

# Hypertension Control and Stroke: Population and Global Risks

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# Disclosures

- Member of NHLBI Risk Assessment Workgroup
- Member of 2014 Hypertension Guidelines (JNC 8)
- Member of Evidence Rating Committee for ACC/AHA Hypertension Guidelines
- **No financial disclosures**



# 'CAME OUT OF CLEAR SKY,' SAYS PRESIDENT'S PHYSICIAN

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Adm. Ross T. McIntire  
Asserts There Was No  
Indication of Immi-  
nent Danger.

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By CHARLES G. ROSS

DEATH DUE TO CEREBRAL  
HEMORRHAGE --- BLOOD  
VESSEL IN BRAIN BROKE

WASHINGTON, April 13 (AP).  
**P**RESIDENT ROOSEVELT  
died from what doctors call  
a cerebral hemorrhage,  
which means a sudden exten-

Figure 1. Headlines of the *St. Louis Post-Dispatch*,  
April 13, 1945.

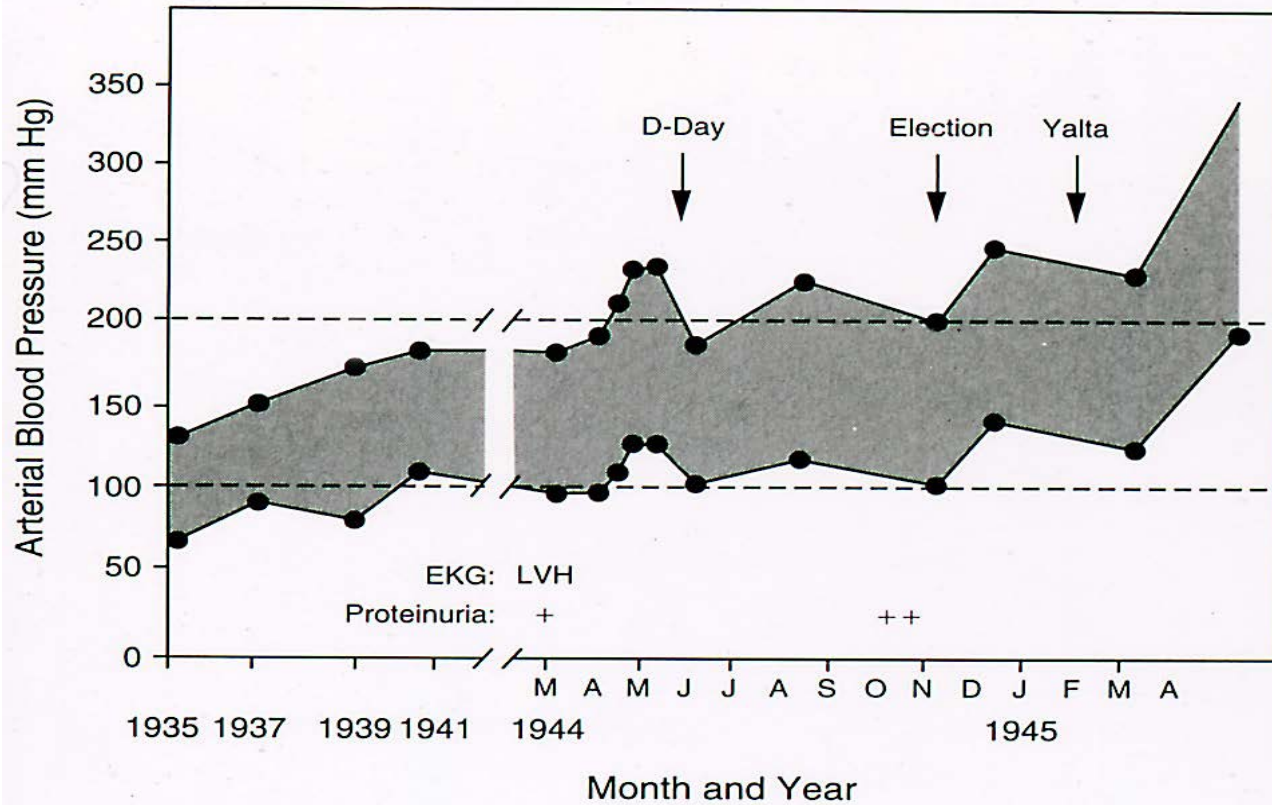
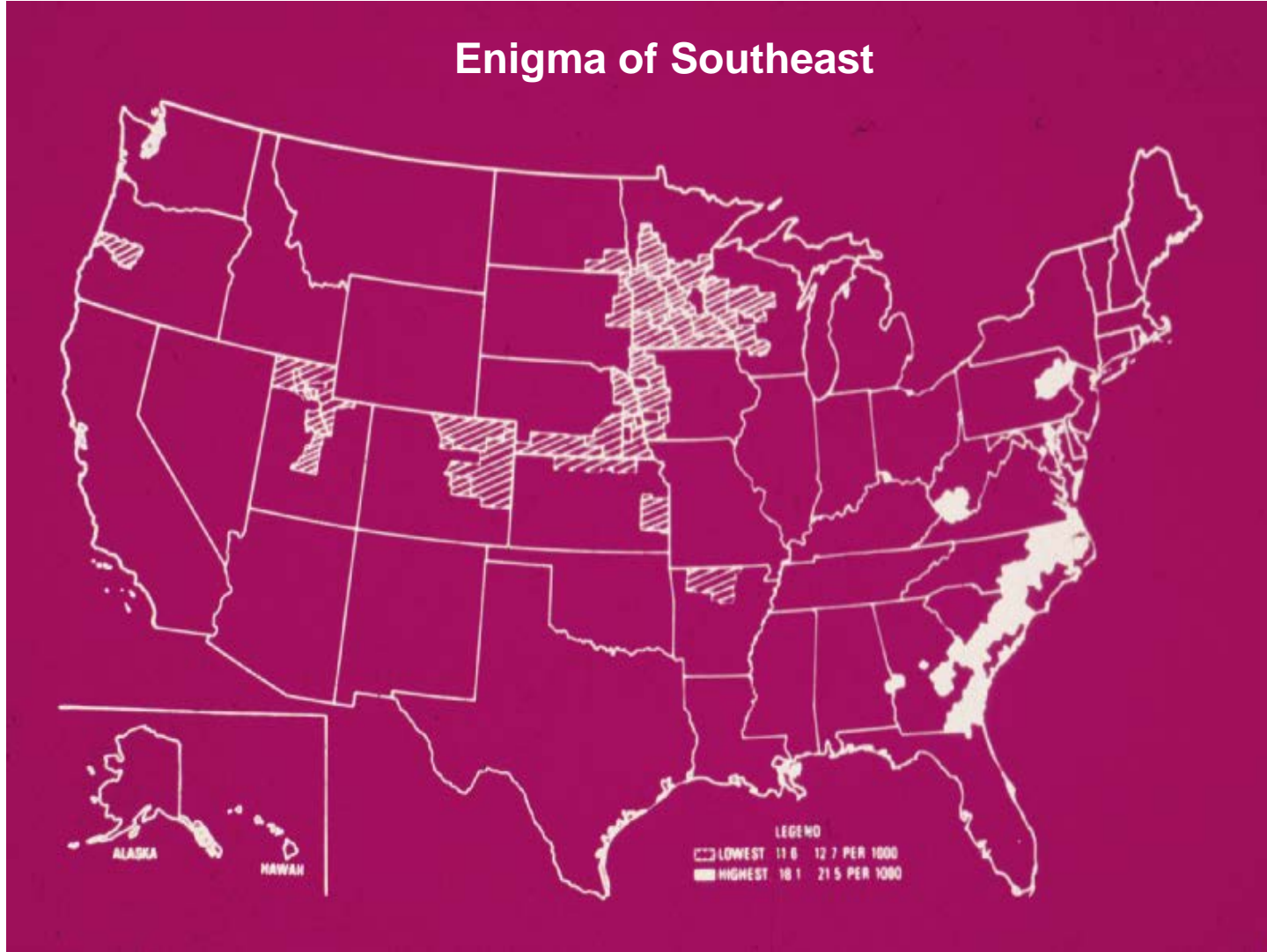


Figure 2: Diastolic and Systolic Arterial Pressure of Franklin D. Roosevelt from 1935 until His Death on April 12, 1945.

EKG denotes electrocardiogram, and LVH left ventricular hypertrophy. Data are from the diary of Dr. Howard G. Bruenn.<sup>2</sup>

## Enigma of Southeast



# Stroke

JOURNAL OF THE AMERICAN HEART ASSOCIATION



## **Factors Influencing the Decline in Stroke Mortality: A Statement From the American Heart Association/American Stroke Association**

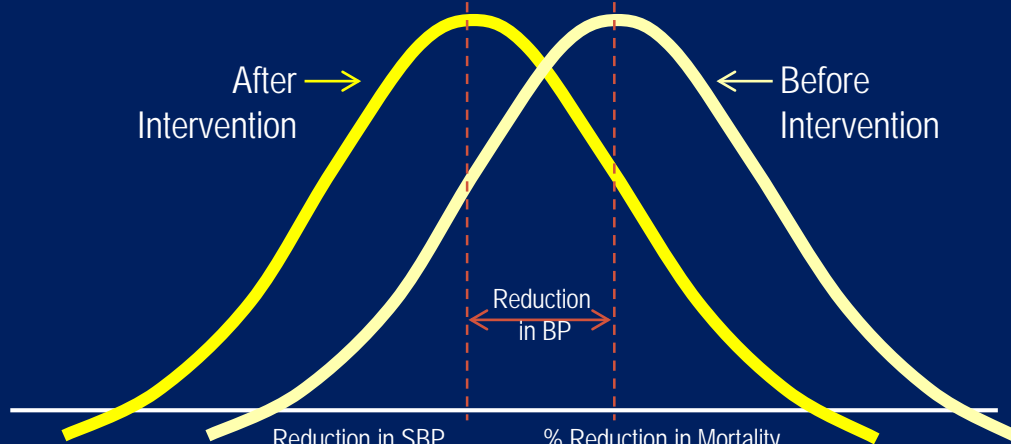
Daniel T. Lackland, Edward J. Roccella, Anne F. Deutsch, Myriam Fornage, Mary G. George, George Howard, Brett M. Kissela, Steven J. Kittner, Judith H. Lichtman, Lynda D. Lisabeth, Lee H. Schwamm, Eric E. Smith and Amytis Towfighi

*Stroke.* published online December 5, 2013;

**Stroke. 45(1):315-53, 2014**

## Population-Based Strategy

### SBP Distributions



Reduction in SBP  
mmHg

% Reduction in Mortality

Stroke CHD Total

2

-6

-4

-3

3

-8

-5

-4

5

-14

-9

-7

JAMA. 2003;289:2560-2572



## Mean Systolic Blood Pressure (SBP) by Time Period NHANES I-IV

| TABLE 1 |          |
|---------|----------|
| YEAR    | SBP (Hg) |
| 1960-62 | 131 mm   |
| 1971-74 | 129 mm   |
| 1976-81 | 126 mm   |
| 1988-91 | 119 mm   |
| 1988-94 | 121 mm   |
| 1999-04 | 123 mm   |
| 2001-08 | 122 mm   |

Stroke. 45(1):315-53, 2014

# Mean and 90<sup>th</sup> Percentile Systolic Blood Pressure by Time Period and Age Group

## 18 – 29 years

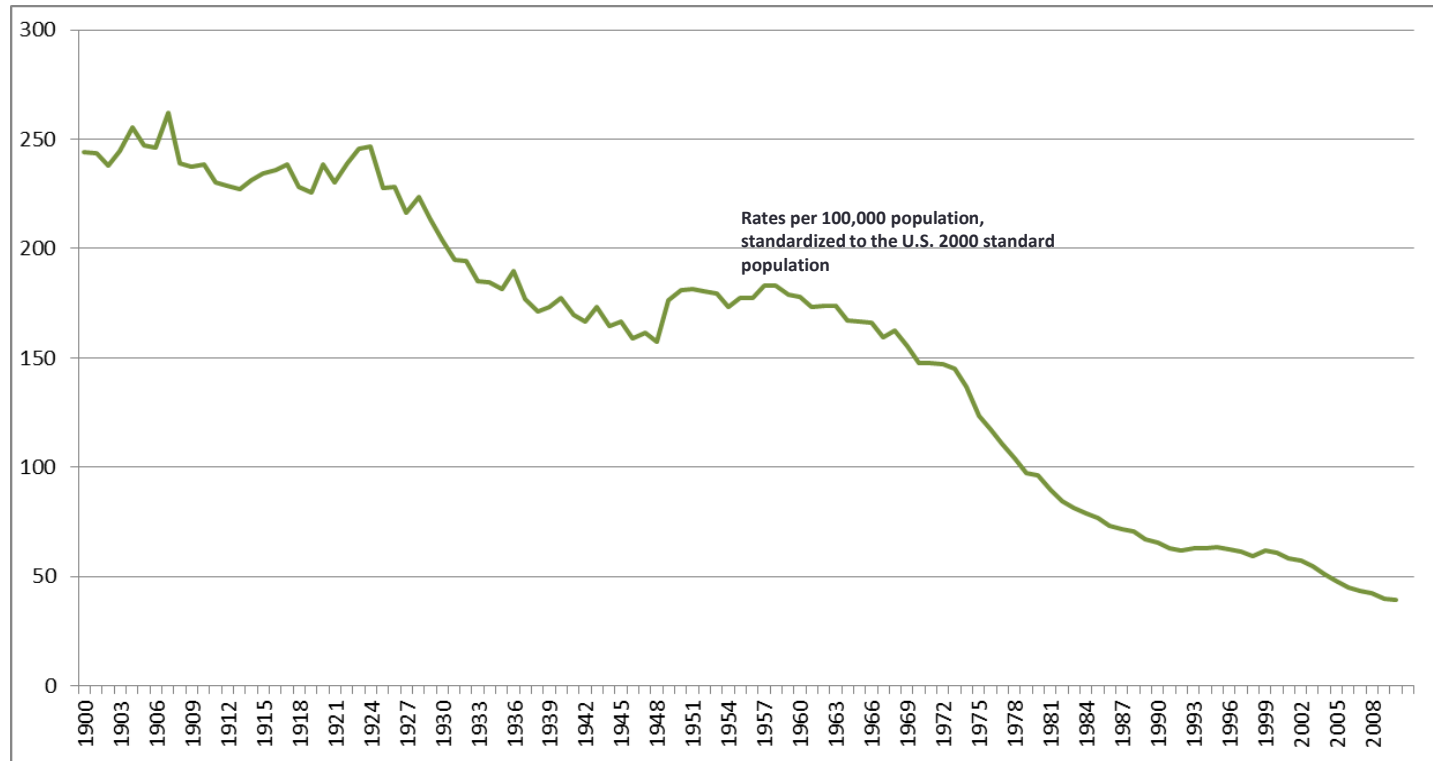
## 30 – 59 years

## 60 – 74 years

|           | Median   | 90 <sup>th</sup> Percentile | Median   | 90 <sup>th</sup> Percentile | Median   | 90 <sup>th</sup> Percentile |
|-----------|----------|-----------------------------|----------|-----------------------------|----------|-----------------------------|
| 1960-1962 | 119 mmHg | 137 mmHg                    | 127 mmHg | 155 mmHg                    | 148 mmHg | 188 mmHg                    |
| 2001-2008 | 113 mmHg | 126 mmHg                    | 118 mmHg | 138 mmHg                    | 129 mmHg | 156 mmHg                    |

Lackland DT, Beilin LJ, Campbell NRC, Jaffe MG, Orias M, Ram CV, Weber MA, Zhang XH; World Hypertension League. Global Implications of Blood Pressure Thresholds and Targets: Guideline Conversations From the World Hypertension League. Hypertension. 2018 Jun;71(6):985-987

## Age-Adjusted Death Rates for Cerebrovascular Disease by Year—United States, 1900-2010



Diseases were classified to the International Classification of Disease codes in use at the time the deaths were reported.

Stroke. 45(1):315-53, 2014

Circulation

**ORIGINAL RESEARCH ARTICLE**

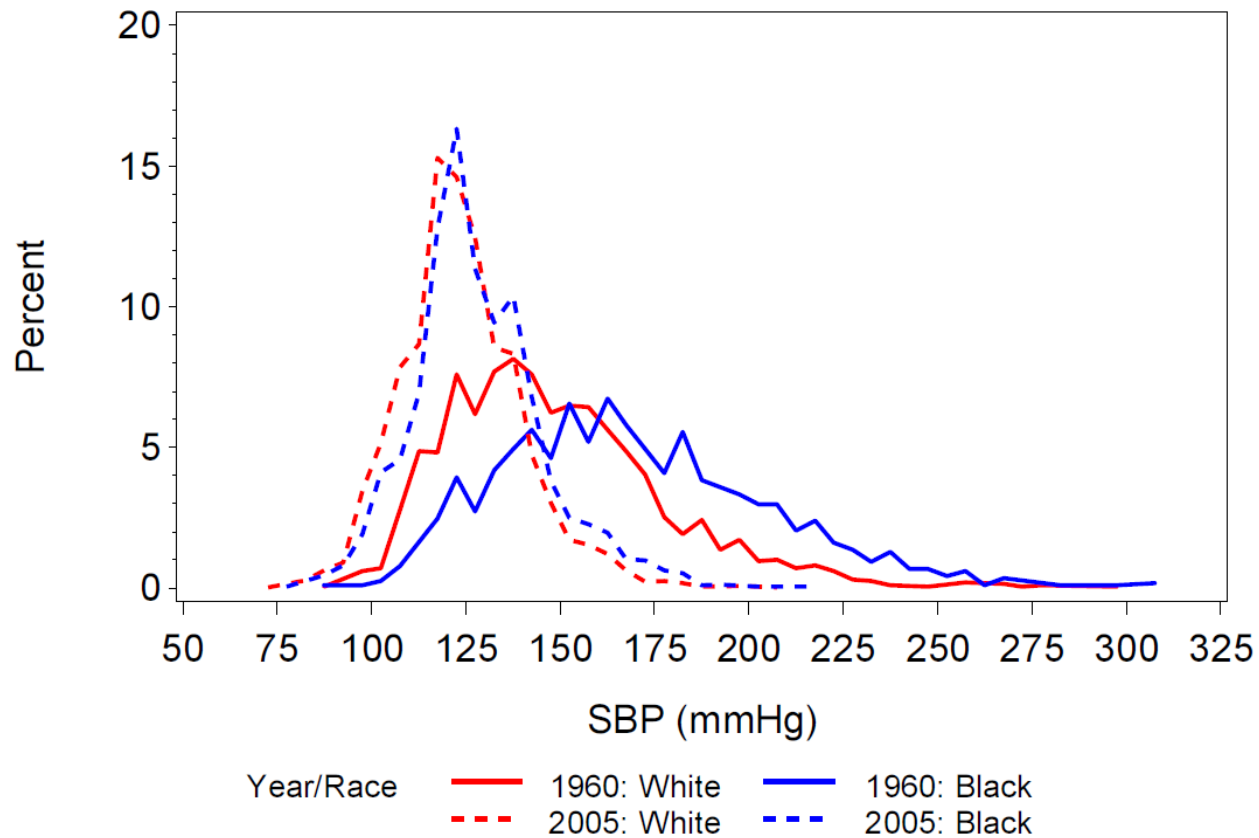
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# Forty-Year Shifting Distribution of Systolic Blood Pressure With Population Hypertension Treatment and Control

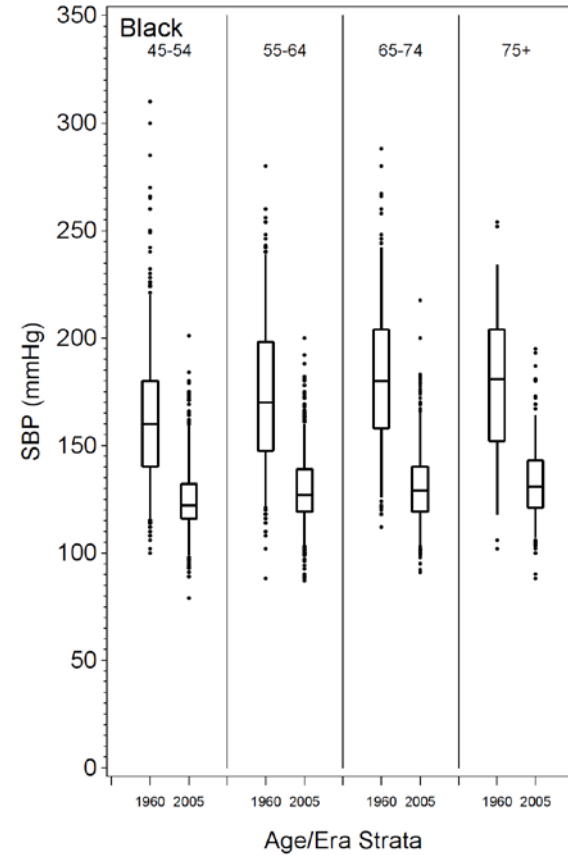
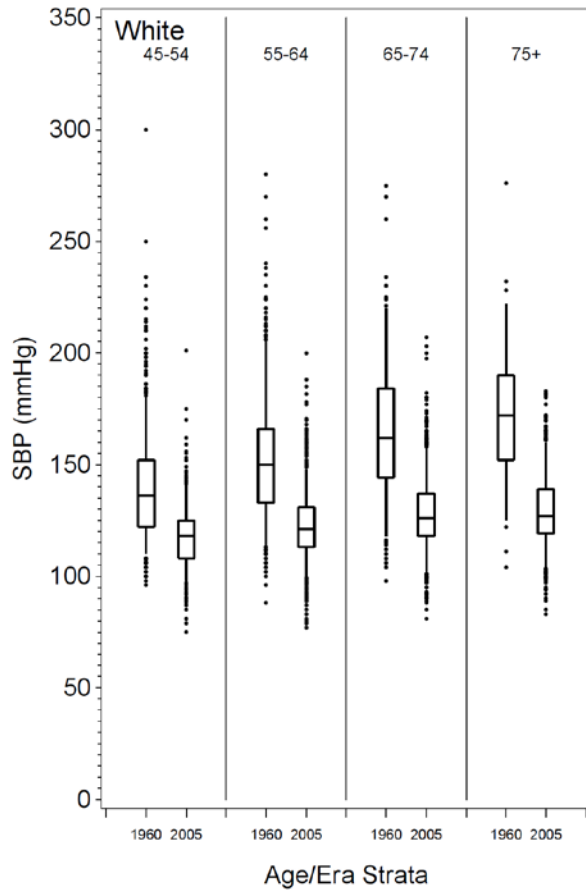
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Circulation. 2020;142:00–00. DOI: 10.1161/CIRCULATIONAHA.120.048063

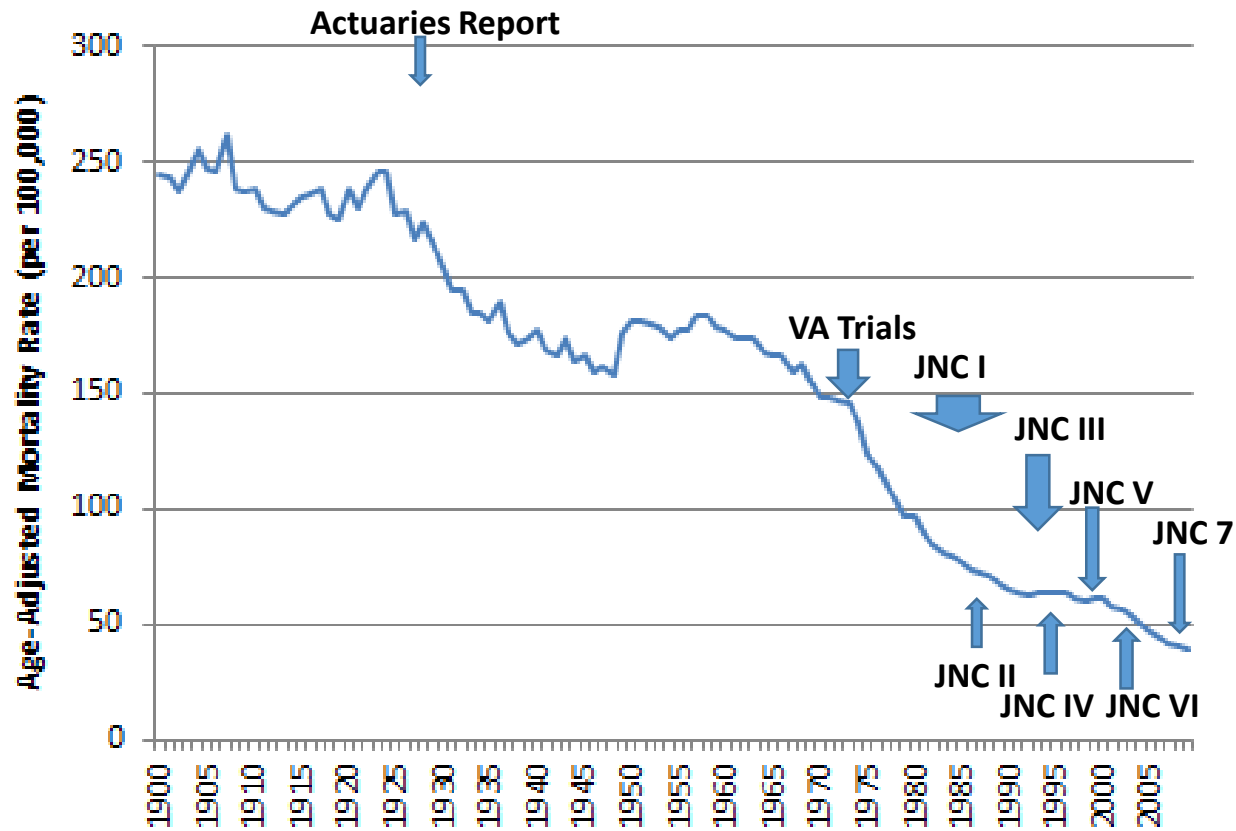
# Shift in Systolic Blood Pressure Distribution 1960-2005



# Changes in Systolic Blood Pressure by Age Strata 1960-2005



- The **clinical strategies of high BP detection, treatment, and control implemented** in the later part of the last century are effective in all patients
- **Primordial and primary prevention** activities implemented at the clinical setting can have impact on BP levels.
- **Early detection of hypertension** using proper BP measurement and prompt appropriate treatment can be effective in high BP control for all patients regardless of population social determinants.



Lackland DT, Beilin LJ, Campbell NRC, Jaffe MG, Orias M, Ram CV, Weber MA, Zhang XH; World Hypertension League. Global Implications of Blood Pressure Thresholds and Targets: Guideline Conversations From the World Hypertension League. *Hypertension*. 2018 Jun;71(6):985-987



*The* NEW ENGLAND JOURNAL *of* MEDICINE

ORIGINAL ARTICLE

## Final Report of a Trial of Intensive versus Standard Blood-Pressure Control

The SPRINT Research Group\*

N Engl J Med 2021;384:1921-30

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

ESTABLISHED IN 1812

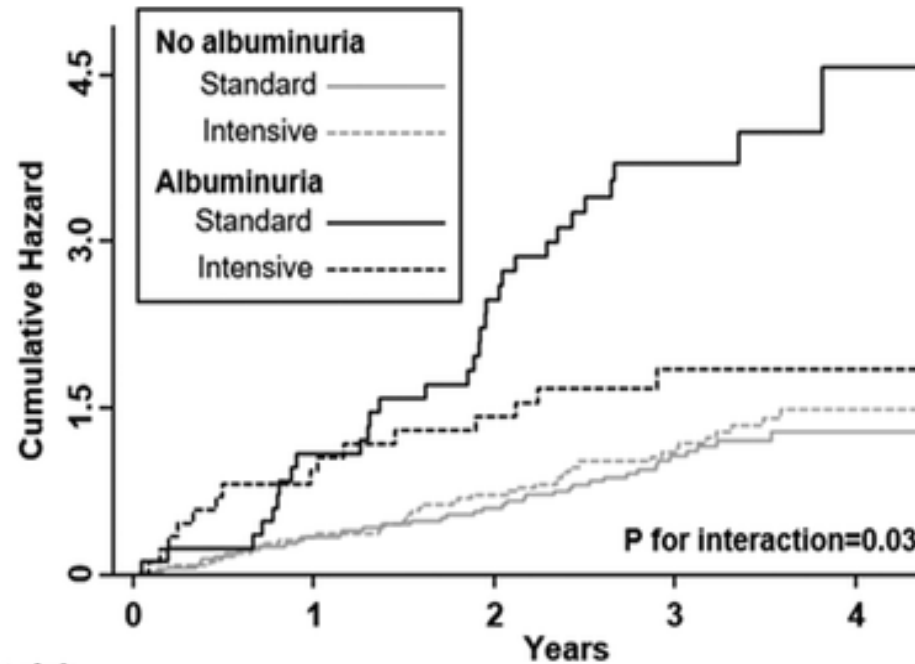
NOVEMBER 26, 2015

VOL. 373 NO. 22

A Randomized Trial of Intensive versus  
Standard Blood-Pressure Control

The SPRINT Research Group\*

## Stroke



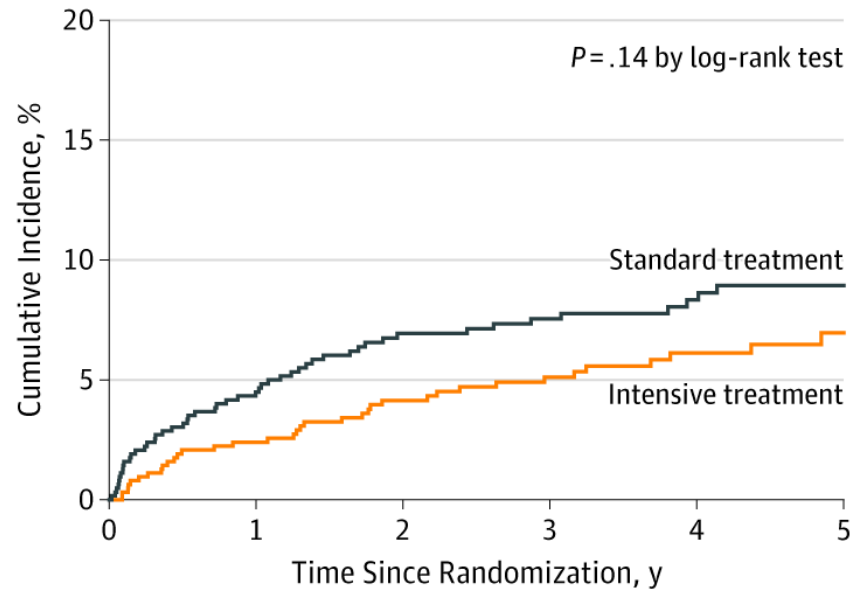
|                |           | Number at risk |      |      |      |     |   |
|----------------|-----------|----------------|------|------|------|-----|---|
|                |           |                | 0    | 1    | 2    | 3   | 4 |
| No albuminuria | Standard  | 3552           | 3466 | 3363 | 2341 | 631 |   |
|                | Intensive | 3560           | 3462 | 3371 | 2360 | 638 |   |
| Albuminuria    | Standard  | 835            | 808  | 761  | 483  | 115 |   |
|                | Intensive | 859            | 827  | 789  | 518  | 138 |   |

# SPRINT TRIAL

- Among patients at high risk for cardiovascular events but without diabetes, **targeting a systolic blood pressure of less than 120 mm Hg, as compared with less than 140 mm Hg, resulted in lower rates of fatal and nonfatal major cardiovascular events and death from any cause**, although significantly higher rates of some adverse events were observed in the intensive-treatment group.

From: **Effect of Standard vs Intensive Blood Pressure Control on the Risk of Recurrent Stroke: A Randomized Clinical Trial and Meta-analysis**

JAMA Neurol. 2019;76(11):1309-1318. doi:10.1001/jamaneurol.2019.2167



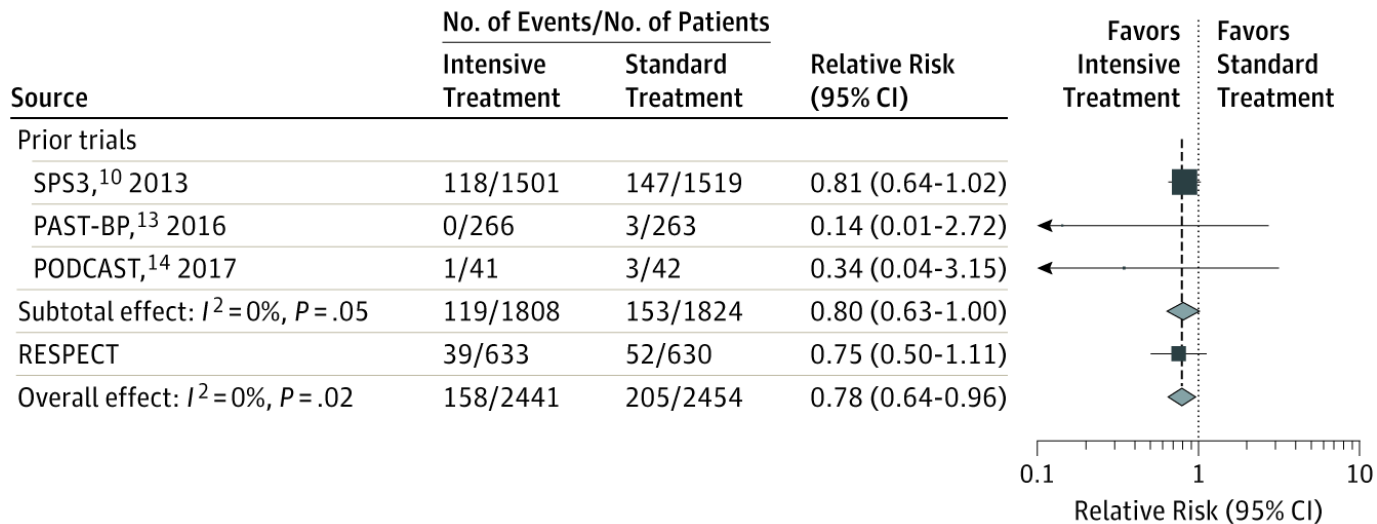
| No. at risk         |     |     |     |     |     |     |
|---------------------|-----|-----|-----|-----|-----|-----|
| Standard treatment  | 630 | 578 | 495 | 419 | 308 | 170 |
| Intensive treatment | 633 | 591 | 523 | 442 | 318 | 165 |

Figure Legend:

Cumulative Incidence of Stroke by Randomized Groups Stroke is a composite of ischemic stroke and intracerebral hemorrhage.

From: **Effect of Standard vs Intensive Blood Pressure Control on the Risk of Recurrent Stroke: A Randomized Clinical Trial and Meta-analysis**

JAMA Neurol. 2019;76(11):1309-1318. doi:10.1001/jamaneurol.2019.2167



Effects of Intensive Blood Pressure Lowering on Recurrent Stroke in a Meta-analysis of Randomized Clinical Trials Boxes and horizontal lines represent relative risks and 95% CIs for each trial. The size of boxes is proportional to the inverse variance. Diamonds show the 95% CIs for pooled estimates of effect and are centered on the pooled relative risk. PAST-BP indicates Prevention After Stroke–Blood Pressure; PODCAST, Prevention of Decline in Cognition After Stroke Trial; RESPECT, Recurrent Stroke Prevention Clinical Outcome; and SPS3, Secondary Prevention of Small Subcortical Strokes.

## ***Changes in BP Categories from JNC7 to the New Guideline***

| <b>SBP</b> |     | <b>DBP</b> | <b>JNC7</b>          | <b>2017 ACC/AHA</b> |
|------------|-----|------------|----------------------|---------------------|
| <120       | and | <80        | Normal BP            |                     |
| 120–129    | and | <80        | Prehypertension      |                     |
| 130–139    | or  | 80–89      | Prehypertension      |                     |
| 140–159    | or  | 90–99      | Stage 1 hypertension |                     |
| ≥160       | or  | ≥100       | Stage 2 hypertension |                     |

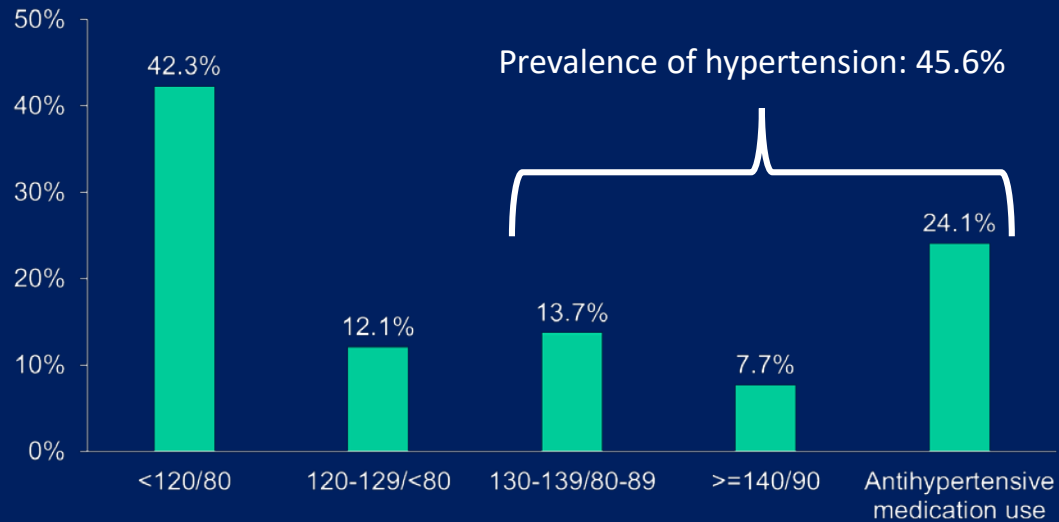
The categorization of BP should be based on the average of ≥ 2 readings on ≥ 2 occasions following a standardized protocol.

## ***Changes in BP Categories from JNC7 to the New Guideline***

| <b>SBP</b> |     | <b>DBP</b> | <b>JNC7</b>          | <b>2017 ACC/AHA</b>  |
|------------|-----|------------|----------------------|----------------------|
| <120       | and | <80        | Normal BP            | Normal BP            |
| 120–129    | and | <80        | Prehypertension      | Elevated BP          |
| 130–139    | or  | 80–89      | Prehypertension      | Stage 1 hypertension |
| 140–159    | or  | 90–99      | Stage 1 hypertension | Stage 2 hypertension |
| ≥160       | or  | ≥100       | Stage 2 hypertension | Stage 2 hypertension |

The categorization of BP should be based on the average of ≥ 2 readings on ≥ 2 occasions following a standardized protocol.

## *Distribution of US adults into BP Categories – NHANES 2011-2014*



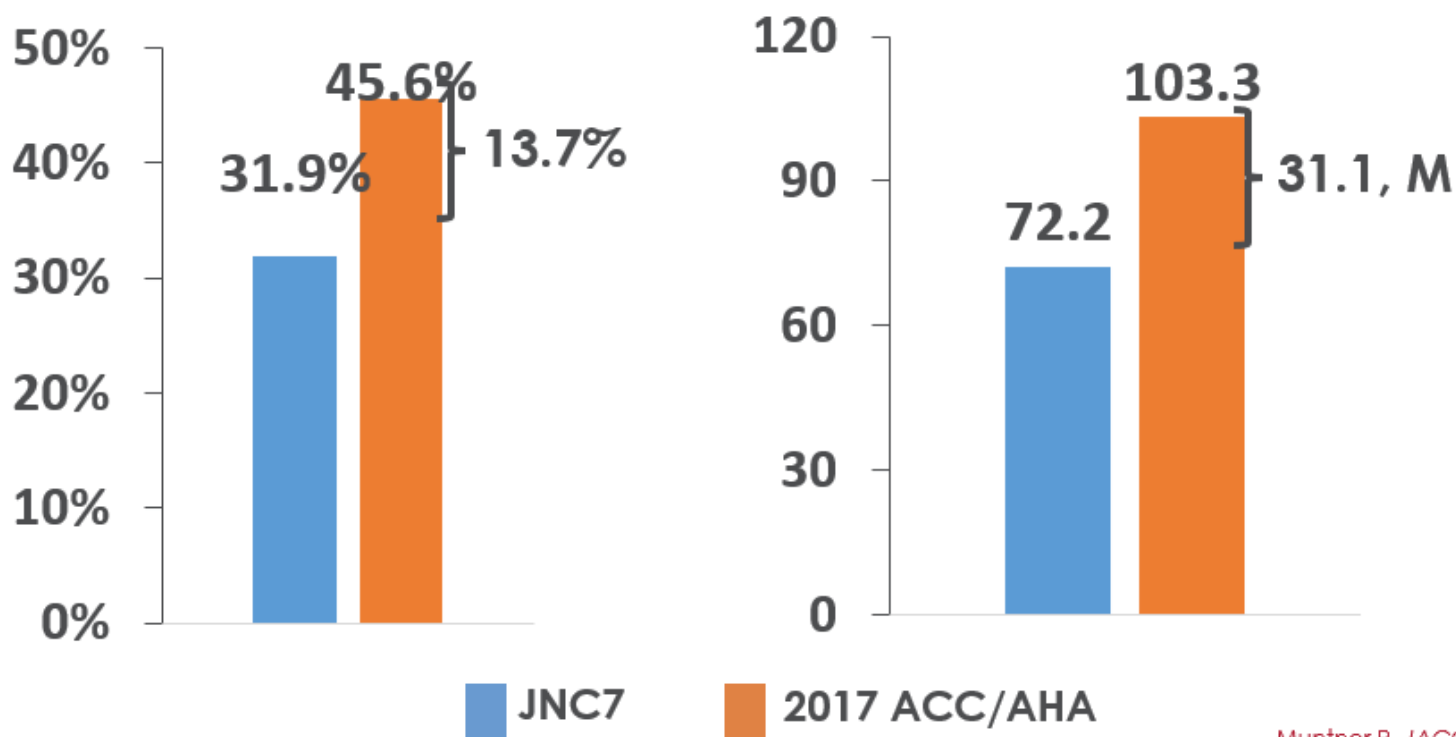
Muntner et. al., Journal of the American College of Cardiology 2017 (in press)

Muntner, et. al., Circulation 2017 (in press)



# IMPACT: PREVALENCE OF HYPERTENSION – 2017 ACC/AHA AND JNC7 GUIDELINES

Prevalence of hypertension Number of US adults with hypertension, millions

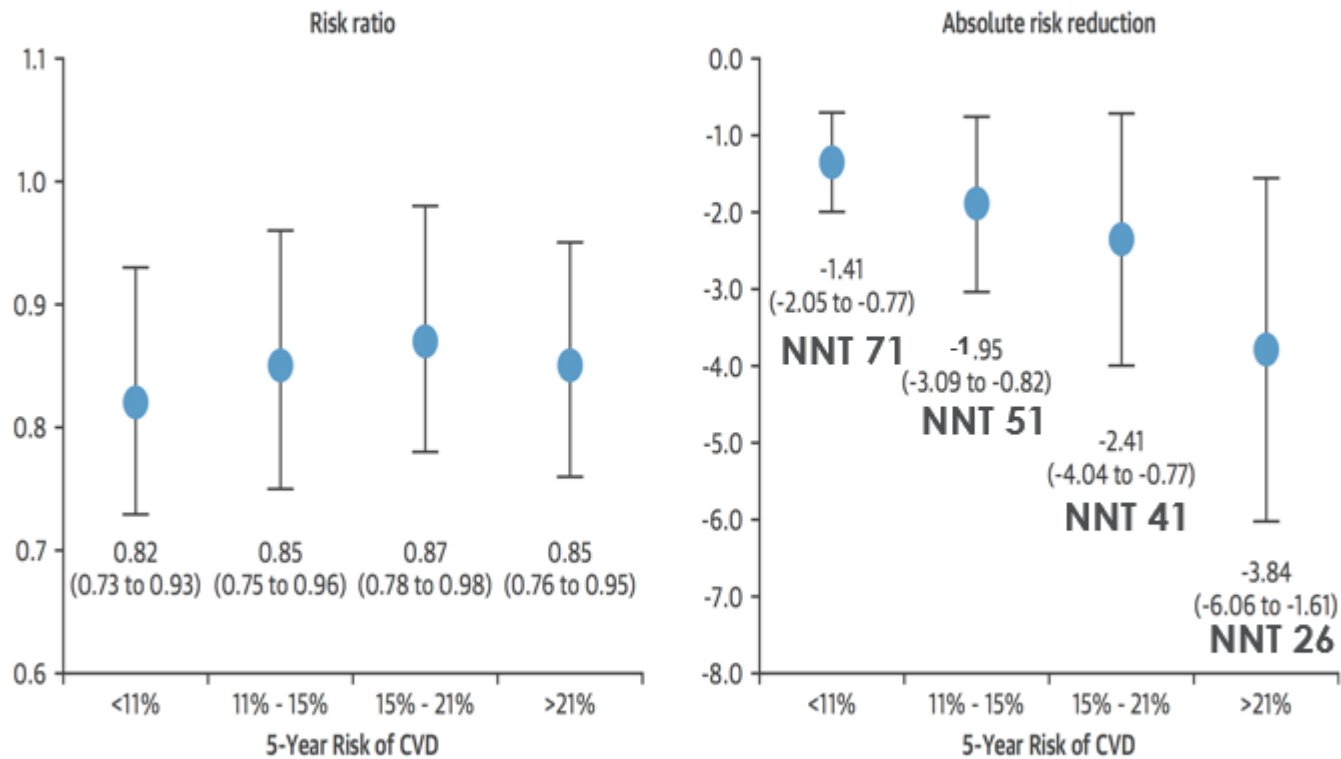


Muntner P. JACC. 2018.

# Treatment initiation is based BP levels and CVD risk

- **SBP <130 and <80 mm Hg**
  - Don't treat
- **SBP ≥130-140 or DBP ≥80-90 mm Hg**
  - Treat if any of the following:
    - History of CVD, DM, or CKD
    - 10 yr risk of CVD ≥ 10% using the Pooled Cohort equations
    - Age ≥65 years and SBP ≥130
- **SBP ≥140 or DBP ≥ 90, mm Hg**
  - Treat all

# TREATING HIGH RISK ADULTS RESULTS IN LARGER ABSOLUTE CVD RISK REDUCTION WITH SIMILAR RRR



Sundstrom, Lancet, 2014

*JAMA.* 2013;310(7):699-705.

Research

Original Investigation

## Improved Blood Pressure Control Associated With a Large-Scale Hypertension Program

Marc G. Jaffe, MD; Grace A. Lee, MD; Joseph D. Young, MD; Stephen Sidney, MD, MPH; Alan S. Go, MD

**IMPORTANCE** Hypertension control for large populations remains a major challenge.

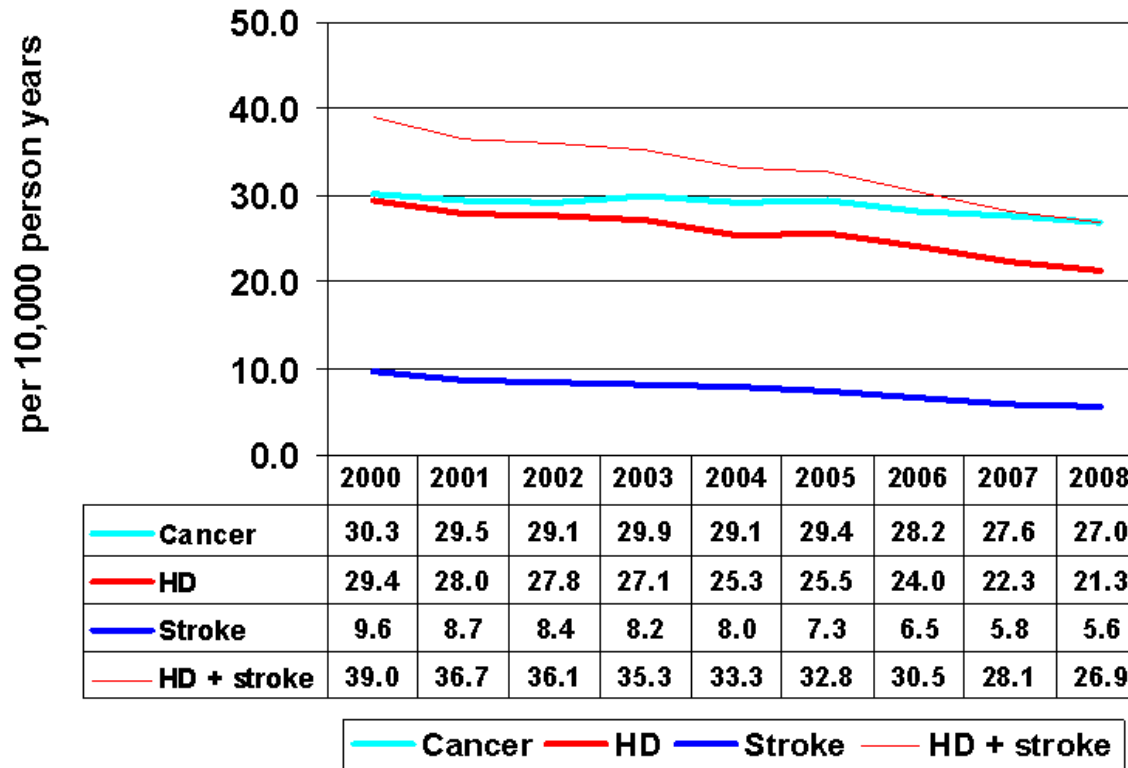
**OBJECTIVE** To describe a large-scale hypertension program in Northern California and to compare rates of hypertension control in that program with statewide and national estimates.

**DESIGN, SETTING, AND PATIENTS** The Kaiser Permanente Northern California (KPNC) hypertension program included a multifaceted approach to blood pressure control. Patients identified as having hypertension within an integrated health care delivery system in Northern California from 2001-2009 were included. The comparison group comprised insured patients in California between 2006-2009 who were included in the Healthcare Effectiveness Data and Information Set (HEDIS) commercial measurement by California health insurance plans participating in the National Committee for Quality Assurance (NCQA) quality measure reporting process. A secondary comparison group was included to obtain the reported national mean NCQA HEDIS commercial rates of hypertension control between 2001-2009 from health plans that participated in the NCQA HEDIS quality measure reporting process.

**MAIN OUTCOMES AND MEASURES** Hypertension control as defined by NCQA HEDIS.

- ← Editorial page 695
- + Author Video Interview at [jama.com](http://jama.com)
- + Supplemental content at [jama.com](http://jama.com)

## KPNC Mortality 2000-2008



- **30% reduction** in mortality from CVD
- **42% reduction** in mortality from stroke
- 

Sidney S, Jaffe M, Nguyen-Hyunha M, Kushi L, Young J, Sorel M, Selby J, Go A. Closing the Gap Between Cardiovascular and Cancer Mortality in an Integrated Health Care Delivery System, 2000-2008: The Kaiser Permanente Experience. *Circulation* 2011; 124: A13610

# Global Hearts initiative technical package for CVD management

- Health lifestyle
- Evidence based Treatment
- Access to medicine and
- Risk Based management
- Team base care
- System monitoring



# Stroke and Salt intake

- BMJ 2009;339:b4567
- doi:10.1136/bmj.b4567

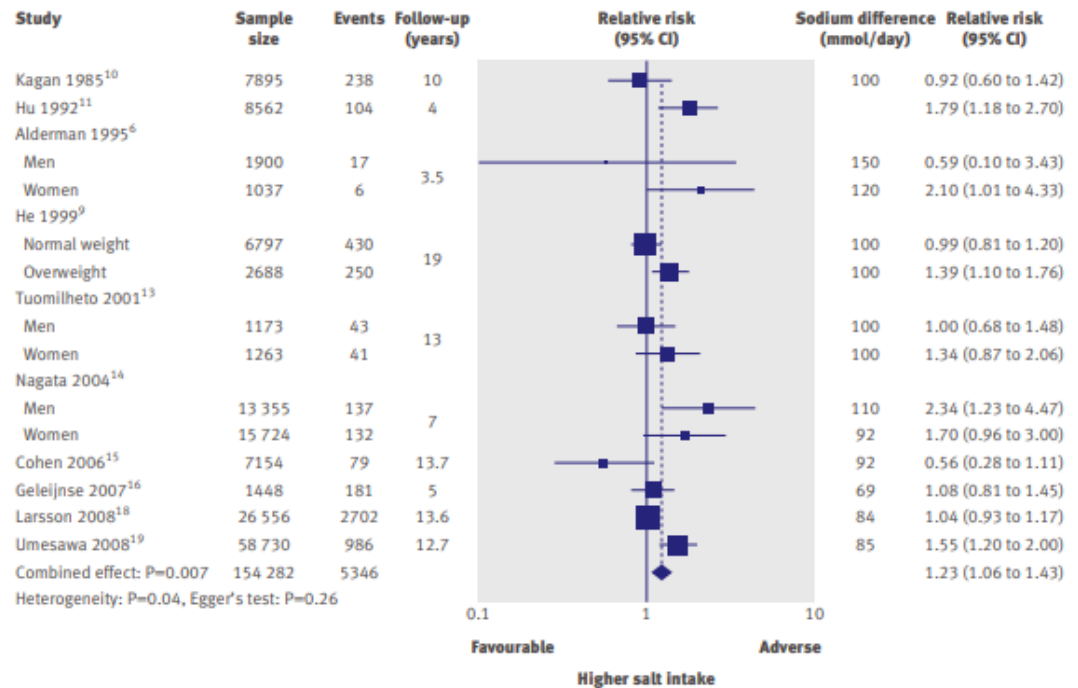
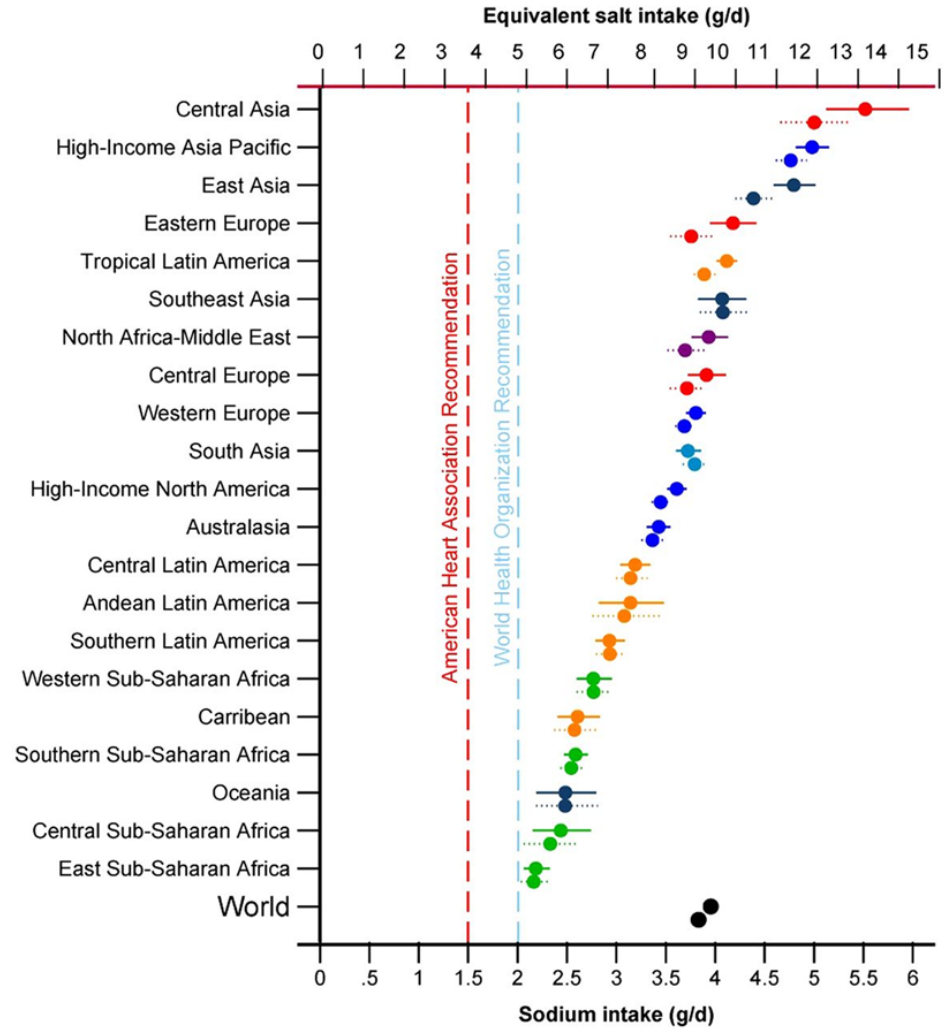


Fig 1 | Risk of incident stroke associated with higher compared with lower salt intake in 14 population cohorts from 10 published prospective studies including 154 282 participants and 5346 events

## Global and regional sodium intakes





# How much sodium is in a Chicken Cesar Salad at the Costco Food Court?

- ➔ A. 2680mg
- B. 725 mg
- C. 1130 mg
- D. 2060 mg



# How much sodium is an order of PF Chang's, double pan fried noodles with pork?

- A. 1500 mg
- B. 7900 mg
- C. 2700 mg
- D. 4300 mg



3 servings  
2910 mg Sodium



**TRADER JOE'S**  
PULLY BAKED  
**Chicken Pot Pie**  
Pulled Chicken Meat & Vegetables Under A Flaky Crust  
PERISHABLE. KEEP REFRIGERATED

**Nutrition Facts**  
Serving Size 1 cup (227g/8oz)  
Servings Per Container about 3

| Amount Per Serving            |                       |            |
|-------------------------------|-----------------------|------------|
| <b>Calories</b> 470           | Calories from Fat 230 |            |
|                               | <b>% Daily Value*</b> |            |
| <b>Total Fat</b> 25g          |                       | <b>38%</b> |
| Saturated Fat 15g             |                       | <b>75%</b> |
| Trans Fat 0g                  |                       |            |
| <b>Cholesterol</b> 110mg      |                       | <b>37%</b> |
| <b>Sodium</b> 970mg           |                       | <b>40%</b> |
| <b>Total Carbohydrate</b> 40g |                       | <b>13%</b> |
| Dietary Fiber 1g              |                       | <b>5%</b>  |
| Sugars 4g                     |                       |            |
| <b>Protein</b> 18g            |                       |            |
| Vitamin A 40% • Vitamin C 4%  |                       |            |
| Calcium 6% • Iron 6%          |                       |            |

\* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

|                    |                   |         |
|--------------------|-------------------|---------|
| Total Fat          | Less Than 65g     | 80g     |
| Sat Fat            | Less than 20g     | 25g     |
| Cholesterol        | Less than 300mg   | 300mg   |
| Sodium             | Less than 2,400mg | 2,400mg |
| Total Carbohydrate | 300g              | 375g    |
| Dietary Fiber      | 25g               | 30g     |

Calories per gram:  
Fat 9 • Carbohydrate 4 • Protein 4



Serving Suggestion

Chicken should be the prominent ingredient in chicken pot pie, shouldn't it? We think so, but find that this is rarely the case... So, in order to create the best possible version of this homey dish we loaded it up with large pieces of chicken meat and then added chunks of flavorful vegetables. On top of everything, we laid flaky puff pastry and pre-baked it for you. There's no longer any reason to make Chicken Pot Pie yourself!

**INGREDIENTS: POT PIE FILLING:** COOKED CHICKEN (CHICKEN MEAT, WATER, SEASONING (DEXTROSE, SALT, MODIFIED CORNSTARCH, CHICKEN BROTH FLAVOR, FENYON BROTHER SALT FLAVOR, MALTODEXTRIN), ONION POWDER, SPICES (BLACK PEPPER, THYME), NATURAL FLAVOR (CELLERY), TRICALCIUM PHOSPHATE AS ANTI-CAKING AGENT), WATER, HALF & HALF (MILK/CREAM), CARROTS, MUSHROOMS, POTATOES, PEAS, CONTAINS 2% OR LESS OF THE FOLLOWING: CELERY, UNBLEACHED ENRICHED FLOUR (WHEAT FLOUR, MALTED BARLEY FLOUR, NIACIN, REDUCED IRON, ASCORBIC ACID, THIAMINE MONONITRATE, RIBOFLAVIN AND FOLIC ACID), BUTTER (CREAM, SALT), ONIONS, CHICKEN BASE (OVEN ROASTED CHICKEN MEAT WITH NATURAL CHICKEN JUICES, SALT, SUGAR, CORN SYRUP, REDUCED CHICKEN FAT, YEAST EXTRACT, NATURAL FLAVORING, ONION POWDER, RICE FLOUR, MALTODEXTRIN, TURMERIC POWDER), MODIFIED CORNSTARCH, KOSHER SALT, PARSLEY, THYME, WHITE PEPPER, BLACK PEPPER. **PUFF PASTRY:** UNBLEACHED ENRICHED FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, THIAMINE MONONITRATE, RIBOFLAVIN, FOLIC ACID, ENZYME), BUTTER (CREAM, NATURAL FLAVORS), WATER, SALT, EGG WASH (WHOLE EGG, CITRIC ACID).

**CONTAINS MILK, WHEAT, EGG.**

DIST. AND SOLD EXCLUSIVELY BY: TRADER JOE'S, MONROVIA, CA 91706

**HEATING INSTRUCTIONS:**

**CONVENTIONAL OVEN (Recommended for flakier crust):** Remove tray from carton and remove plastic film. Place tray on a baking sheet (do not place tray directly on oven rack) and heat at 375°F for 25-30 minutes or until crust is crisp and pie is heated through. Let stand 1 minute before serving.

**MICROWAVE:** Remove tray from carton and remove plastic film. Heat on high for 6-7 minutes, or until heated through. Cooking times may vary with oven. Let stand for 1 minute before serving.



0093 8099



# WORLD HYPERTENSION DAY **May 17th 2023**

*Measure Your Blood Pressure Accurately  
Control it, Live Longer.*

Initiated by the World Hypertension League [www.whleague.org](http://www.whleague.org)