Accelerating cancer prevention

We already know how to prevent most cancer.

Joint BSA&NCAB meeting

Dec 4 2014

National Cancer Institute

Graham A. Colditz, MD DrPH, FAFPHM

Department of Surgery
Division of Public Health Sciences

Washington University in St. Louis
School of Medicine

Goals of talk

Review potential for prevention

Challenge us to address and define – distinctive roles for NCI in cancer prevention research

Issues:

- Improving cancer prevention,
- Implementing what we know,
- Identifying what needs to be done to achieve desired effects, and
- NCI's role/priorities and collaborations with other agencies.

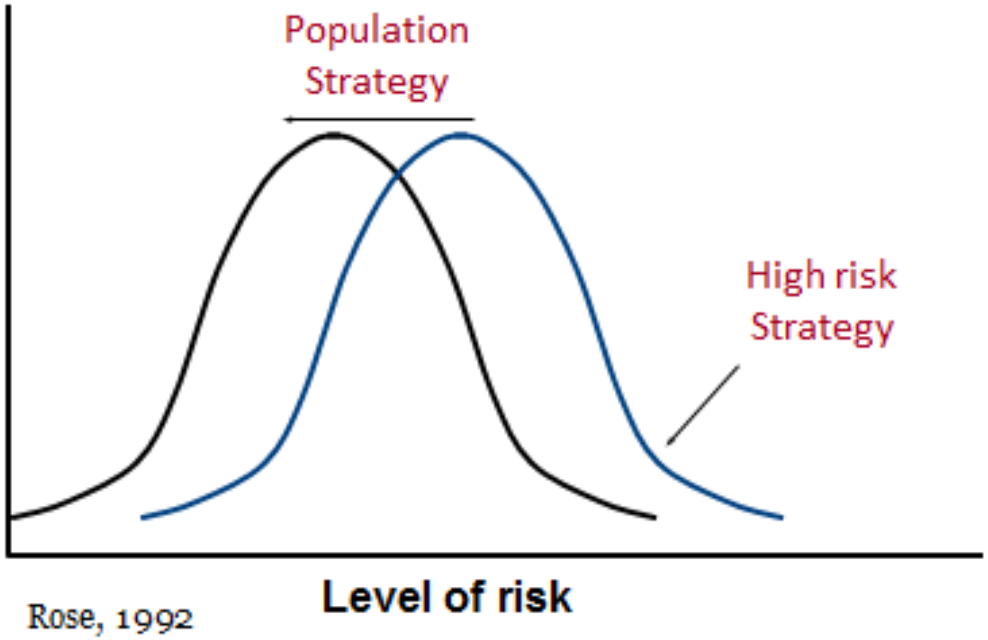
Shared understanding of what implementation science is

Clarity on boundaries between components of HHS

Medical interventions proven to prevent cancer (Sci Trans Med 2012)

Intervention	Target	Magnitude of reduction	Time (yrs)
Aspirin	Colon mortality	40%	20+
SERMs	Breast incidence	40-50%	5+
Salpingo oophorectomy	Familial breast ca	50%	3+
Screening for colorectal ca	Colon ca mortality	30-40%	10
Vaccination	Cervical ca incidence	50-100%	20+
	Liver ca incidence	70-100%	20+
Mammography	Breast ca mortality	30%	10-20
Serial CT lung	Lung ca mortality	20%	6+

Population approach versus high risk strategy



Rose, 1992

Behavioral, Social and Policy interventions that impact Cancer Prevention

Intervention	Target	Type of Ix	
Reduce tobacco use	Chidlren and Adolescents Smokers to quit	Combined Pharmaco/behavioral ixs Smoke-free policies Tobacco taxes	SG
Increase physical activity	Individuals and community norms	Urban design Stairs and workplace	SG
Reduce Obesity	Population	Messages School & work environ Physical activity Food & beverage	IOM report
Limit alcohol	Population	Taxes	WHO

When we implement what we know, we prevent cancer

Tobacco –

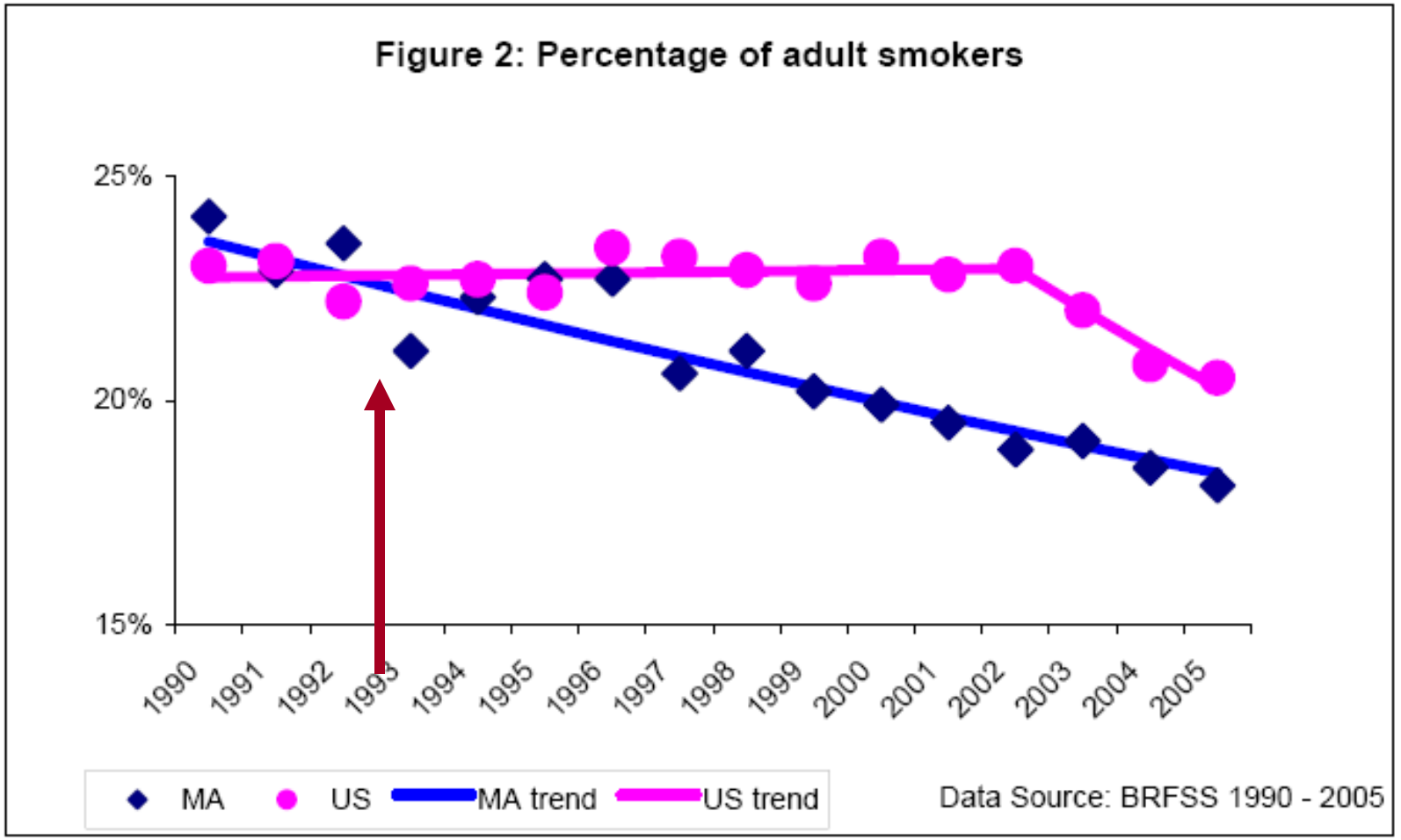
lung cancer mortality decreased by one third

- Adolescent smoking decrease 35% (1999) to 18% (2011)

Colorectal cancer screening –

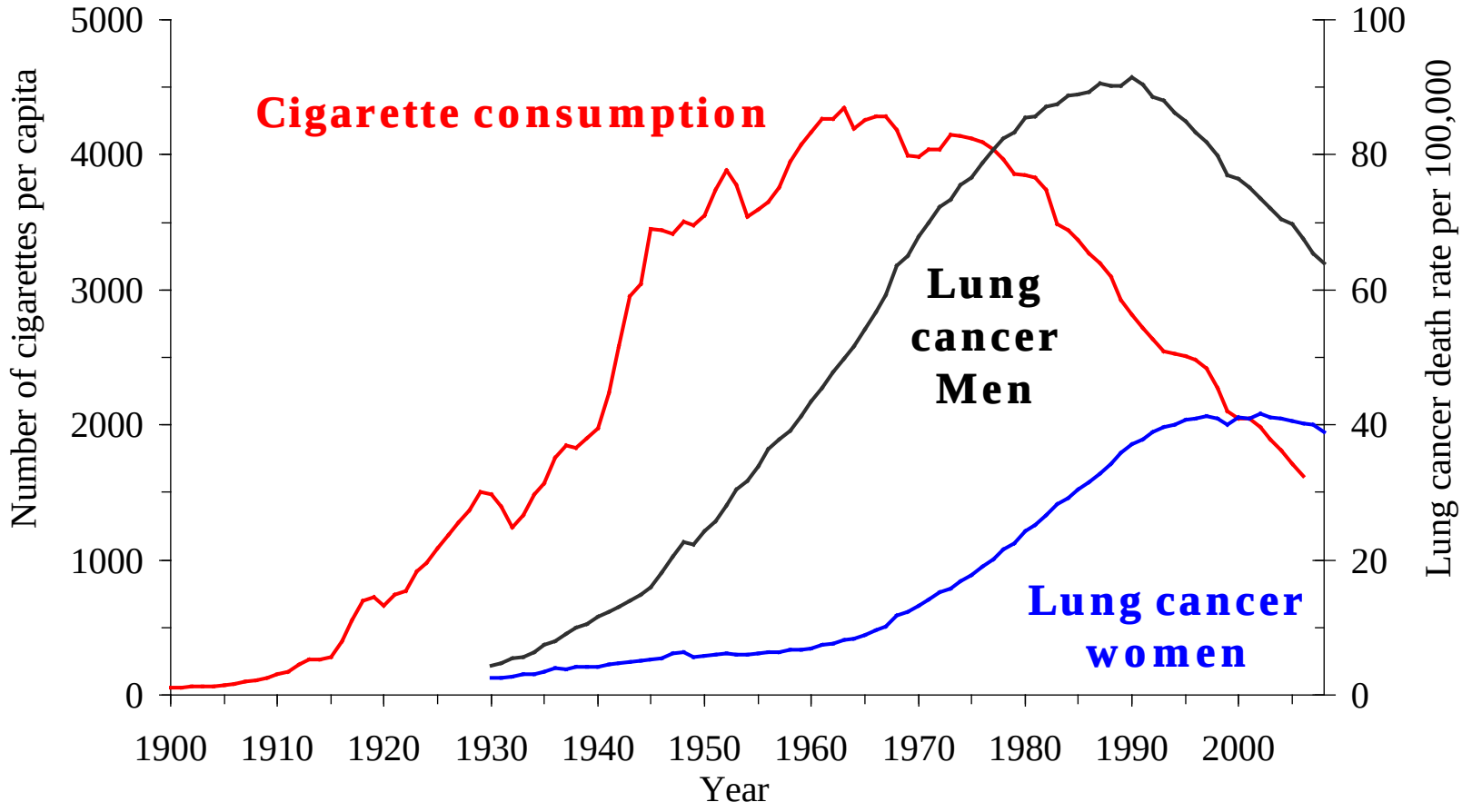
steady increase in use and reduction in CRC mortality over time

Adult smoking prevalence US & Massachusetts, 1990-2005



Massachusetts Dept of Public Health, 2007

Trends in smoking and lung cancer, USA



Lifestyle: high income countries

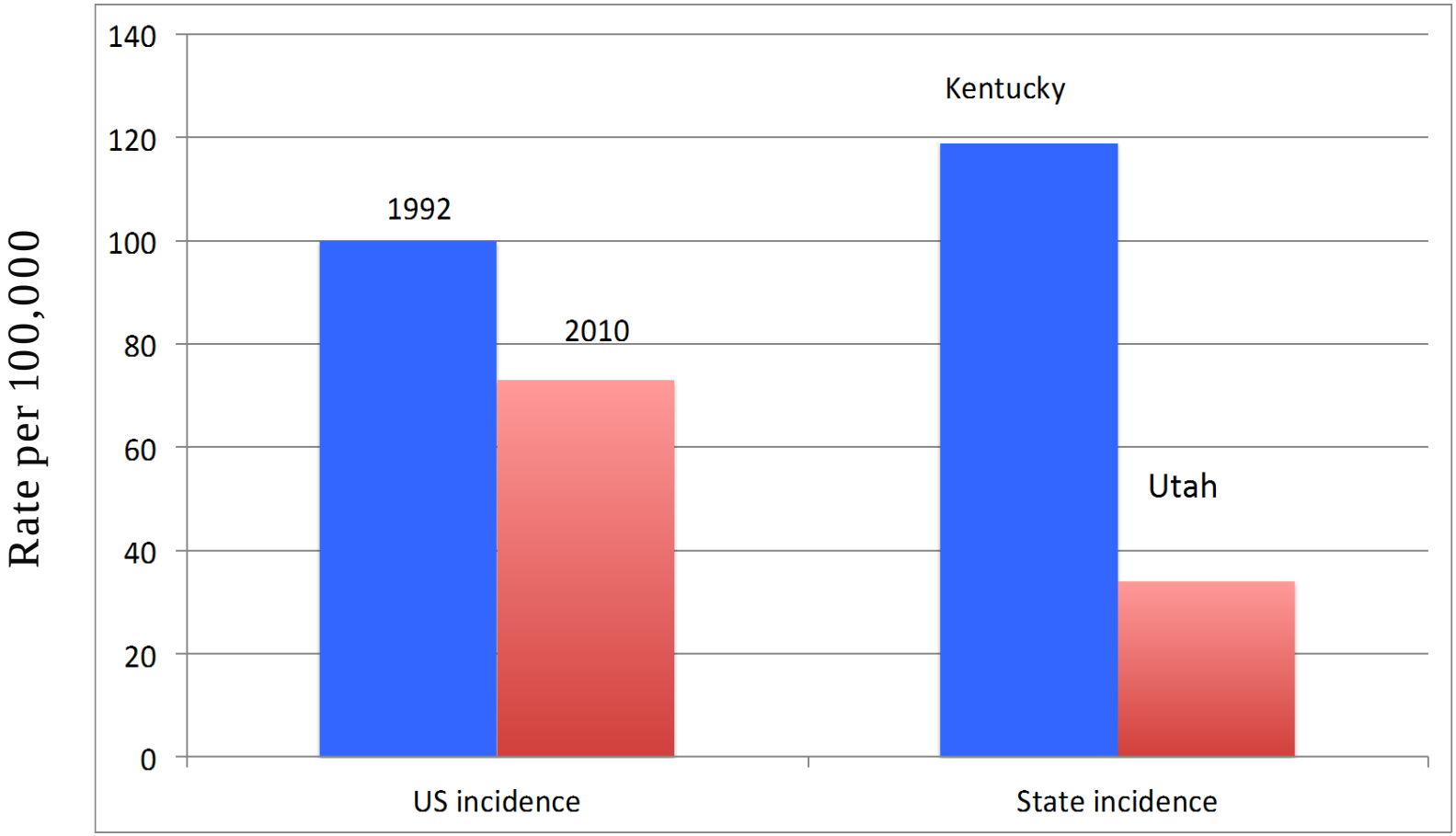
Cause	% cancer caused	Magnitude possible reduction	Time (yrs)
Smoking	33		
Overweight/obesity	20		
Diet	5		
Lack of exercise	5		
Occupation	5		
Viruses	5-7		
Family history	5		
Alcohol	3		
UV/ionizing radiation	2		
Reproductive	3		
Pollution	2		

Colditz et al. Sci Transl Med 2012: March 28

Lifestyle: high income countries

Cause	% cancer caused	Magnitude possible reduction	Time (yrs)
Smoking	33	75%	
Overweight/obesity	20	50%	
Diet	5	50%	
Lack of exercise	5	85%	
Occupation	5	50%	
Viruses	5-7	100%	
Family history	5	50%	
Alcohol	3	50%	
UV/ionizing radiation	2	50%	
Reproductive	3	0	
Pollution	2	0	

Burden Cigarette Smoking, USA

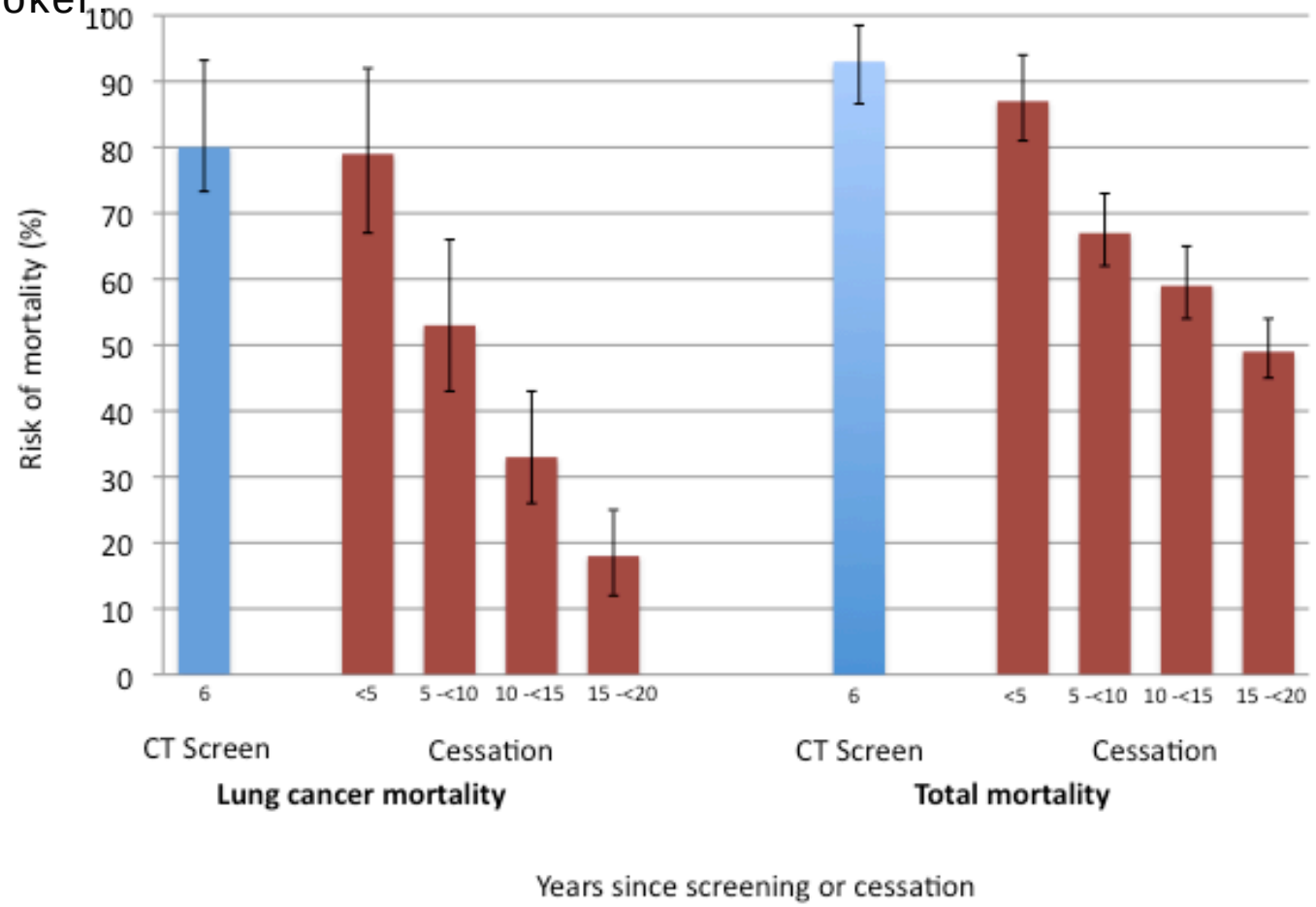


Lifestyle: high income countries

Cause	% cancer caused	Magnitude possible reduction	Time (yrs)
Smoking	33	75%	10-20
Overweight/obesity	20	50%	2-20
Diet	5	50%	5-20
Lack of exercise	5	85%	5-20
Occupation	5	50%	20-40
Viruses	5-7	100%	20-40
Family history	5	50%	2-10
Alcohol	3	50%	5-20
UV/ionizing radiation	2	50%	2-10
Reproductive	3	0	N/A
Pollution	2	0	N/A

Time course: lung & total mortality

Current smoker: continuing



Sources: Kenfield et al, 2008; Aberle et al, 2011

Infections

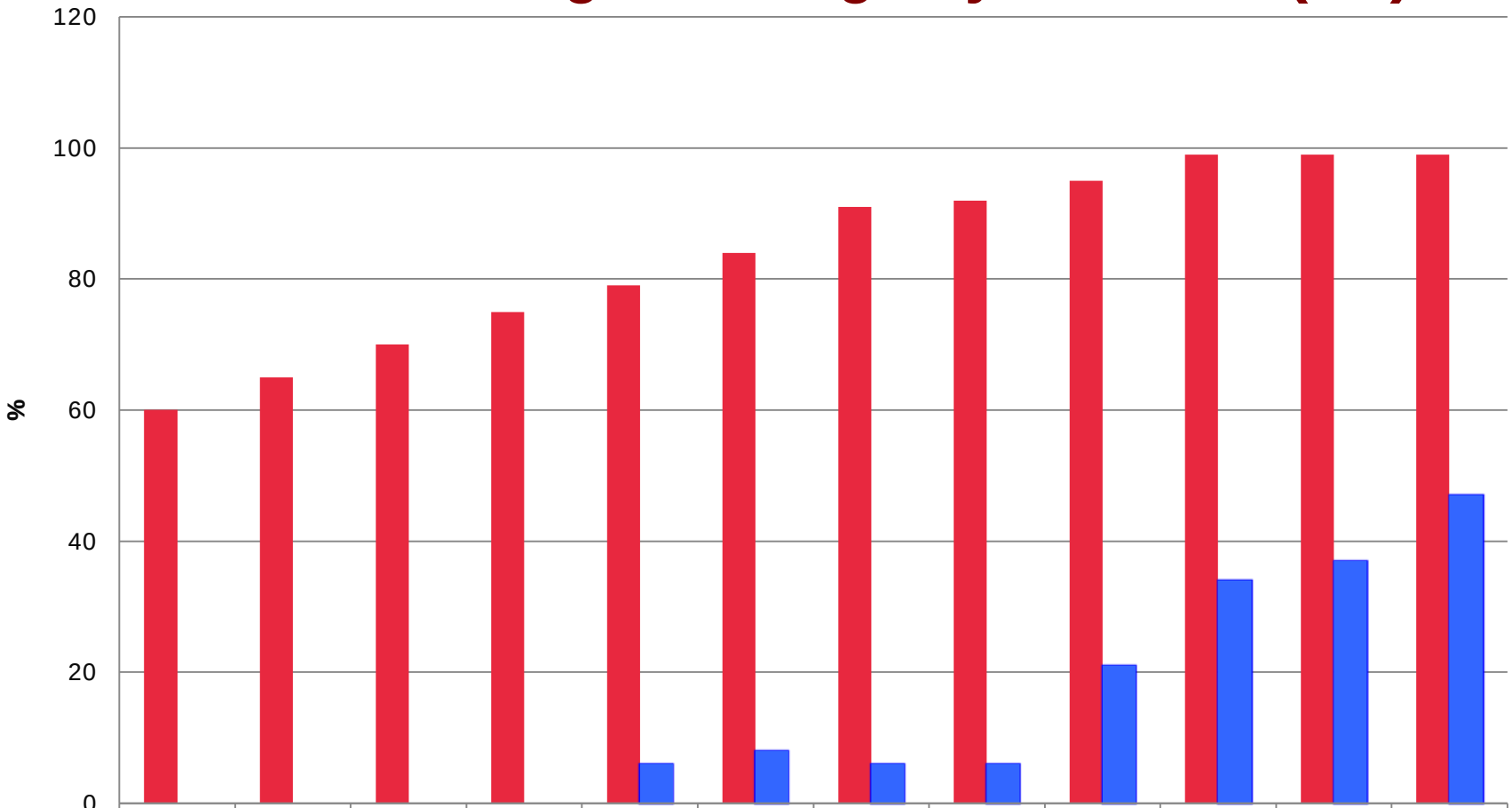
- Helicobacter pylori
- HPV
- Hepatitis B
- Hepatitis C
- Epstein-Barr virus
- HTLV
- Human herpes virus 8
- *Schistosoma haematobium*
- *Opisthorchis viverrini*

- High income countries 7.4%
- Low and middle income countries 23% of cancer
- 2 million cases/yr (16%)

- Note: IARC excludes HIV as only a co-factor for other infectious causes through immunosuppression

de Martel et al, Lancet Oncology, 2012

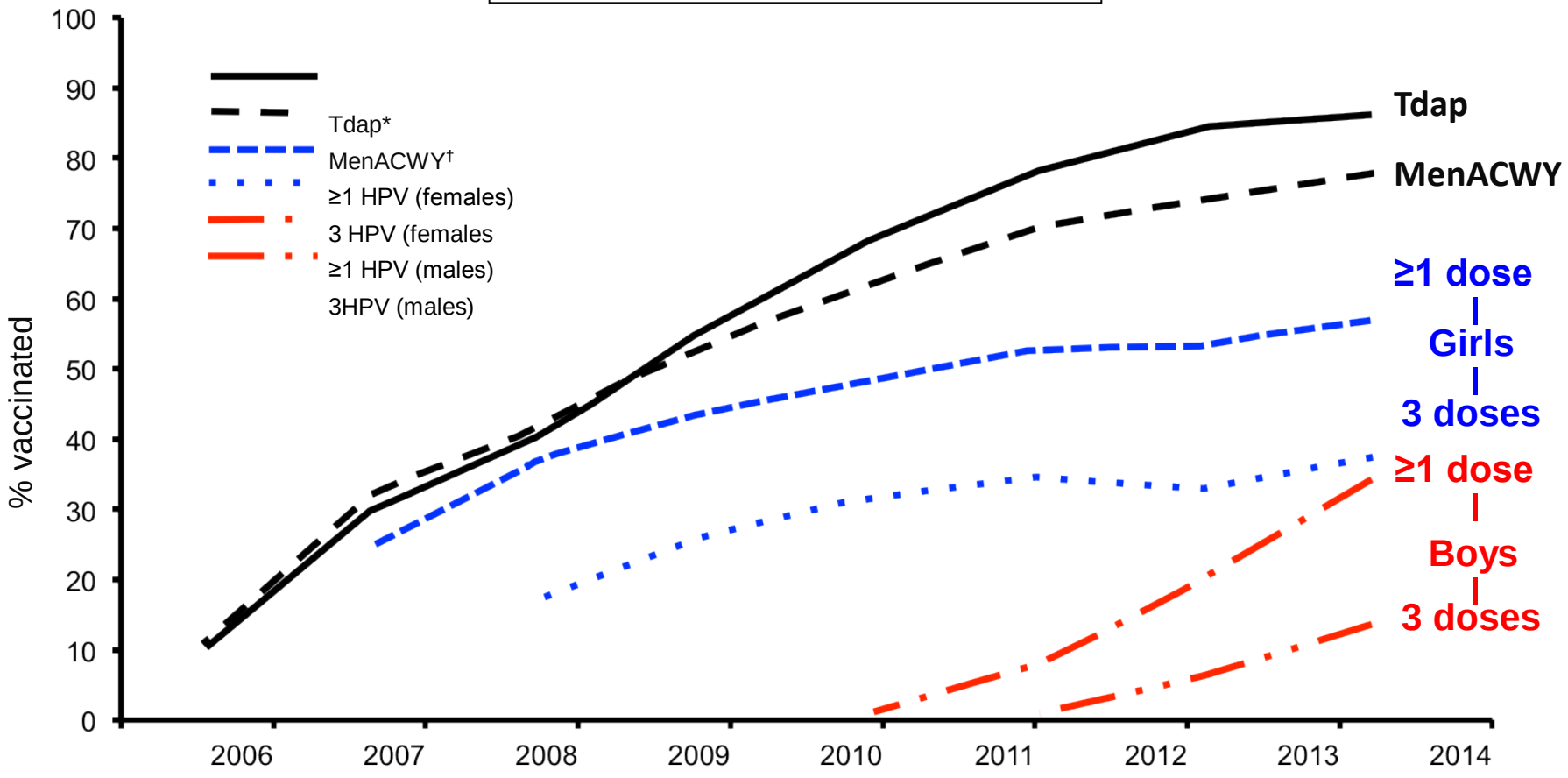
Hepatitis B (HepB3) immunization coverage among 1-year-olds (%)



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
China	60	65	70	75	79	84	91	92	95	99	99	99
India					6	8	6	6	21	34	37	47

Trends in U.S. Vaccination Rates: Ages 13-17 Yrs

MMWR Vol 63, #29, July 25, 2014



Abbreviations: Tdap = tetanus, diphtheria, acellular pertussis vaccine; MenACWY = meningococcal conjugate vaccine; HPV-1 = human papillomavirus vaccine, ≥1 dose; HPV-3 = human papillomavirus, ≥3 doses.

* Tdap and MenACWY vaccination recommendations were published in March and October 2006, respectively.

† HPV vaccination recommendations were published in March 2007.

Gaps → Research opportunities
Target vaccine: whole population

- Convenient dosing current vaccines
- Next generation vaccine / broader protection, easier storage, etc, fewer doses
- Oropharyngeal HPV infections and cancer
- More effective ways to communicate about HPV-associated disease and HPV vaccines
- Determine how best to integrate HPV vaccination and cervical cancer screening

President's Cancer Panel Annual Report 2012-13

Gaps ➔ Research opportunities
Target: high risks women – SERMs to prevent breast cancer

Stratify risk (epidemiology/genomics/imaging)

Identify

Identify “high risk” women

↓

Communicate risks and benefits

Deliver

Clinical implementation of tools and strategies

↓

Uptake and sustained use by women

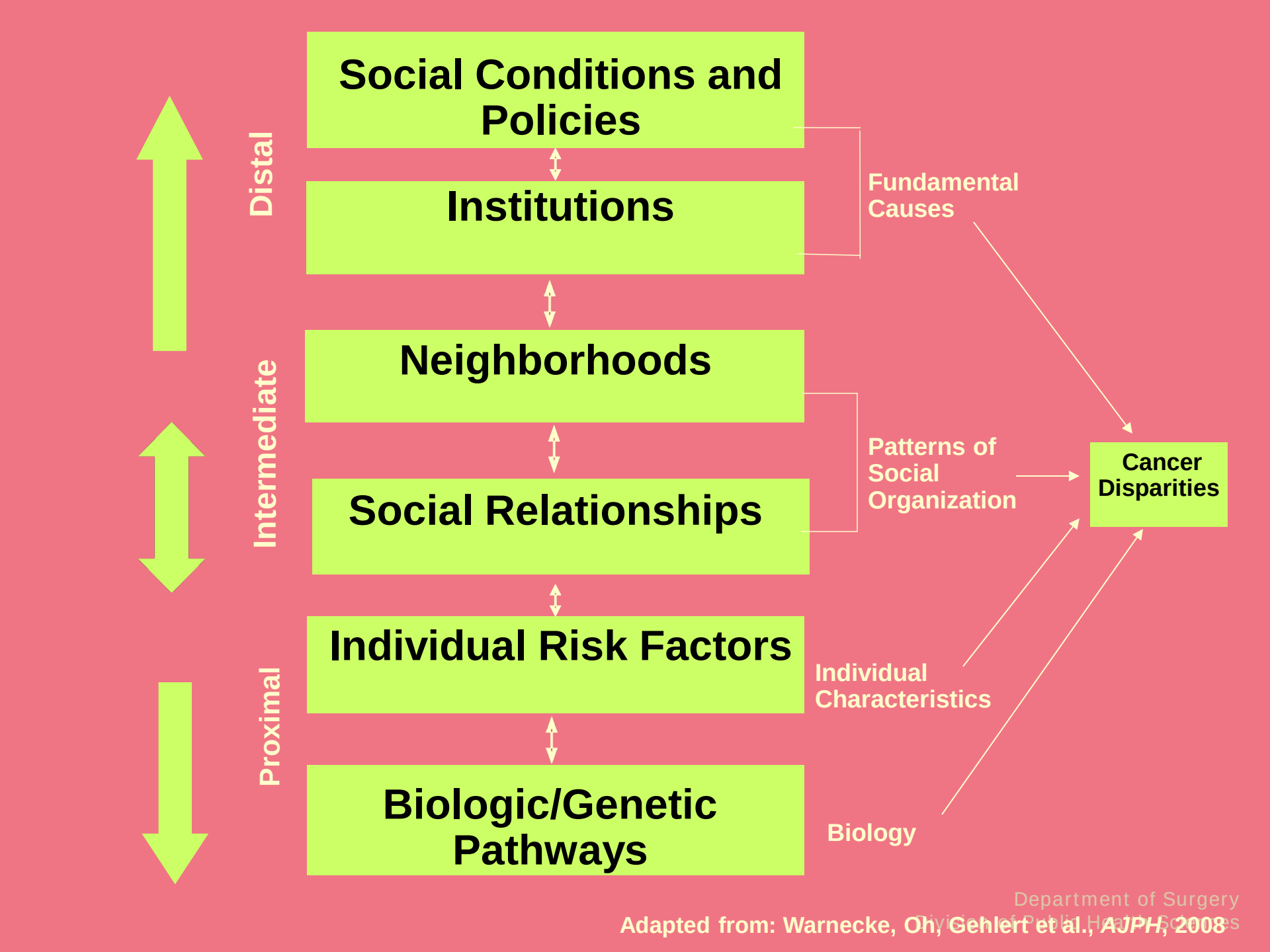
Reduce incidence

Moving from Discovery to Delivery

Translation scientific evidence base to population health

- Implementation of what works
- Evidence ➔ guidelines (USPSFT or CDC community guide)
- Benefit estimates ➔ time frame for risk reduction
- Disparities ➔ Worsened, improved, or unchanged?

Understanding how to sustain changes



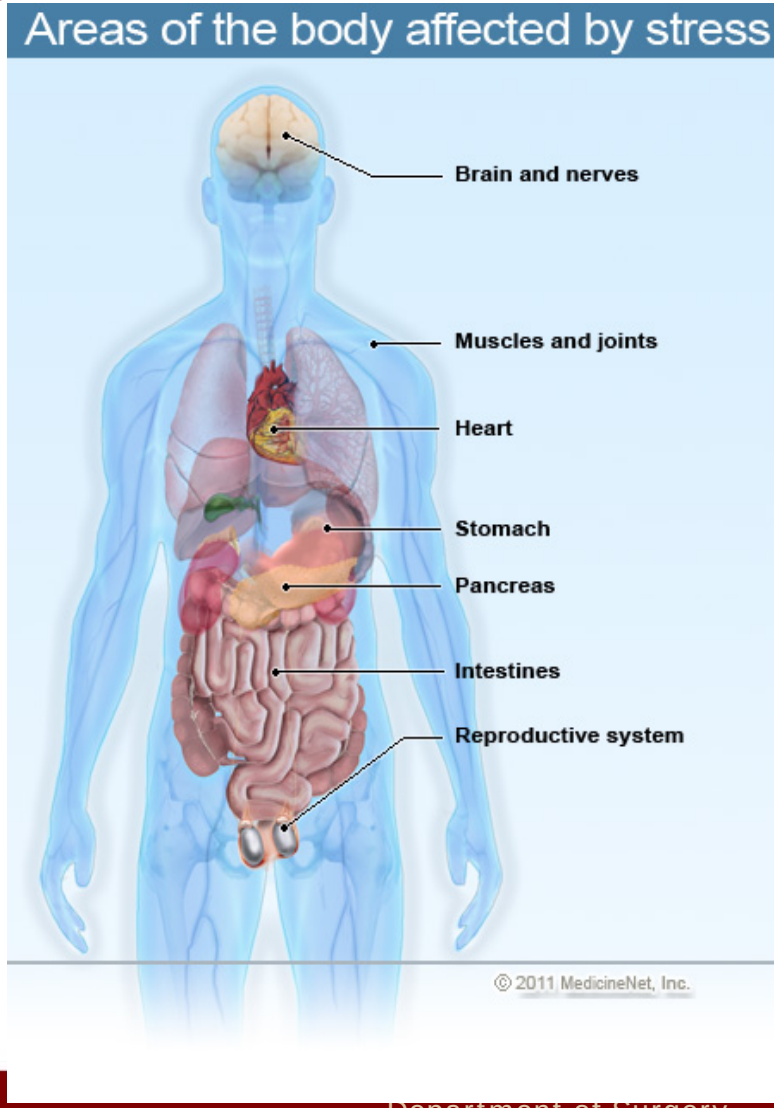
Adapted from: Warnecke, Oh, Gehlert et al., *AJPH*, 2008

The Critical Intersection of Basic and Population Science

What are the biological mechanisms that translate disadvantaged social and economic circumstances into poorer health???

University of Chicago's Center for Interdisciplinary Health Disparities Research

- Does the social-psychological environment that inner city black women live in increased their chances of dying from breast cancer??
  - Socially isolated mice:
    - Experience stress as a result of isolation
    - Developed spontaneous mammary gland cancers faster than control-group rats that were not kept in isolation.
  - Studied 230 newly diagnosed black breast cancer patients living on Chicago's South Side.
    - Endocrine burn-out?



Why are we not preventing more cancer now?

Multiple barriers:

1. **Skepticism that cancer can be prevented**
2. **Short term focus of cancer research**
3. **Interventions deployed too late in life**
4. Research focused on treatment not prevention
5. Debates among scientists
6. Societal factors ignored
7. Lack of transdisciplinary training
8. Complexity of implementation

Colditz et al Sci Transl Med 2012: March 28

Barrier 2: *Short-term* focus

Time required for cancer prevention does not match funding periods

Long-term benefits, e.g., smoking cessation takes decades to show at population level

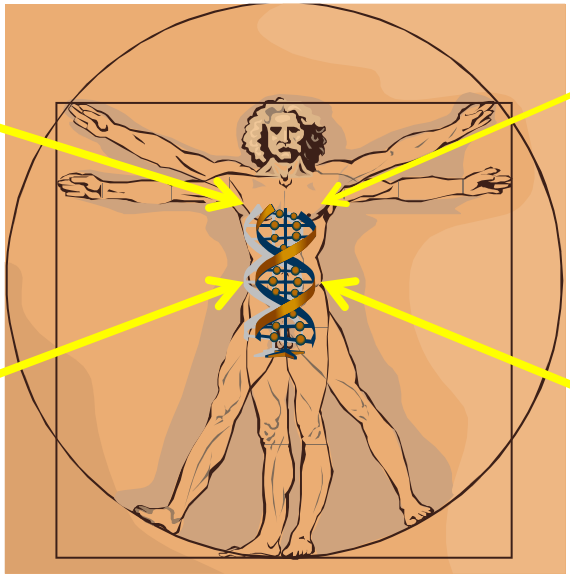
Funded studies focus too late in disease development process

In contrast, the natural history or time-course of cancer shows development over decades

Colditz et al. Sci Transl Med 2012: March 28

What Potentially Influences Cancer?

Genetic factors
telomere length
Inherited mutations
sporadic mutations



Macro-level factors
crime
poverty
availability of services
toxins

Individual-level factors
diet
health behaviors

Demographic factors
age
gender
ancestry

Definition – implementation science

Scientific study of how to move evidence-based interventions into practice and policy

Includes study of how to sustain changes to improve population health

**PAR13-055

Cancer Prevention Gaps to Fill

- How do we identify gaps in discovery?
- Where do we strengthen science?
- How do we sharpen focus: on individual/community/broader public health programs
  High risk vs. population-wide programs
- Increase translation and delivery to all members of society
- How much should NCI be doing and where do responsibilities of funding partners (NIH, CDC, AHRQ,) tie in?
- Even when program implemented, research gaps remain to achieve full population coverage and health benefits

Graham Colditz, MD, DrPH
Niess-Gain Professor of Surgery
Chief, Division of Public Health Sciences,
Dept. of Surgery
Campus Box 8100
660 South Euclid
St. Louis, MO 63110
(314) 454-7939

colditzg@wustl.edu