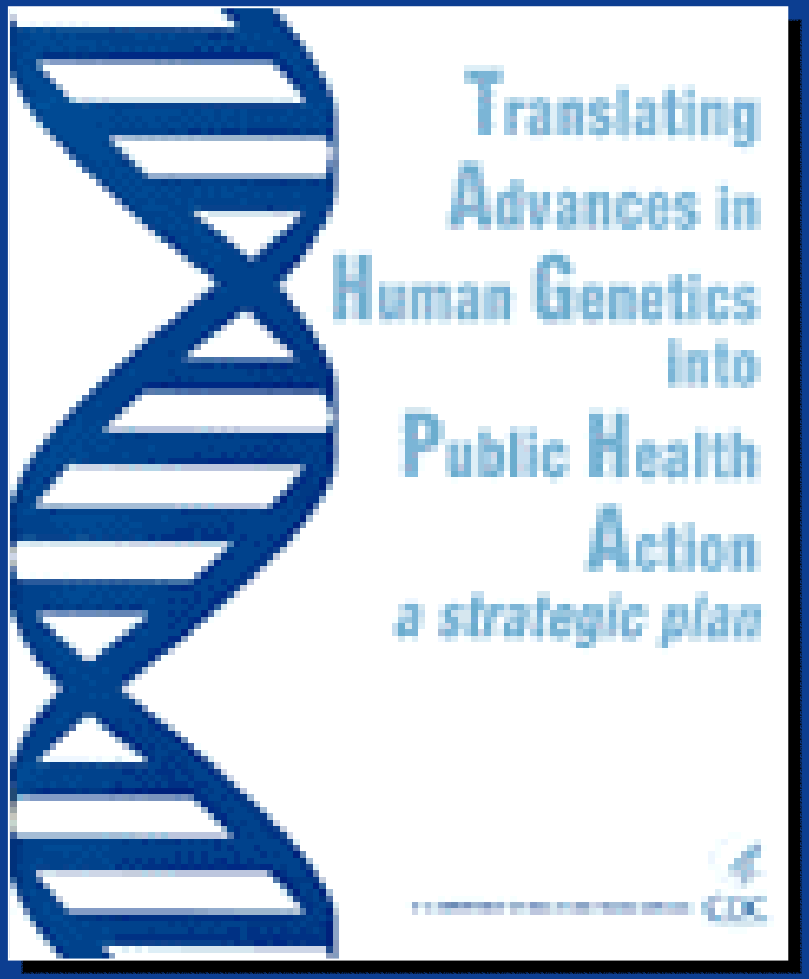
C. Lenfant NEJM 2003;349:868

- < 33% of patients with coronary artery disease (without contraindications) prescribed aspirin

”Let's be realistic: If we didn't do it with aspirin, how can we expect to do it with DNA?”

CDC: Nation's Prevention Agency
2003 Genomics Plan of Action

- 1997 Strategic Plan
- OGDP to CDC Director's Office
- NIH Research collaboration
- Partners Team
- CDC's Futures Initiative



CDC Genomics and Public Health Priorities:

Integrate Human Genomics into

- Sciences
- Services
- Systems

CDC Genomics and Public Health Priorities:

Integrate Human Genomics into

– **Sciences**: Assessing the impact of genomic variation on population health

– **Ongoing Activities:**

- NHANES: Gene Prevalence and Associations
- Genomics & the Acute Public Health Response
- Family History Public Health Research Initiative

Genomics and Population Health:
Real Communities in Real Time

- Population Prevalence of Genetic Variation
- Population Burden for Various Diseases
- Gene-Environment Interaction
- Epidemic Investigations

NHANES III DNA BANK
Prevalence of Genes of Public Health Significance

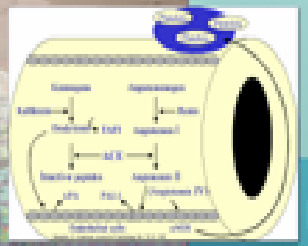
Background

NHANES III DNA Bank

- National Health and Nutrition Examinaiton Survey (NHANES) is a nationally representative survey
- Detailed interviews, clinical, laboratory and radiologic examinations are conducted
- Phenotypic data, such as serostatus for many infectious exposures, blood count, chemistries, etc. were collected
- During second phase NHANES III (1991-1994), white blood cells were frozen and cell lines were immortalized with EBV
- NHANES III DNA bank is located at NCEH,CDC, with specimens available from over 7000 participants
- In 2002, NCHS announced a call for proposals to use these specimens in the Federal Register

Collaborative CDC-wide Proposal Objective

- Determine the prevalence of genotypes of public health importance.



Criteria for Genetic Variants

Public Health Importance

- Known or hypothesized association with diseases of public health importance
- Role in pathways affecting multiple diseases
- Identified functional variants
- Relatively common (i.e., >2.0%)
- Previously described gene-environment or gene-gene interactions
- Relevant phenotypic data available in NHANES dataset
- No current use for clinical risk assessment or intervention

Challenges to Identifying Genes of Public Health Importance

- Gaps in information in the literature
- Methodological issues of many available studies
  - -Selection bias, power, interaction
- Non-replication of gene-disease association

Public Health Significance of Proposal

- Prevalence of gene variants
  - -Basis for estimating population attributable fraction in combination with measure of gene-disease association
  - -Enable assessment of potential for screening population subgroups for susceptibility genes
  - -Prevalence of combinations of variants in pathways and at different loci
- Examine gene-disease association, gene-environment and gene-gene interactions

Selected Pathways of Gene Variants
(87 variants of 57 genes)

- Nutrient Metabolism (e.g., folate and homocysteine; lipids; glucose; alcohol; vitamin D)
- Immune and Inflammatory responses (e.g., cytokines, receptors)
- Activation and detoxification pathways (e.g., drugs, carcinogens, environmental contaminants)
- DNA repair pathways (e.g. ionizing radiation, environmental toxins)
- Hemostasis pathway and renin/angiotension (e.g. vasomotor) pathway
- Developmental (e.g., hearing loss)

Laboratory Methods

- Genotyping
  - -Assessing Capability of External Laboratories to conduct high throughput, accurate, low-cost, genotyping for >600,000 SNPs (~7300 specimens X 87 variants*)

*Table of gene variants available upon request

Next Steps

- Pending approval from NCHS:
- Laboratory Selected
- Genotype-Phenotype analyses

CDC Working Group

ATSDR Olivia Harris **NCBDDD** Karen Abe, Cynthia Moore, Lorenzo Botto, Quanhe Yang **NCHSTP** Mary Reichler **NCID** Tom Hodge, Craig Hooper, Jai Lingappa, Janet McNicoll, Anne Dilley **NCEH** Amanda Brown, Peg Gallagher, Marta Gwinn, Omar Henderson, Bruce Lin, Mary Lou Lindegren, Julian Little, Karen Steinberg **NCCDPHP** Heidi Blanck, Wayne Giles, Ingrid Hall, Giuseppina Imperatore, Ann Malarcher **NIOSH** MaryAnn Butler, Ainsley Weston **PHPPO** Bin Chen **NIP** Scott Campbell **NCHS** Gerry McQuillan

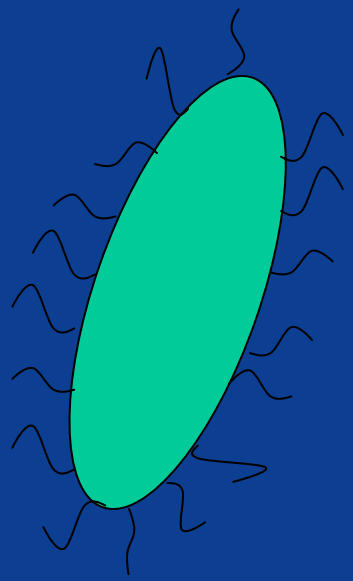
CDC

Integrating Human Genomics into the Acute Public Health Investigations

Environment

Host

Pathogen



From Jay Lingappa, CDC

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Leptospirosis

- **Pathogen:**

  serovars of spirochete *L. interrogans*

- **Environment:**
  - Water (lakes, rivers, wells)
  - Cuts and abrasions

- Host: ?

Springfield Ironhorse Triathlon June, 1998 Outbreak Investigation

- 98 suspected cases based on clinical criteria
- 52 serologically confirmed cases (ELISA/ MAT)-1 culture positive case
- Persons who swallowed one or more mouthfuls of water were at higher risk for
  - being a case (OR=2, p=0.002)
  - being seropositive (OR=2, p=0.02

Genetic Susceptibility to Leptospirosis: Preliminary Results

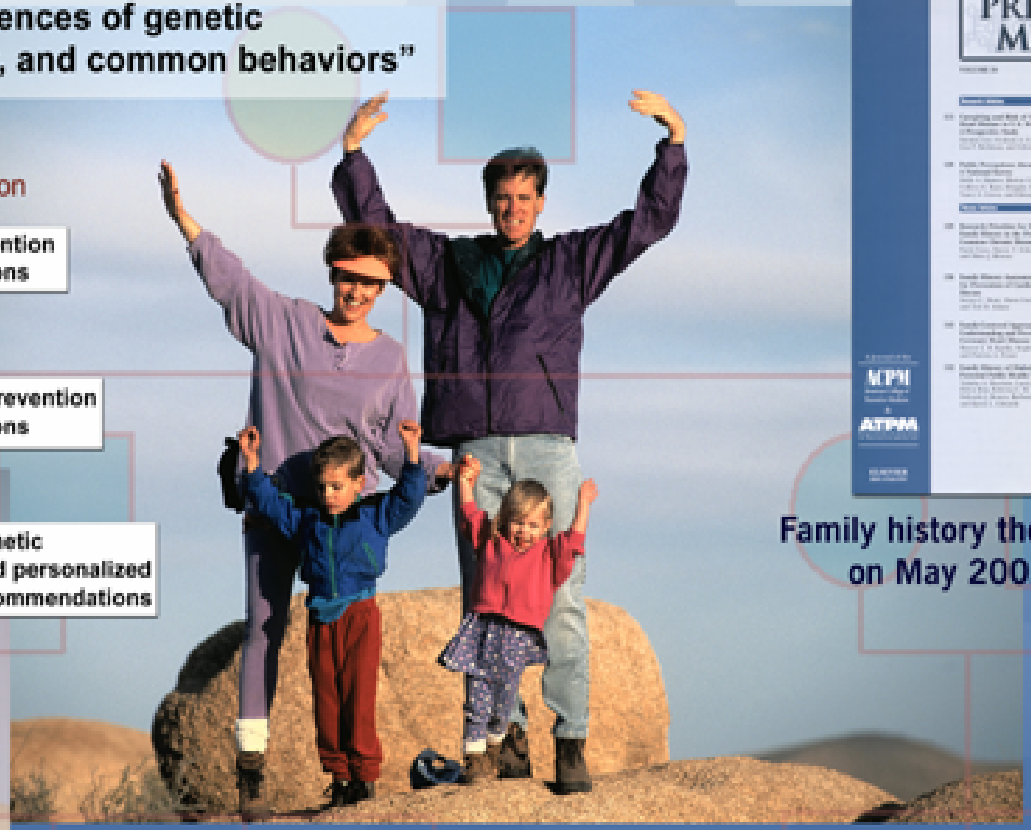
- Triathletes who were HLA-DQ6 positive were
  - more likely than DQ6 negatives to be seropositive for leptospirosis (OR=2.8, p=0.03)
  - Especially for those who reported swallowing water (OR=8.5, p=0.001)

Family History for Preventive Medicine and Public Health

http://www.cdc.gov/genomics/activities/famhx.htm

"Family history reflects the consequences of genetic susceptibilities, shared environment, and common behaviors"

Assessment	Classification	Intervention
Family History Questionnaire	Average	Standard prevention recommendations
	Moderate	Personalized prevention recommendations
	High	Referral for genetic evaluation aand personalized prevention recommendations



Family history theme issue based on May 2002 workshop

Family History Public Health Initiative

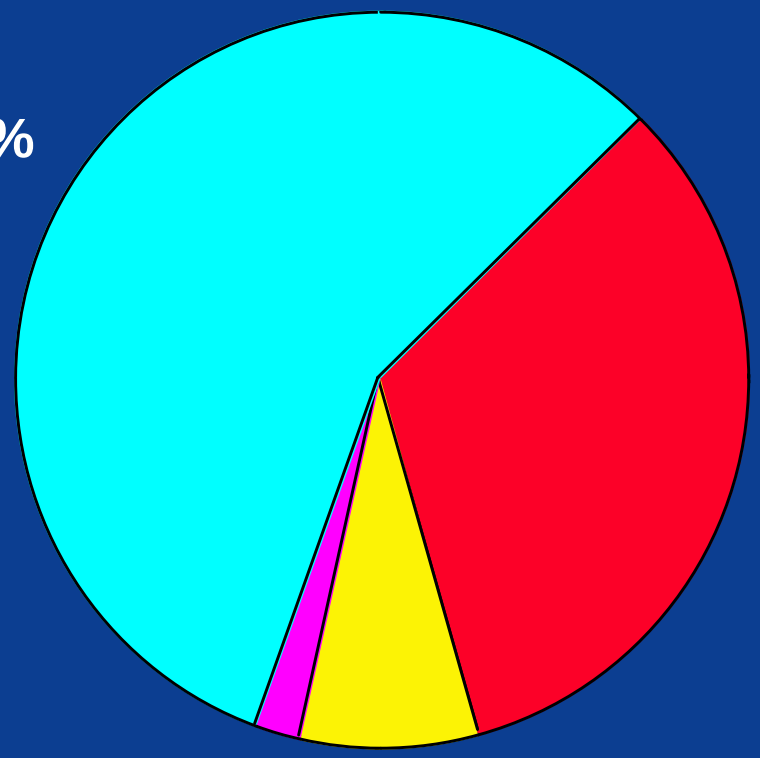
A multidisciplinary work group has been formed to:

- assess existing strategies for collecting family history
- develop a new computer-based FHx questionnaire
- establish a research agenda for evaluating validity and utility
- design public health messages and provider education

“This is Happening Every Day”
CNNSI Online June 24, 2002

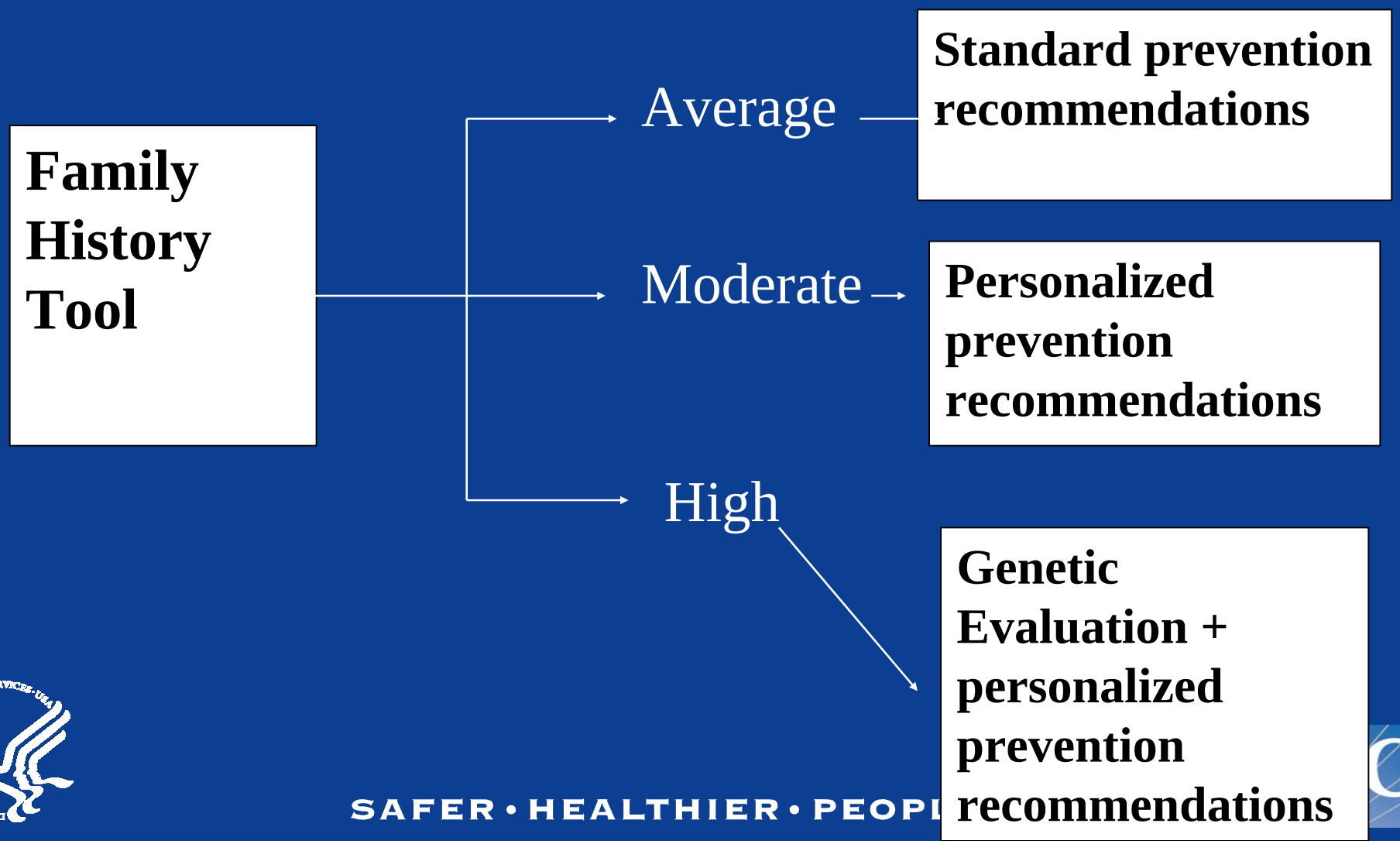
- “Doctors say Kile's condition is common, preventable”
- “Kile's father's death from cardiovascular disease in his 40s should have been a red flag signaling that the pitcher had an in creased risk of the same fate”

Family History of Common Diseases



Scheuner et al. Am J Med Genet 1997;71:315-324.

Schema for Using Family History to Guide and Inform Prevention Activities



CDC Genomics and Public Health Priorities:

Integrate Human Genomics into

– **Services**: Using and evaluating genomic information in prevention and practice

– **Ongoing Activities:**
- Centers for Genomics and Public Health
- State Cooperative Agreements
- Public Health Assessment of Genetic Testing
- CDC Genomics Workforce Development

Centers for Disease Control and Prevention (CDC) Awards Funds for Genetics Programs

(Oct 18, 2001) The Centers for Disease Control and Prevention (CDC) has awarded funding to three schools of public health establishing the first "Centers for Genomics and Public Health." Genomics, a new science arising from the discoveries of the human genome project, is the study of all elements of our human genome and how they relate to human health and disease. The University of Michigan, the University of North Carolina, and the University of Washington will each receive $300,000 per year for three years.

Through a cooperative agreement with the Association of Schools of Public Health and CDC, each Center for Genomics and Public Health will develop a regional hub of expertise for using genetic information to improve health and prevent disease. The Centers will build on and complement existing programs at the universities, both within and outside the schools of public health, and will create links with local and state health departments. Centers may also draw on other regional resources, such as professional organizations, the clinical community, and industry.

CDC Funding Press Release for the Centers for Genomics in Public Health - Microsoft Internet Explorer

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Address http://www.cdc.gov/genomics/activities/fund2003.htm Go Links

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Genomics and Disease Prevention

Centers for Disease Control and Prevention (CDC) Awards Funds for Genomics and Chronic Disease Prevention

Program Announcement 03022: Genomics and Chronic Disease Prevention Component

(July, 2003) The Centers for Disease Control and Prevention (CDC) has awarded funding to four states; Michigan, Minnesota, Oregon, Utah.

Component 7: Genomics and Chronic Disease Prevention--The purpose of the program is to assist States in developing agency-level genomics leadership and coordination capacity that ensures effective planning, implementation and evaluation of knowledge and tools for using genetic risk factors and family history in improving chronic disease prevention and health outcomes. The study of genes and their function has led to recent advances in genomics and our understanding of the molecular mechanisms of disease, including the complex interplay of genetic and environmental factors. This program requires the integration of genomics and family history assessments into ongoing and new population-based strategies for identifying and reducing the burden of specific

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Assessing Genetic Tests for Screening and Prevention

- Model Project: Systematic Reviews of Genetic Tests-ACCE
- Expert Panels
  - 1997: Cystic Fibrosis
  - 1997: Hemochromatasis
  - 2001: Factor V Leiden
  - 2001: Primary Immune Deficiency

Genetic Testing and the Public's Health

Myriad Genetics Launches Direct to Consumer Advertising Campaign For Breast Cancer Test - Microsoft Internet Explorer

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Address http://biz.yahoo.com/prnews/020912/lath024_1.html Go Links

Press Release Source: Myriad Genetics, Inc.

Myriad Genetics Launches Direct to Consumer Advertising Campaign For Breast Cancer Test

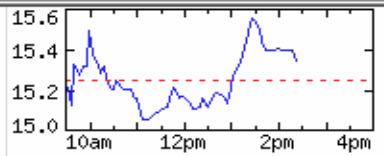
Thursday September 12, 6:30 am ET

- First Ever Campaign for Cancer Predictive Test To Market BRACAnalysis in Denver and Atlanta -

SALT LAKE CITY, Sept. 12 /PRNewswire-FirstCall/ -- Myriad Genetics, Inc. (Nasdaq: MYGN - News), today initiated an intensive five-month advertising campaign to raise awareness of cancer prevention options among women with a family history of breast cancer or ovarian cancer. The first-of- its-kind campaign will focus on Atlanta and Denver, using television, radio and print media to carry its message of hope and help to those at high risk of cancer.

ADVERTISEMENT

Denver and Atlanta comprise 3.2% of the target population, consisting of women in the United States between the ages of 25 and 54, with a strong family history of breast or ovarian cancer. Market research among 300 high-risk women representing this population, conducted prior to the campaign, indicated that 85% would contact their doctor about having the test. An impressive 94% agreed with



MYGN 15.35 +0.10 News

View Detailed Quote

Delayed 20 mins

Quote data provided by Reuters

Related News Stories

- Japan-Led Group Decodes Rice Genome - Associated Press (Wed Dec 18)
- MYRIAD GENETICS INC FILES (8-K) Disclosing Other Events and Financial Statements & Exhibits - EDGAR Online (Tue Nov 26)
- Myriad Genetics Raises $57.3 Million - PR Newswire (Thu Nov 21)
- Myriad Genetics Names Richard Marsh As General Counsel - PR Newswire (Thu Nov 21)

More...

- By industry: Advertising,

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Ongoing Public Health Assessment of Impact of DTC Campaign

- 4 Health Departments + CDC Programs
- 2 “Exposed”: Atlanta & Denver
- 2 “Unexposed”: Raleigh/Durham & Seattle
- Survey of Women Ages 25-54
- Survey of Health Care Providers
- Knowledge, Attitudes, Behaviors, Practices
- Association with Source of Information

Training and Education for Genetics and Public Health - Microsoft Internet Explorer

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Genomics and Disease Prevention NCEH

Training & Education

OGDP Office of Genomics & Disease Prevention

weekly Update

- Information
- CDC Activities
- Training & Education
- Events
- Links

HuGENet

- On-Line Presentations (lectures, slides, audio, video)
- Fellowships & Career Opportunities
- Training Opportunities
- Meetings, Courses, & Conferences
- Core Competencies in Genetics Essential for All Health-Care Professionals
- Public Health Workforce Genomic Competencies

http://www.cdc.gov/ Internet

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CDC Genomics and Public Health Priorities:

Integrate Human Genomics into

- **Systems**: Integrating genomic information into the public health information network

- **Ongoing Activities:**
  - Genomics & Disease Prevention Information System
  - Human Genome Epidemiology Network (HuGE Net)

Genomics and Disease Prevention Information System (GDPInfo)

GDPInfo is a searchable database of documents available on the Office of Genomics and Disease Prevention's (OGDP) Web site as well as links to relevant documents on other sites.

Try it! Search by

- Gene
- Disease
- Interactive Factor

What is in GDPInfo?

- fact sheets
- reviews
- case studies
- published literature
- online presentations
- books and book chapters
- materials from conferences and workshops

Why GDPInfo?

To provide access to information and resources for guiding public health research, policy, and practice on using genetic information to improve health and prevent disease.

Who Uses GDPInfo?

Public health professionals are the target audience but there are data and information for researchers, health care providers, and the general public.

http://www.cdc.gov/genomics

CDC

Human Genome Epidemiology Network - Microsoft Internet Explorer

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OGDP Office of Genomics & Disease Prevention

weekly Update

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GDPInfo

Human Genome Epidemiology Network

HuGE Net

Welcome to HuGENet™: a global collaboration of individuals and organizations committed to the assessment of the impact of human genome variation on population health and how genetic information can be used to improve health and prevent disease.

Through collaborative research, systematic reviews, training, and information dissemination, HuGE Net seeks to advance our global knowledge base on population prevalence of human genetic variation, association between genetic variants and human diseases, measurement of gene-environment interaction, and evaluation of genetic tests for screening and prevention. This knowledge is crucial to an evidence-based integration of human genomics into the practice of medicine and public health in the 21st century.

Learn more about HuGENet's™ purpose, goals and ongoing activities

http://www.cdc.gov/genomics/default.htm Internet

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CDC Genomics and Public Health Priorities:

Integrate Human Genomics into

- **Sciences**: Assessing the impact of genomic variation on population health
- **Services**: Using and evaluating genomic information in prevention and practice
- **Systems**: Integrating genomic information into the public health information network