

# Public Health Genomics at CDC: Where Are We Now & Where Do We Want to Go?

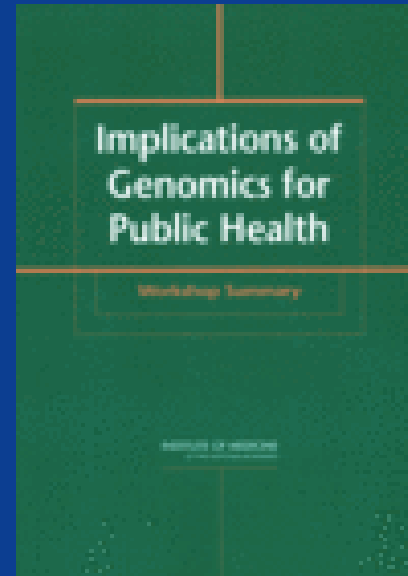
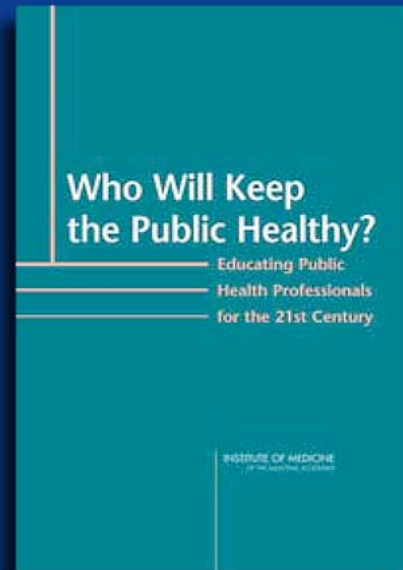
Muin J. Khoury MD, PhD

CDC Office of Genomics and Disease Prevention



“Genomics is to the 21<sup>st</sup> century what infectious disease was to the 20<sup>th</sup> century...”

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“...Genomics should be considered in every facet of public health: infectious disease, chronic disease, occupational health, environmental health, in addition to maternal and child health.”

Gerard S, Hayes M, Rothstein MA. J Law Med Ethics. 2002



# Use of Genomic Information Today Prevents Disease and Promotes Health

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## Infants

Newborn screening prevents morbidity and disability in thousands of children annually.

## Children

Genomics may explain why some healthy children die from influenza infection.

## Adolescents

Understanding gene-drug interaction could help reduce asthma morbidity and drug side effects.

## Adults and Older Adults

Promoting screening for persons with family history could double the number of prevented colorectal cancers.



# What is “Public Health Genomics”? (IOM, 2005)

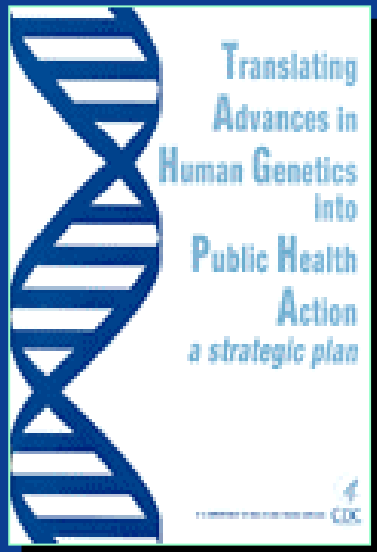
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“An emerging field that assesses the impact of genes and their interaction with behavior, diet and the environment on the population’s health”



# Public Health Genomics at CDC

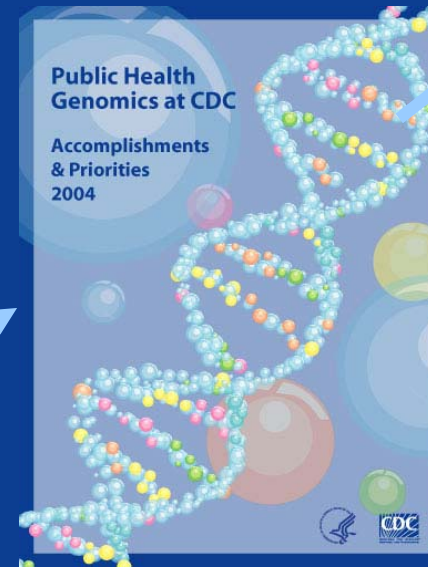
1997  
CDC Strategic Plan  
Dr. David Satcher



2003  
Foundation Initiatives  
Dr. Julie Gerberding



2004



2005

CoCHP  
NCCDPPH



# Where Are We Today? Building Block Initiatives

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1. Family History Public Health Initiative
2. Evaluating Genomic Applications in Practice and Prevention (EGAPP)
3. Integrating Genomics into Public Health Surveys and Investigations
4. Centers for Excellence in Genomics and Public Health
5. Model State Public Health Genomics Programs



# 1. Family History Public Health Initiative

## Impact

- Family Healthware™
- Validating family history tool for use by practitioners and the public for six common chronic diseases (breast, ovarian, colorectal cancer, diabetes, heart disease, stroke)
- Goal to improve targeting of screening and interventions for health impact



## 2. Evaluating Genomic Applications in Practice and Prevention (EGAPP)

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### Impact

- Form independent panel to evaluate genetic tests and other genomic applications
- Protect public from harm and provide practitioners with evidence base
- CDC accepts key leadership role recommended by many groups





# 3. Integrating Genomics into Public Health Surveys and Investigations

## Impact

- Measure prevalence of variants in 57 genes in US (NHANES)
- Develop tools and methods for understanding population susceptibility to infectious and environmental exposures and response to intervention



Environment



Host



Pathogen

# 4. Centers for Excellence in Genomics and Public Health

## Impact

- 3 Centers provide bridge between genomics research and practice
- Provide public sector access to specialized expertise
- Create networked partnership spanning academic and public sectors and multiple levels of government

**Want to Learn More about Genomics?**

**Six Weeks to Genomic Awareness** is a free, online series of six modules designed to provide public health professionals a foundation for understanding how genomics advances are relevant to public health.



The series includes:

- Introductory Genomics Concepts
- Examination of Genes in Populations
- Genetic Testing
- Gene-Environment Interactions
- Ethical, Legal and Social Issues
- State and National Resources

You can conveniently view the modules at your own pace. For information on CEUs, please contact [mcgph@umich.edu](mailto:mcgph@umich.edu).

<http://www.genomicawareness.org/index.htm>

Six Weeks to Genomic Awareness was developed by the Michigan Center for Genomics and Public Health in collaboration with the Centers for Genomics and Public Health at the University of North Carolina and the University of Washington and the CDC's Office of Genomics and Disease Prevention.



more info

# 5. Integrating Genomics into State Public Health Programs

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## Impact

- 4 states developing workforce and genomic applications for public health practice
- State-to-state networks to share experience and expertise



# Where Do We Want to Go?

## CDC Beyond Gene Discovery Initiative

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Develop a “public health genomics” strategy for FY2007 with new resources to all Coordinating Centers and accountability to CDC goals.



# Public Health Genomics: a Vision for the Future

2015

Infant, child & adolescent health  
Common chronic diseases  
Infectious diseases  
Environmental exposures  
Occupational health  
Preparedness

2005



# Public Health Genomics: a Vision for the Future

2015

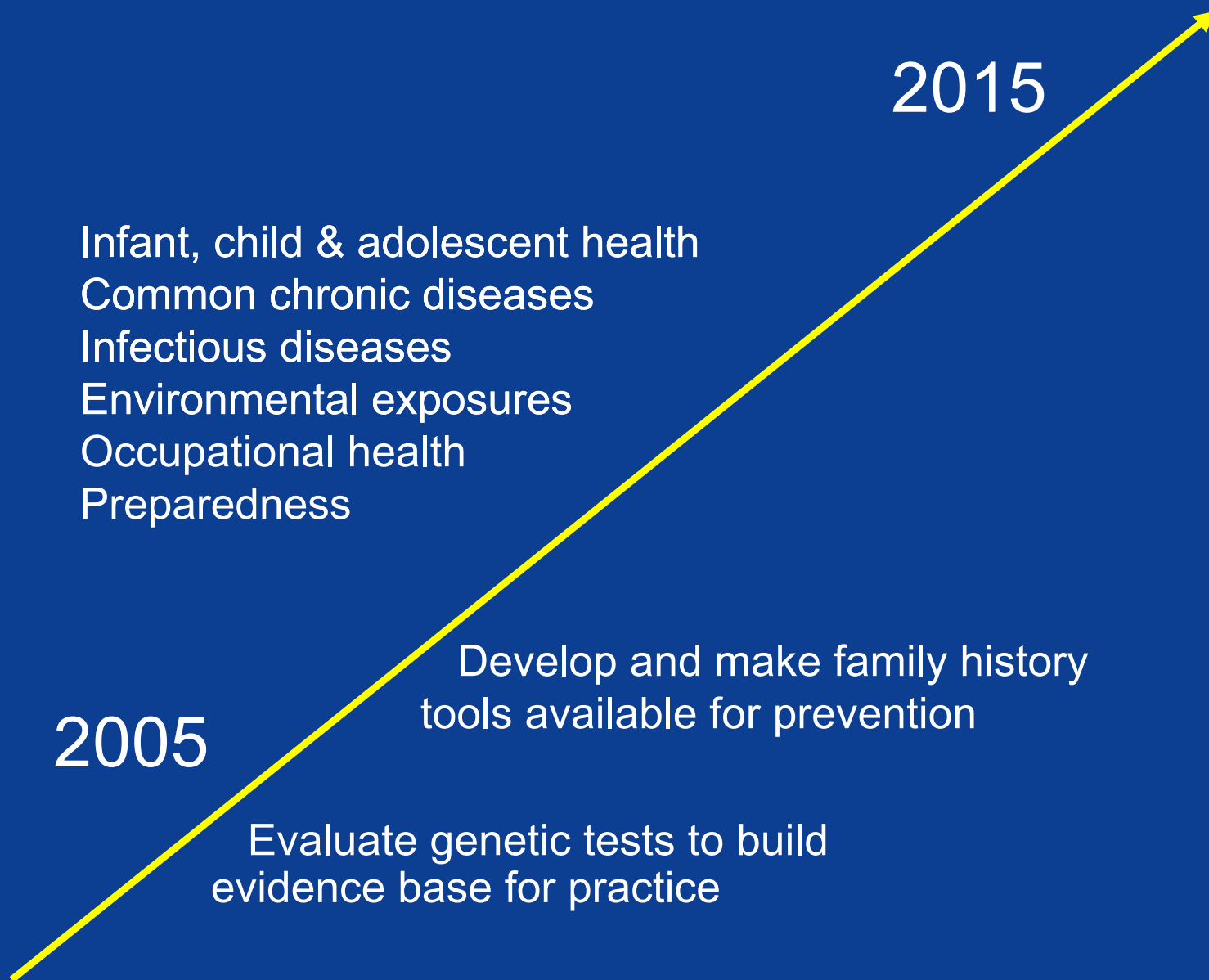
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2005

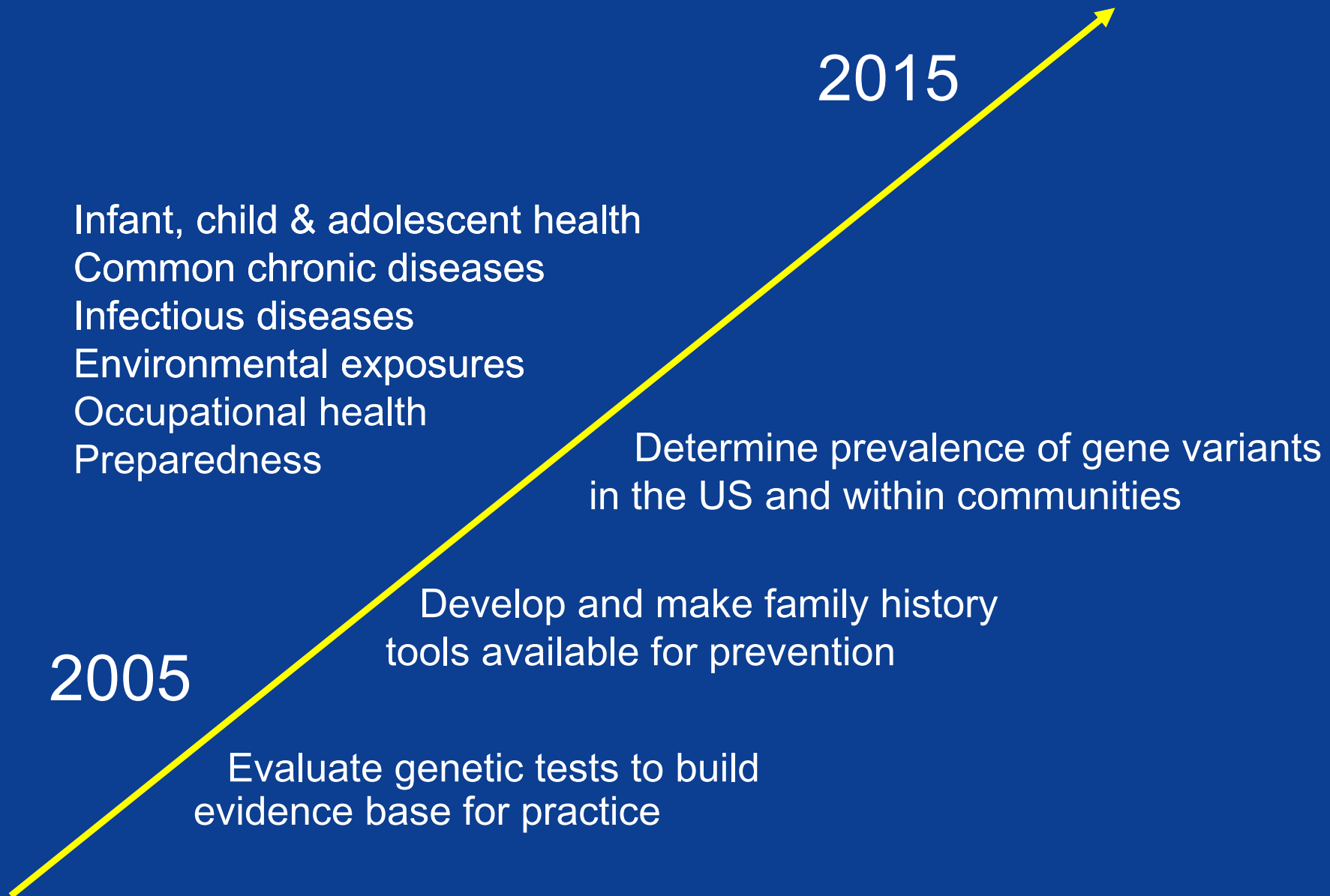
Evaluate genetic tests to build  
evidence base for practice



# Public Health Genomics: a Vision for the Future

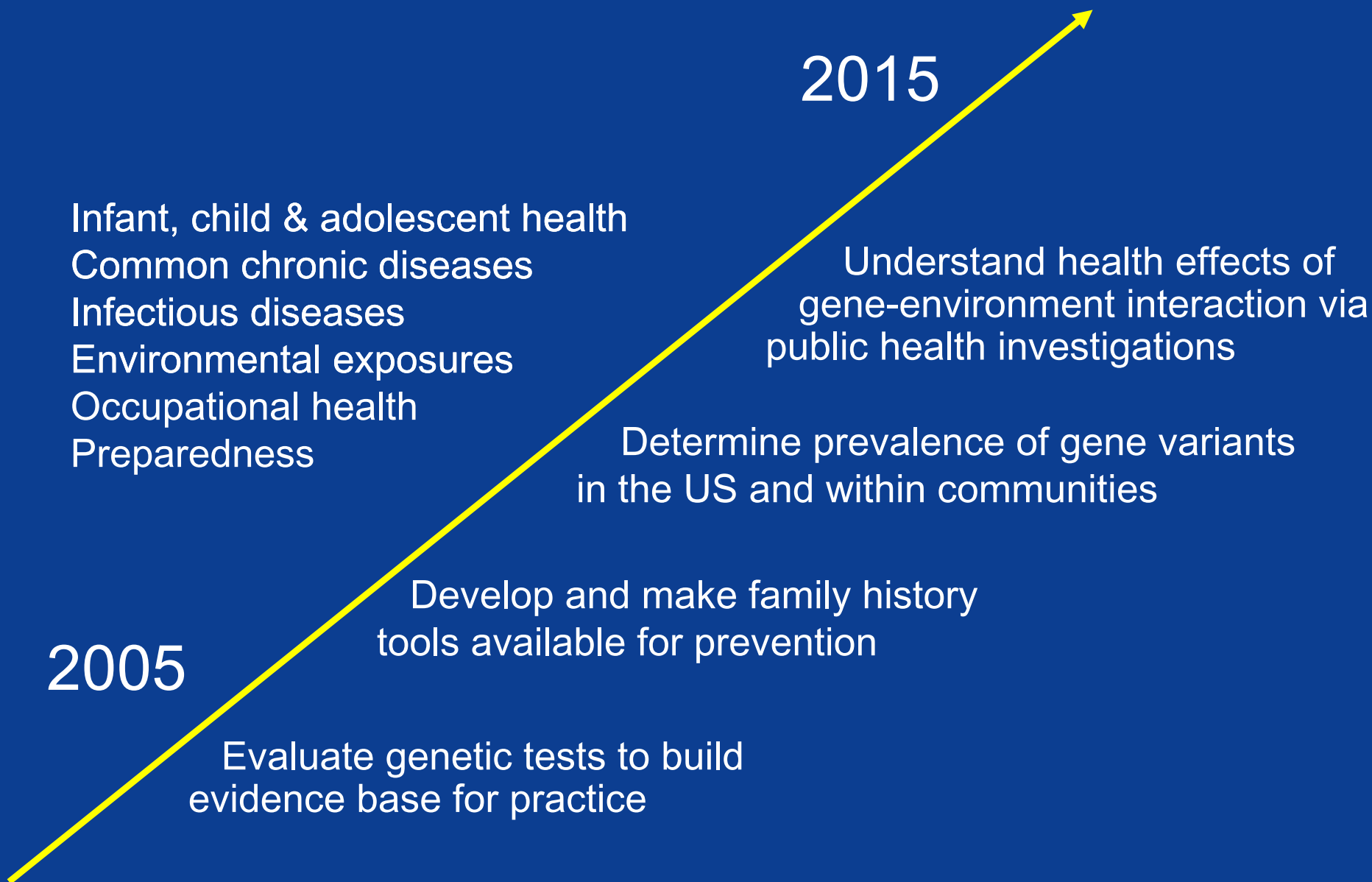


# Public Health Genomics: a Vision for the Future

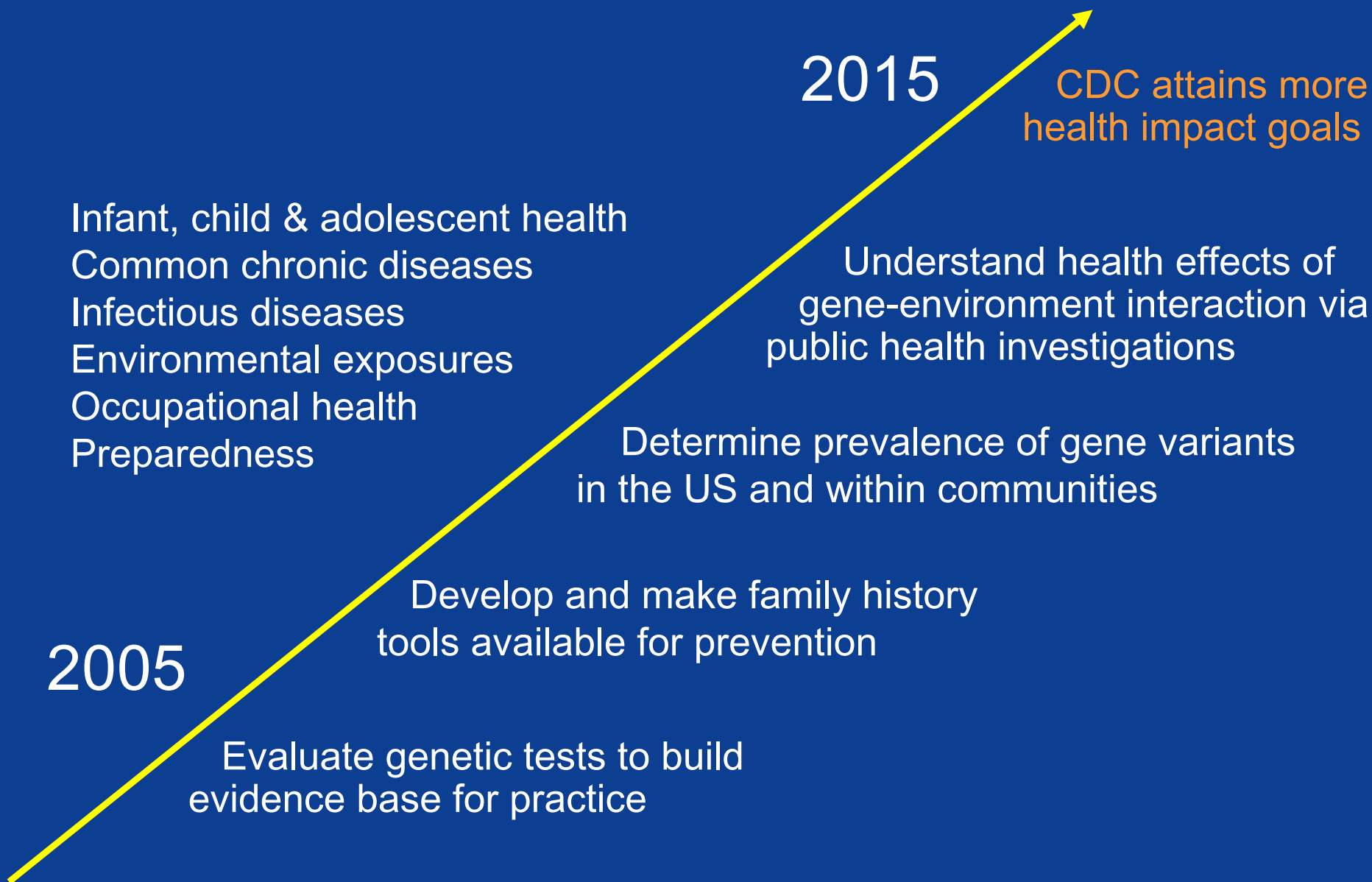




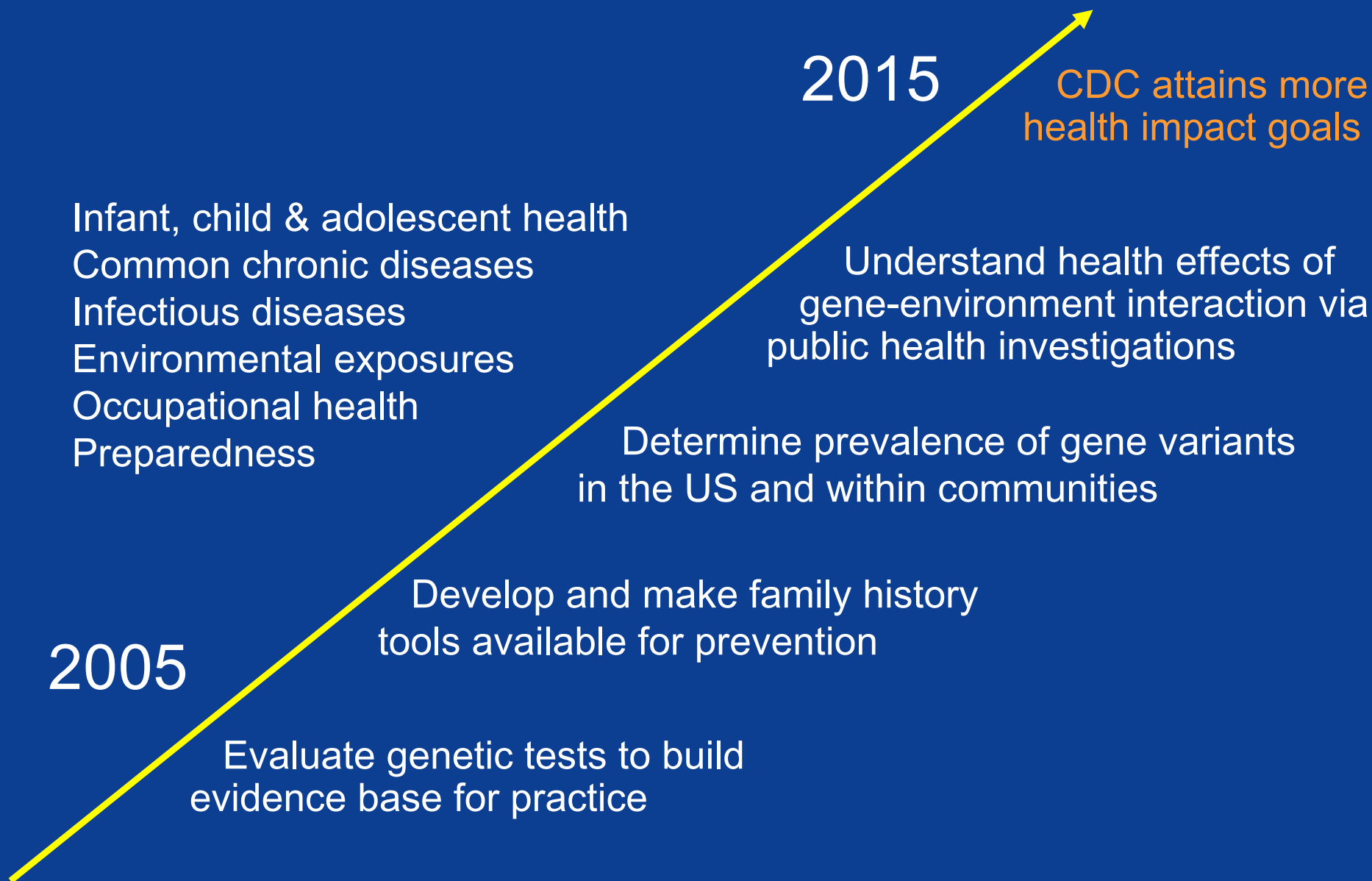
# Public Health Genomics: a Vision for the Future



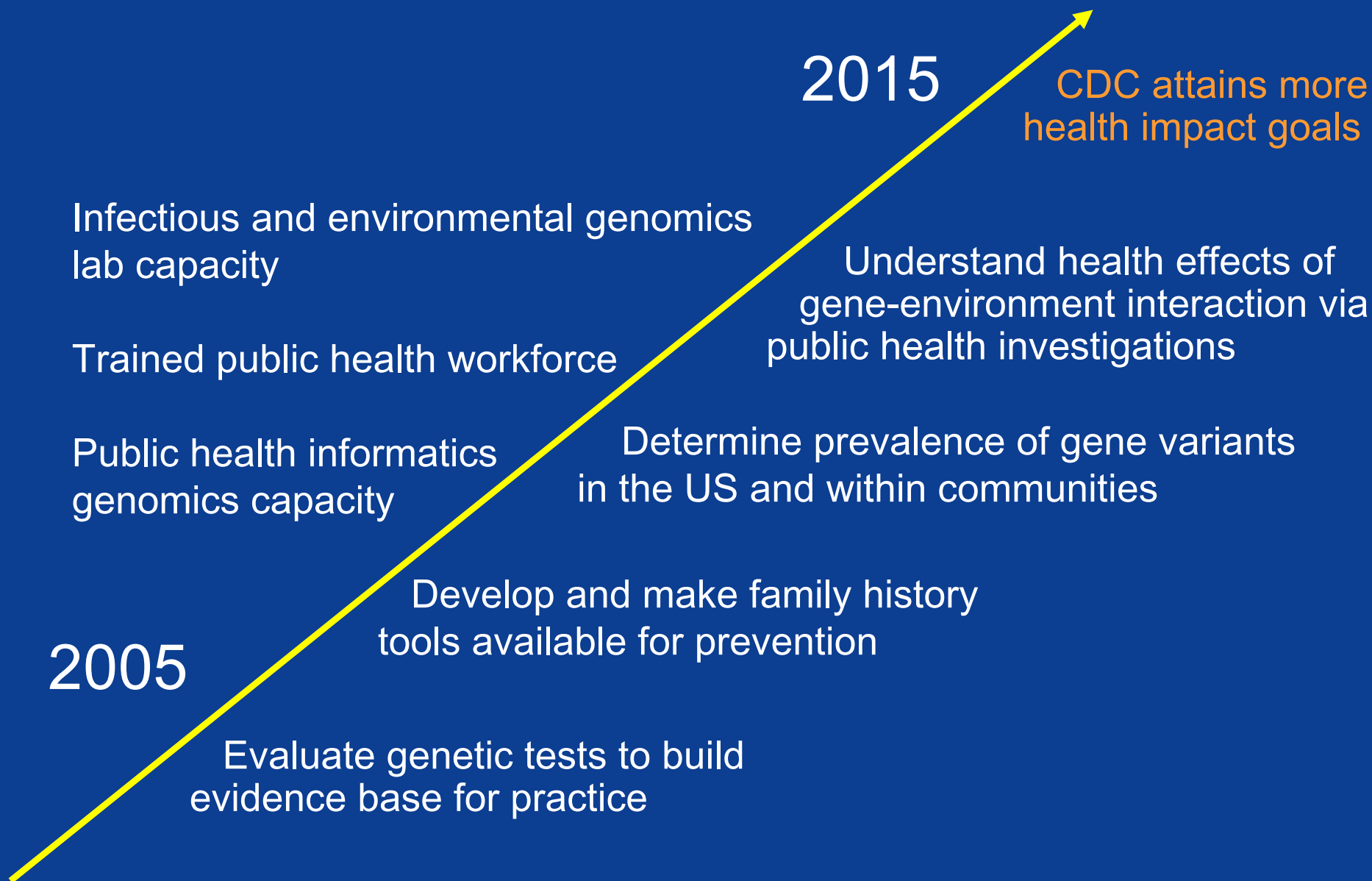
# Public Health Genomics: a Vision for the Future



# Public Health Genomics: a Vision for the Future



# Public Health Genomics: a Vision for the Future



# CDC's 2007 Beyond Gene Discovery Initiative

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- Family history
- Evaluation of genetic tests
- Prevalence of gene variants
- Public health investigations



# CDC's 2007 Beyond Gene Discovery Initiative: Family History

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Develop validated family history–based strategies for 10 or more conditions and implement personalized and family-based interventions to reduce disease burden.



# CDC's 2007 Beyond Gene Discovery Initiative: Family History

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- 14% of families account for almost half of the burden of heart attacks in Utah (Hunt 2003)
- Almost half the population has a family history of a close relative with one or more common chronic diseases (Scheuner, 1997)
- More than 70% of adults with diabetes have a family history of diabetes (Hariri et al, 2005)



# CDC's 2007 Beyond Gene Discovery Initiative: Family History

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“This is Happening Every Day”



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

CNNSI June, 2002





# CDC's 2007 Beyond Gene Discovery Initiative: Evaluation of Genetic Tests

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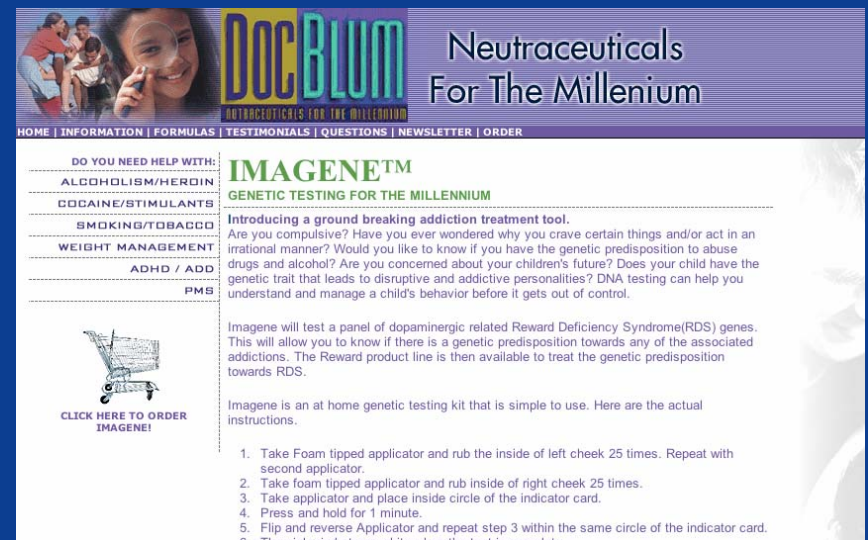
Evaluate 10 or more genetic tests per year to provide a sound evidence base for genomic applications in practice, save health care dollars and protect consumers from unneeded or harmful tests.



# CDC's 2007 Beyond Gene Discovery Initiative: Evaluation of Genetic Tests

“Are you concerned about your children’s future? Does your child have the genetic trait that leads to disruptive and addictive personalities? DNA testing can help you to understand and manage a child’s behavior before it gets out of control.”

<http://www.docbluminc.com>



The screenshot shows the DocBlum website for the Imagene genetic testing kit. The header includes the DocBlum logo and the tagline "Neutraceuticals For The Millenium". A navigation bar contains links for HOME, INFORMATION, FORMULAS, TESTIMONIALS, QUESTIONS, NEWSLETTER, and ORDER. The main content area features a list of conditions under "DO YOU NEED HELP WITH:" including ALCOHOLISM/HEROIN, COCAINE/STIMULANTS, SMOKING/TOBACCO, WEIGHT MANAGEMENT, ADHD / ADD, and PMS. The "IMAGENE™ GENETIC TESTING FOR THE MILLENNIUM" section introduces a "ground breaking addiction treatment tool" and asks if the user is compulsive or concerned about their child's future. It explains that the kit tests for dopaminergic related Reward Deficiency Syndrome (RDS) genes. A shopping cart icon with the text "CLICK HERE TO ORDER IMAGENE!" is visible. The instructions for use are listed as follows:

1. Take Foam tipped applicator and rub the inside of left cheek 25 times. Repeat with second applicator.
2. Take foam tipped applicator and rub inside of right cheek 25 times.
3. Take applicator and place inside circle of the indicator card.
4. Press and hold for 1 minute.
5. Flip and reverse Applicator and repeat step 3 within the same circle of the indicator card.
6. The pink circle turns white when the test is complete.

# CDC's 2007 Beyond Gene Discovery Initiative: Prevalence of Gene Variants

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Measure prevalence of 25,000 gene variants in the US and in communities to provide an important foundation for research and programs to achieve health impact.



# CDC's 2007 Beyond Gene Discovery Initiative: Public Health Investigations

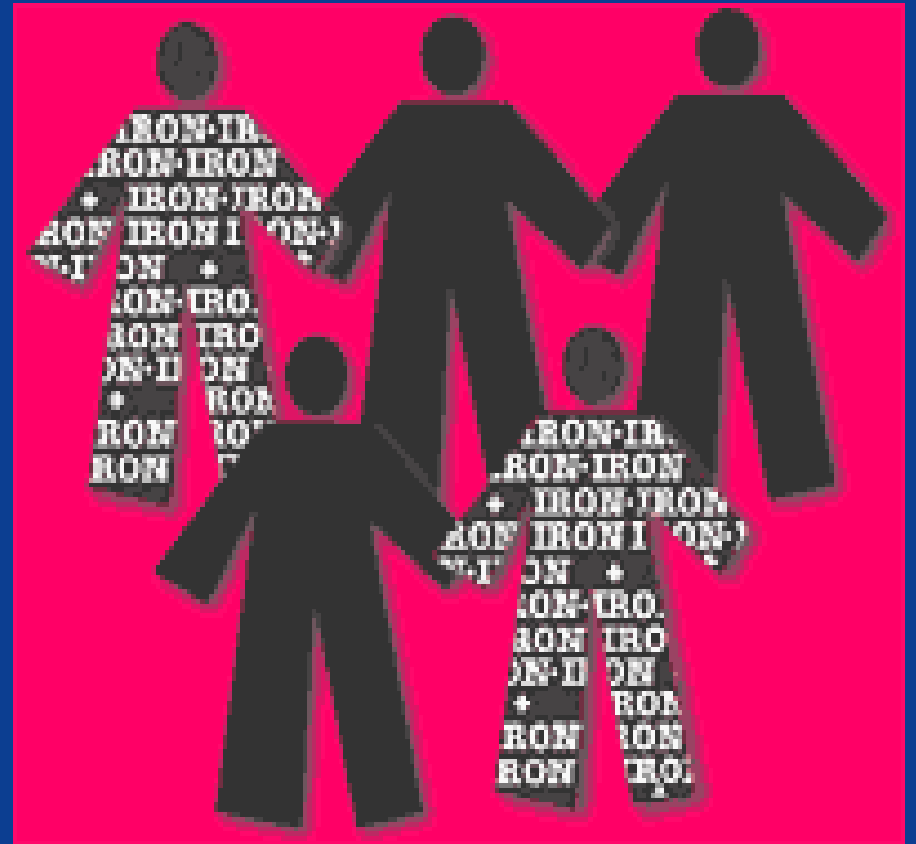
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Integrate genomics into 20 or more public health investigations, surveys and biobanks per year; assess genotype-phenotype relationships in CDC and partner specimen/data sources; and use information to develop targeted interventions.



# Hereditary Hemochromatosis

- Iron Overload
- Multiple organ system
- Intervention: simple
- Gene Chromosome 6
- 1997 Expert Panel on Population Screening
- Public health research Agenda
- CDC Provider education campaign



# Prevalence of Hereditary Hemochromatosis Mutations in the USA

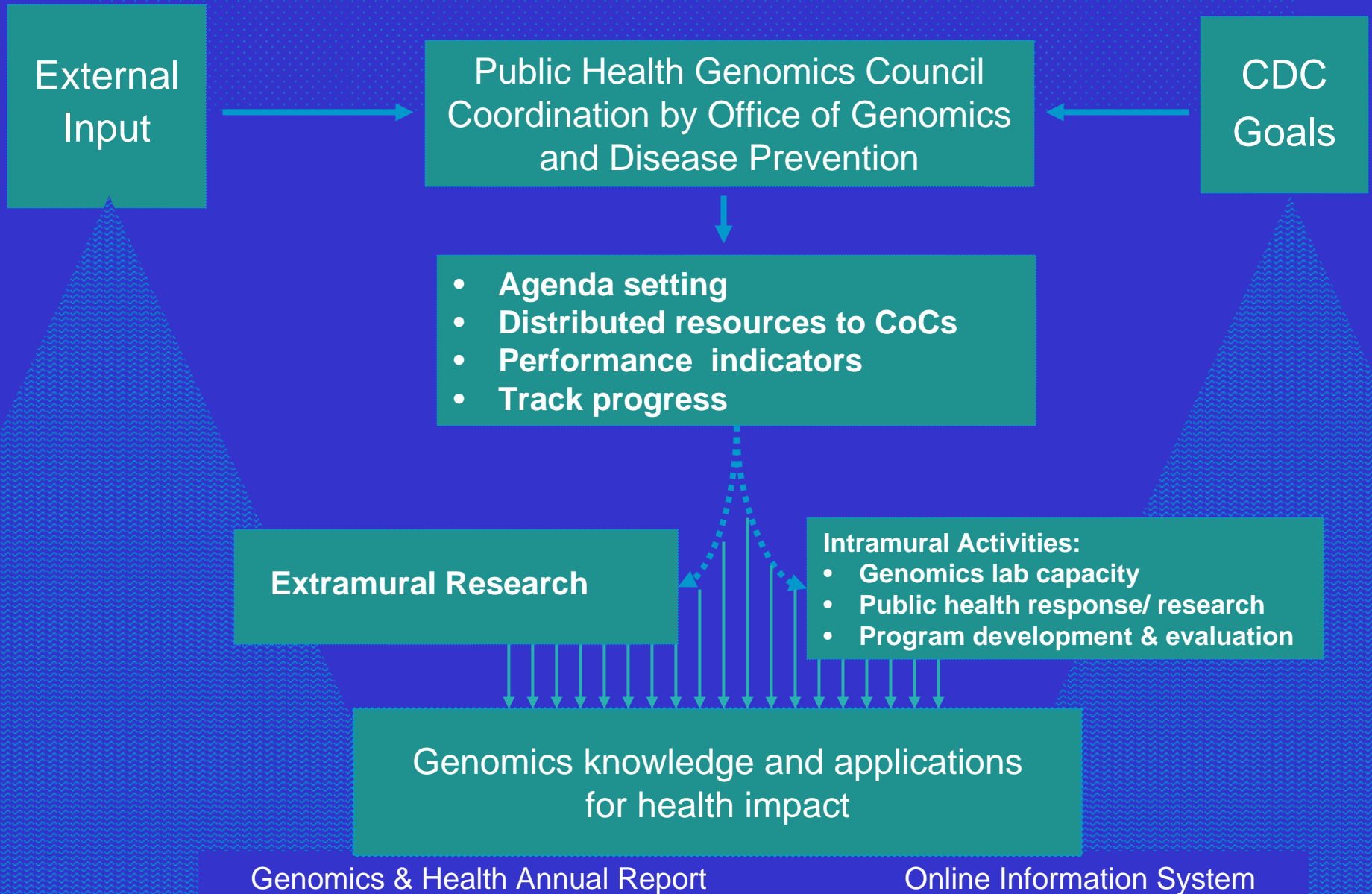
## NHANES III

Genotype/Group	Genotype Prevalence (%)		
	White	Black	Hisp
C282Y/C282Y	0.3	.06	.03
H63D/H63D	2.2	0.3	1.1
C282Y/H63D	2.4	.06	0.2

Steinberg KK et al., JAMA 2001;285:2216



# CDC Beyond Gene Discovery Initiative



SPECIAL REPORT

JANUARY 17, 1994 \$2.95

# TIME



## Genetics THE FUTURE IS NOW

New breakthroughs can cure diseases and save lives,  
but how much should nature be engineered?



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