



Bold Plans to Overcome Health Disparities:  
Using Imaging, Prevention and Big Data with Tobacco-Related  
Diseases

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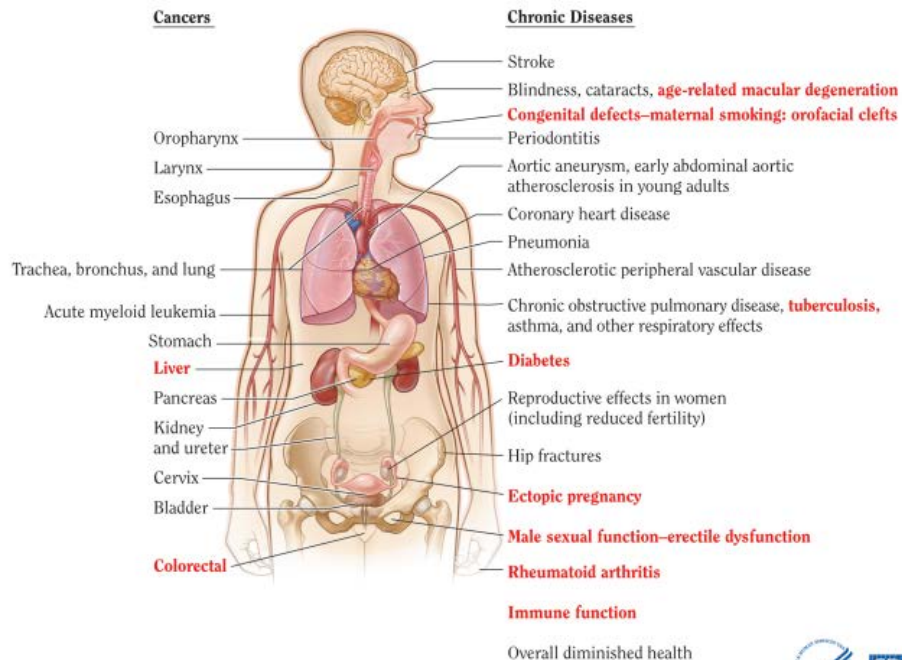
# Objectives

- Disparities in Smoking and Campaigns by Tobacco Industry
- Health Inequalities/Disparities Related to Tobacco Use
- Scientific Areas to be Addressed to Eliminate Tobacco-Related Health Inequalities
  - Prevention
  - Big Data
  - Imaging

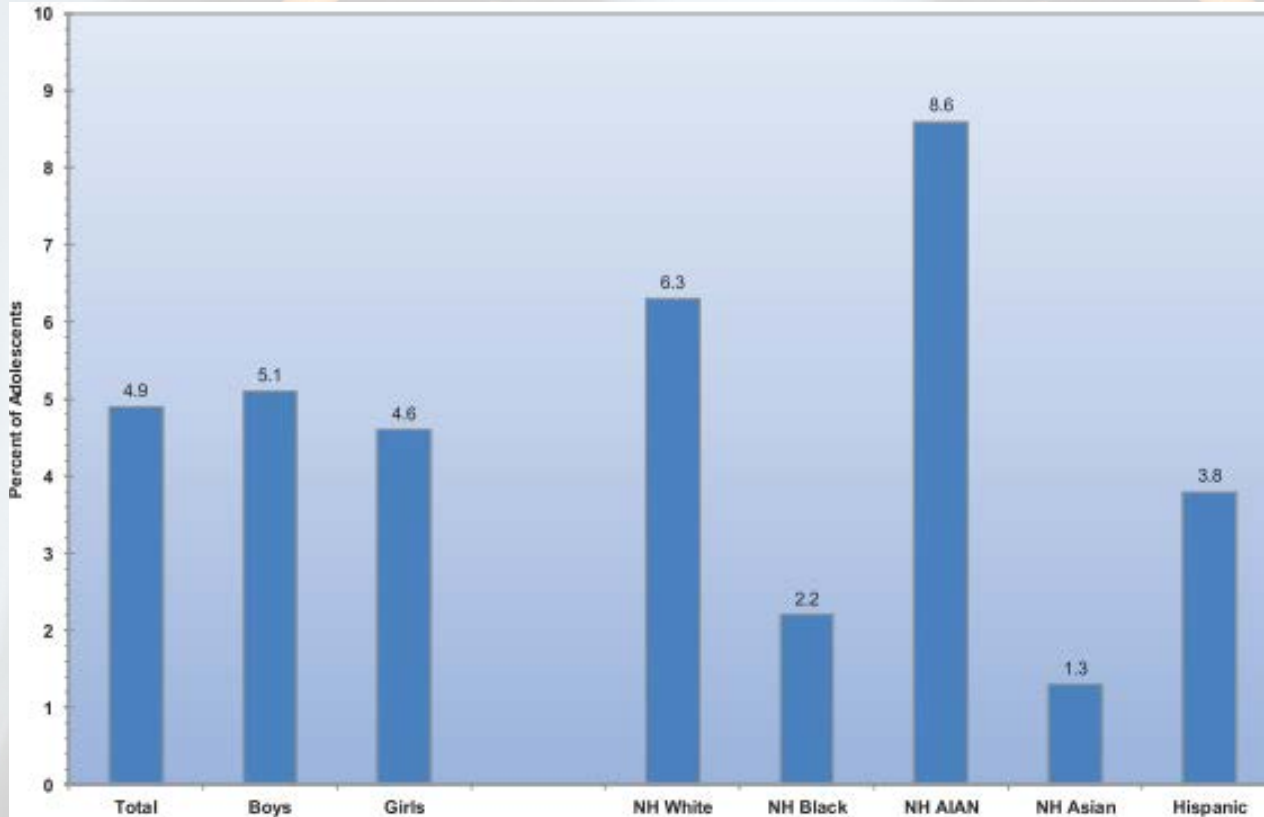
# Diseases and Illness Created from Cigarette Use

## Risks from Smoking

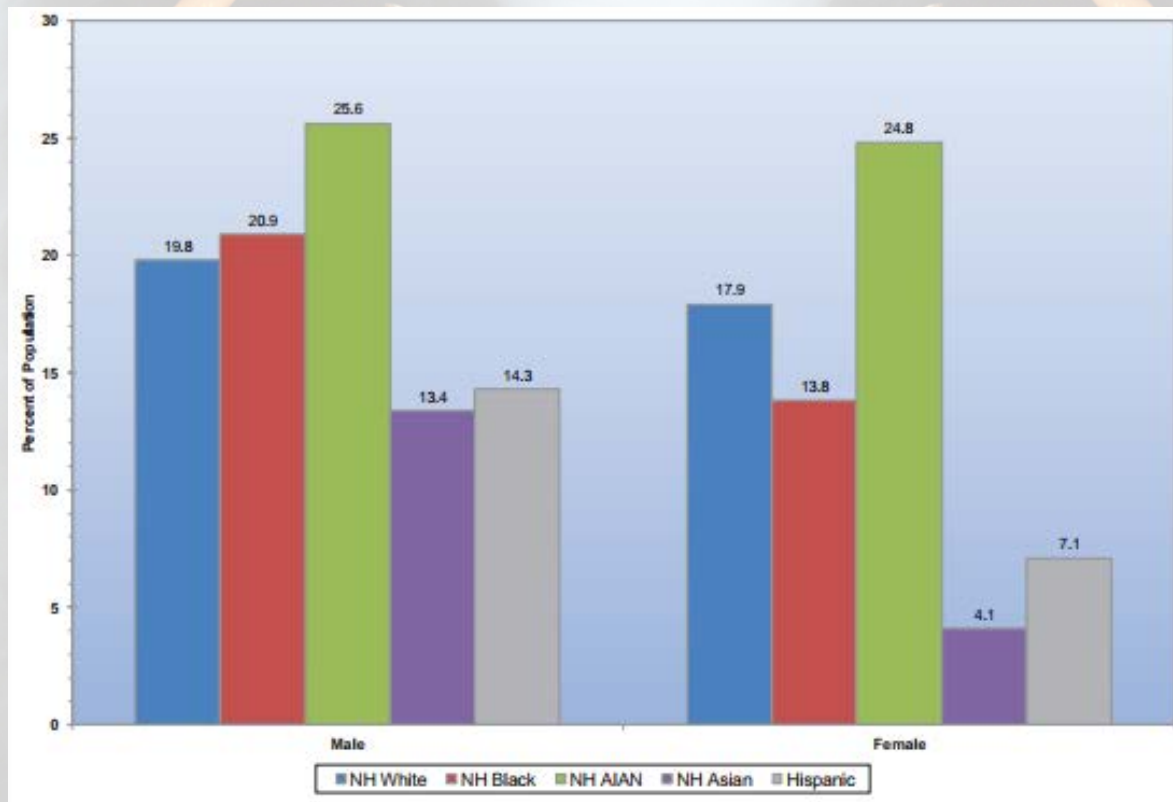
Smoking can damage every part of your body



# Prevalence of Cigarettes Use in the Past Month Among Adolescents, Based on Sex and Race



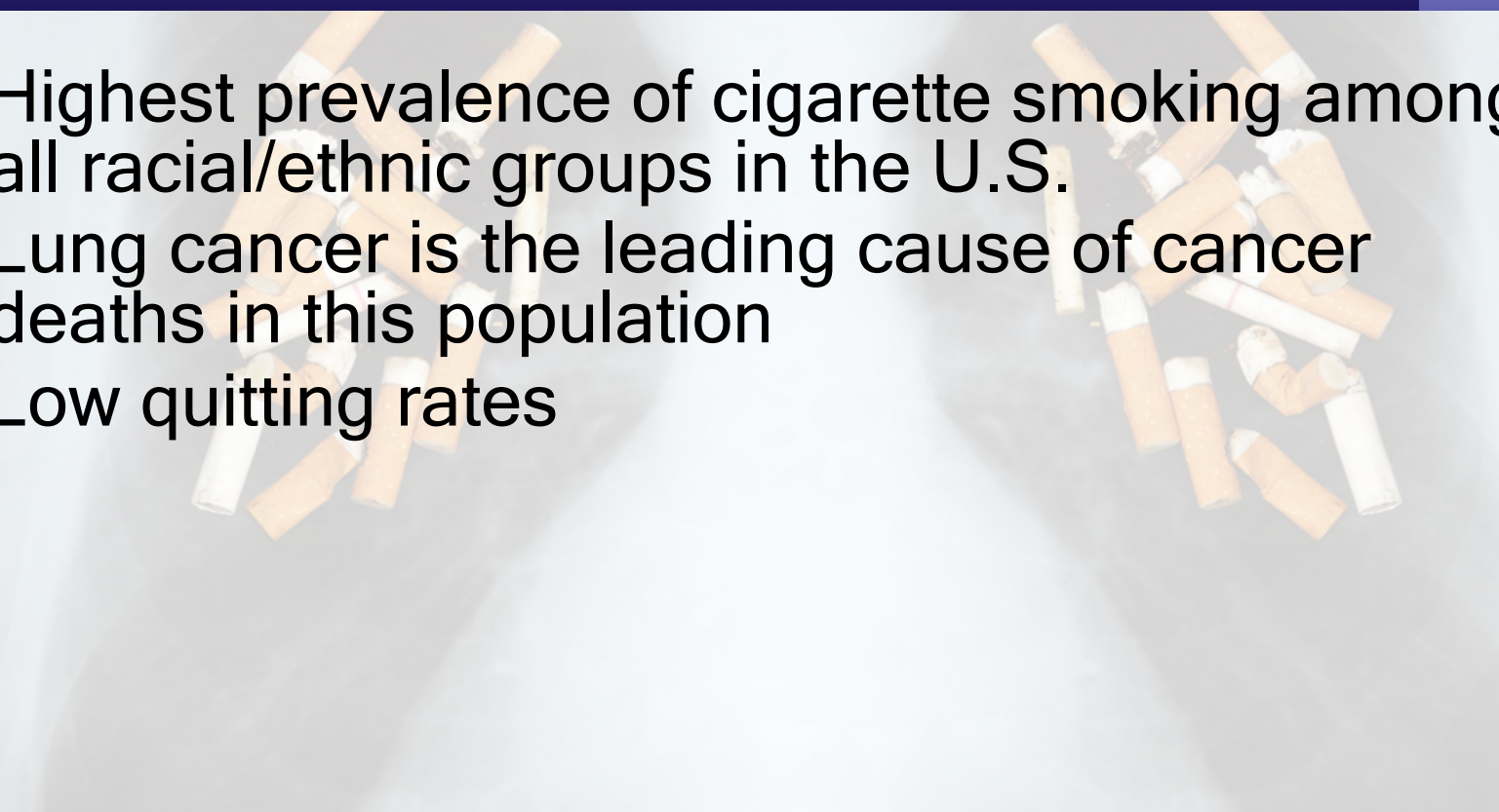
# Prevalence (%) of Current Cigarette Smoking for Adults $\geq$ 18 Years by Sex and Race/Ethnicity (2013-2015)



# African Americans

- Smoke fewer cigarettes
- Start smoking cigarettes at an older age
- More likely to die from smoking-related diseases than whites

# American Indian/Alaska Natives

- Highest prevalence of cigarette smoking among all racial/ethnic groups in the U.S.
  - Lung cancer is the leading cause of cancer deaths in this population
  - Low quitting rates
- 
- A background image showing a pair of hands, one light-skinned and one dark-skinned, holding several lit cigarettes. The cigarettes are held in a way that they appear to be being offered or presented. The image is semi-transparent and serves as a visual metaphor for the high prevalence of smoking mentioned in the text.

# Asian American/Pacific Islander

- Lower than other racial ethnic groups
- Varying prevalence within this subgroup

Asian Sub-Group	Cigarette Smoking Prevalences <sup>7</sup>
Chinese	7.6%
Asian Indian	7.6%
Japanese	10.2%
Filipino	12.6%
Vietnamese	16.3%
Korean	20.0%

Related to cultural, social, environmental, and individual factors



# Hispanics/Latinos

- Variations in cigarette smoking exist among different Hispanic subgroups
- Lower health insurance coverage and less healthcare access than whites
  - Less likely to be advised by a health care provider to quit smoking cigarettes
  - Less access to cessation treatments

# Tobacco Industry Marketing and Influence

- Targeted Marketing
  - Supporting cultural events, e.g. Chinese/Vietnamese New Year, heritage months, etc.
  - Making contributions to minority higher education institutions, elected officials, civic and community organizations, and scholarship programs
  - Larger amounts of advertising in African American publications, exposing African Americans to more cigarette ads than whites
- Menthol Cigarette Advertising
  - Targeted heavily toward African Americans through culturally tailored advertising images/messages
  - Menthol in cigarettes is thought to make harmful chemicals more easily absorbed in the body
    - Easier to inhale cigarette smoke
    - More addictive

# Tobacco Industry Marketing and Influence

- Through branding, financial contributions, and targeted advertising
  - Brand names such as “Rio” and “Dorado”, including advertisements in many Hispanic publications
  - The American Spirit™ cigarettes were promoted as “natural” cigarettes, and their packaging featured an American Indian smoking a pipe
- Tobacco companies often target their advertising campaigns toward low-income neighborhoods and communities
  - Higher density of tobacco retailers in low-income neighborhoods

# Low Income Population

- Secondhand smoke exposure is higher among people living below the poverty level and those with less education
  - Service workers, especially bartenders and wait staff, report the lowest rates of workplace smoke-free policies than other occupation categories
- Cigarette smoking disproportionately affects the health of people with low SES
  - Populations in the most socioeconomically deprived groups have higher lung cancer risk than those in the most affluent groups
  - People with less than a high school education have higher lung cancer incidence than those with a college education

# Mental Illness

- Nicotine has mood-altering effects that can temporarily mask the negative symptoms of mental illness
  - Higher risk for cigarette use and nicotine addiction
- People with mental illness or substance use disorders die about 5 years earlier than those without these disorders
  - Many caused by smoking cigarettes
  - Heart disease, cancer, and lung disease, which can all be caused by smoking
- Drug users who smoke cigarettes are 4 times more likely to die prematurely than those who do not smoke
  - Tobacco smoke can interact with and inhibit the effectiveness of certain medications

# Cigarette Smokers are More Prone to Illicit Drug Use/Substance Abuse

65.2% of adult cigarette smokers reported co-use of alcohol in 2013 compared to 48.7% of adult non-smokers.<sup>4</sup>

Current Illicit Drug and Alcohol Use Among Adult Cigarette Smokers Compared with Non-Smokers<sup>±4</sup>

	Smokers	Non-Smokers
Current illicit drug use (in past month)	18.9%	4.2%
Marijuana	15.3%	3.0%
Cocaine	1.8%	0.2%
Heroin	0.3%	0.0%
Hallucinogens	0.7%	0.2%
Inhalants	0.3%	0.1%
Non-medical use of prescription drugs	5.3%	1.2%

# Facts About Smoking

- If smoking continues at the current rate, 5.6 million of today's Americans < 18 years of age are expected to die prematurely from a smoking-related illness
- The total economic cost of smoking in the US is estimated at more than \$300 billion a year
  - Approx. \$170 billion in direct medical care for adults
  - More than \$156 billion in lost productivity due to premature death and exposure to secondhand smoke
- 10% relative reduction in smoking prevalence between a state and the national average in one year was followed by an average \$6.3 billion reduction (in 2012 dollars) in health care expenditure the following year
- State governments collect \$25.8 billion each year from tobacco taxes and legal settlements
  - Not expensive to enforce smoking reduction/cessation
  - Reduces smoking and raises government revenue
  - Smoke free policies are widely supported
  - Restrictions on tobacco industry promotion of cigarettes

# Health Inequalities Related to Tobacco Use

- Various public health efforts → general decline in the prevalence of tobacco use worldwide
  - Total number of smokers has increased due to population growth
  - The poor, marginal, and vulnerable sections of the society have not benefitted
    - Low SES, homeless people, indigenous and minority ethnic groups
    - Patients with debilitating conditions such as tuberculosis, HIV, and mental disorders
    - Coping mechanism
    - Poor health, less money for essentials, economic burden
  - Rising health inequalities



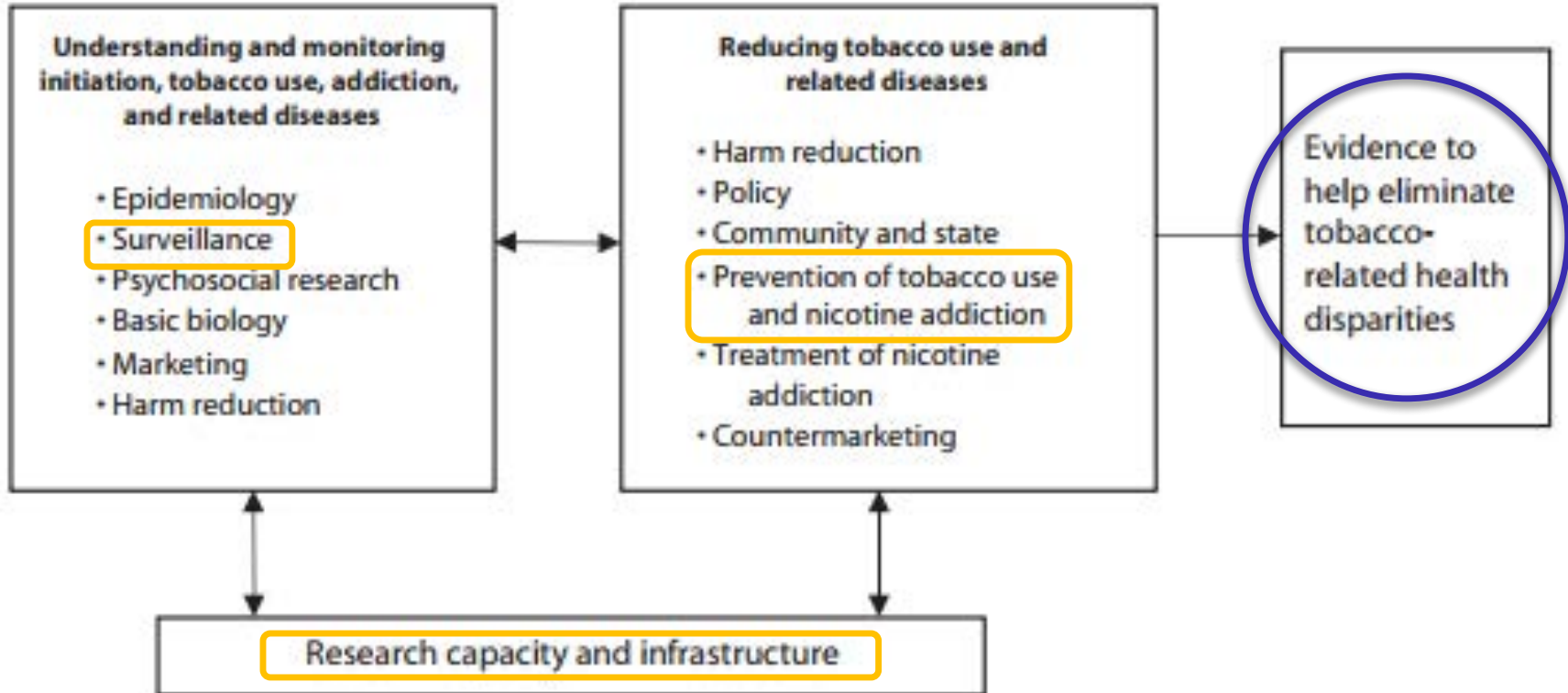
# Reducing Tobacco-Related Health Disparities

- Potential barriers
  - Very little understanding about how exposure to disadvantaged circumstances shapes smoking through life
  - Measures such as SES are often not included in the evaluation of tobacco control interventions
  - Tobacco control interventions are often not tailored to the specific needs of disadvantaged populations
  - Tobacco control policy is generally not linked to policies to tackle social determinants of health
- Apart from taxation measures, tobacco control interventions are not successful in reducing health inequalities

# Heart Disease and Lung Cancer Related to Smoking

- Smokers are more likely than non-smokers to develop heart disease, stroke, and lung cancer
  - Higher risk of heart disease and stroke: 2 to 4 times
  - Higher risk of lung cancer: 25 to 26 times
- Diminished overall health, increased absenteeism from work, and increased health care utilization and cost

# Scientific Areas to be Addressed to Eliminate Tobacco-Related Health Inequalities

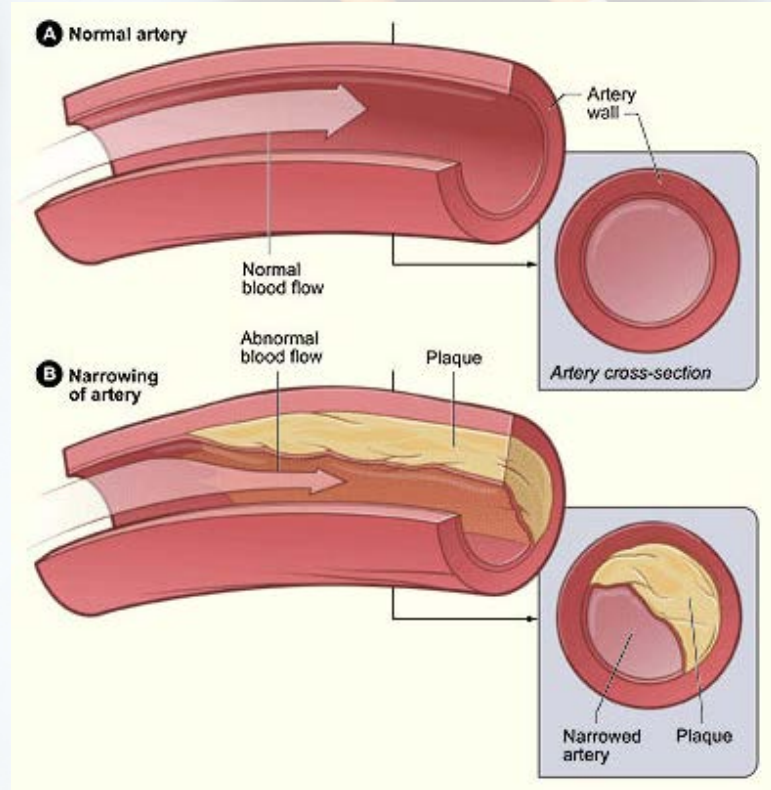


# One Stop Shop to Reducing Tobacco-Related Disparities in Health

- Imaging
  - CAC and Lung Cancer screening with CT
- Big Data/Research
- Prevention
  - Lifestyle modifications
    - Smoking Cessation, Diet, Exercise, Stress Reduction
  - Reducing inflammation
    - The story of Canakinumab

# Imaging

- Chest CT
  - Lung Cancer
  - Coronary artery calcification

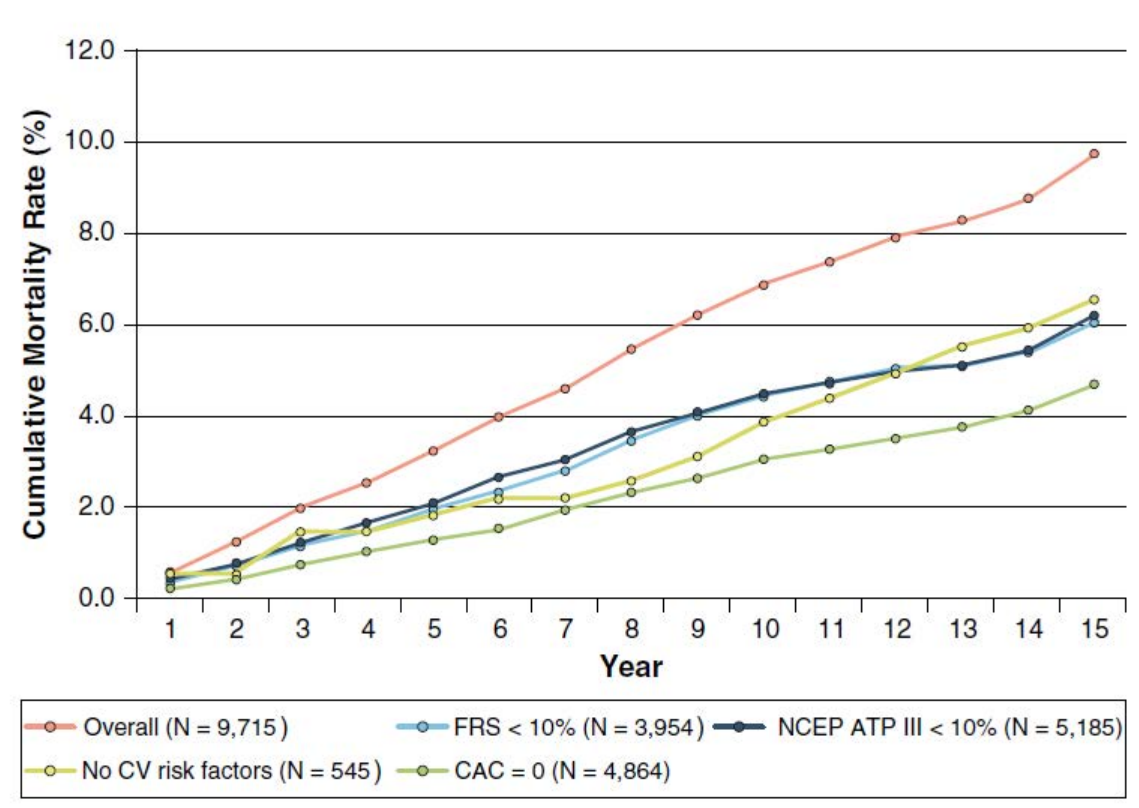


# Fifteen-Year All-Cause Mortality in Asymptomatic Persons According to CAC Score

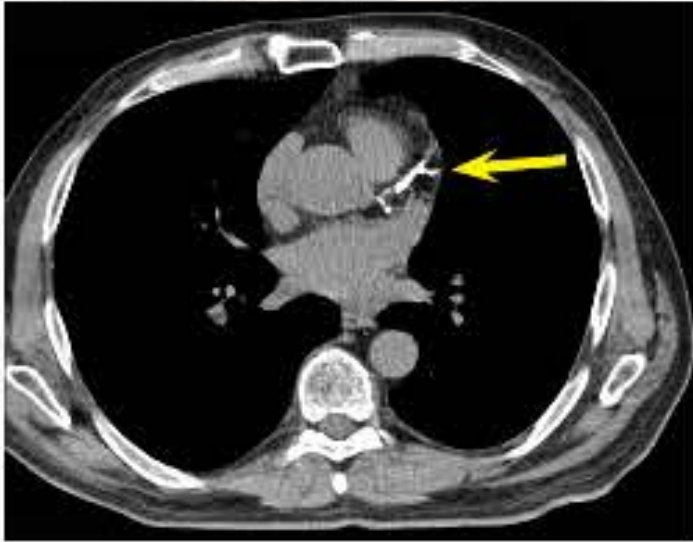
CAC Score	Overall (N = 9,715)		
	Univariable	Multivariable	
		Adjusted for FRS	Adjusted for NCEP ATP III
0	1.00 (Ref.)	1.00 (Ref.)	1.00 (Ref.)
1-99	2.21 (1.86-2.64), p < 0.001	2.08 (1.74-2.48), p < 0.001	2.03 (1.70-2.42), p < 0.001
100-399	3.85 (3.19-4.66), p < 0.001	3.42 (2.83-4.14), p < 0.001	3.32 (2.74-4.02), p < 0.001
400-999	5.98 (4.84-7.39), p < 0.001	4.93 (3.98-6.12), p < 0.001	4.81 (3.87-5.97), p < 0.001
≥1,000	8.66 (6.79-11.05), p < 0.001	6.79 (5.29-8.72), p < 0.001	6.99 (5.46-8.95), p < 0.001

Values are hazard ratio (95% confidence interval).

# Fifteen-Year Cumulative Mortality Rate



# Coronary Calcium on Chest CT Scan

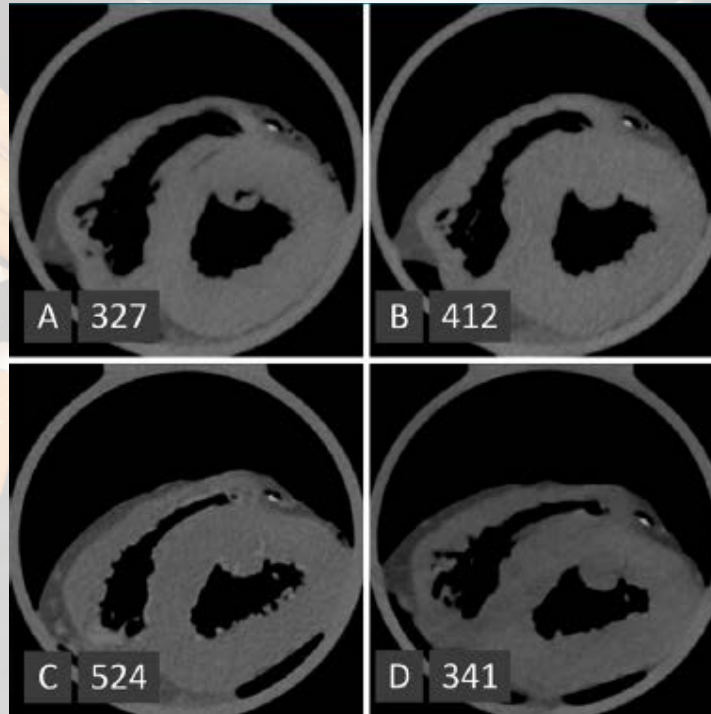




# Lung Cancer CT



# Coronary Artery Calcification Scoring with “State -of-the-Art” CT Scanners from Different Vendors has Substantial Effect on Risk of Classification



Example CT images of the same heart with corresponding Agatston scores acquired with different CT systems: *A*, Philips Healthcare; *B*, Toshiba Medical Systems; *C*, GE Healthcare; and *D*, Siemens Healthcare

# Big Data/Research to Reduce Disparities Related to Smoking and Health Effects

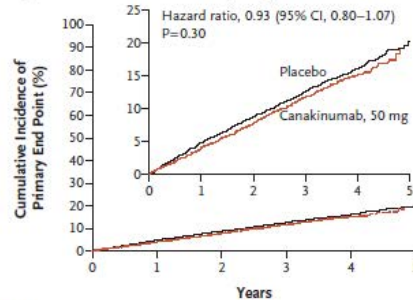
- Expand and fund mentorship programs
  - Minority supplements, with mentor stipends to increase opportunities for training in community-based intervention and infrastructure research
- Fund the training and mentoring of minority researchers
  - Train researchers in effective community research and skills related to building and maintaining relationships, negotiation, and group facilitation
- Develop strategies to facilitate change in the culture of research in academic and federal settings to make research more receptive to diverse perspectives
- Develop community-based research processes based on establishing and maintaining long-term relationships within the community
  - Disseminate scientific data in a usable manner for academic research, community researchers, community members, and the general public
  - Develop funding mechanisms that allow for co-principal investigator structure between researchers and community organizations and develop mechanisms to ensure equity in terms of resources incorporate principles of community participatory research and outcomes into studies and databases
- Develop and explore funding mechanisms that incorporate methods to increase the likelihood that tobacco prevention efforts are culturally relevant and evidence based
- Develop funding mechanisms to promote collaborations between investigators at minority-serving institutions and investigators at larger research institutions

# Anti-inflammatory Therapy with Canakinumab for Atherosclerotic Disease

**10 061 patients with atherosclerosis with prior myocardial infarction, were free of previously diagnosed cancer, and had concentrations of high-sensitivity C-reactive protein (hsCRP) of 2 mg/L or greater**

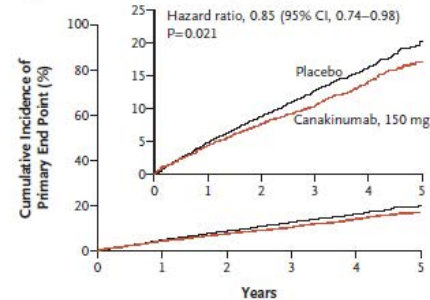
The primary efficacy end point was nonfatal myocardial infarction, nonfatal stroke, or cardiovascular death

**A Primary End Point with Canakinumab, 50 mg, vs. Placebo**



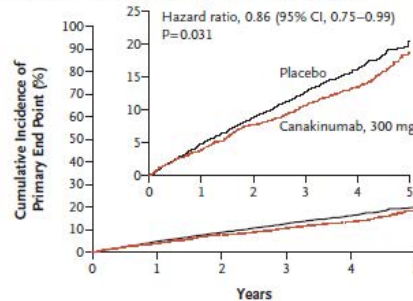
No. at Risk	0	1	2	3	4	5
Placebo	3344	3141	2973	2632	1266	210
Canakinumab	2170	2057	1950	1713	762	47

**B Primary End Point with Canakinumab, 150 mg, vs. Placebo**



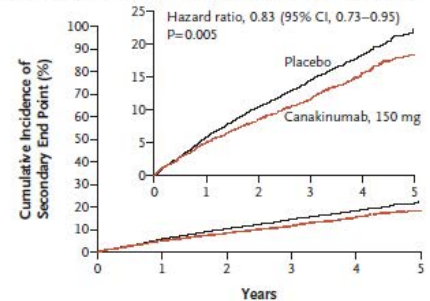
No. at Risk	0	1	2	3	4	5
Placebo	3344	3141	2973	2632	1266	210
Canakinumab	2284	2151	2057	1849	907	207

**C Primary End Point with Canakinumab, 300 mg, vs. Placebo**



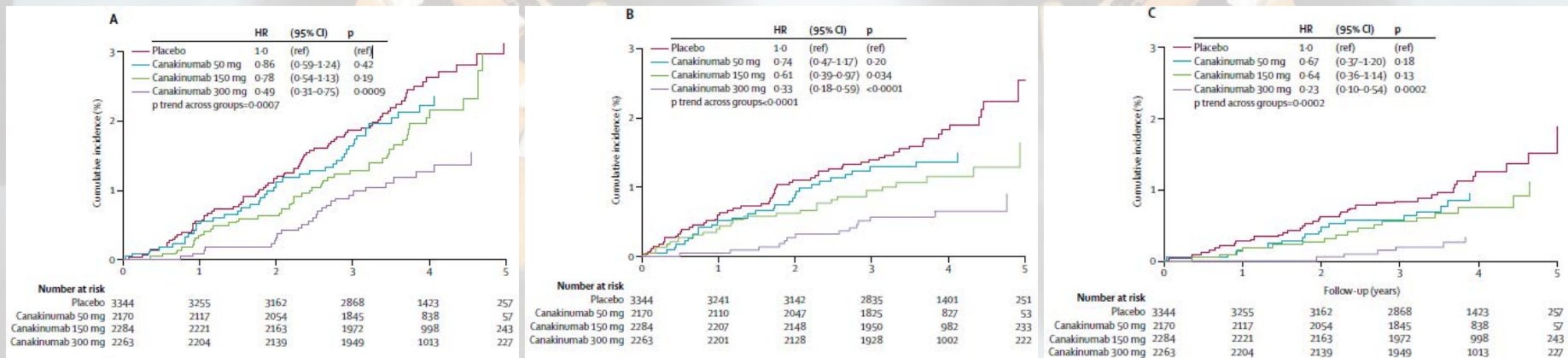
No. at Risk	0	1	2	3	4	5
Placebo	3344	3141	2973	2632	1266	210
Canakinumab	2263	2149	2038	1819	938	199

**D Key Secondary End Point with Canakinumab, 150 mg, vs. Placebo**



No. at Risk	0	1	2	3	4	5
Placebo	3344	3107	2921	2578	1238	206
Canakinumab	2284	2135	2039	1824	892	201

# Effect of interleukin-1 $\beta$ inhibition with canakinumab on incident lung cancer in patients with atherosclerosis: exploratory results from a randomised, double-blind, placebo-controlled trial



**Cumulative incidence of All fatal cancer (A) Lung cancer (B) Fatal lung cancer (C) among CANTOS participants**

**10 061 patients with atherosclerosis who had had a myocardial infarction, were free of previously diagnosed cancer, and had concentrations of high-sensitivity C-reactive protein (hsCRP) of 2 mg/L or greater**

# Prevention Geared Towards Disparities Associated with Smoking

- Create a repository of tobacco control resources developed for populations in which there are disparities
- Ensure that evidence-based programs are culturally appropriate and effective
- Develop surveys and intervention materials in the native (non-English) language of survey respondents, intervention participants, communities, and so forth
- Fund randomized controlled trials of comprehensive community-based adolescent prevention programs
- Fund more studies to develop interventions to reduce children's exposure to environmental tobacco smoke in homes

# Facts about Tobacco Use Prevention

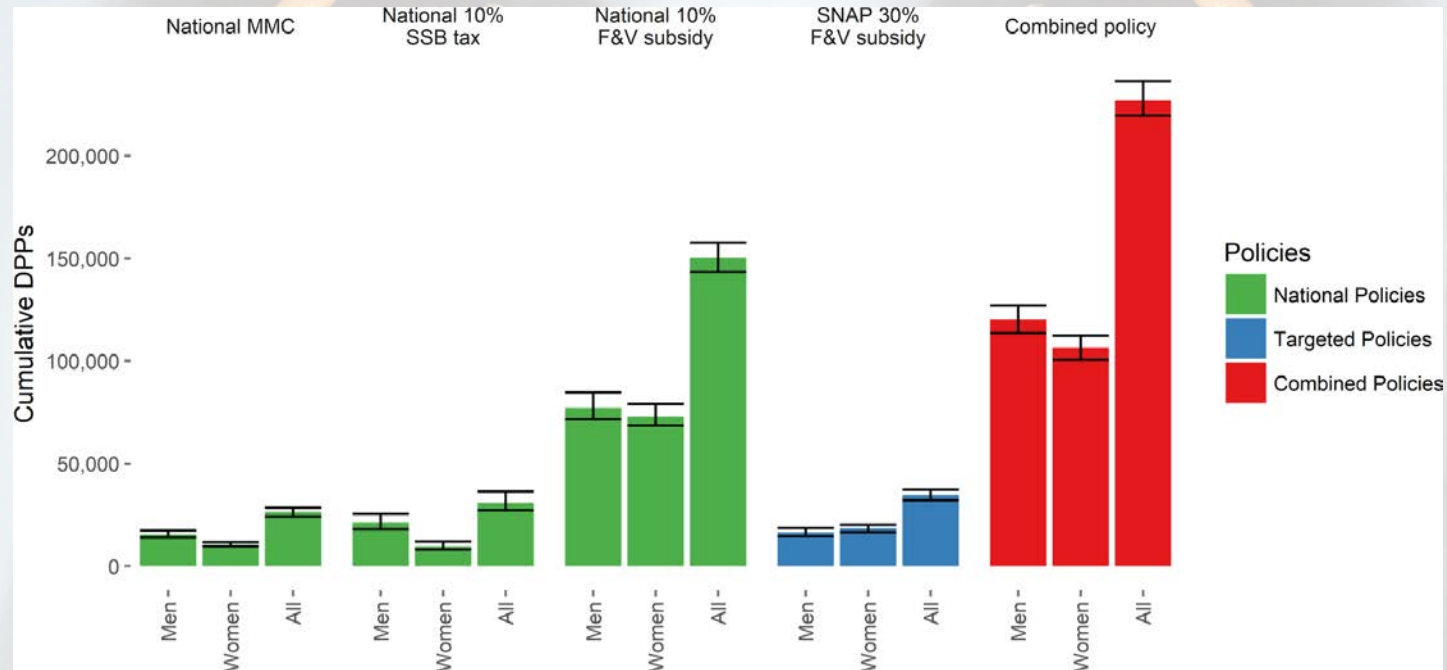
- Tobacco control interventions continue to be under-utilized and under-funded in the US
- The \$468 million allocated by the states amounts to a small fraction of the \$3.3 billion the CDC recommends for all states combined.
  - It would take less than 13% of total state tobacco revenue to meet the CDC recommendations in every state
- States that have implemented well-funded, sustained tobacco prevention programs continue to report significant progress, adding to the evidence that these programs work
  - Florida, with one of the longest running programs, recently reported reducing its high school smoking rate to 6.9% in 2015, one of the lowest ever reported by any US state
- Appropriate state expenditure would accelerate the decline in tobacco use in youth and adults and bring forward an end to the tobacco smoking epidemic while saving billions of dollars in avoidable health care costs

# Dietary Policies

- Supplemental Nutrition Assistance Program (SNAP), the largest federal feeding program which serves approximately 46 million low-income Americans



# Reducing US cardiovascular disease burden and disparities through national and targeted dietary policies: A modeling study



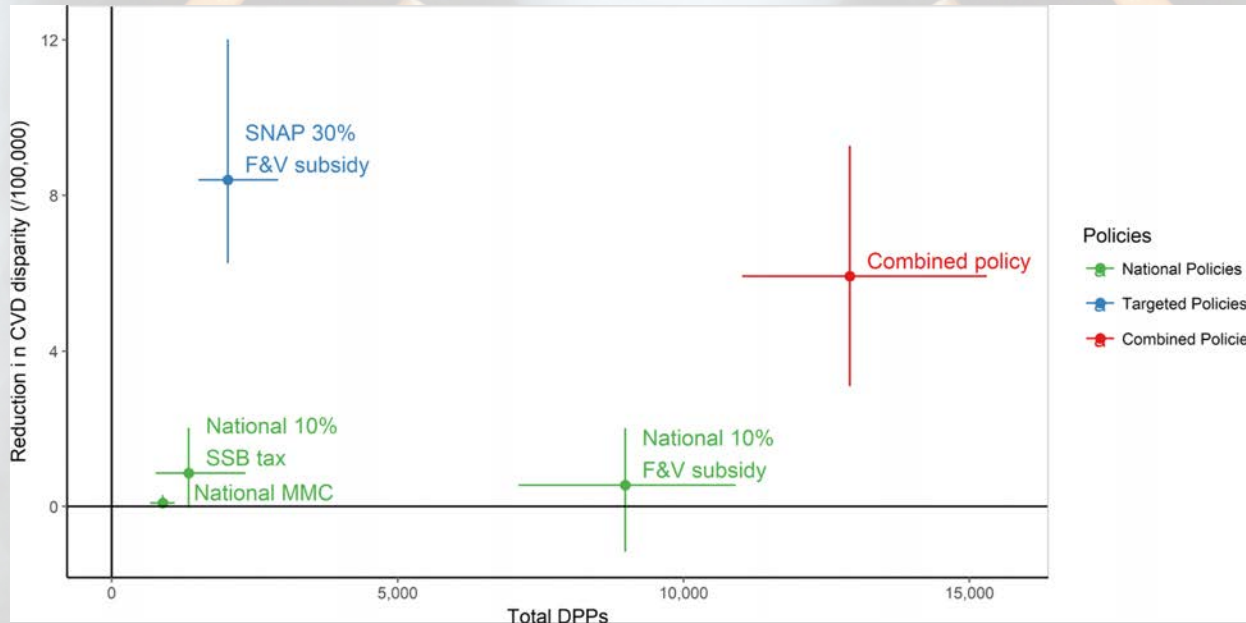
**Cumulative deaths prevented or postponed from 2015 to 2030 under each policy modeled, by sex.** Error bars indicate 95% uncertainty intervals. DPPs, deaths prevented or postponed; F&V, fruit and vegetable; MMC, mass media campaign; SNAP, Supplemental Nutrition Assistance Program; SSB, sugar-sweetened beverage.

# Reducing US cardiovascular disease burden and disparities through national and targeted dietary policies: A modeling study

Scenario	Measure	Coronary heart disease aggregate	Stroke aggregate	Cardiovascular disease		
				Aggregate	Men	Women
Media campaign	DPPs	17,000 (15,600–19,200)	8,800 (8,000–10,100)	25,800 (24,300–28,500)	15,400 (14,000–17,500)	10,400 (9,600–11,900)
	DPPs/100,000	0.46 (0.42–0.52)	0.24 (0.22–0.27)	0.69 (0.65–0.76)	0.85 (0.78–0.97)	0.54 (0.50–0.62)
10% SSB tax	DPPs	31,000 (26,800–35,300)	0 (0–0)	31,000 (26,800–35,300)	21,200 (17,600–25,100)	9,800 (7,900–11,900)
	DPPs/100,000	0.83 (0.72–0.95)	0.00 (0.00–0.00)	0.83 (0.72–0.95)	1.18 (0.97–1.39)	0.51 (0.41–0.62)
10% F&V subsidy	DPPs	78,100 (72,000–84,300)	72,400 (66,200–77,800)	150,500 (141,400–158,500)	77,300 (70,900–83,500)	73,100 (67,200–78,600)
	DPPs/100,000	2.10 (1.94–2.27)	1.95 (1.78–2.09)	4.04 (3.80–4.26)	4.28 (3.92–4.63)	3.82 (3.51–4.11)
SNAP 30% F&V subsidy	DPPs	20,000 (17,600–22,200)	15,100 (13,100–16,500)	35,100 (31,700–37,500)	16,700 (14,400–18,500)	18,400 (16,200–20,200)
	DPPs/100,000	0.54 (0.47–0.60)	0.41 (0.35–0.44)	0.94 (0.85–1.01)	0.92 (0.80–1.03)	0.96 (0.85–1.06)
Combined	DPPs	137,300 (128,100–145,400)	90,700 (83,600–96,000)	228,000 (215,600–237,100)	120,500 (111,700–128,200)	107,600 (100,100–113,600)
	DPPs/100,000	3.69 (3.44–3.91)	2.44 (2.25–2.58)	6.13 (5.80–6.37)	6.67 (6.18–7.10)	5.62 (5.23–5.93)

**Total cumulative cardiovascular disease deaths prevented or postponed from 2015 to 2030 under each policy modeled, stratified by cardiovascular disease subtype and sex**

# Reducing US cardiovascular disease burden and disparities through national and targeted dietary policies: A modeling study



## Total deaths prevented or postponed versus change in cardiovascular disease disparities in 1 year - 2030

The reduction in CVD disparities is the difference in DPPs/100,000 population between SNAP participants and SNAP-ineligible individuals (a positive number indicates more DPPs/100,000 in SNAP participants than in SNAP-ineligible individuals). Point estimate and 95% uncertainty intervals.

# Cloud-Based Technology

- Access to:
- General details – This comprises general patient details, such as name, age, sex, blood group, etc. This also may include highly confidential details, such as medical insurance, bank account and personal home address information.
- Medical images and surgery data – This includes medical images that might be taken at pre-operative or post-operative times when the patient was admitted to the hospital.
- Research data – In some cases, the patient might be suffering from some rare and peculiar symptoms currently under analysis. In this example, the patient may have a medical condition that requires consent for research. These consent documents would be stored under medical research data.

**Any questions?**

