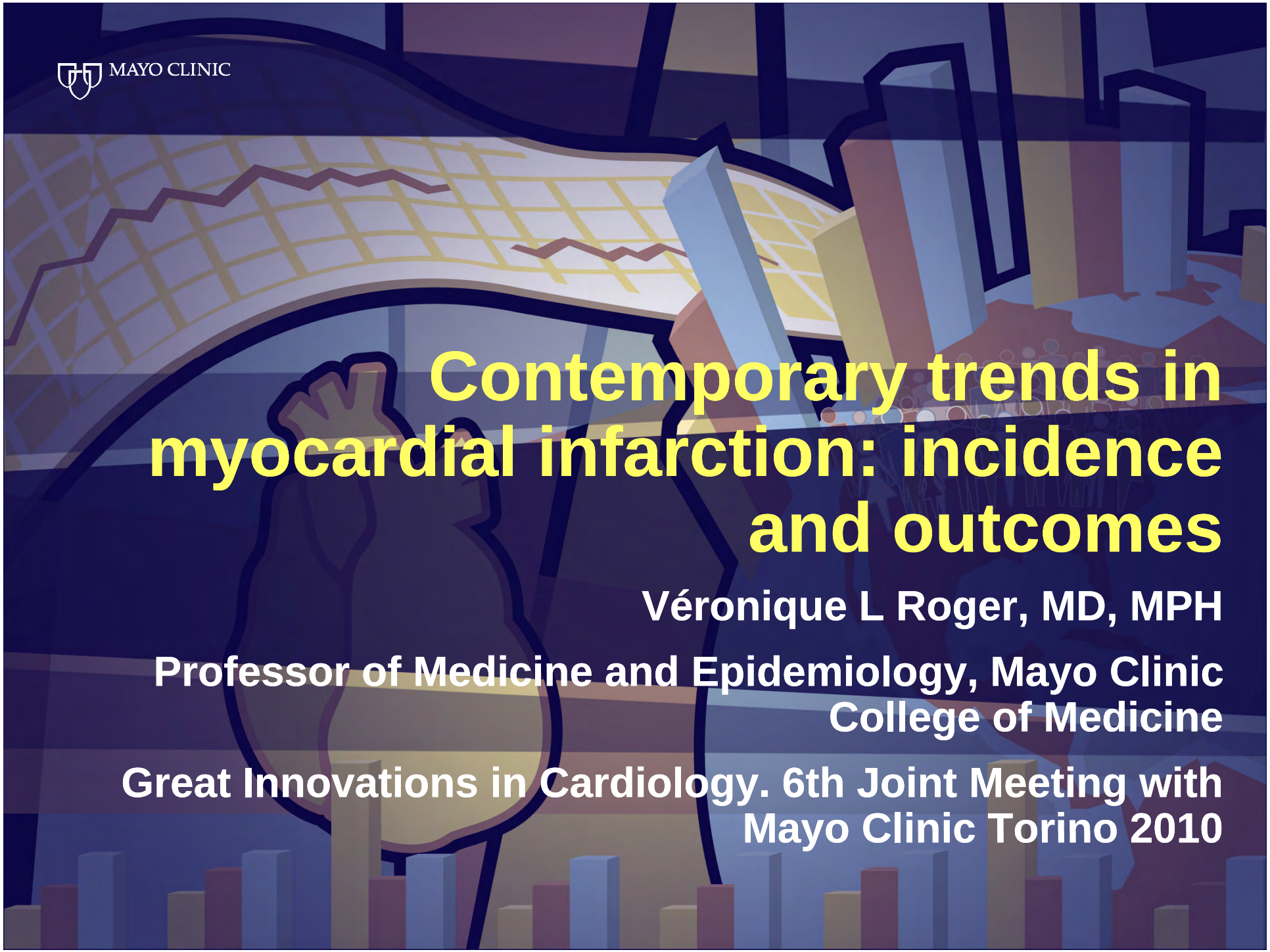

Contemporary trends in myocardial infarction: incidence and outcomes

Véronique L Roger, MD, MPH

Professor of Medicine and Epidemiology, Mayo Clinic College of Medicine

Great Innovations in Cardiology. 6th Joint Meeting with Mayo Clinic Torino 2010

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Disclosures

National Heart Lung and Blood Institute

ROCHESTER EPIDEMIOLOGY PROJECT

IMPROVING COMMUNITY HEALTH THROUGH RESEARCH

www.RochesterProject.org

American Heart Association

Learn and Live.

RO1 HL 59205

RO1 HL 72435

K24 HL 68765

R01 AR 30582

American Heart Association

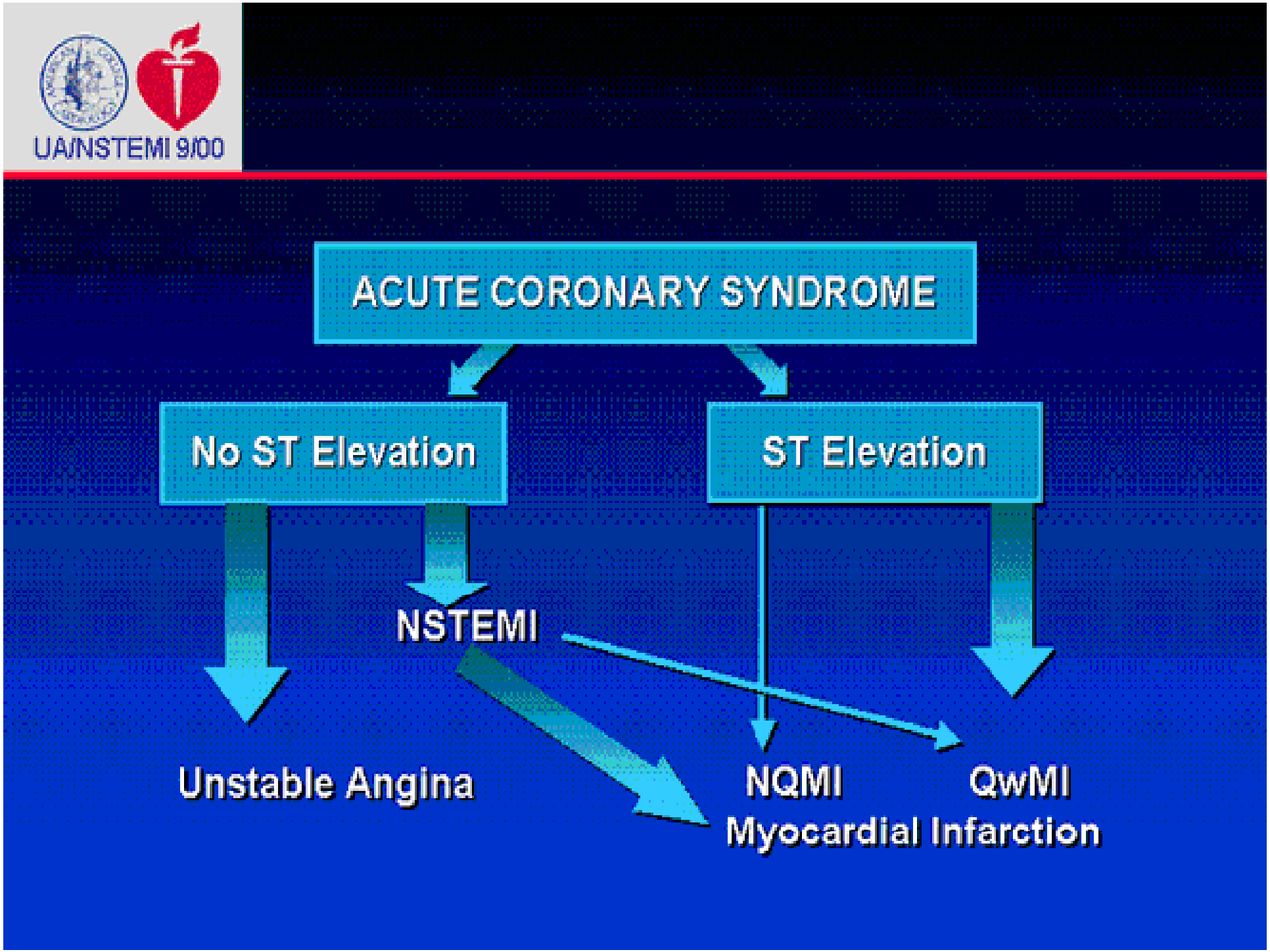
Established Investigator award

Objectives

- Why and how to measure MI trends?
- MI trends: then and now
- What does this mean?

roger.veronique@mayo.edu

UA/NSTEMI 9/00



Why measure MI trends?

Science: measurement of trends and determinants generates mechanistic hypotheses

Clinical practice: Effectiveness and quality of care, detecting disparities

Public health: design interventions, plan for resources, delineate policies

Trends in MI and ACS

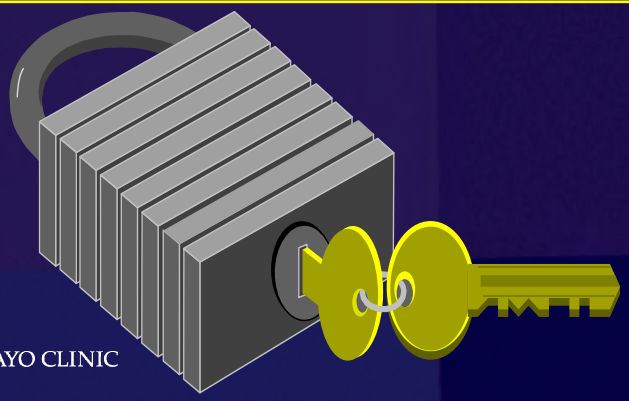
Concepts

Incidence

Fatalities

Primary prevention

Medical care
Reperfusion Rx



Better prevention
Better care

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How to measure MI trends

- National statistics and surveys
- Administrative databases
- Community surveillance

National Statistics and Surveys

- Mortality and morbidity reports
- Hospital discharge data
- Procedural registries (surgery)
- EuroAspire
- National Health and Nutrition Examination Survey

Not validated, captures episodes not persons
Useful to ask questions

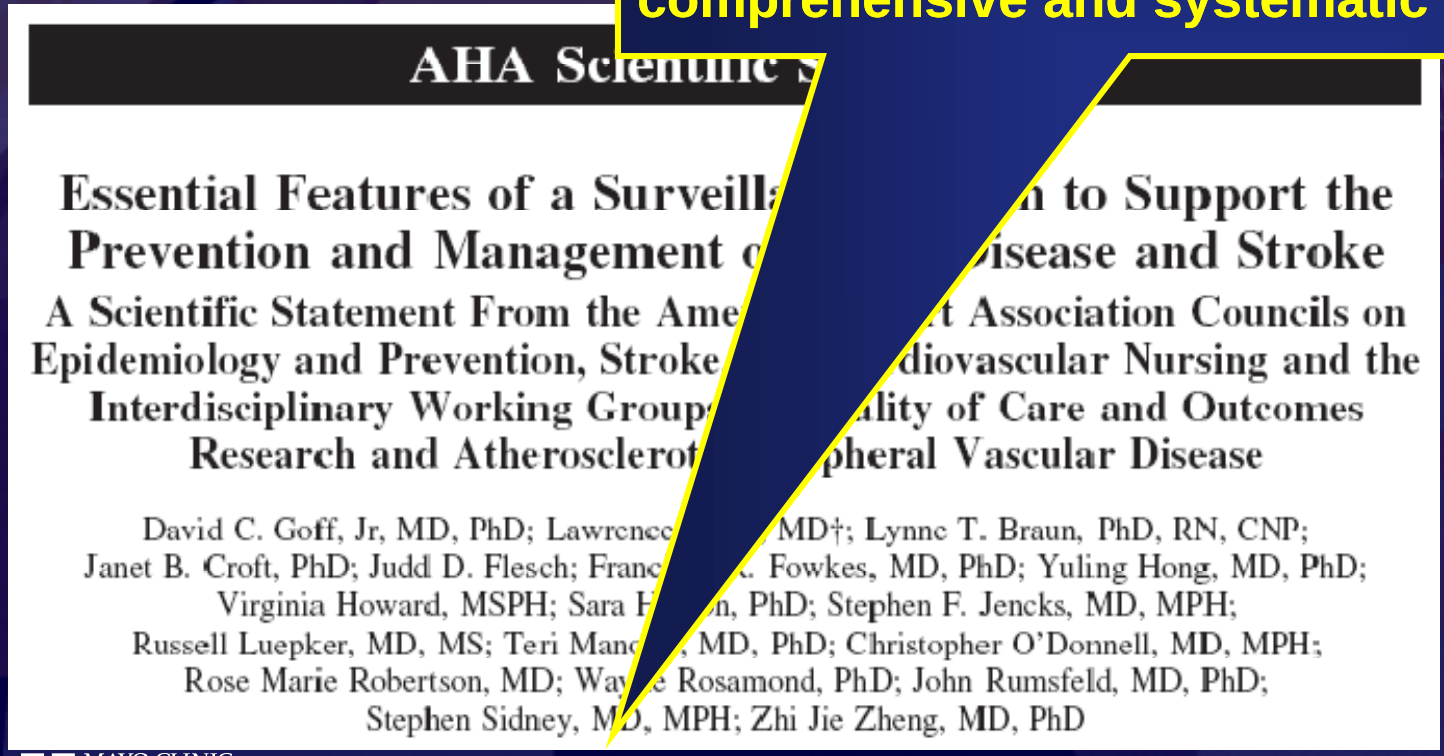
Disease surveillance

Systematic approach to measure validated MI mortality, MI incidence, and post-MI survival to provide insight into the determinants of the trends

- **Defined** population
- **Rigorous** event definition
- **Constant** criteria across time, place, person

CVD surveillance

"A strategic goal of the AHA is to reduce heart disease, stroke, and the risk for both by 25%,… However, the current health tracking systems (surveillance) in the United States cannot track progress toward these goals in a comprehensive and systematic manner"



AHA Scientific S

Essential Features of a Surveill n to Support the Prevention and Management o isease and Stroke

A Scientific Statement From the Ame t Association Councils on Epidemiology and Prevention, Stroke diovascular Nursing and the Interdisciplinary Working Group lity of Care and Outcomes Research and Atherosclerot pheral Vascular Disease

David C. Goff, Jr, MD, PhD; Lawrence MD†; Lynne T. Braun, PhD, RN, CNP; Janet B. Croft, PhD; Judd D. Flesch; Franc . Fowkes, MD, PhD; Yuling Hong, MD, PhD; Virginia Howard, MSPH; Sara H n, PhD; Stephen F. Jencks, MD, MPH; Russell Luepker, MD, MS; Teri Manc , MD, PhD; Christopher O'Donnell, MD, MPH; Rose Marie Robertson, MD; Wa e Rosamond, PhD; John Rumsfeld, MD, PhD; Stephen Sidney, M D, MPH; Zhi Jie Zheng, MD, PhD

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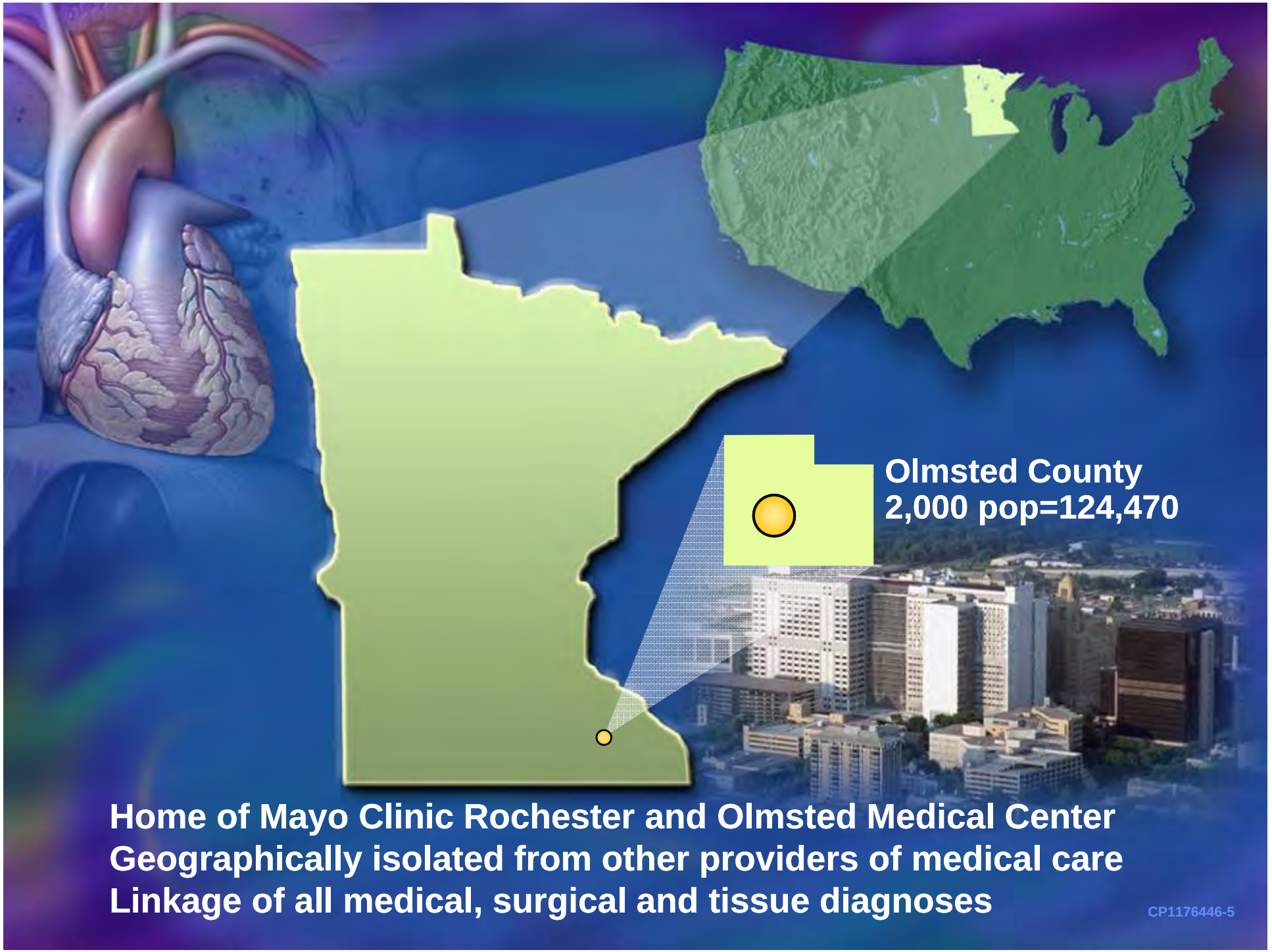
Circulation, 2007 115:127-55

Community surveillance

In defined populations

- **Rigorous** event definition
- **Constant** criteria across time, place, person

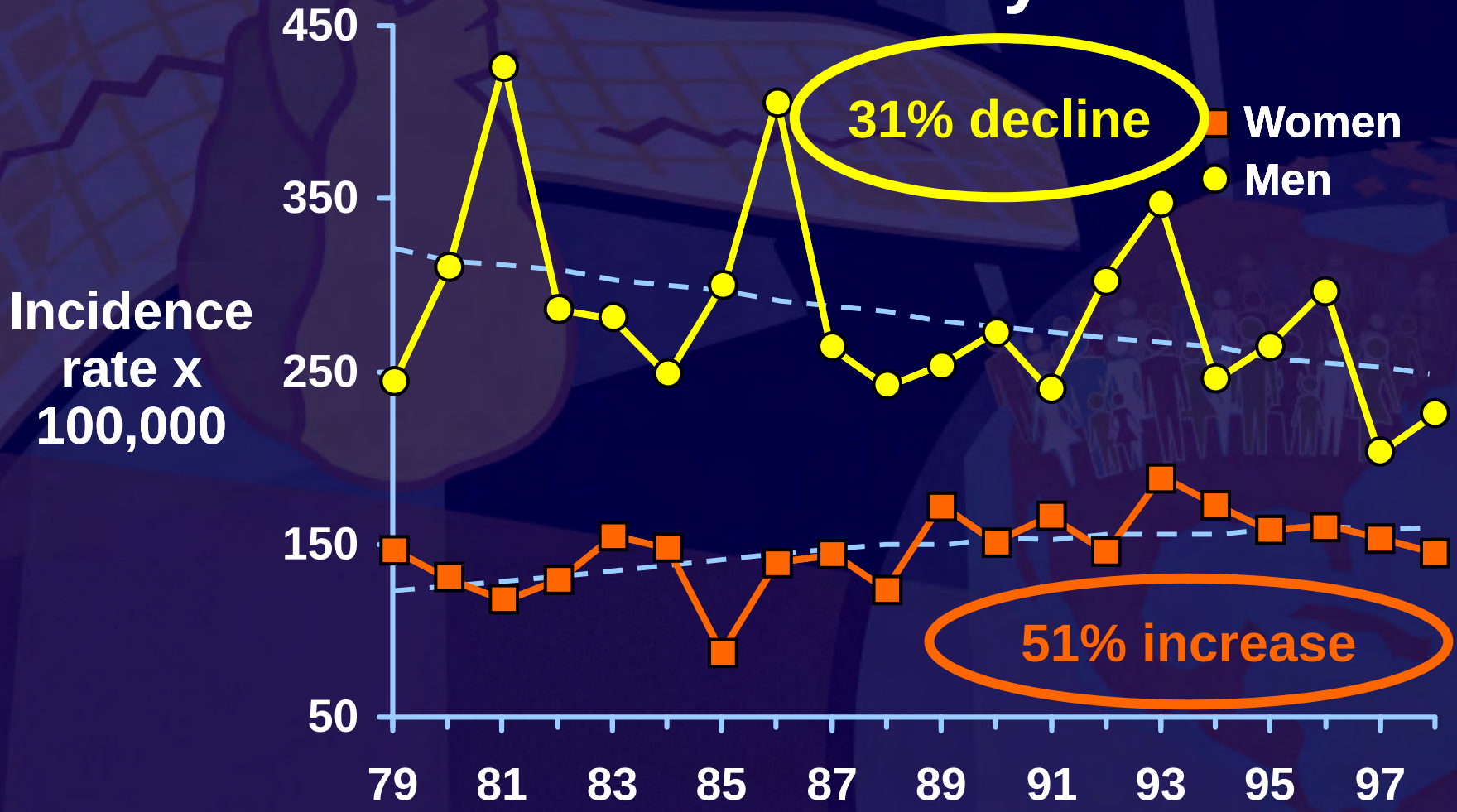
ARIC, Minnesota Heart Survey, Olmsted County Study
Worcester Heart Attack Study, some insurance plans
MONICA


Olmsted County
2,000 pop=124,470
Home of Mayo Clinic Rochester and Olmsted Medical Center
Geographically isolated from other providers of medical care
Linkage of all medical, surgical and tissue diagnoses
CP1176446-5

Objectives

- Why and how to measure MI trends?
- MI trends: then and now
- What does this mean?

MI Incidence
Olmsted County



Annals of Int Med, 2002

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CP1145262-1

MI incidence

Olmsted County-1998 vs 79

	Men	Women
40 years old	0.69 (0.48-0.97)*	0.92 (0.68-1.54)
60 years old	0.83 (0.67-1.02)	1.24 (0.96-1.60)
80 years old	1.00 (0.78-1.28)	1.49 (1.16-1.92)*

31% decline

51% increase

Annals of Int Med, 2002

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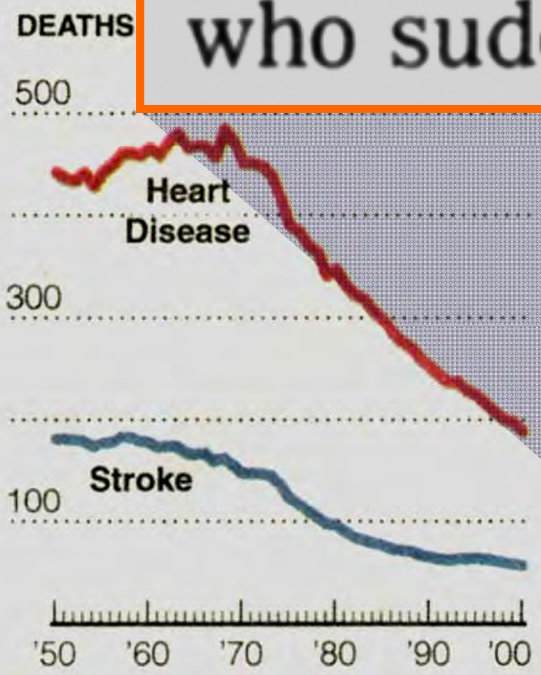
The stereotypical heart attack patient is no longer a man in his 50's who suddenly falls dead.



Source: National Institutes of Health

The New York Times

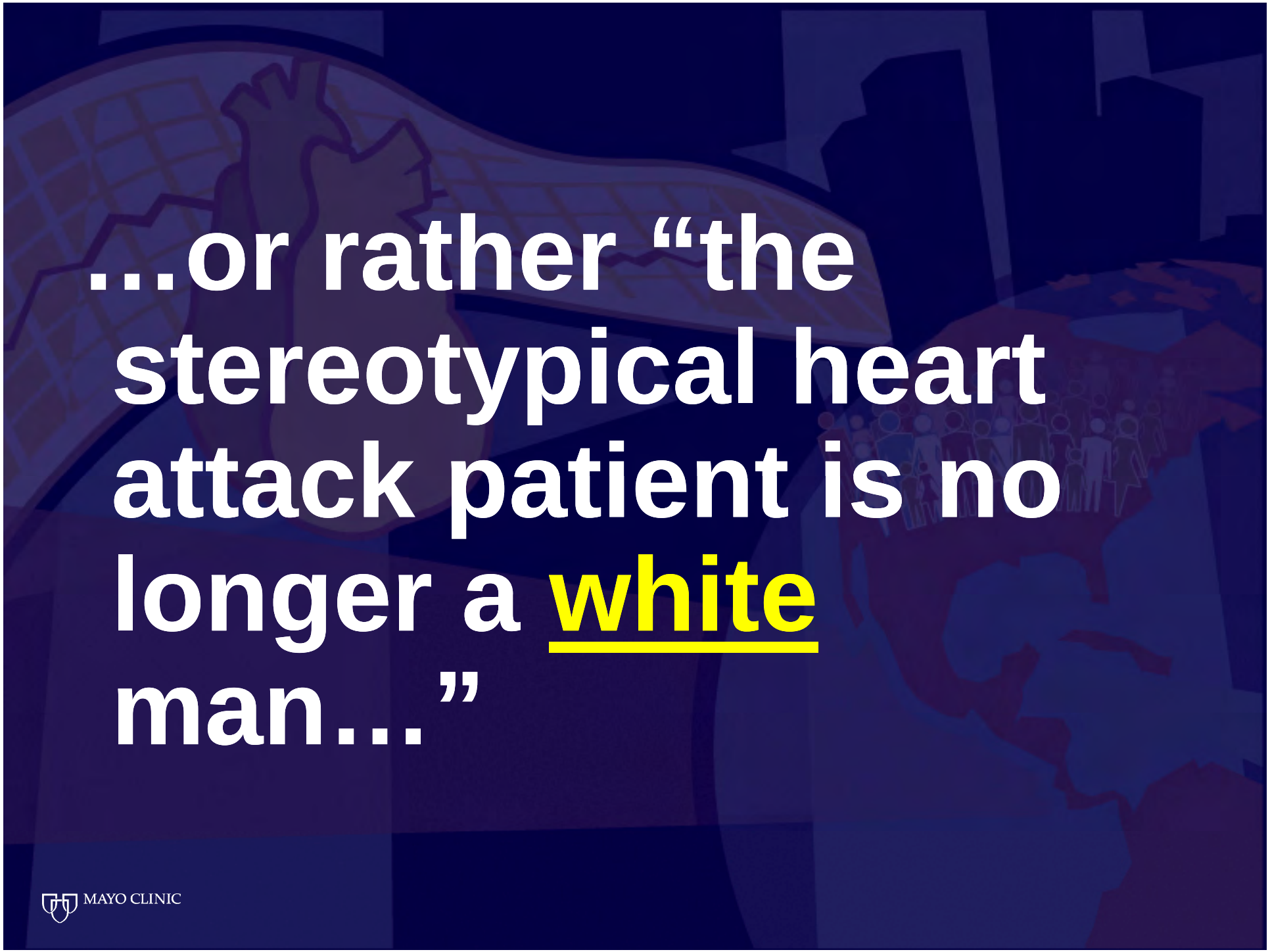
have doctors begun to appreciate how profoundly things have changed for heart attacks and strokes.

They remain the leading cause of death in the United States, but their toll is nothing like what it used to be. They kill proportionately fewer people and — in another major change — they strike far later in life. Despite the obesity epidemic, the trends are continuing with no end in sight.

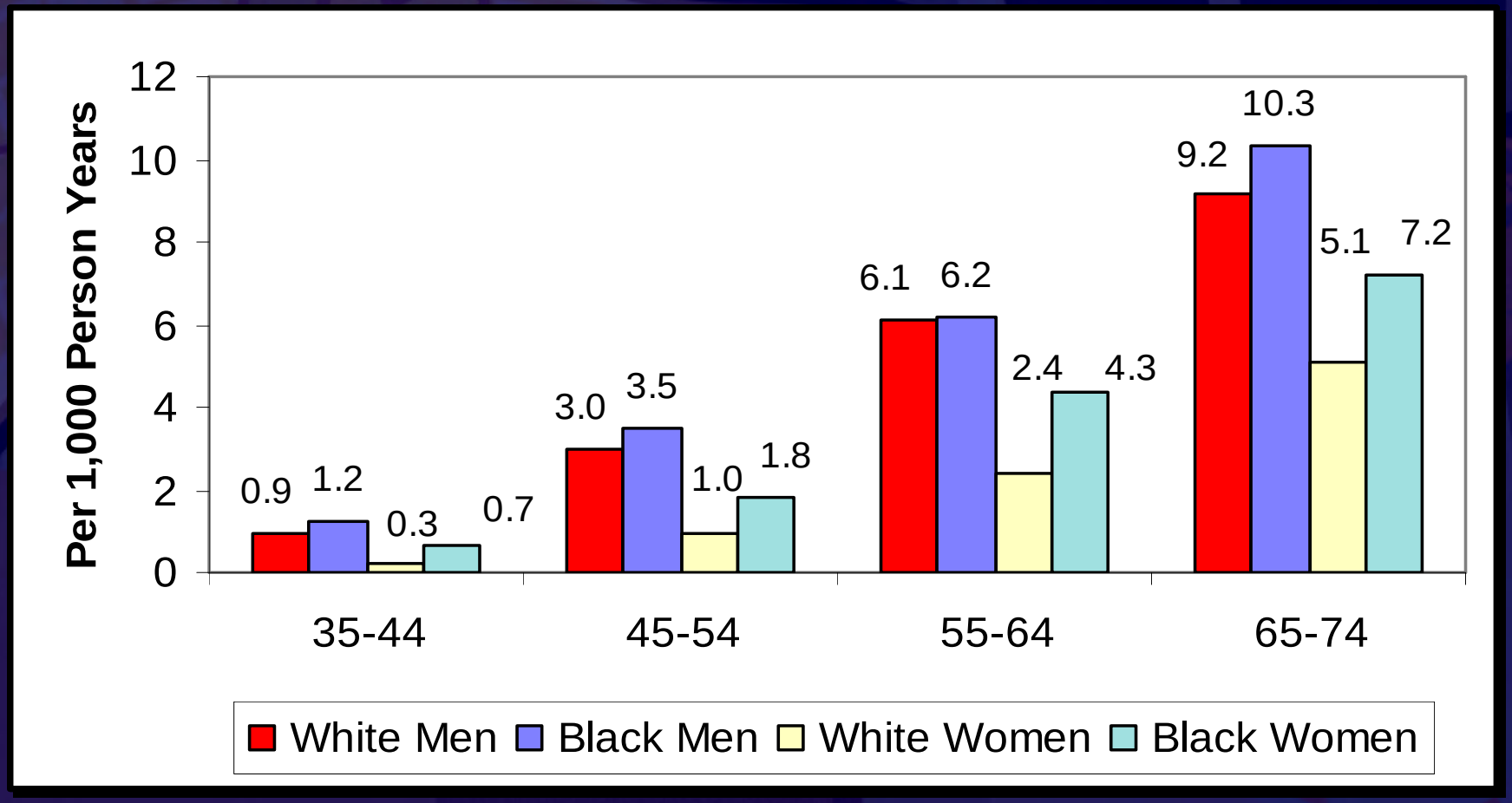
The stereotypical heart attack patient is no longer a man in his 50's who suddenly falls dead.

"That death rate is so low now that we're no longer able to track it," said Dr. Teri Manolio, director of the epidemiology and biometry programs

The New York Times May 2003

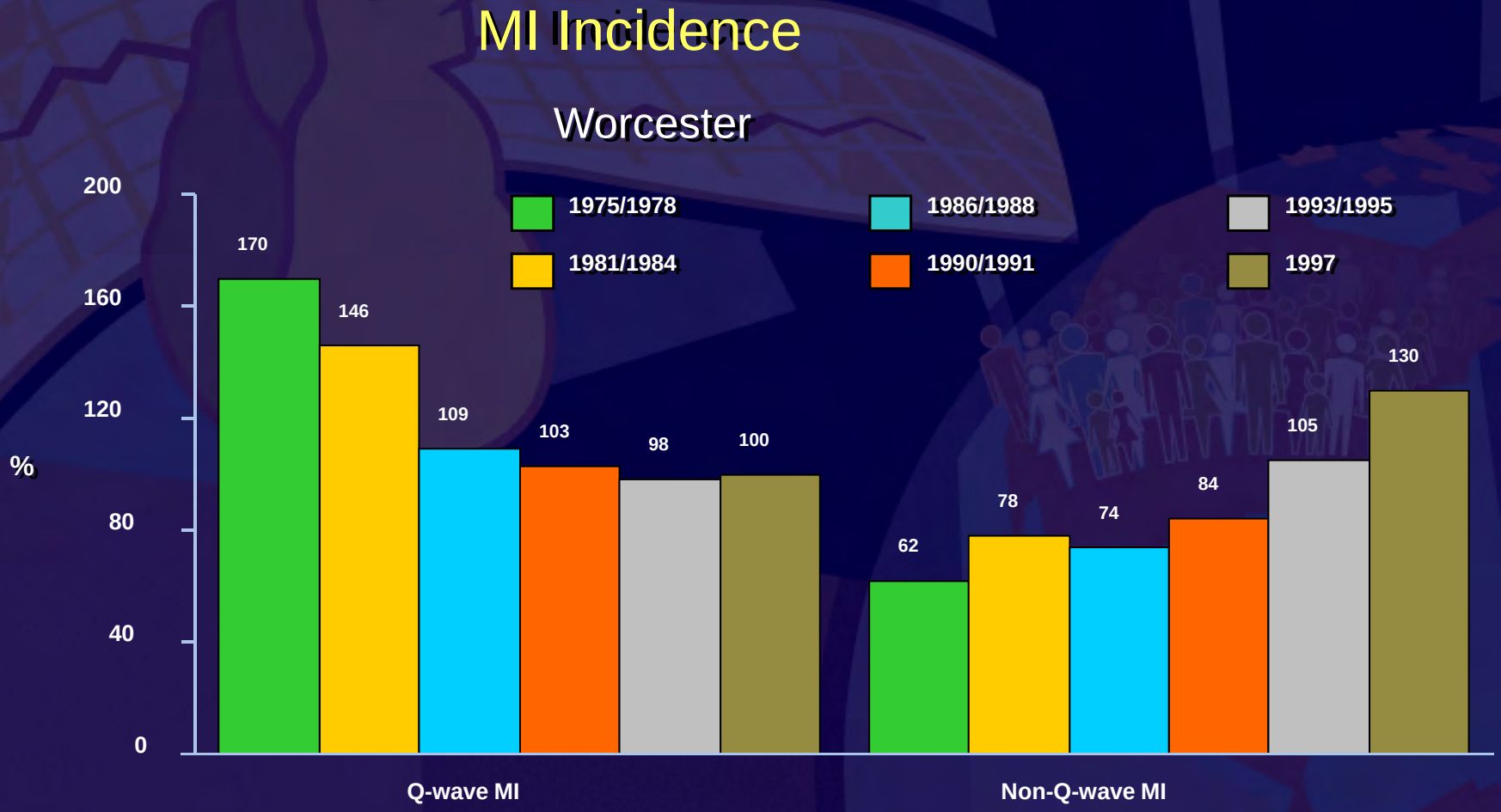

…or rather “the stereotypical heart attack patient is no longer a white man…”

Incidence of Myocardial Infarction



ARIC Surveillance: 1987-2004

Q wave and non-Q wave MI



Furman et al: JACC, 2001

Furman et al: JACC, 2001

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In the 1980's and 90's shift of the burden of MI towards…

- Elderly
- Women
- Non Caucasians
- "Non Q wave" MIs

What about now?

Journal of the American College of Cardiology
© 2000 by the American College of Cardiology and the European Society of Cardiology
Published by Elsevier Science Inc.

Vol. 36, No. 3, 2000
ISSN 0735-1097/00/$20.00
PII S0735-1097(00)00804-4

Myocardial Infarction Redefined—A Consensus Document of The Joint European Society of Cardiology/American College of Cardiology Committee for the Redefinition of Myocardial Infarction

The Joint European Society of Cardiology/
American College of Cardiology Committee**

Elliott Antman, Jean-Pierre Bassand, Werner Klein, Magnus Ohman, Jose Luis Lopez Sendon, Lars Rydén, Maarten Simoons and Michal Tendera

ESC/ACC consensus document

All elevated (trop)values are associated with a worsened PROGNOSIS. It should be emphasized that there is a continuous relation between minimal myocardial damage, characterized by elevation of troponin without elevation of other bio-markers (e.g., CK-MB) and large infarcts."

"Thus, any amount of myocardial necrosis caused by ischemia should be labeled as MI."

Definitions of acute MI

WHO

- At least 2 of the following
  - Rise and fall of serum markers
  - ischemic symptoms
  - Serial changes on ECG

ACC/ESC 2000

- 1. Typical rise and fall of bio-marker with at least one :
  - ischemic symptoms
  - development of pathologic Q waves on the ECG
  - ECG changes indicative of ischemia (ST segment elevation or depression)
  - coronary artery intervention (e.g., angioplasty)
- 2. Pathologic findings of acute MI

Preferred biomarker troponin, more sensitive and less specific

Journal of the American College of Cardiology

Published by Elsevier Science Inc.

LETTERS TO THE EDITOR

Redefinition of Myocardial Infarction by a Consensus Dissenter

H Tunstall-Pedoe, 2001

Editorial

Troponisms, Necrosettes, Enzyme Leaks, Creatinine Phosphokinase Bumps, and Infarctlets

What's Behind This New Lexicon and What Does It Add?

David R. Holmes, Jr, MD; Peter B. Berger, MD

"Small degrees of biomarker elevations undoubtedly reflect myocardial necrosis but whether it has any impact on survival after otherwise uncomplicated procedures"…..
remains to be demonstrated.
Circulation 2001

Challenges of the new definition

- Interventional cardiology outcomes
- Rehabilitation
- Employment
- Insurance
- Health care costs
- Labeling and public misunderstanding

Elevations of Troponin - False Positives, the Real Truth
Jaffe, AS, Cardiovascular Toxicology 2001

- Trauma (contusion, ablation, pacing, ICD firings, DCCV, endomyocardial bx, cardiac surgery)
- Heart failure
- Hypertension or Hypotension, often with arrhythmias
- Postoperative noncardiac surgery patients who seem to do well
- Renal failure
- Sepsis, critically ill patients, esp. with diabetes
- Drug toxicity, eg adriamycin, 5 FU, herceptin
- Hypothyroidism and inflammatory diseases eg. myocarditis. Infiltrative diseases including amyloidosis, hemachromatosis, sarcoidosis and scleroderma
- Post PCI patients who appear to be uncomplicated
- Pulmonary embolism
- Burns, esp. if TBSA > 30%
- Acute neurological disease, including CVA
- Rhabdomyolysis with cardiac injury
- Transplant vasculopathy
- Vital Exhaustion

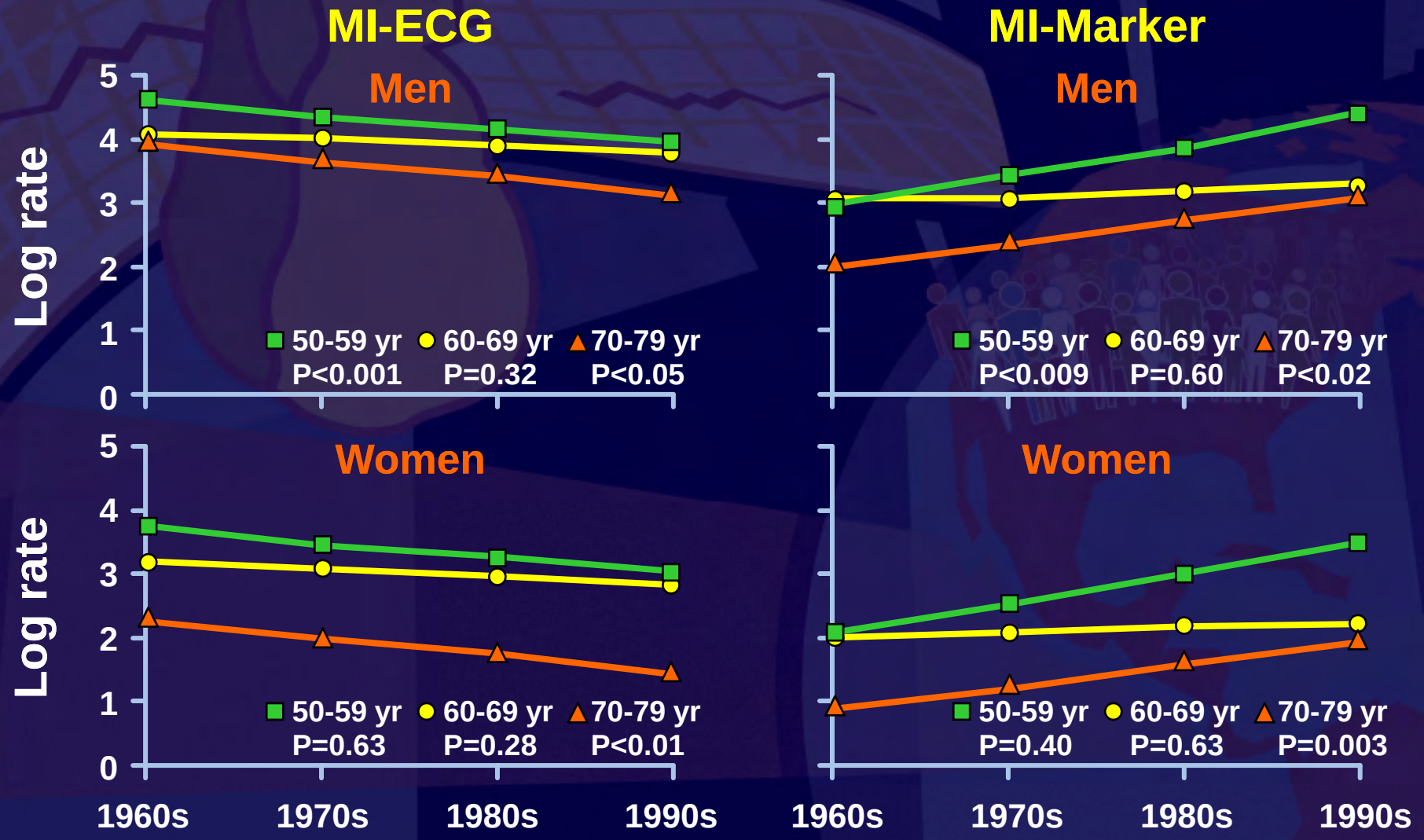
New definition of MI ESC/ACC consensus document

- **The change in MI criteria "will confuse efforts to follow trends in disease rates and outcomes."**

Journal of the American College of Cardiology
September 2000; Pages 959-969

MI Incidence- The role of biomarkers

Framingham



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Parikh et al: Circ, 2009

CP1348386-14

February 2010

Epidemiology and Prevention

Trends in Incidence, Severity, and Outcome of Hospitalized Myocardial Infarction

Véronique L. Roger, MD, MPH; Susan A. Weston, MS; Yariv Gerber, PhD; Jill M. Killian, BS; Shannon M. Dunlay, MD; Allan S. Jaffe, MD; Malcolm R. Bell, MBBS, FRACP; Jan Kors, PhD; [illegible] MD, PhD

What if troponin had never existed?

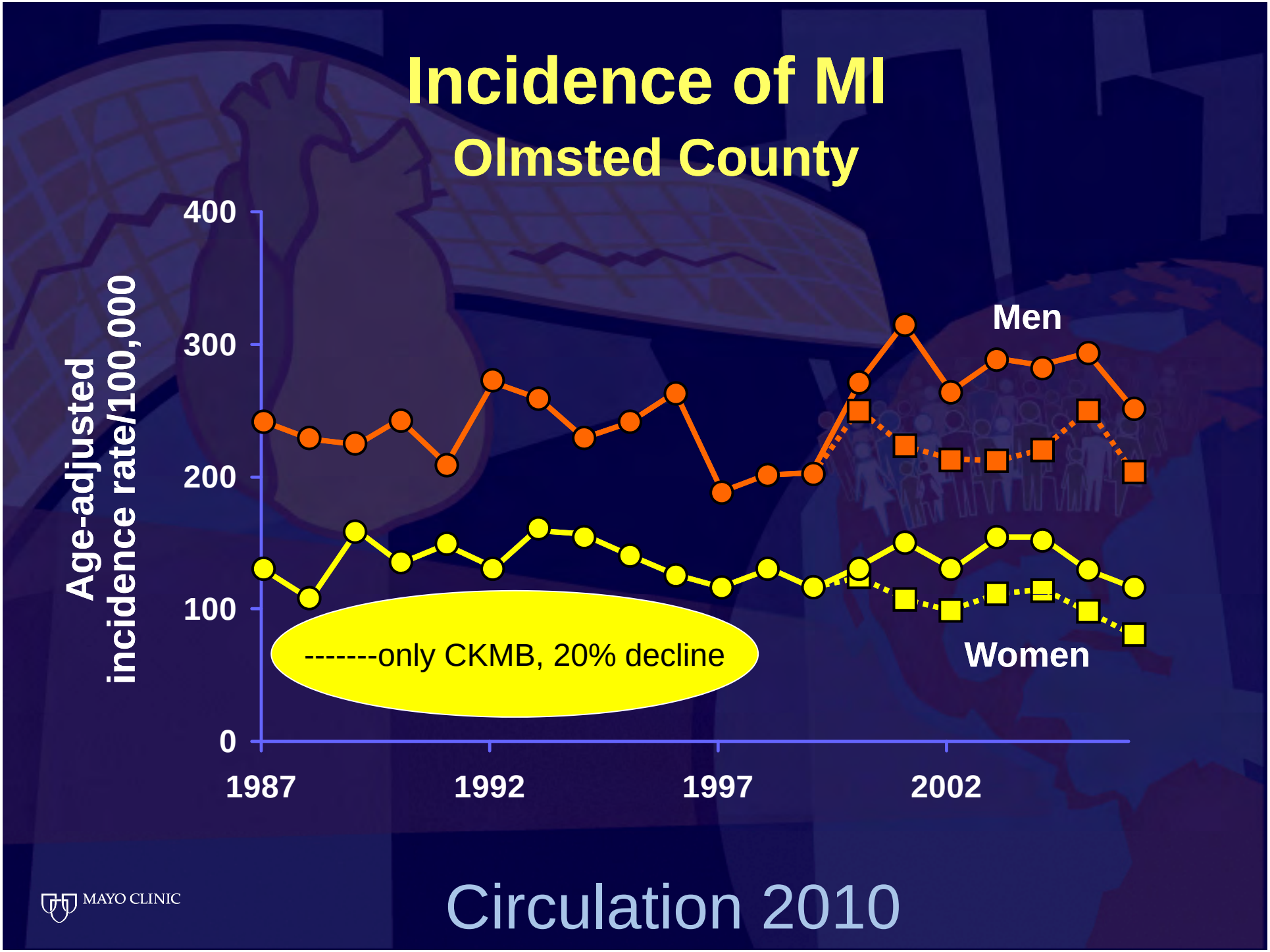
(CK) defined.

Methods and [illegible] from 1987 to 2006 in Olmsted County, Minnesota, with prospective measurements of troponin and CK-MB from August 2000 forward. Outcomes were MI incidence, severity, and survival. After troponin was introduced, 278 (25%) of 1127 incident MIs met only troponin-based criteria. When cases meeting only troponin criteria were included, incidence did not change between 1987 and 2006. When restricted to cases defined by CK/CK-MB, the incidence of MI declined by 20%. The incidence of non–ST-segment elevation MI increased markedly by relying on troponin, whereas that of ST-segment elevation MI [illegible] infarction occ[illegible] survivors, su[illegible] Trends in lor[illegible]

Conclusions—[illegible] mediated by the introduction of troponin. Non–ST-segment elevation MIs now constitute the majority of MIs. Although the 30-day case fatality improved markedly, long-term survival did not change, and the cause of death shifted from cardiovascular to noncardiovascular. (*Circulation*. 2010;121:863-869.)

Prospective community-based epidemiology study

Incidence of MI
Olmsted County



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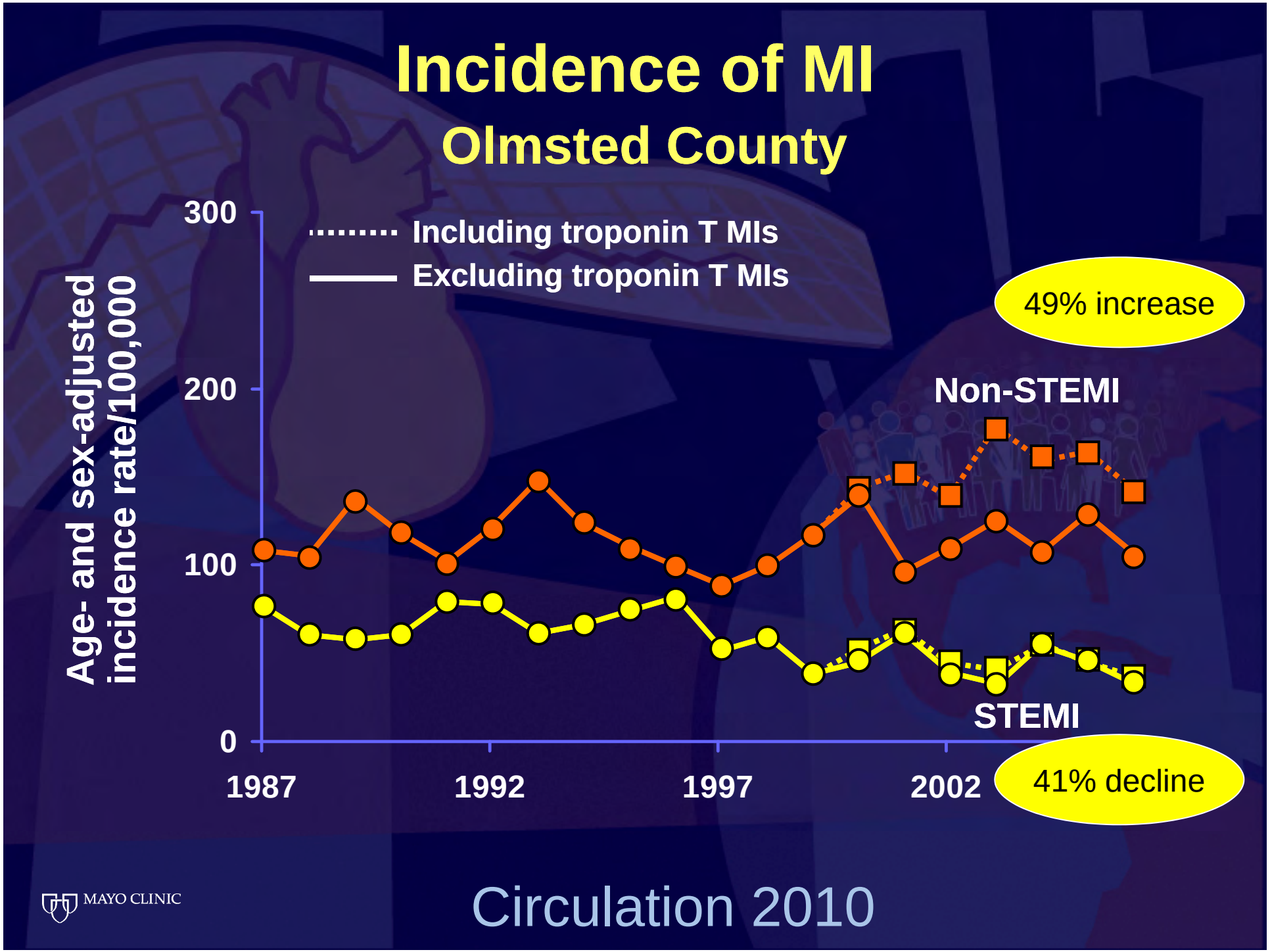
Circulation 2010

Incidence of MI
Olmsted County



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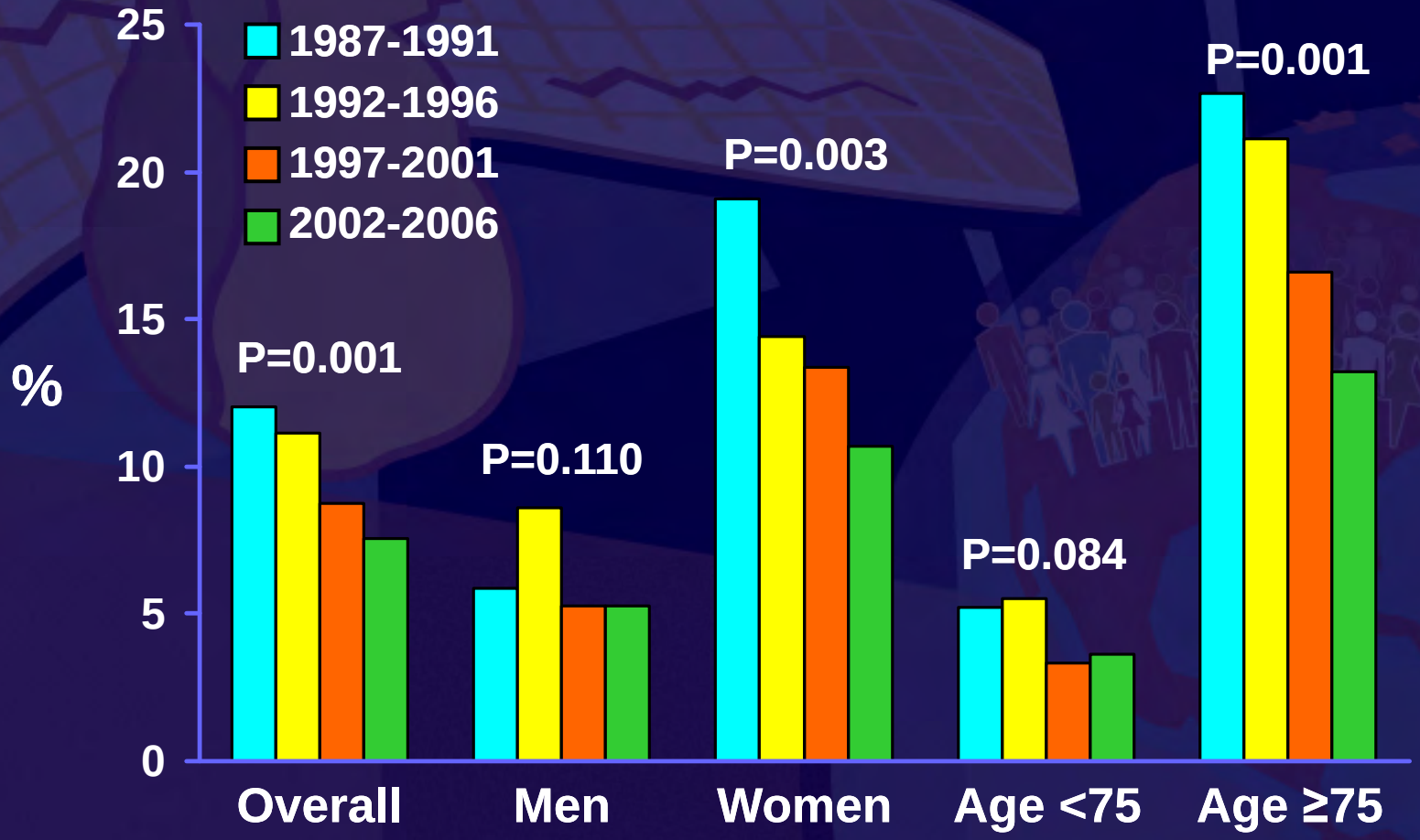
Circulation 2010

Death at 30 days post MI
Olmsted County



MAYO CLINIC

Circulation 2010

June 2010

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 JUNE 10, 2010 VOL. 362 NO. 23

Population Trends in the Incidence and Outcomes of Acute Myocardial Infarction

Robert W. Yeh, M.D., Stephen Sidney, M.D., M.P.H., Malini Chandra, M.B.A., Michael Sorel, M.P.H., Joseph V. Selby, M.D., M.P.H., and Alan S. Go, M.D.

ABSTRACT

BACKGROUND

Few studies have characterized recent population trends in the incidence and outcomes of myocardial infarction.

METHODS

We identified patients 30 years of age or older in a large, diverse, community-based population who were hospitalized for incident myocardial infarction between 1999 and 2008. Age- and sex-adjusted incidence rates were calculated for myocardial infarction overall and separately for ST-segment elevation and non–ST-segment elevation myocardial infarction. Patient characteristics, outpatient medications, and cardiac biomarker levels during hospitalization were identified from health plan databases, and 30-day mortality was ascertained from administrative databases, state death data, and Social Security Administration files.

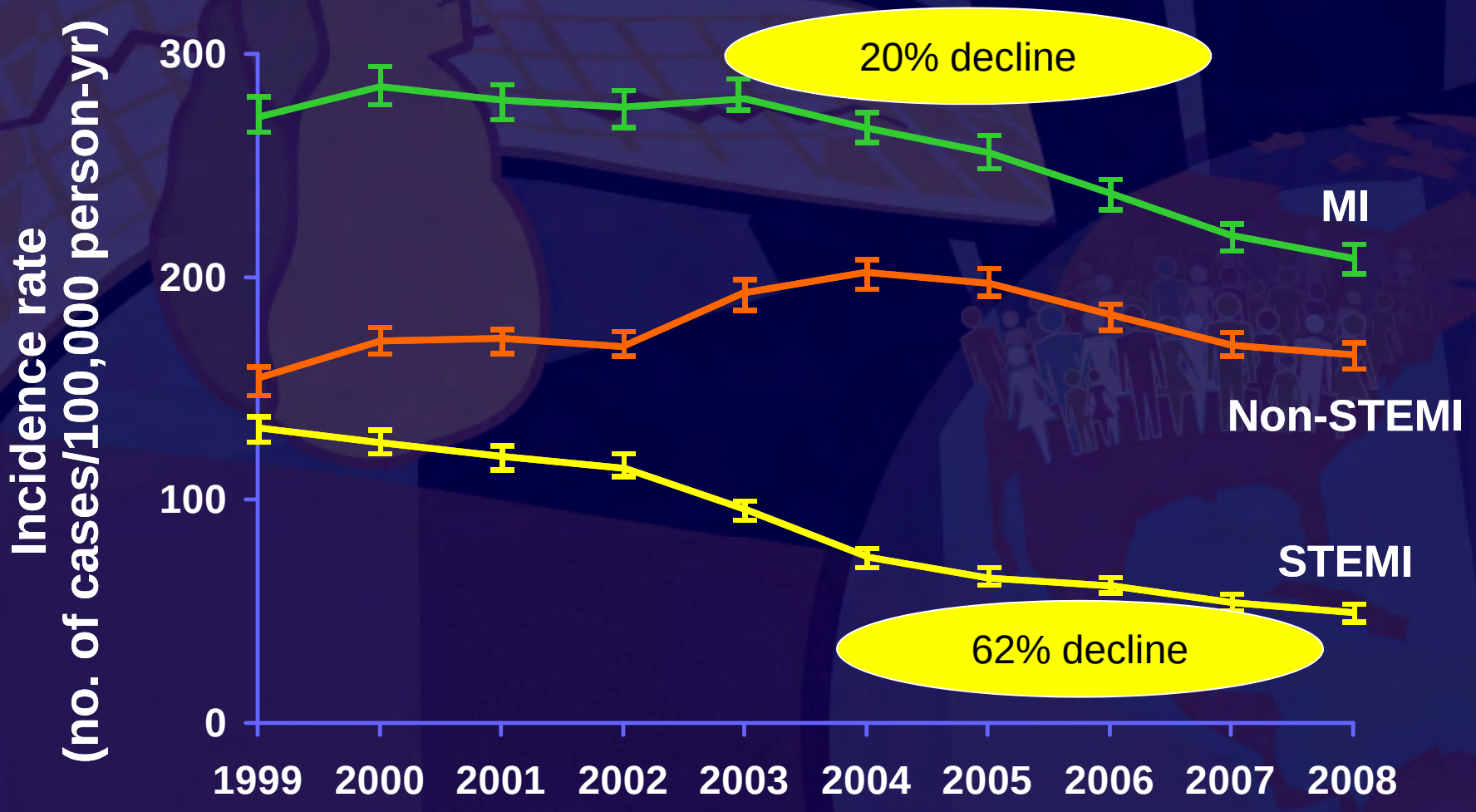
RESULTS

We identified 46,086 hospitalizations for myocardial infarctions during 18,691,131 person-years of follow-up from 1999 to 2008. The age- and sex-adjusted incidence of myocardial infarction increased from 274 cases per 100,000 person-years in 1999 to 287 cases per 100,000 person-years in 2000, and it decreased each year thereafter, to 208 cases per 100,000 person-years in 2008, representing a 24% relative decrease over the study period. The age- and sex-adjusted incidence of ST-segment elevation myocardial infarction decreased throughout the study period (from 133 cases per

From the Cardiology Division, Department of Medicine, Massachusetts General Hospital, Harvard Medical School, Boston (R.W.Y.); the Division of Research, Kaiser Permanente Northern California (S.S., M.C., M.S., J.V.S., A.S.G.) and the Permanente Medical Group (S.S., J.V.S., A.S.G.) — both in Oakland; and the Departments of Epidemiology, Biostatistics, and Medicine, University of California, San Francisco, San Francisco (A.S.G.). Address reprint requests to Dr. Go at the Division of Research, Kaiser Permanente Northern California, 2000 Broadway St., 3rd Fl., Oakland, CA 94612, or at alan.s.go@kp.org.

N Engl J Med 2010;362:2155-65.

Incidence of MI
Kaiser Permanente



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Yeh, NEJM 2010

Death at 30 days post MI
Kaiser Permanente

- 1999: 10.5%
- 2008: 7.8%
- Adjusted for age and sex, driven by improvement in survival among NSTEMI, no change in STEMI

Objectives

- Why and how to measure MI trends?
- MI trends: then and now
- What does this mean?

Summary

Enormous changes in epidemiology of MI

- **Incidence declining, partially masked by introduction of troponin**
- **Decline in STEMI, amplified but not only related to troponin**
- **Shift in case mix towards NSTEMI**
- **Short term outcomes are much better**

Causes: improved primary prevention, population penetration of various drugs…

Implications

Enormous changes = enormous implications

- We are still processing the data
- STEMIs are declining: quality of care efforts should target NSTEMI
- Care of MI beyond the acute phase


Grazie mille!
MAYO CLINIC