Cardiology

June 2017

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The Essex Cardiothoracic Centre Basildon and Thurrock NHS Trust

THE ESSEX CARDIOTHORACIC CENTRE

Cardiology

- Trends in Cardiovascular Disease
- Hypertension – its global impact & new therapies
- The assessment of chest pain
    - Past, present and future
- Recent advances in Cardiology
    - Myocardial infarction and primary PCI
    - Stent technology
- Challenges
    - Predicting the future
    - Definitions – clinical and policy
    - Objective measurements of limitation
- The future…..

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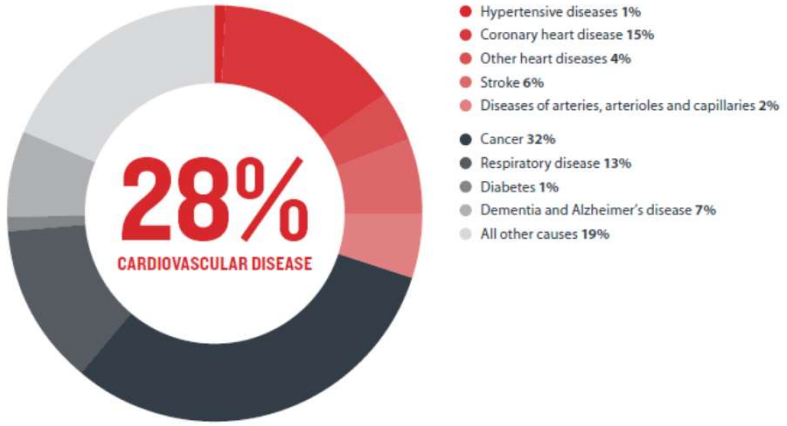
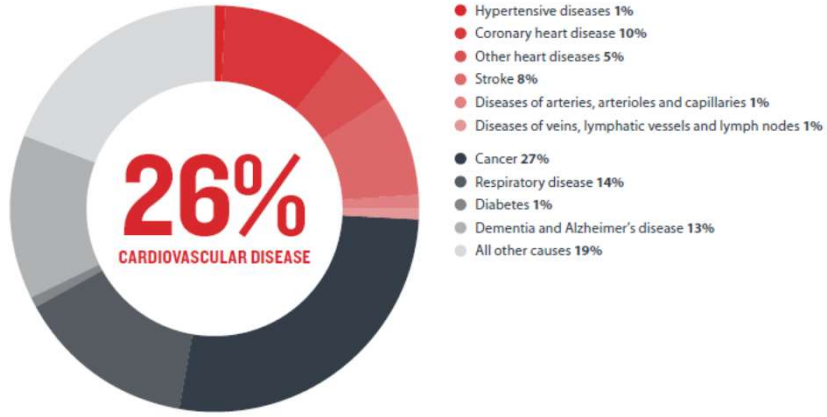
Cardiovascular Mortality in the UK

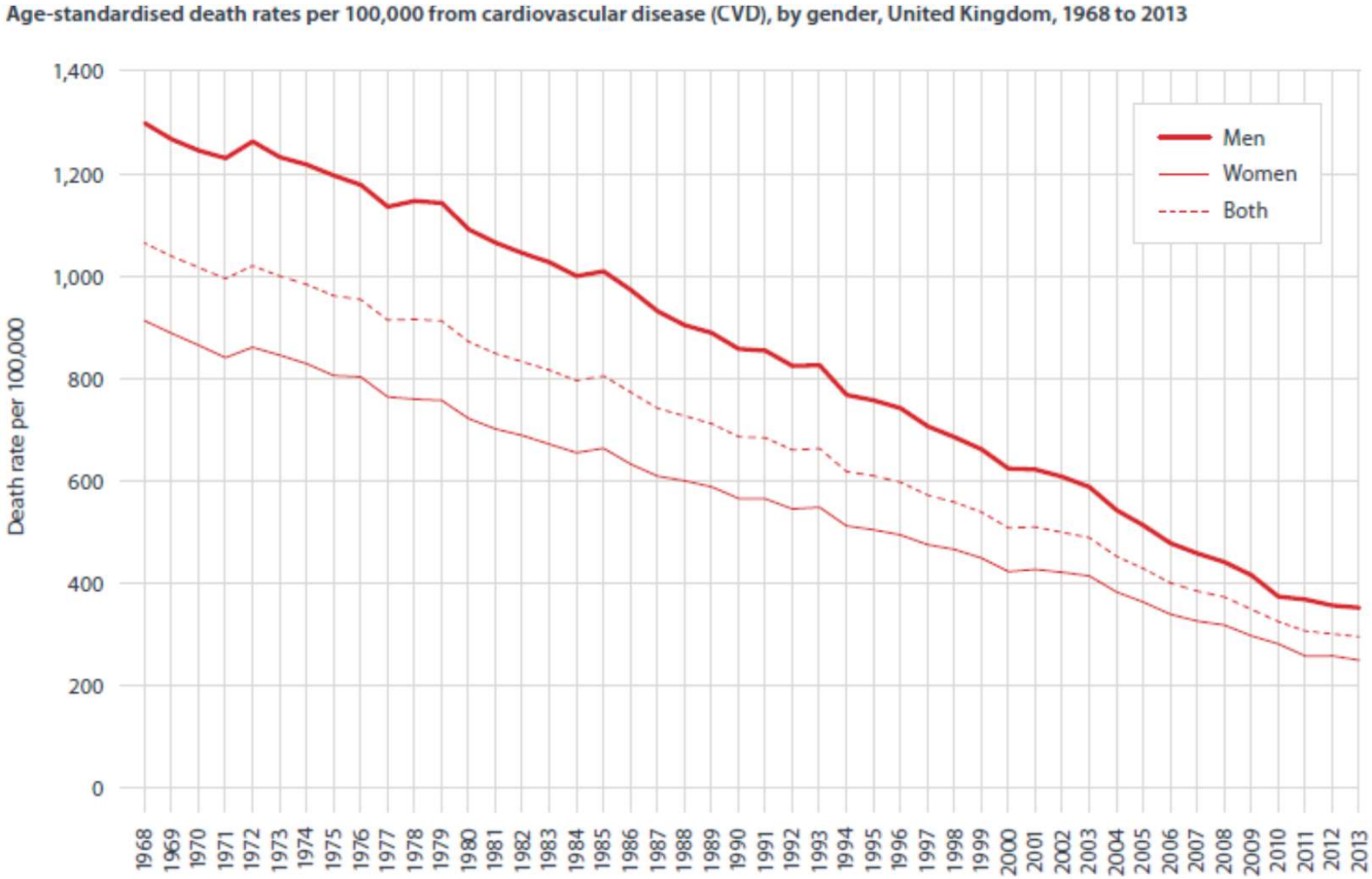
Deaths by cause in men, United Kingdom 2014



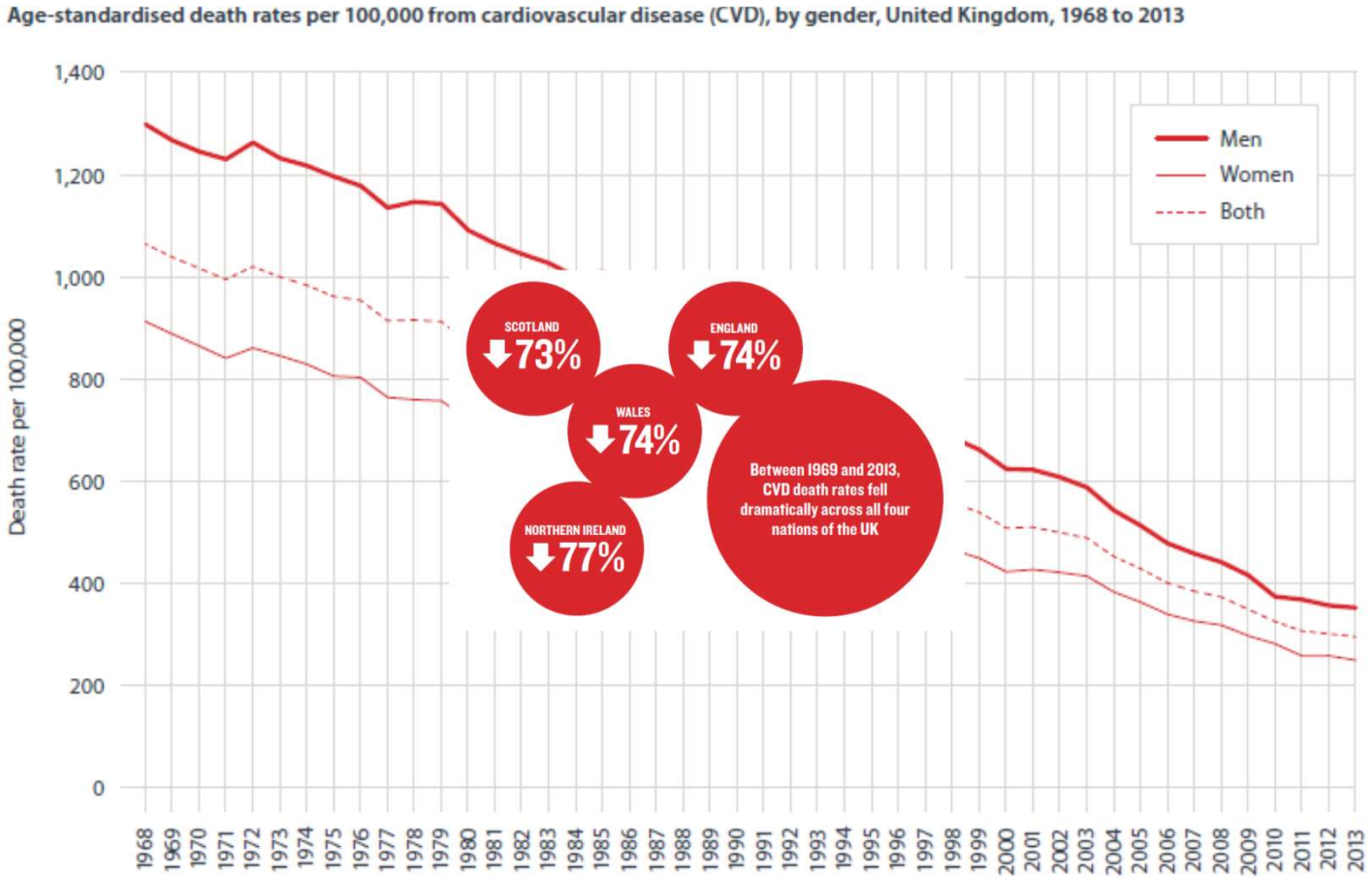
Deaths by cause in women, United Kingdom 2014



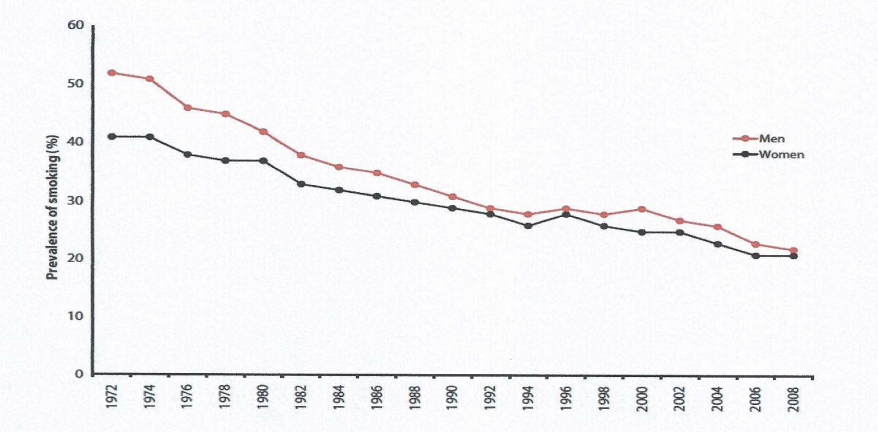
Cardiovascular Mortality in the UK



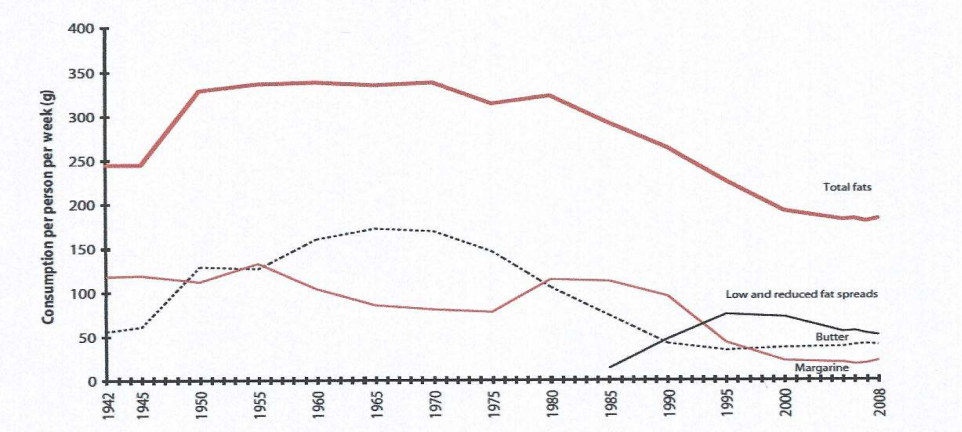
Cardiovascular Mortality in the UK



Smoking and fat consumption



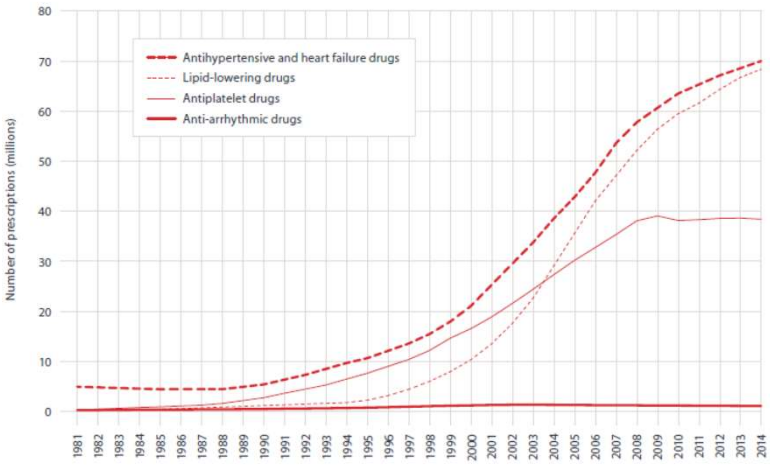
Prevalence of smoking by sex ,1972 to 2008, GB



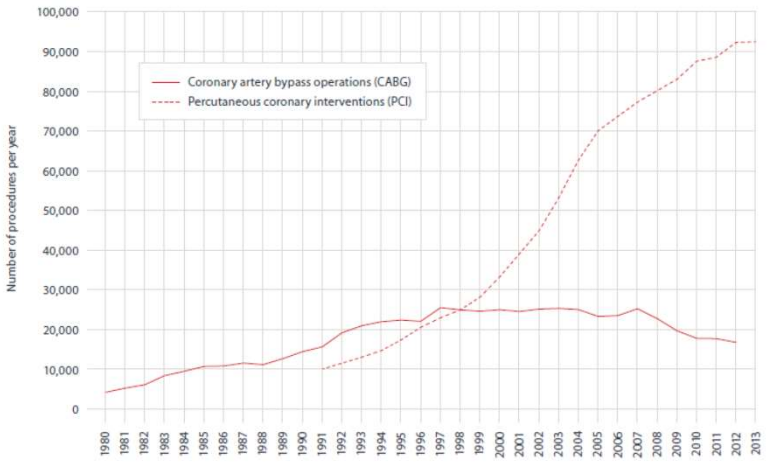
Consumption of fats, adults age 16 and over 1942 to 2008, UK

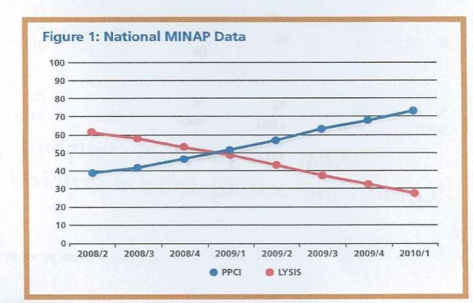
Medical intervention

Prescriptions used in the prevention and treatment of CVD, England 1981 to 2014



Number of coronary artery bypass operations and percutaneous coronary interventions per year, United Kingdom 1980 to 2013





Rates of Primary PCI and thrombolysis UK 2008 – 2010

How Much of the Recent Decline in the Incidence of Myocardial Infarction in British Men Can Be Explained by Changes in Cardiovascular Risk Factors? Evidence From a Prospective Population-Based Study

Sarah L. Hardoon, MSc; Peter H. Whincup, PhD, FRCP; Lucy T. Lennon, MSc;S. Goya Wannamethee, PhD, FFPH; Simon Capewell, MD; Richard W. Morris, PhD

(*Circulation*. 2008;117:598-604.)

Circulation
JOURNAL OF THE AMERICAN HEART ASSOCIATION

American Heart Association.
Learn and Live.

The British Regional Heart Study examined changes in cardiovascular risk factors and MI incidence over 25 years from 1978 in a cohort of 7735 men

3.8% decrease in age-adjusted hazard of MI per year (95% confidence interval 2.6% to 5.0%)

62% decline in MI over the 25 years.

Cigarette smoking prevalence, mean systolic blood pressure, LDL cholesterol decreased, HDL cholesterol rose , and physical activity levels rose. No significant change occurred in alcohol consumption

Body Mass Index rose

Relative contributions of risk factors to decline in MI Incidence (using the IMPACT model)

Fall in cigarette smoking (decreased by by 75%)	23%
Changes in blood pressure (systolic fell by 6mmHg)	13%
Rise in HDL cholesterol (0.16mmol/l)	12%
In combination	46% (95% CI 23%-164%)
Physical activity and alcohol consumption – no influence	
Increase in body mass index	-7%

Conclusions Modest changes in the major CV risk factors contributed to considerable reductions in MI incidence

SCOR Global Life

Explaining the Decrease in U.S. Deaths from Coronary Disease, 1980–2000

Earl S. Ford, M.D., M.P.H., Umed A. Ajani, M.B., B.S., M.P.H., Janet B. Croft, Ph.D., Julia A. Critchley, D.Phil., M.Sc., Darwin R. Labarthe, M.D., M.P.H., Ph.D., Thomas E. Kottke, M.D., Wayne H. Giles, M.D., M.S., and Simon Capewell, M.D.

(N Engl J Med 2007;356:2388-98.)

The New England Journal of Medicine

US adults 25 – 84 years old 1980 to 2000

Applied the IMPACT model to data on the use and effectiveness of specific cardiac treatments and on changes in risk factors

	Deaths / 100,000 pop	
	1980	2000
Men	543	267
Women	263	134

Approximately 47% of this decrease was attributed to treatments

Secondary prevention after MI or revascularisation	11%
Initial treatments for MI or unstable angina	10%
Heart failure treatments	9%
Revascularisation for chronic angina	5%

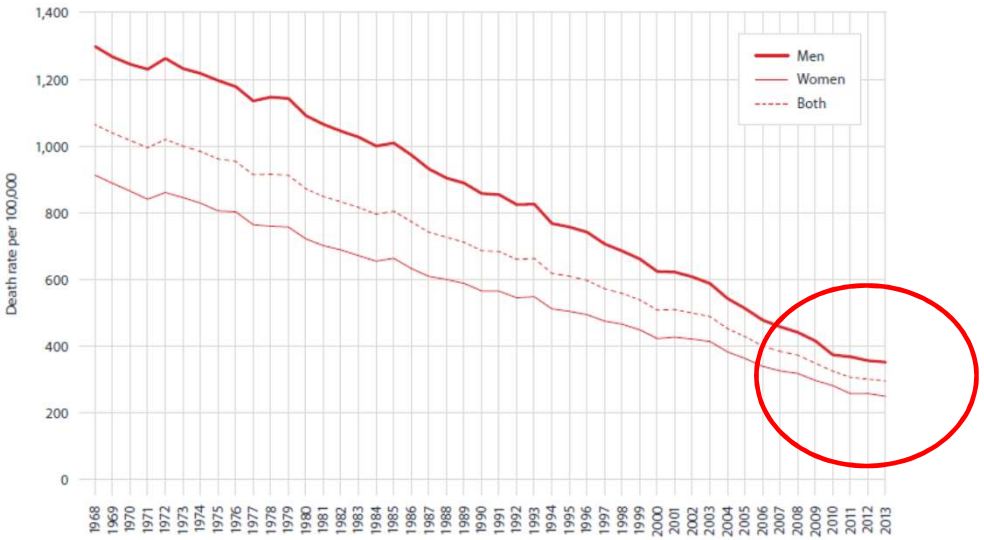
Approximately 44% of this decrease was attributed to risk factors

Offset by increases in BMI (-8%) and diabetes (-10%)

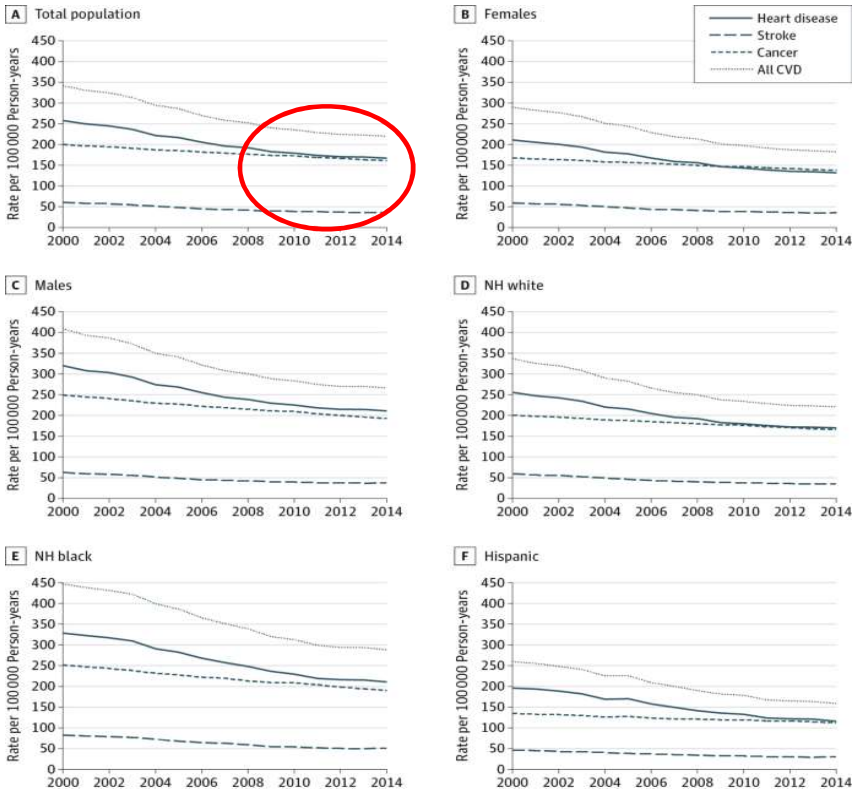
Conclusions Approximately half the decline in U.S. deaths from CHD 1980 - 2000 may be attributable to improved treatments

Cardiovascular Mortality in the UK

Age-standardised death rates per 100,000 from cardiovascular disease (CVD), by gender, United Kingdom, 1968 to 2013

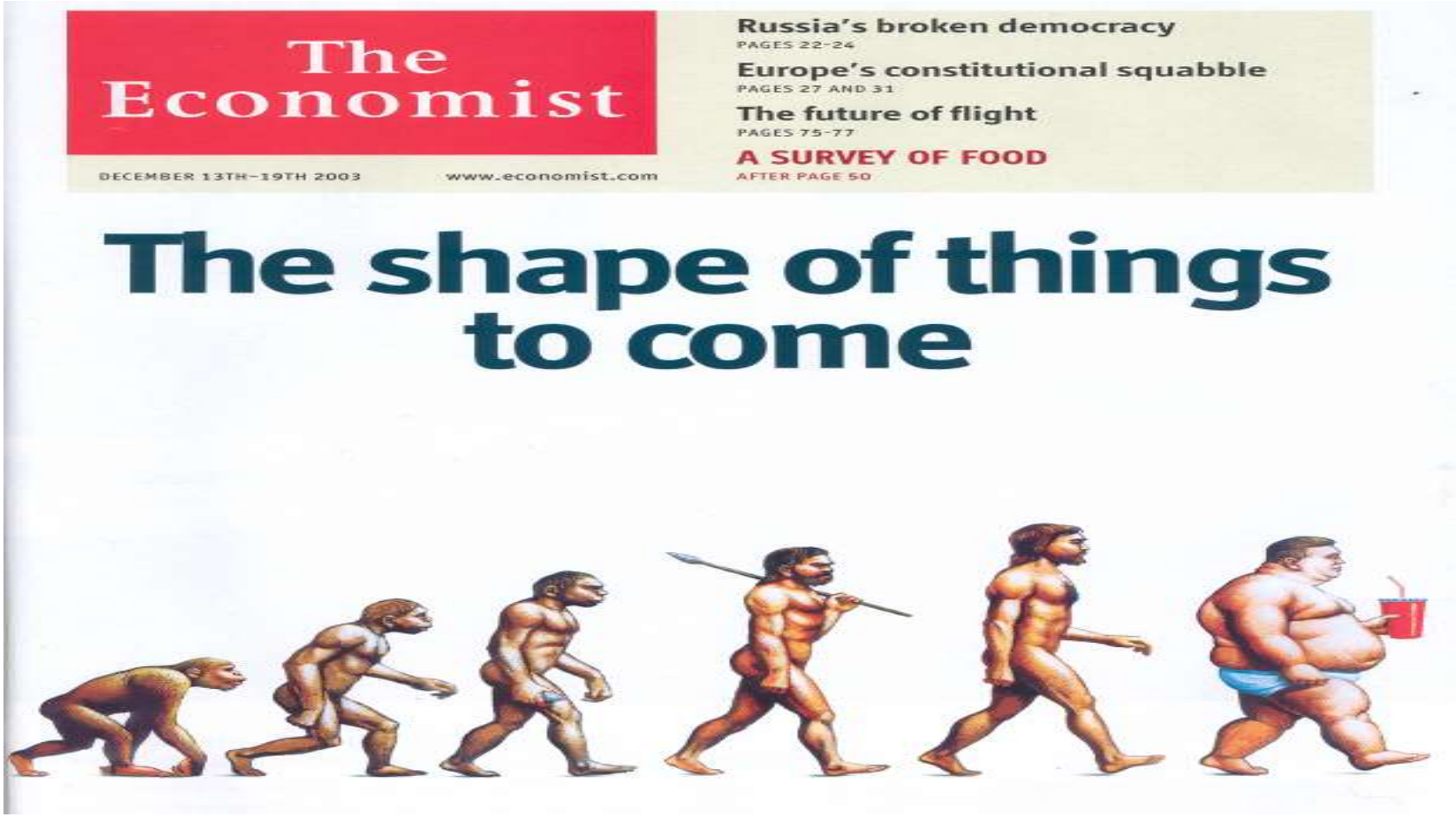


Age-Adjusted Mortality Rates in the United States, 2000-2014



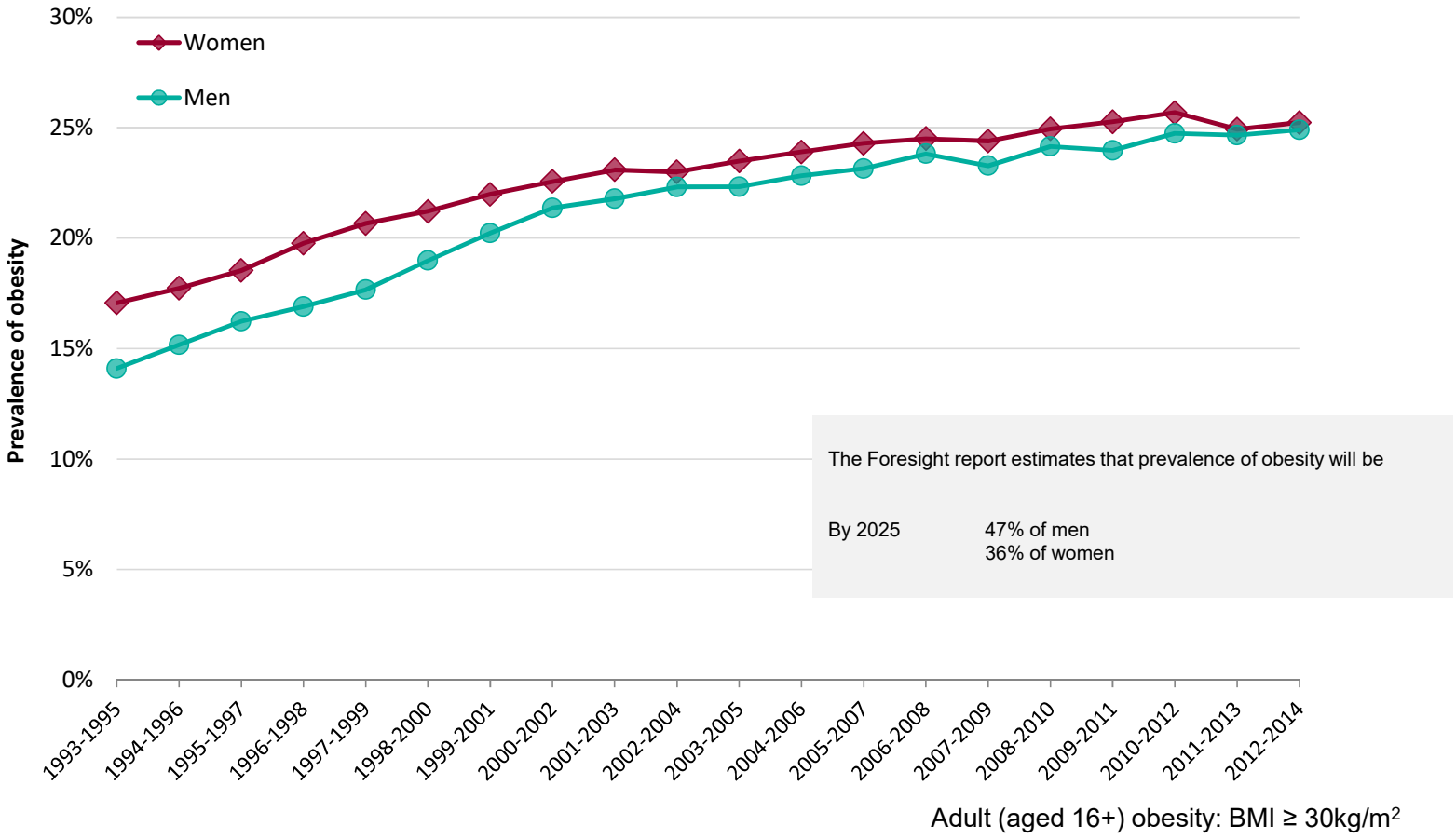
Recent Trends in Cardiovascular Mortality in the United States and Public Health Goals
JAMA Cardiol. 2016;1(5):594-599. doi:10.1001/jamacardio.2016.1326

Cardiovascular Mortality in the UK



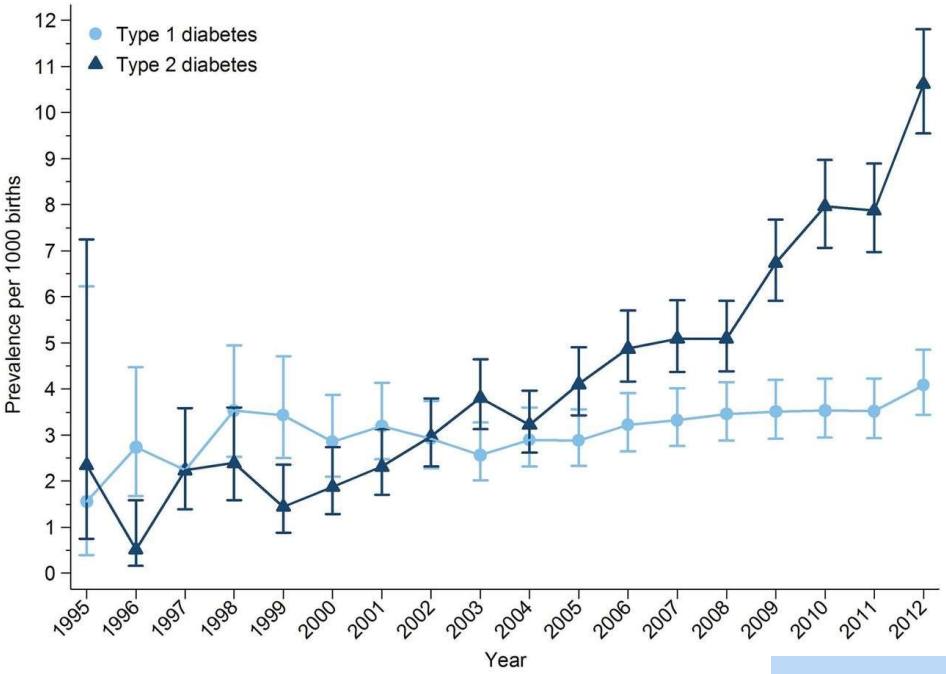
Trend in obesity prevalence among adults

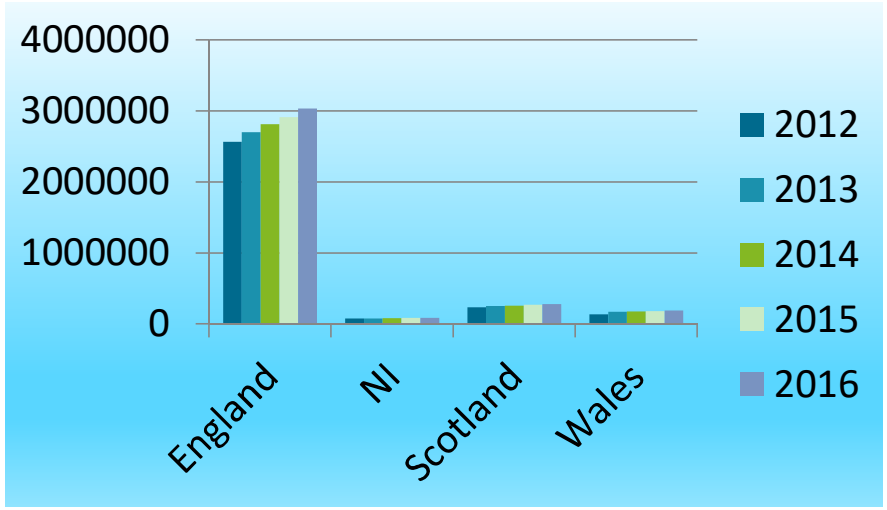
Health Survey for England 1993 to 2014 (three-year average)



Adult (aged 16+) obesity: BMI ≥ 30kg/m^2

Trend in Diabetes prevalence among adults



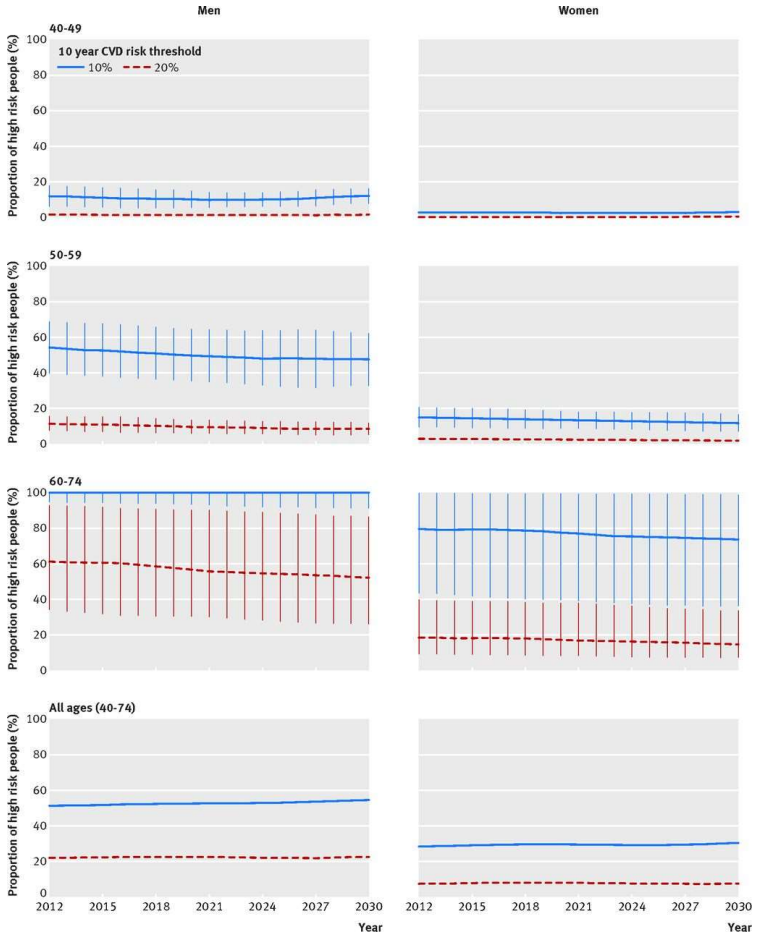


Primary prevention of CVD

Screening
or
population strategies

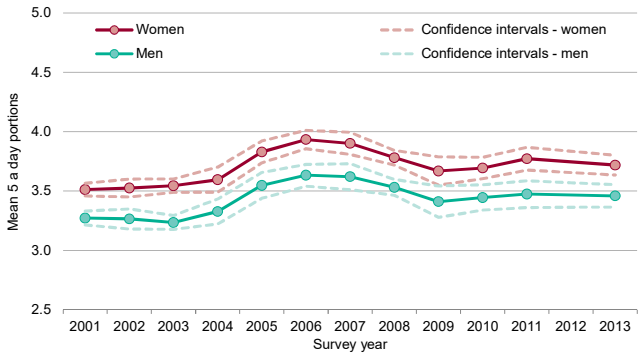
Proportion of high risk people eligible for universal screening population projections, by age group and sex

10 year risk of cardiovascular disease (CVD) was estimated from QRISK2 score

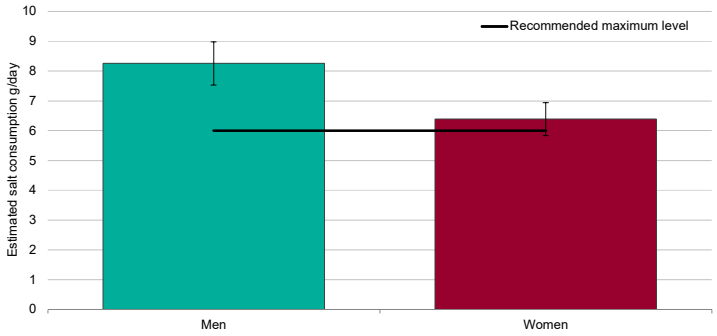


Chris Kypridemos et al. BMJ 2016;353:bmj.i2793

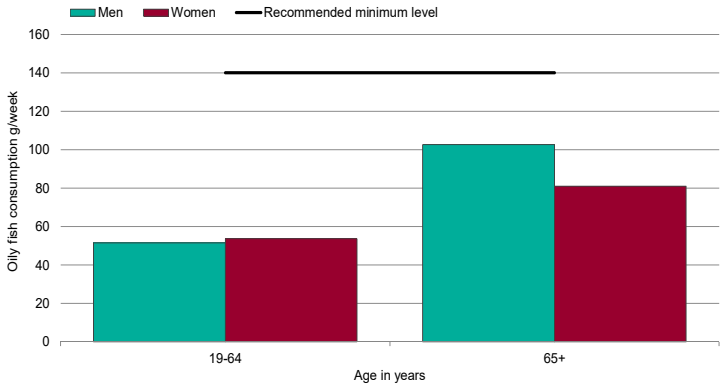
Trend in fruit and vegetable intake



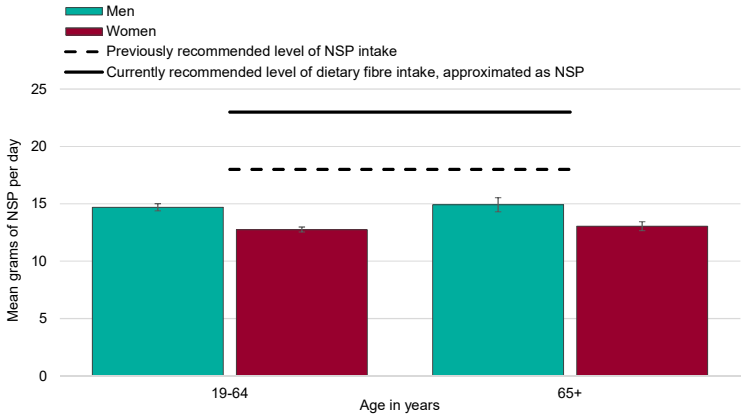
Estimated daily salt intake



Consumption of oily fish



Intake of dietary fibre



Primordial prevention – an uphill struggle?

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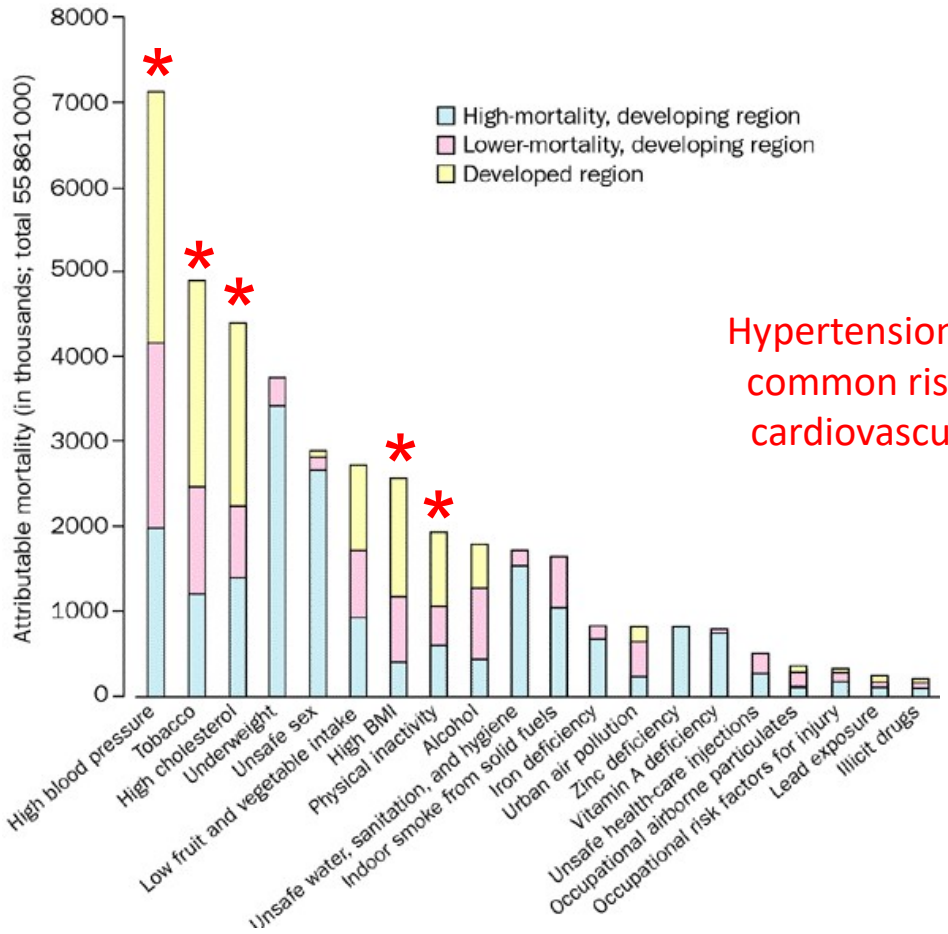
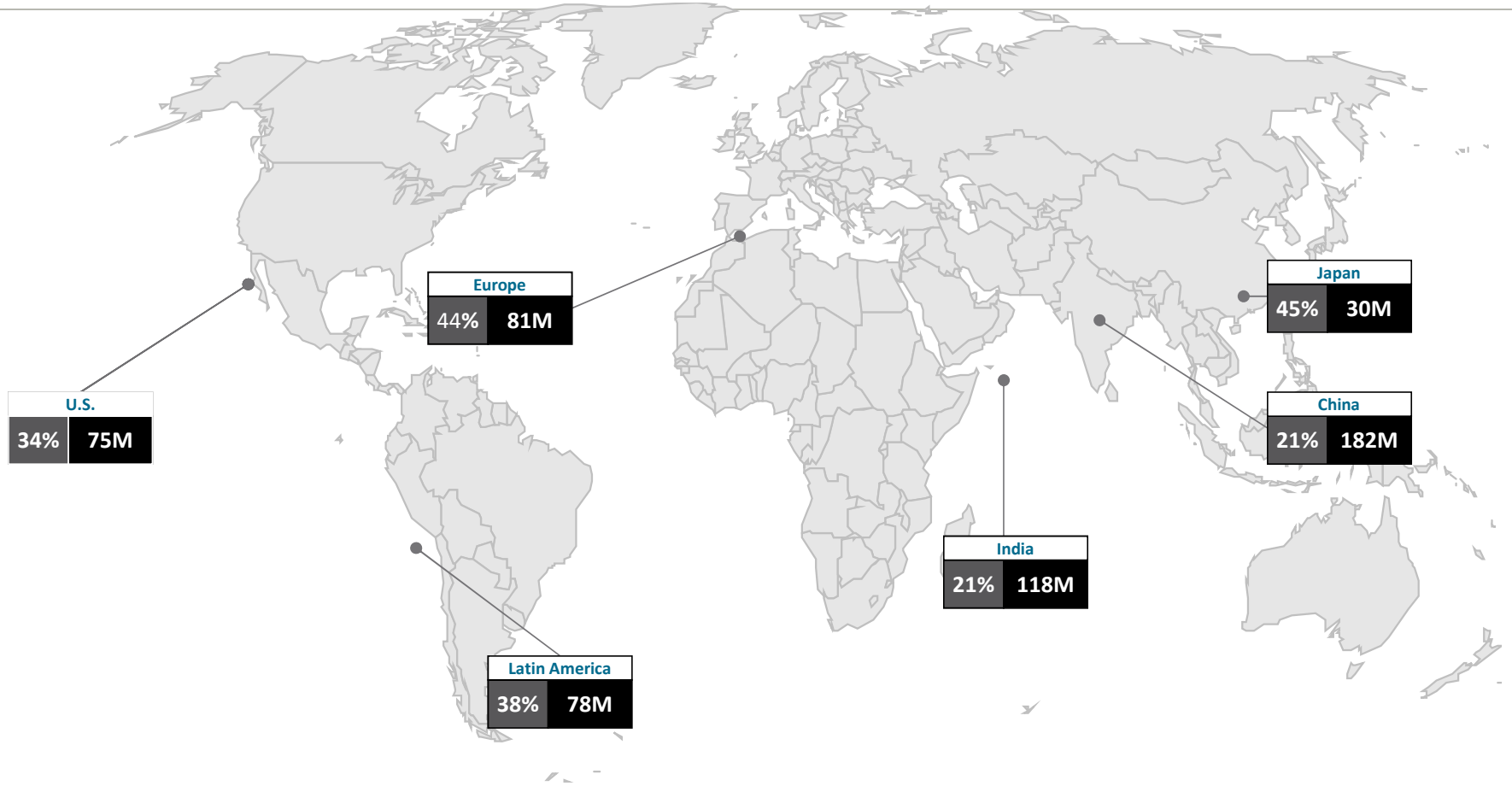
Global mortality and leading risk factors



Hypertension is the most common risk factor for cardiovascular disease

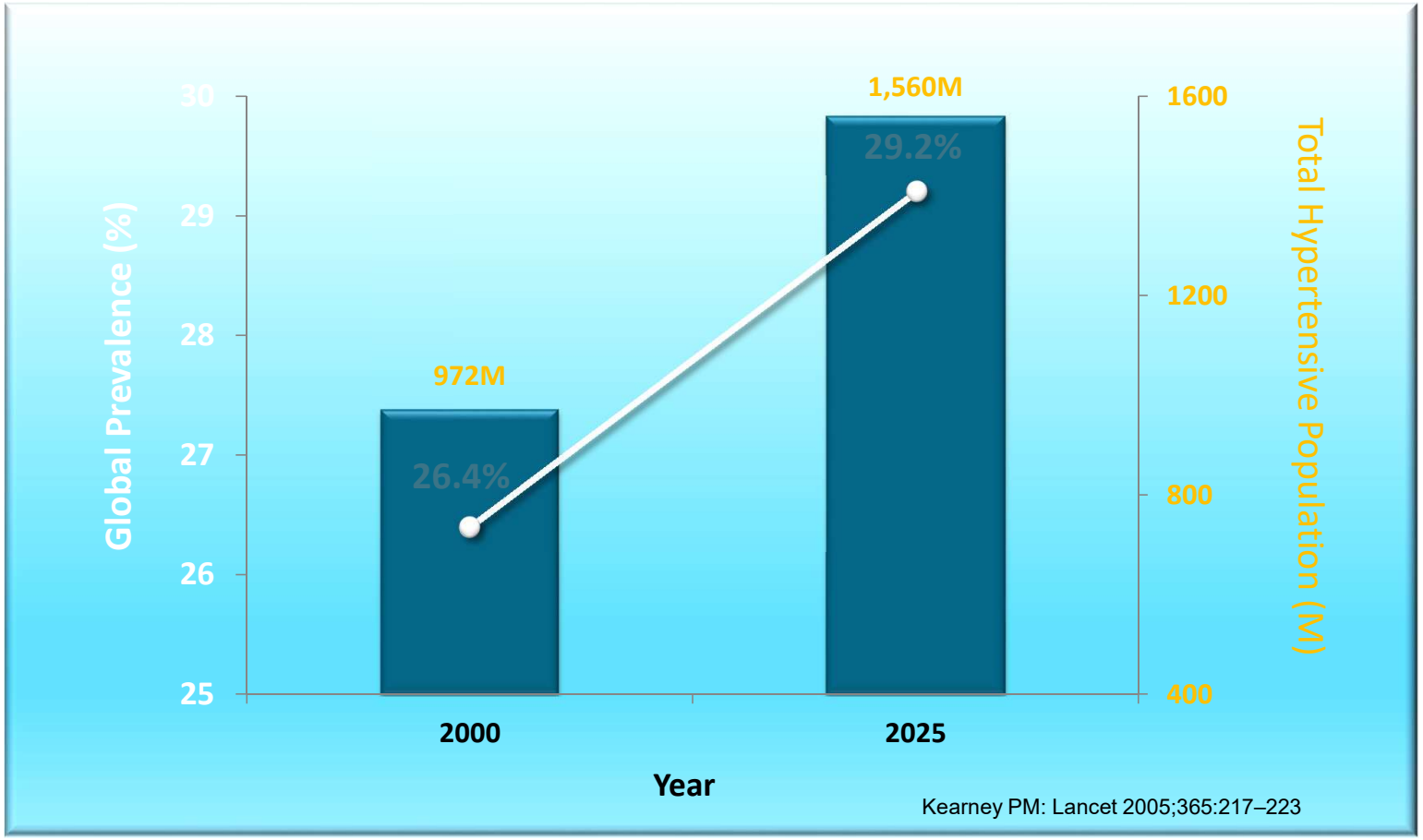
World Health Report 2002

More than one quarter of adults in developed societies are affected by hypertension



Kearney et al. Lancet 2005;365:217-23 Lloyd-Jones et al. Circulation 2010;121:e46–e215 Wolf-Meier et al. JAMA 2003;289:2363–2369 Journal of Human Hypertension 2004;18:911-912

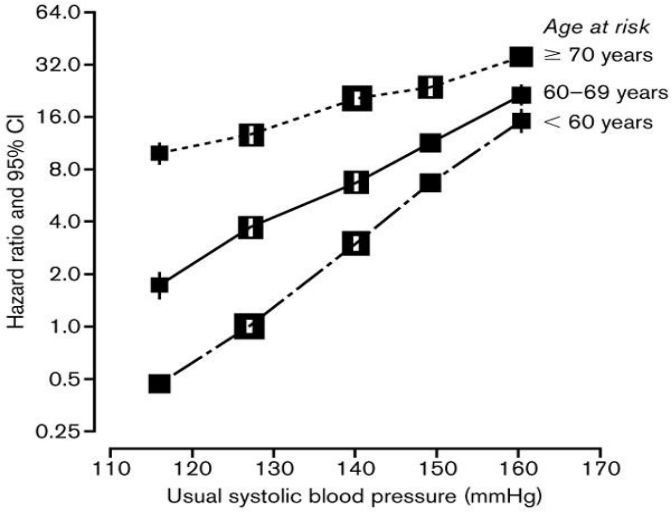
The growing global burden of hypertension



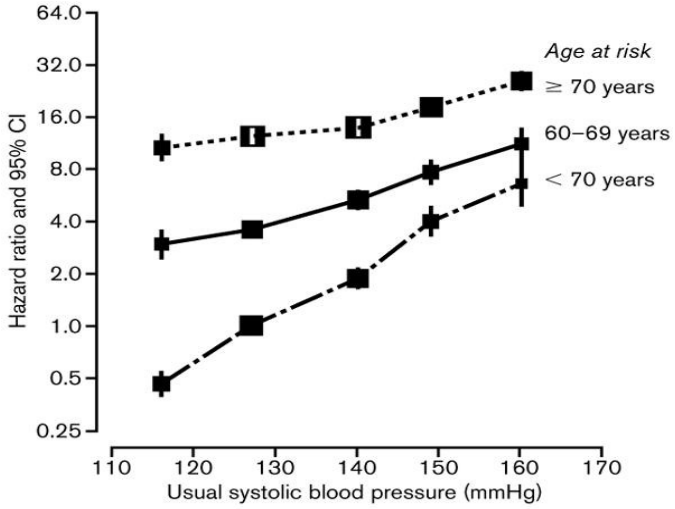
Kearney PM: Lancet 2005;365:217–223

Hypertension: stroke and ischaemic heart disease risk

BP & risk of stroke



BP & risk of IHD



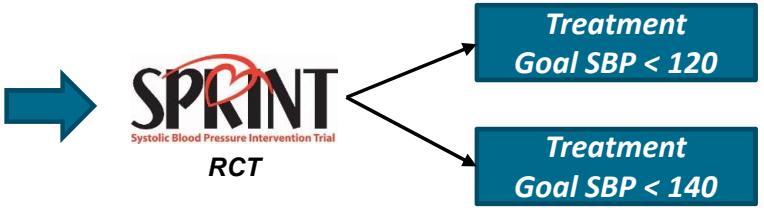
CV mortality risk doubles for every 20 mmHg increase in systolic blood pressure

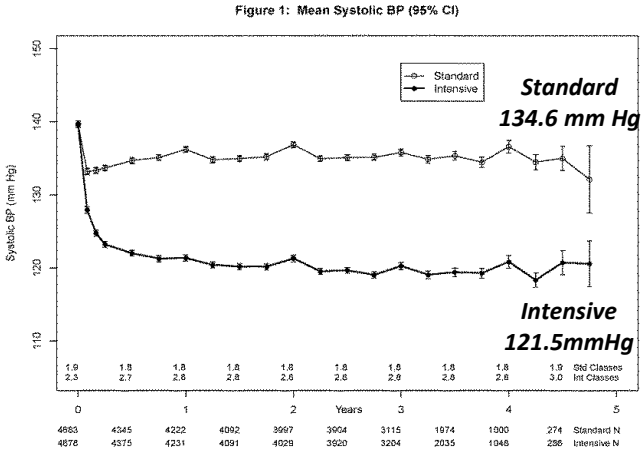
Asia Pacific Cohort Studies Collaboration *J Hypertens* 2003

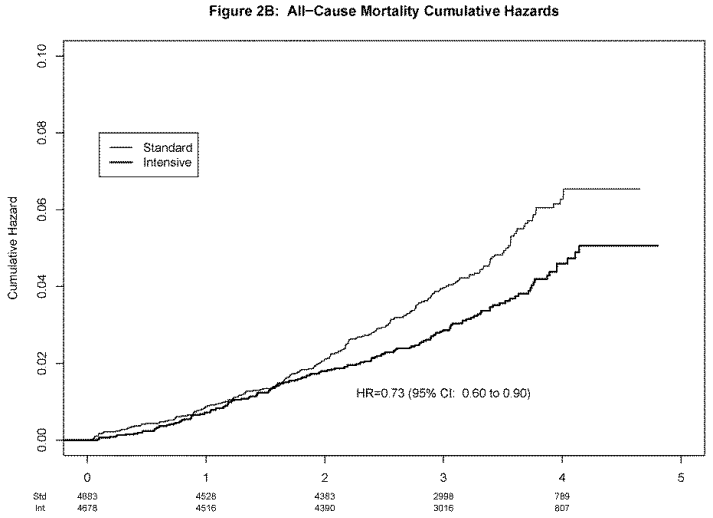
Blood pressure targets

Current BP Targets:

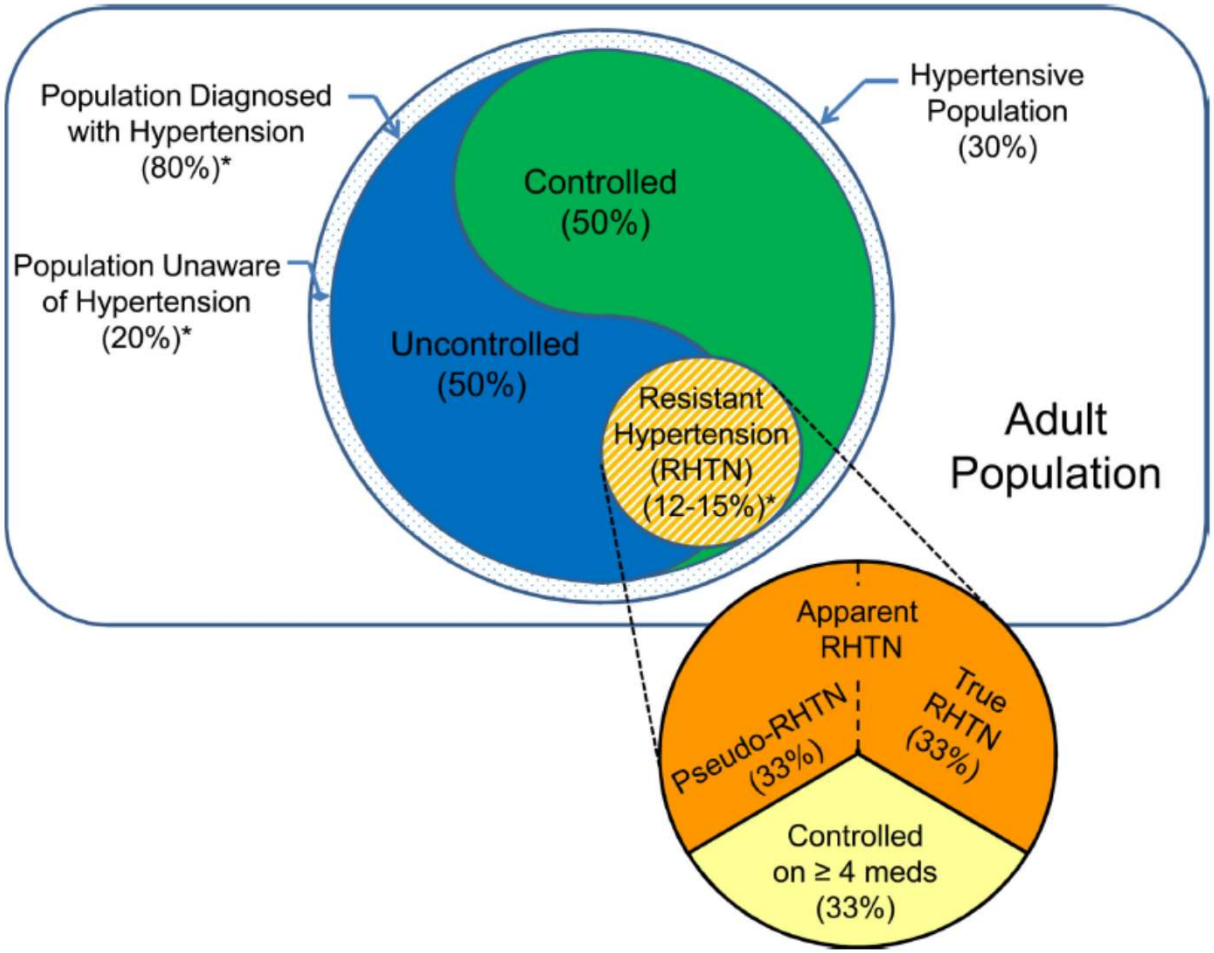
- Age < 80 — Clinic < 140/90; ABPM / Home <135/85
- Age > 80 — Clinic < 150/90; ABPM / Home <145/85







Resistant Hypertension

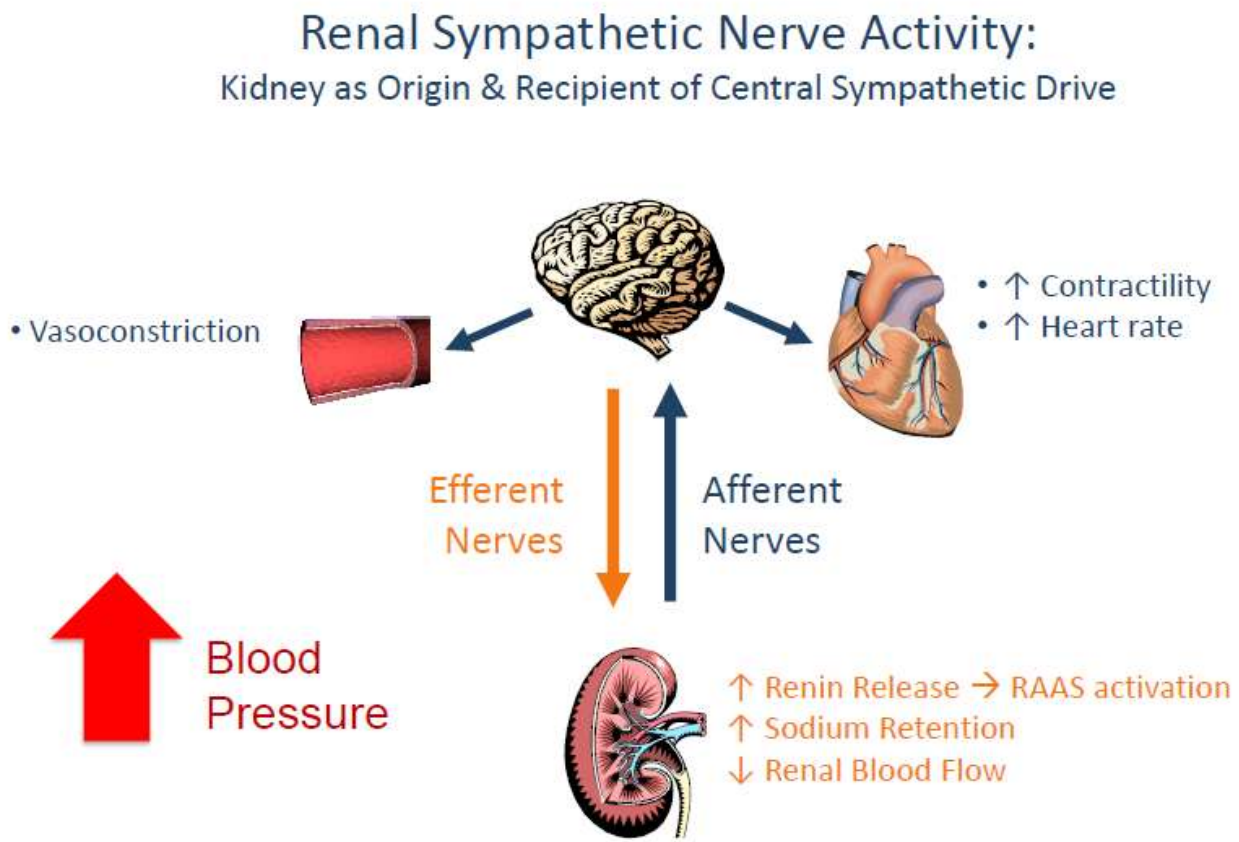


18 million adults with hypertension in the UK

- BP remaining above goal despite the use of ≥3 antihypertensive medications at maximally tolerated doses (one ideally being a diuretic)

- or BP that requires ≥4 agents to achieve control

Hypertension and sympathetic activity



Surgical History: Sympathectomy

THE EFFECTS OF PROGRESSIVE SYMPATHECTOMY ON BLOOD PRESSURE

BRADFORD CANNON

From the Laboratories of Physiology in the Harvard Medical School

Received for publication March 24, 1931

THE BRITISH JOURNAL OF SURGERY

1952

SYMPATHECTOMY IN THE TREATMENT OF BENIGN AND MALIGNANT HYPERTENSION*

A REVIEW OF 76 PATIENTS

By C. J. LONGLAND AND W. E. GIBB

THE JOURNAL

of the American Medical Association

Published Under the Auspices of the Board of Trustees

VOL. 172, NO. 16 CHICAGO, ILLINOIS AUGUST 15, 1953

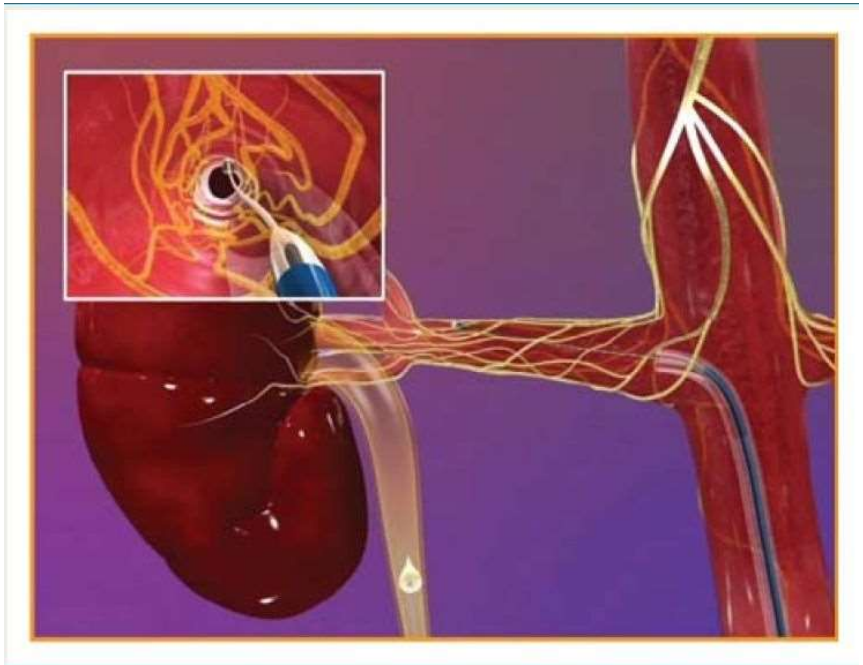
SPLANCHNICECTOMY FOR ESSENTIAL HYPERTENSION

RESULTS IN 1,246 CASES

Reginald H. Smithwick, M.D.
and
Jesse E. Thompson, M.D., Boston

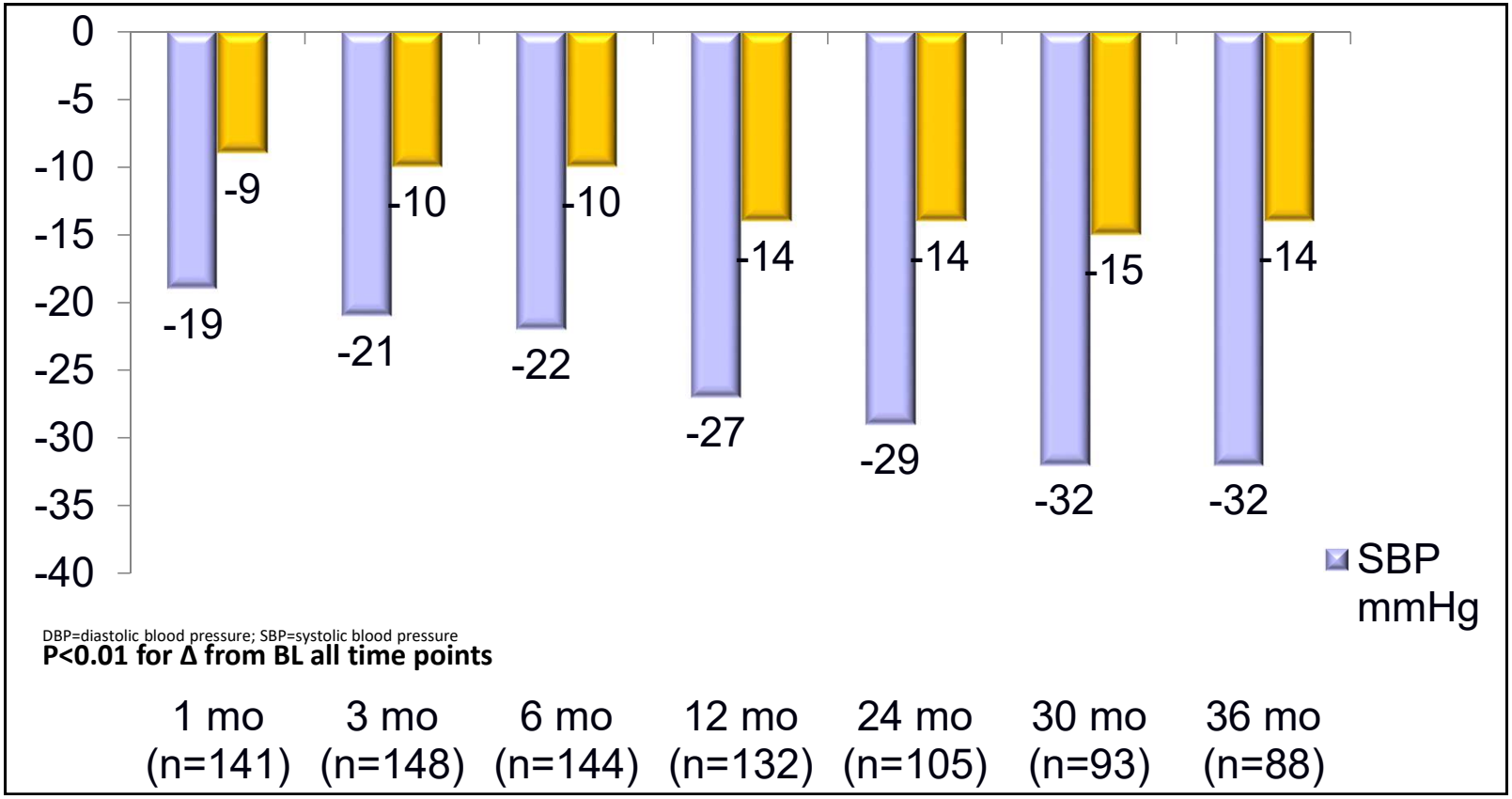
Effective, but significant morbidity

Renal Denervation



The Simplicity HTN-1 Trial

Proof of Concept; Human Feasibility, Safety and Efficacy Registry
Change in Office Blood Pressure Through 36 Months

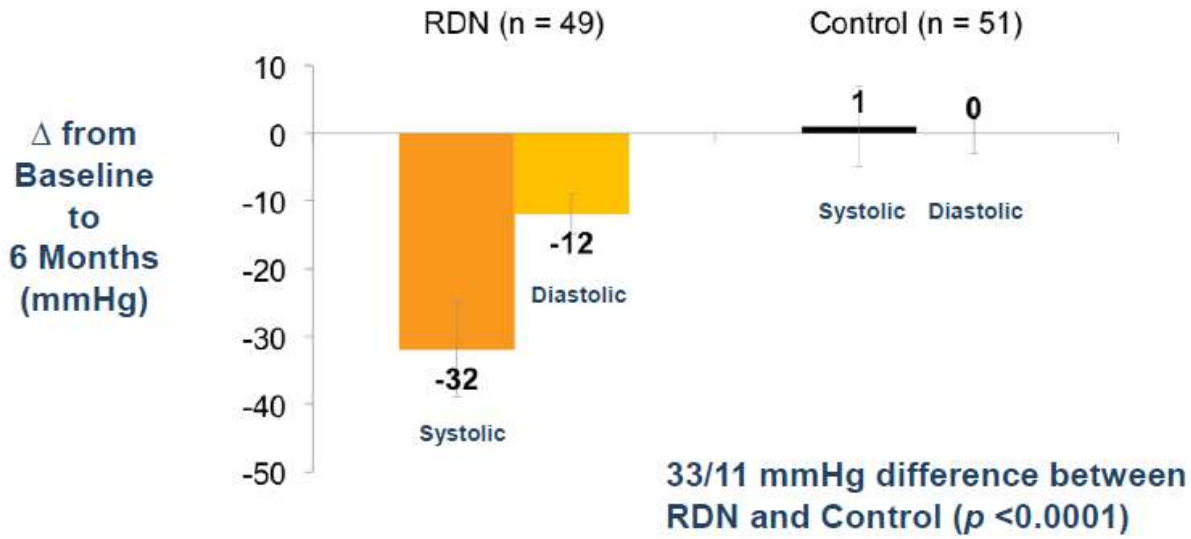


DBP=diastolic blood pressure; SBP=systolic blood pressure

P<0.01 for Δ from BL all time points

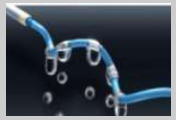
Krum, H. ESC 2013.

Primary Endpoint: 6-Month Office BP

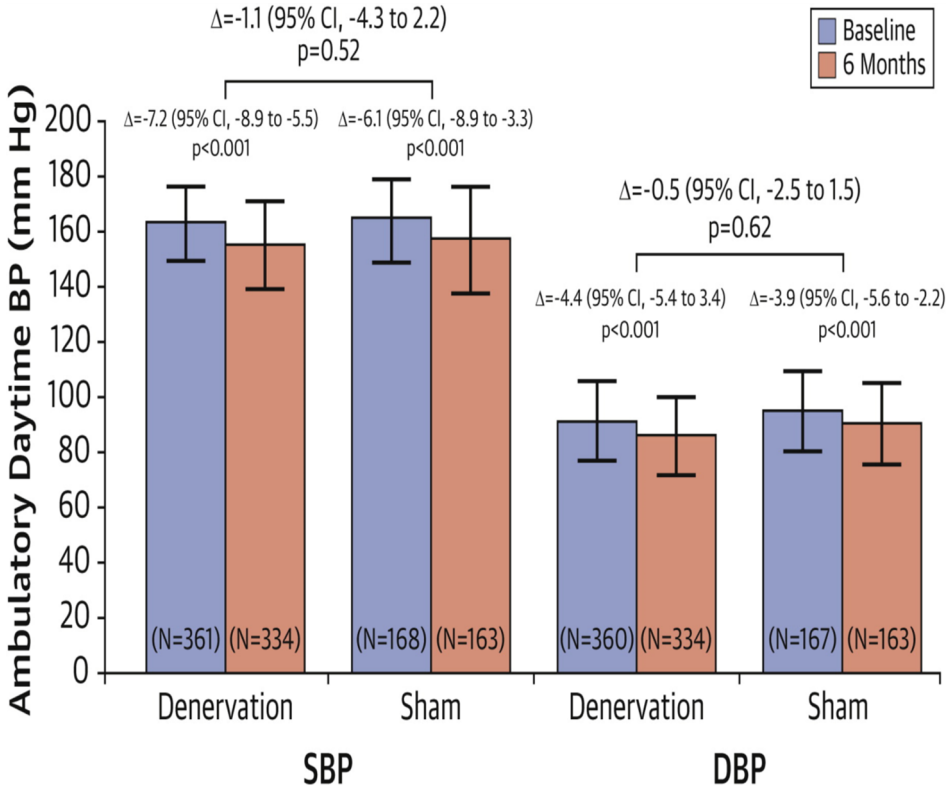


- 84% of RDN patients had ≥10 mmHg reduction in SBP
- 10% of RDN patients had no reduction in SBP

Renal Denervation Technologies

	MDT Symplicity	MDT Spyral	STJ EnligHTN	COV OneShot	ReCor Gen-2 Paradise	JNJ ThermoCool	BSC Vessix
							
CE Mark	✓	No	✓	✓	✓	No	✓
Catheter Design	Catheter with single electrode	Pigtail Catheter 4 electrodes	Basket with four electrodes	Balloon catheter helical electrode and cooling	Balloon catheter; internal cooling; *Circumferential treatment*	Pigtail catheter with 5 electrodes and cooling	Balloon catheter 4-8 electrodes
Balloon	No	No	No	✓	✓	No	✓
Guidewire	No	✓	No	✓	✓	No	✓
Energy	Monopolar RF	Monopolar RF	Monopolar RF	Monopolar RF	Ultrasound	Monopolar RF	Bipolar RF
Power	8W	Unknown	8W	25W	~12W	Unknown	~1W
Energy Delivery Time	2 min.	1 min.	60 sec	2 min.	30 sec.	Unknown	30 sec.
Total Treatment Time	16-24 min.	2 min.	4 min.	4 min.	3 min.	Unknown	2 min.

The Simplicity HTN-3 Trial



Daytime Blood Pressure Readings: Ambulatory daytime systolic and diastolic blood pressure at baseline and at 6 months.

J Am Coll Cardiol. 2014;64(11):1071-1078. doi:10.1016/j.jacc.2014.05.012

•Need Improved Technology

•Better understanding of renal nerve anatomy

•Robust preclinical science

•Need Reproducible Procedures

•Safe, easy access, reduced operator variability

•Consistent denervation

•Need Robust Clinical Study Design

•Standardization of BP measures

•Standardization of medication management

•Need improved understanding of patient selection

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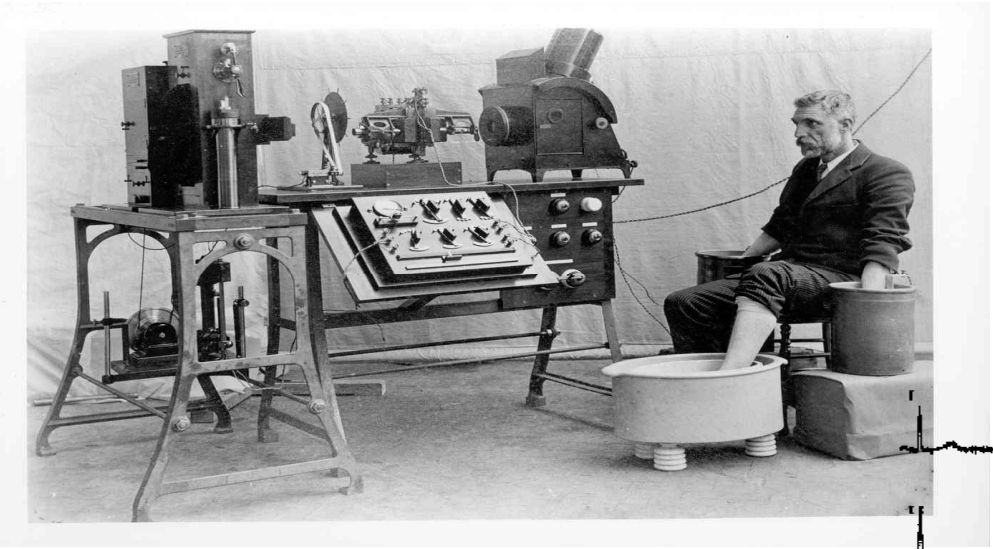
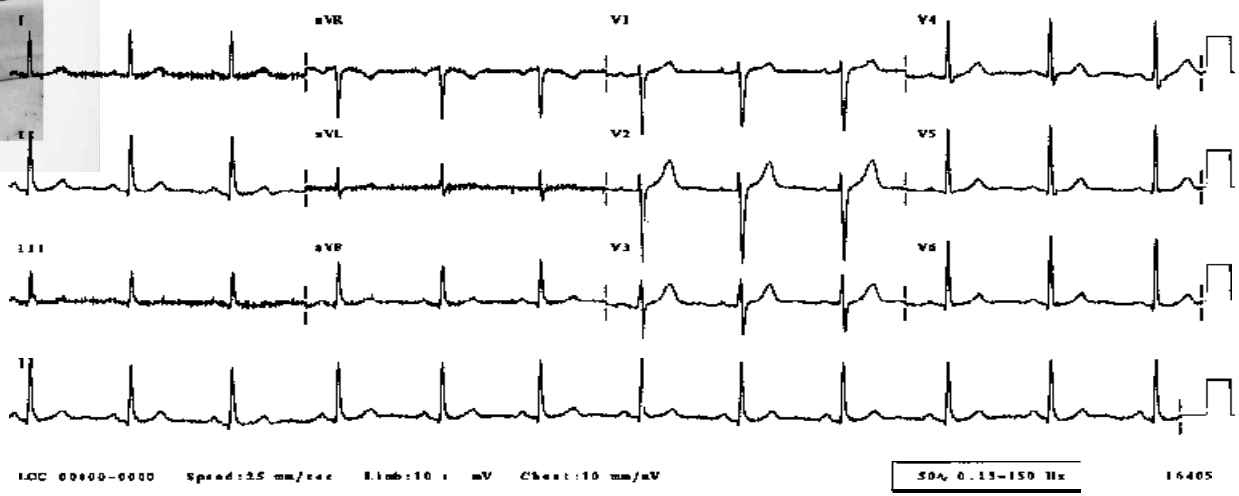
The resting ECG

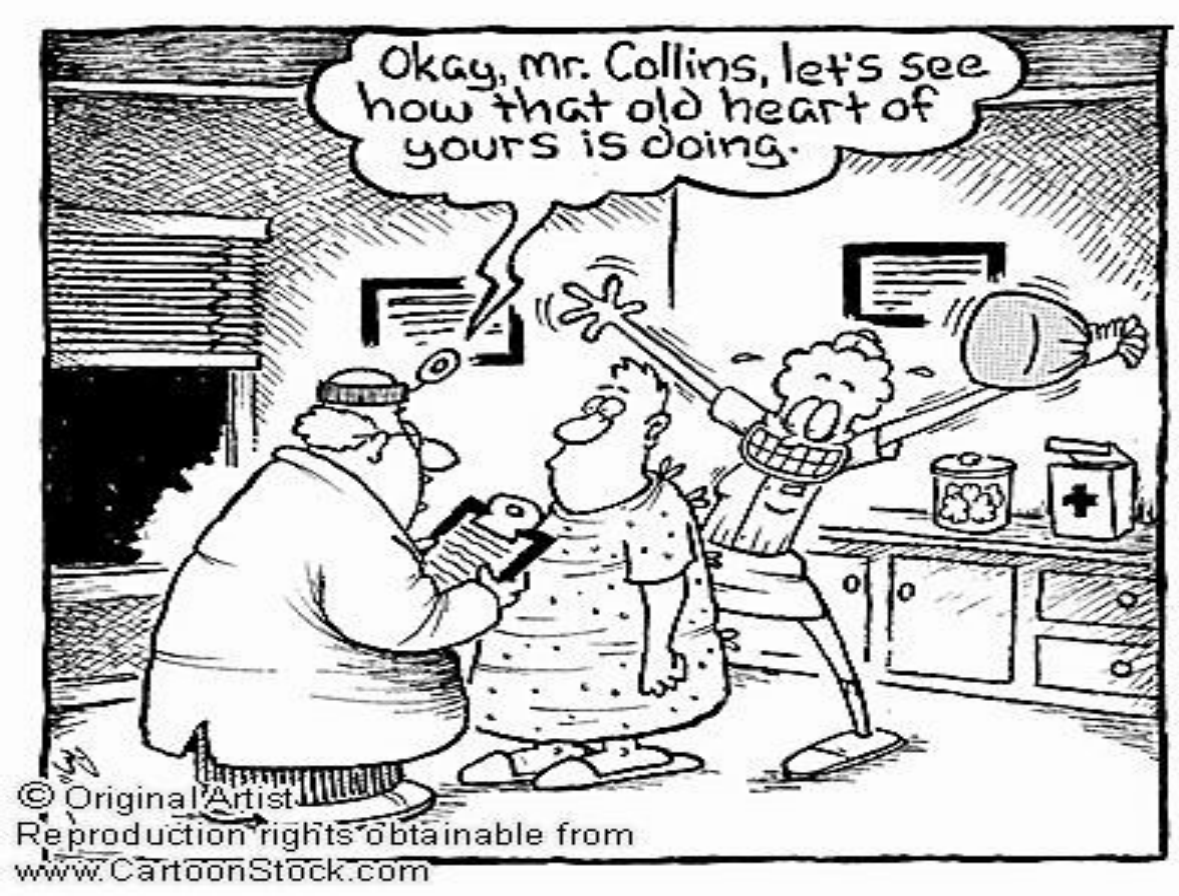


Normal in 50% on patients with chronic stable angina

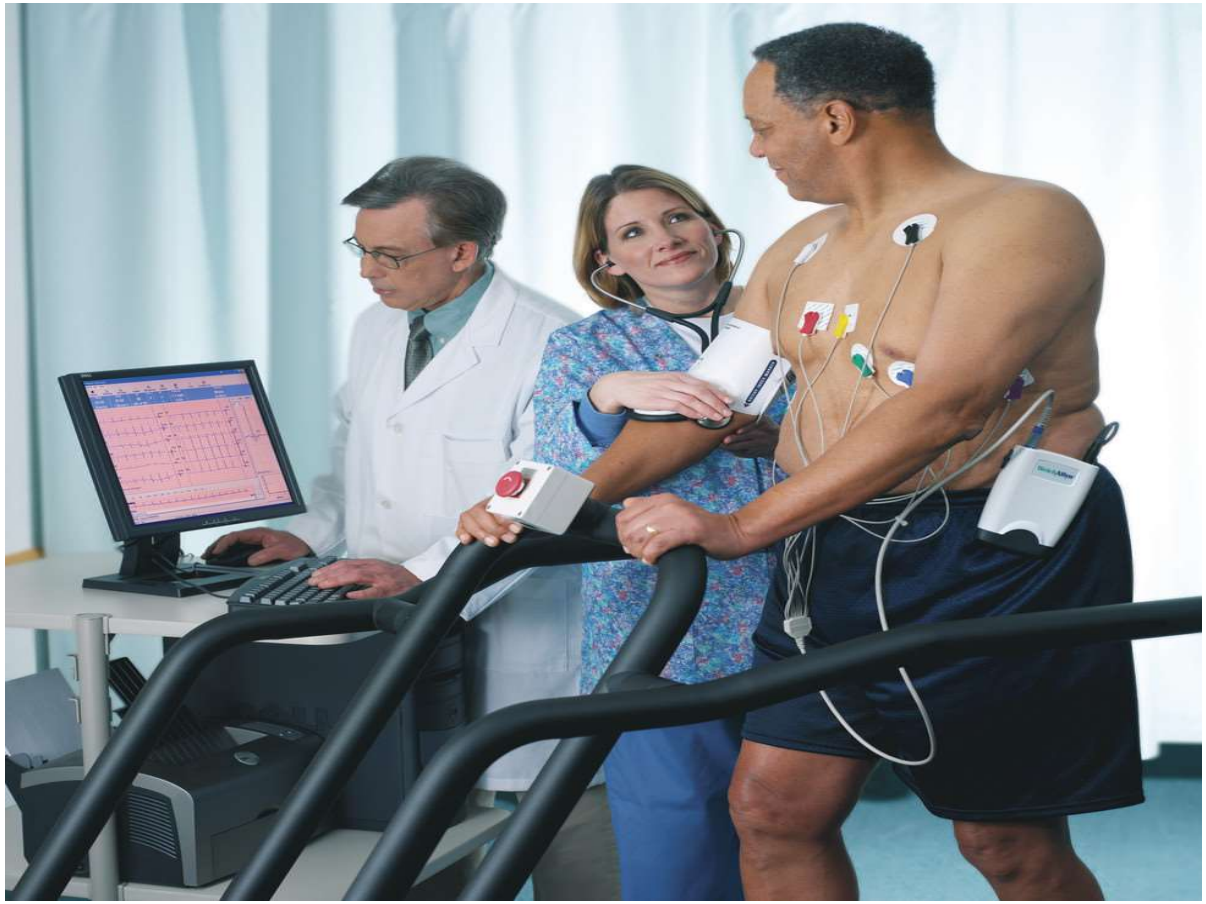


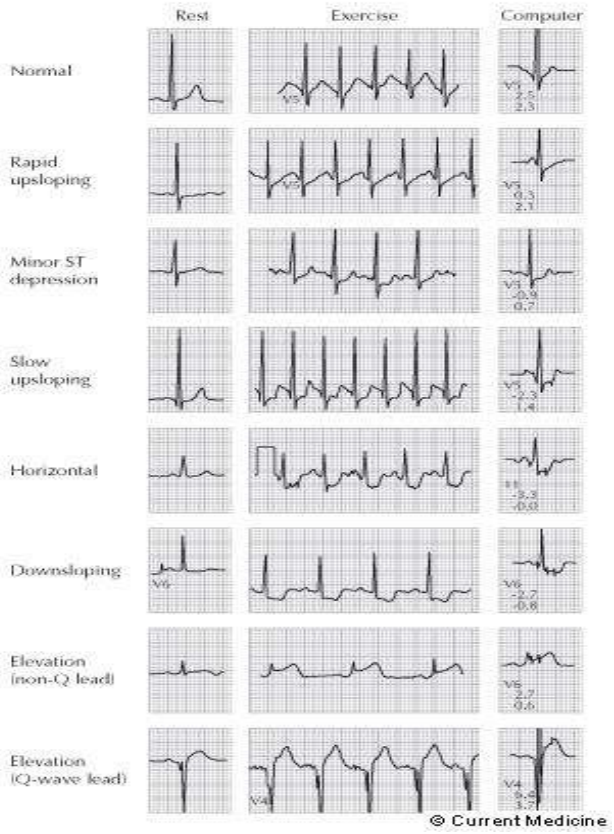
Coronary Heart Disease

Diagnosis



The Exercise ECG

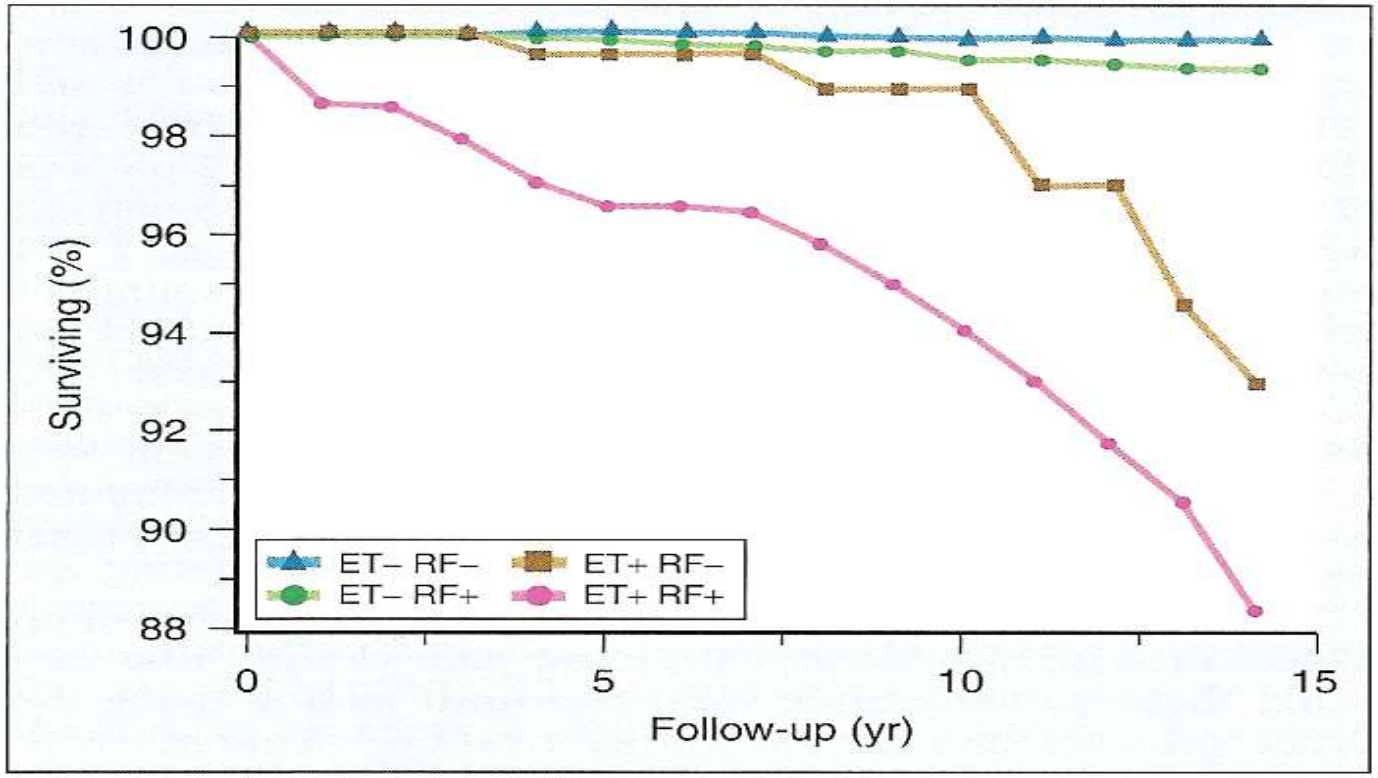




Sensitivity	**50 - 60%**
Specificity	**~ 70%**

True positive (TP)	Abnormal test in individual with disease
False positive (FP)	Abnormal test in individual without disease
True negative (TN)	Normal test in individual without disease
False negative (FN)	Normal test in individual with disease
Sensitivity	% with disease who have an abnormal result (TP/TP + FN)
Specificity	% without disease who have an normal result (TN/TN + FP)

Outcome of 25,927 asymptomatic men undergoing ETT



Issue date: March 2010

Chest pain of recent onset

Assessment and diagnosis of recent onset chest pain or discomfort of suspected cardiac origin

This guideline partially updates NICE technology appraisal guidance 73

Diagnosis of Chest Pain: Guidelines

NHS National Institute for Health and Clinical Excellence

Table 1 Percentage of people estimated to have coronary artery disease according to typicality of symptoms, age, sex and risk factors[2]

Age (years)	Non-anginal chest pain				Atypical angina				Typical angina			
	Men		Women		Men		Women		Men		Women	
	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi
35	3	35	1	19	8	59	2	39	30	88	10	78
45	9	47	2	22	21	70	5	43	51	92	20	79
55	23	59	4	25	45	79	10	47	80	95	38	82
65	49	69	9	29	71	86	20	51	93	97	56	84

For men older than 70 with atypical or typical symptoms, assume an estimate > 90%.
For women older than 70, assume an estimate of 61–90% EXCEPT women at high risk AND with typical symptoms where a risk of > 90% should be assumed.

Values are per cent of people at each mid-decade age with significant coronary artery disease (CAD).
Hi = High risk = diabetes, smoking and hyperlipidaemia (total cholesterol > 6.47 mmol/litre).
Lo = Low risk = none of these three.
The shaded area represents people with symptoms of non-anginal chest pain, who would not be investigated for stable angina routinely.
Note: These results are likely to overestimate CAD in primary care populations.
If there are resting ECG ST-T changes or Q waves, the likelihood of CAD is higher in each cell of the table.

61–90% invasive coronary angiography as the first-line diagnostic investigation if appropriate

30–60% functional imaging as the first-line diagnostic investigation

10–29% CT calcium scoring as the first-line diagnostic investigation

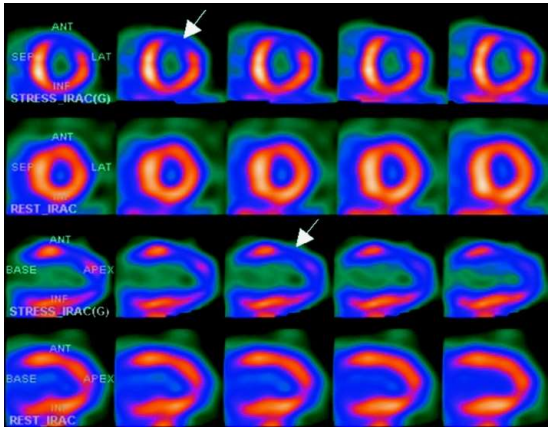
Do not use exercise ECG to diagnose or exclude stable angina for people without known CAD

[1] See the full guideline and the NICE guideline at www.nice.org.uk/guidance/CG95

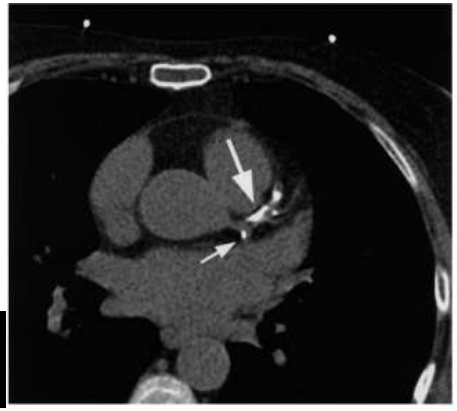
[2] Adapted from Pryor DB, Shaw L, McCants CB et al. (1993) Value of the history and physical in identifying patients at increased risk for coronary artery disease. Annals of Internal Medicine 118 (2): 81–90.

Investigation of Chest Pain

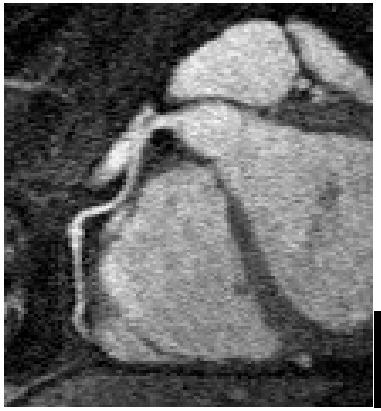
Stress echo



Myocardial perfusion scanning



CT coronary calcium scoring



CT coronary angiogram

	Sensitivity	Specificity	Negative predictive value
ETT	68	77	49
Stress echo	84	86	
Nuclear imaging	85	75	
CT coronary angio (to detect >70% lesion)	83	83	99

NEW NICE Guidelines (November 2016)

Offer 64-slice (or above) CT coronary angiography if:

- clinical assessment (see recommendation 1.3.3.1) indicates typical or atypical angina
  or
- clinical assessment indicates non-anginal chest pain but 12-lead resting ECG has been done and indicates ST-T changes or Q waves. **[recommendation 1.3.4.3, new 2016]**

CT Coronary Angiography

Diagnostic Accuracy

Diagnostic accuracy of CTA

Analysis	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Stenoses > 50%, per patient	93	82	62	97
Stenoses > 50%, per vessel	84	91	51	98
Stenoses > 70%, per patient	91	84	49	98
Stenoses > 70%, per vessel	85	92	33	99

PPV=positive predictive value
NPV=negative predictive value

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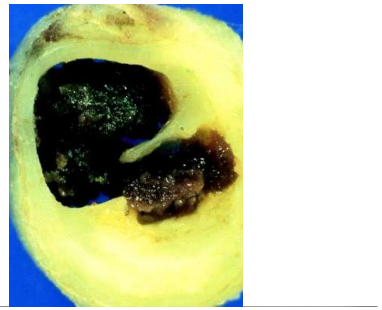
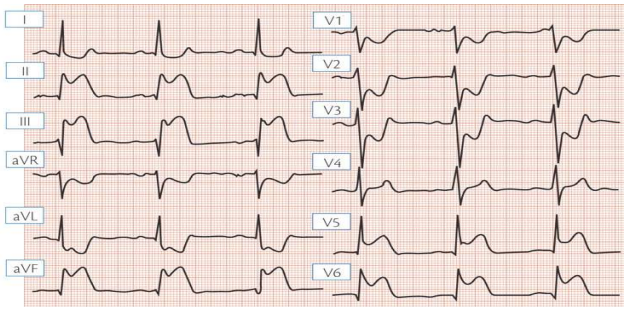
Myocardial Infarction
&
Primary Percutaneous Coronary Intervention





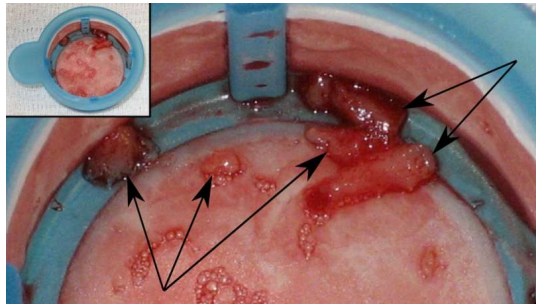
Primary Percutaenous Coronary Intervention

XA000001.AVI

XA000002.AVI

XA000007.AVI

XA000008.AVI



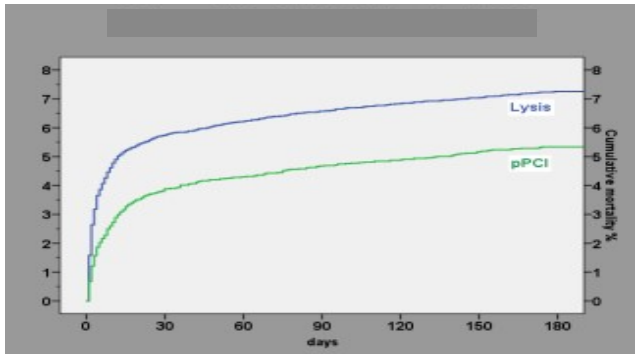
PPCI
&
Outcomes

Intervention	MORTALITY (%)		
	30 days	1 year	18 months
PPCI	5.6	8.7	9.9
Thrombolysis	7.9	12.4	14.8
Nil	16.4	28.3	31.0

HeartImprovement NHS Improvement NHS

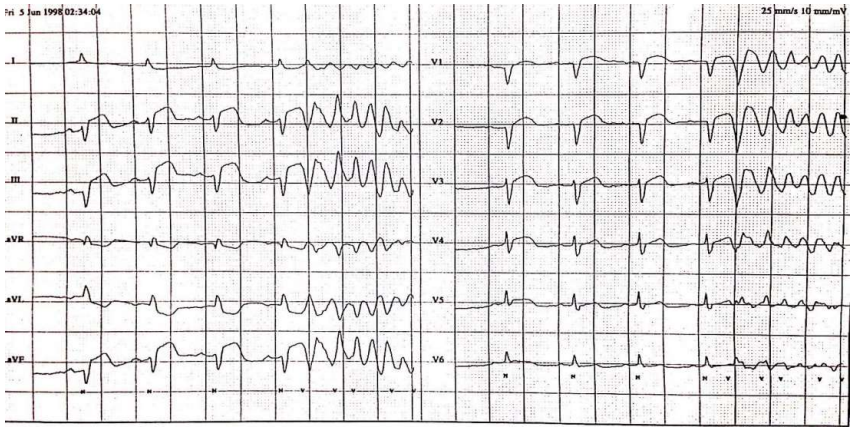
6 month mortality for STEMI

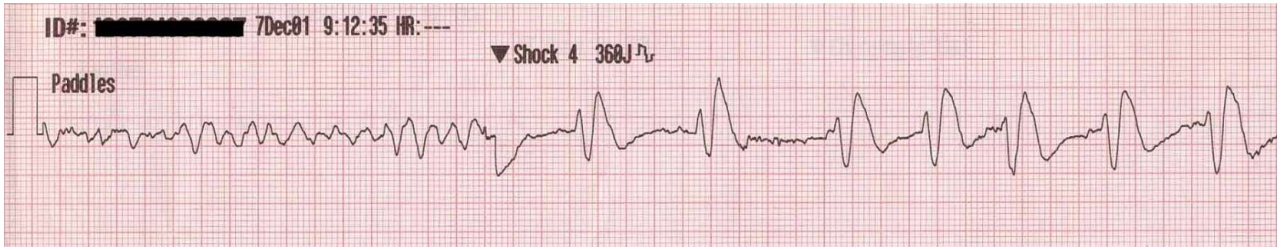
(MINAP Data 2005-7, patients <80 yrs)

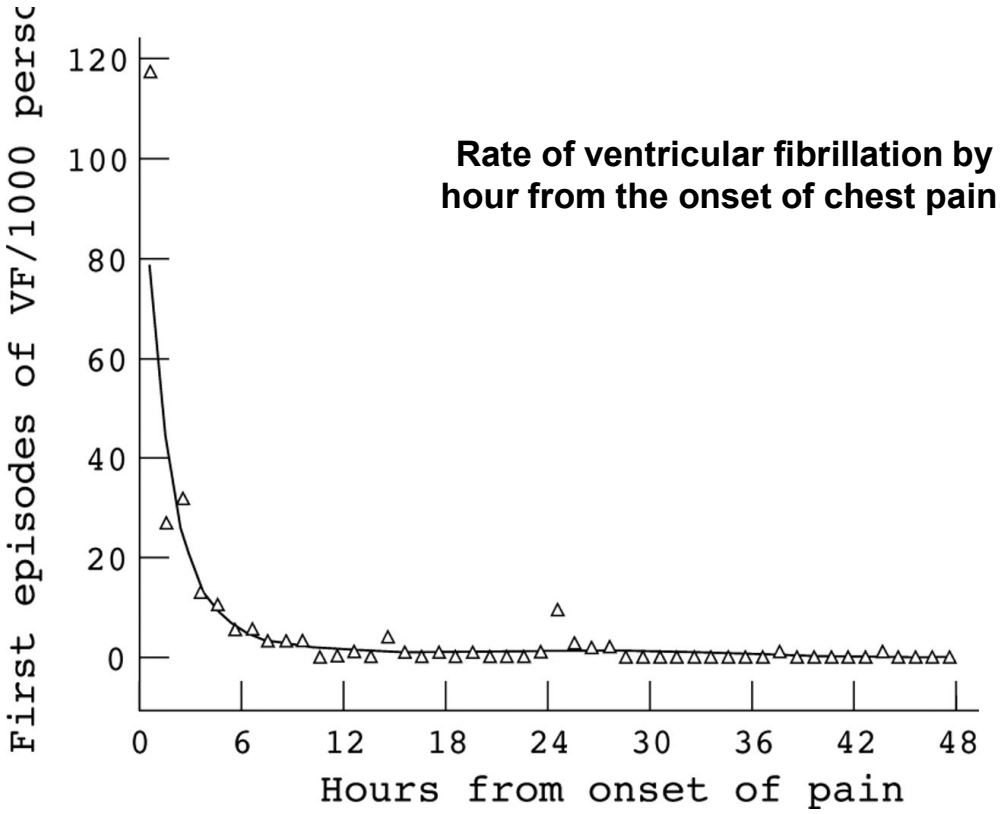


Courtesy: Dr John Birkhead

Ventricular Fibrillation





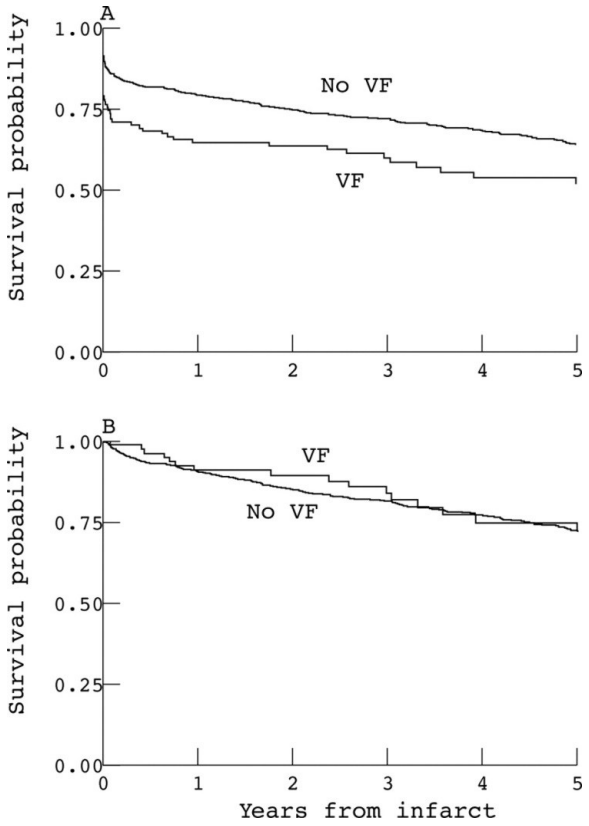


Rate of ventricular fibrillation by hour from the onset of chest pain.

Heart

J W Sayer et al. Heart 2000;84:258-261

Ventricular Fibrillation



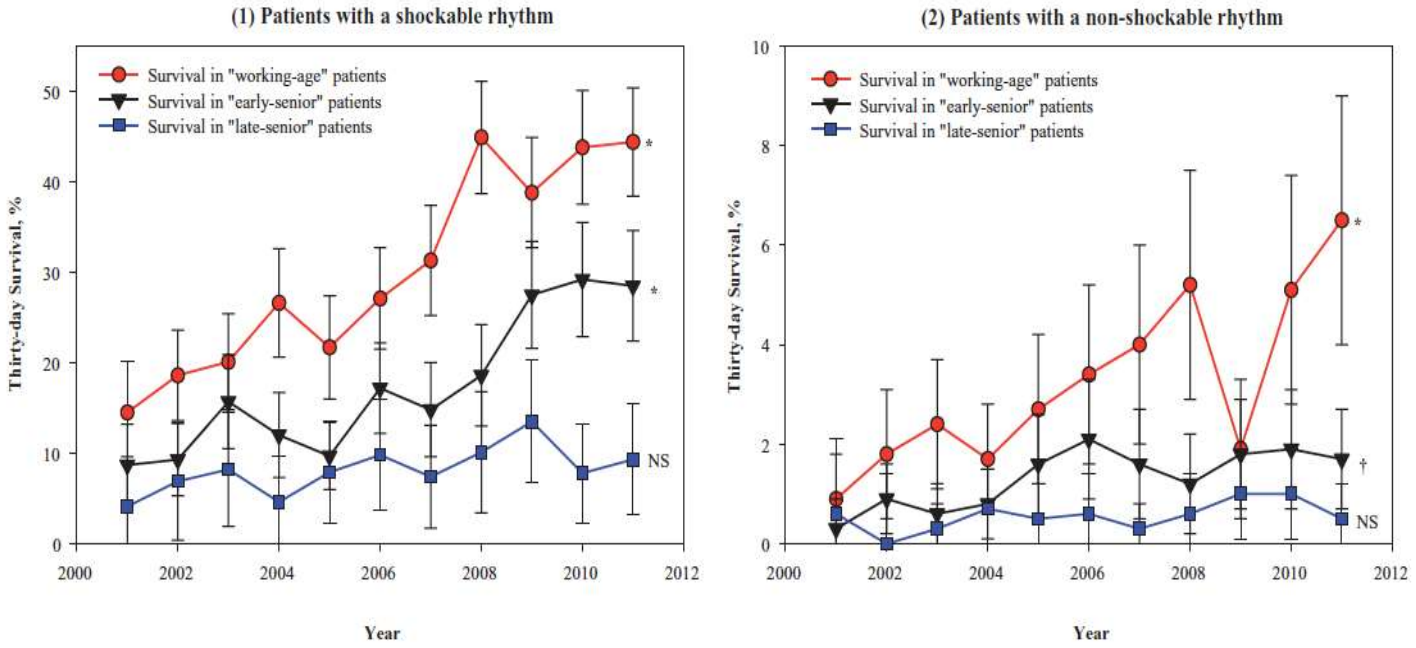
Survival from (A) onset of chest pain and (B) hospital discharge in patients with and without early ventricular fibrillation (VF).

Heart

J W Sayer et al. Heart 2000;84:258-261

Ventricular Fibrillation

Survival from Out of Hospital Arrest



- 21 480 presumed cardiac-caused OOHCA with CPR
- No ROSC at hospital arrival + No prehospital DCCV → 3 / 9499 survived

Danish Cardiac Arrest Registry (2001– 2011) Wissenberg et al. Circulation 2015

Survival from Out of Hospital Arrest
&
Cooling

Contents lists available at ScienceDirect

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

ELSEVIER

EUROPEAN RESUSCITATION COUNCIL

Clinical paper

Early targeted brain COOLing in the cardiac CATHeterisation laboratory following cardiac arrest (COOLCATH)☆,☆☆

Shahed Islam[a,b], James Hampton-Till[a], Noel Watson[a,b], Nilanka N. Mannakkara[b], Ashraf Hamarneh[b], Teresa Webber[b], Neil Magee[b], Lucy Abbey[b], Rohan Jagathesan[b], Alamgir Kabir[b], Jeremy Sayer[b], Nicholas Robinson[b], Rajesh Aggarwal[b], Gerald Clesham[b], Paul Kelly[b], Reto Gamma[b], Kare Tang[b], John R. Davies[a,b,*], Thomas R. Keeble[a,b,*]

[a] Post Graduate Medical Institute (PMI), Anglia Ruskin University, Chelmsford, UK
[b] The Essex Cardiothoracic Centre (CTC), Basildon, Essex, SS16 5NL, UK

Table 3c
Comparison of survival to hospital discharge between two groups.

	Blanketrol	Rhinochill	Overall
Survival to hospital discharge	68.60% (24/35)	65.70% 23/35	67.10% (47/70)

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Evolution of Percutaneous Coronary Intervention

Plain old balloon angioplasty (POBA)

- Acute dissection and vessel closure need surgery
- High stenosis rate (30-50%)

Bare metal stents(BMS)

- Reduced dissection
- Lower restenosis rates (15-25%)

Drug Eluting Stents(DES)

- Restenosis rates <3%
- Some increased risk of late stent thrombosis (0.3% per year)

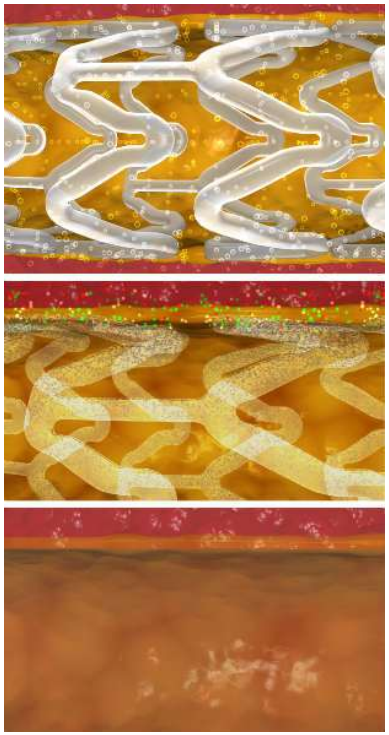
Bioabsorbable Stents

Everolimus/PDLLA (1:1) matrix coating

- 7 µm
- Conformal coating
- Controlled drug release similar to Xience CoCr-EES

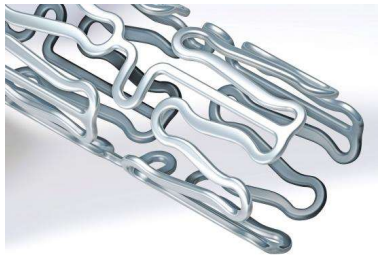
PLLA Backbone

- Semi-crystalline
- Circumferential sinusoidal rings connected by linear links
- Strut thickness 150 µm
- Platinum markers in each end ring



ABSORB III

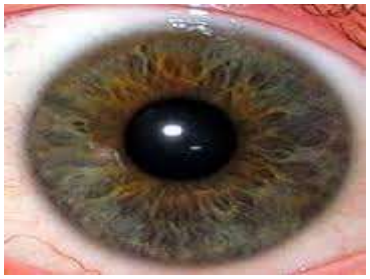
VS

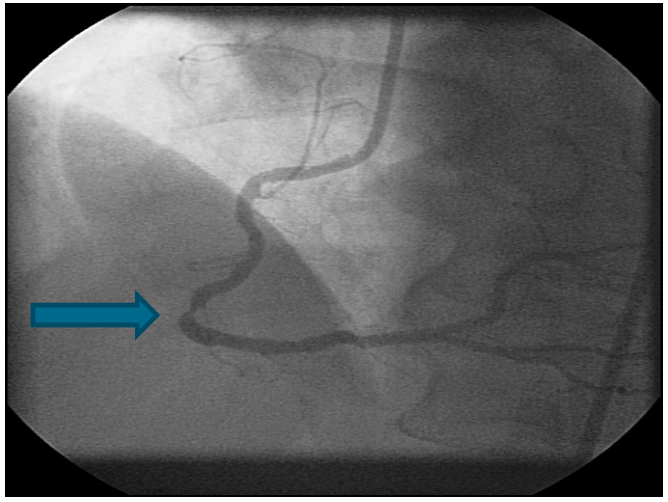


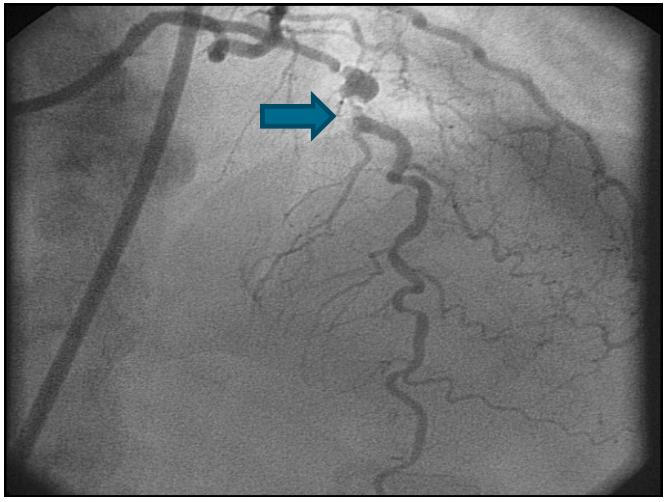
ABSORB vs Xience		
1 – 2 year marks	Noninferior	
25 months	MACE	10.9% vs 7.8%
	TLF	3.7% vs 2.5%

Predicting Cardiovascular Risk

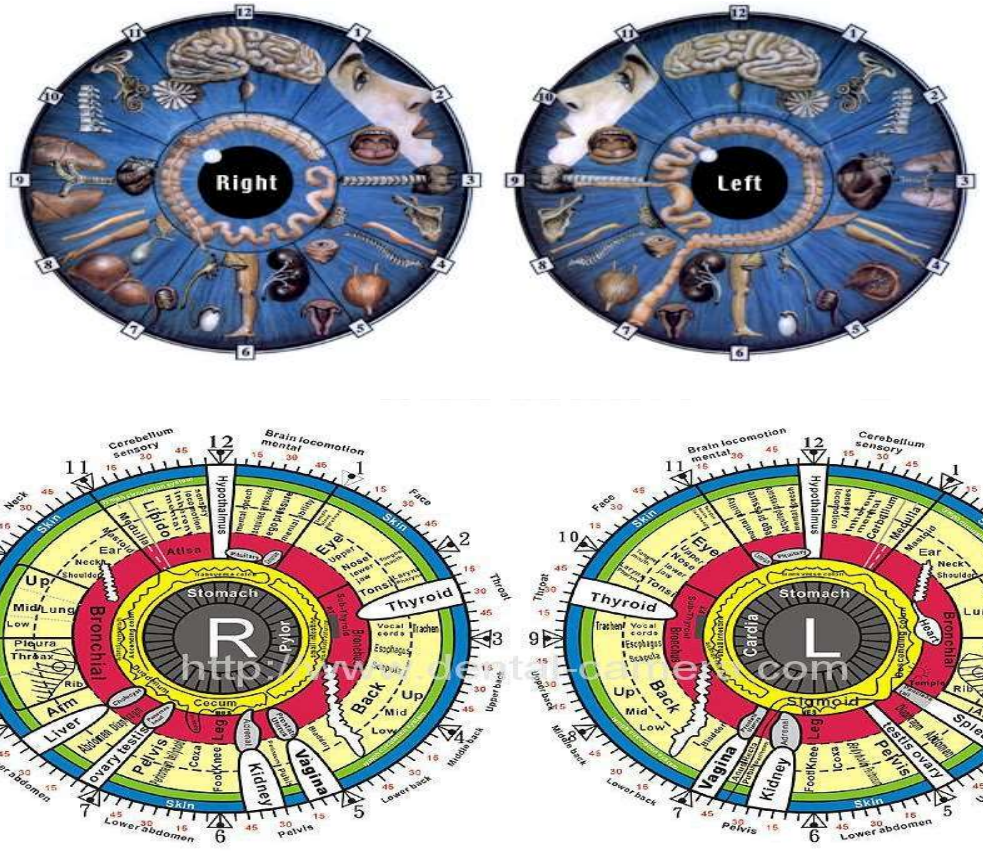
and the possible future……







……Iridology



Predicting Cardiovascular Risk

Risk Charts

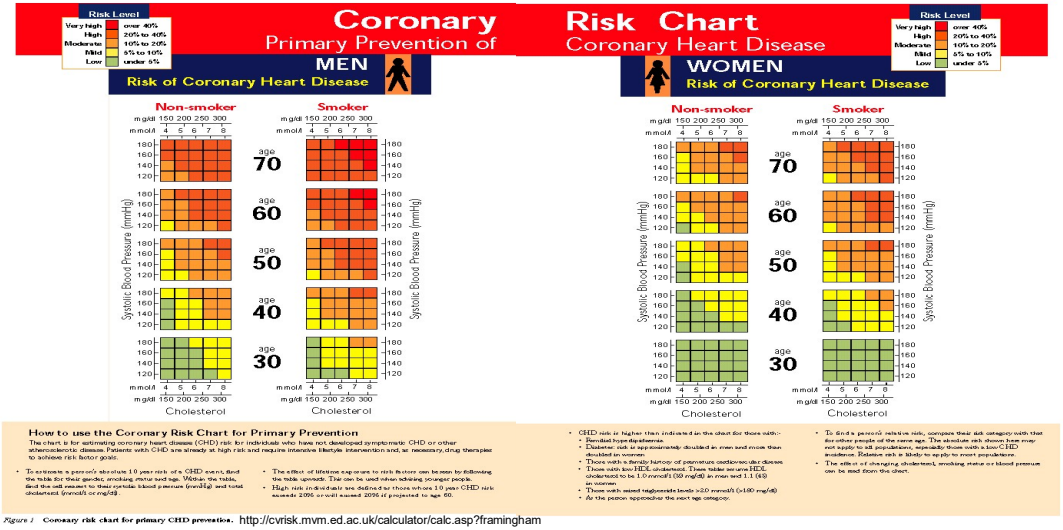
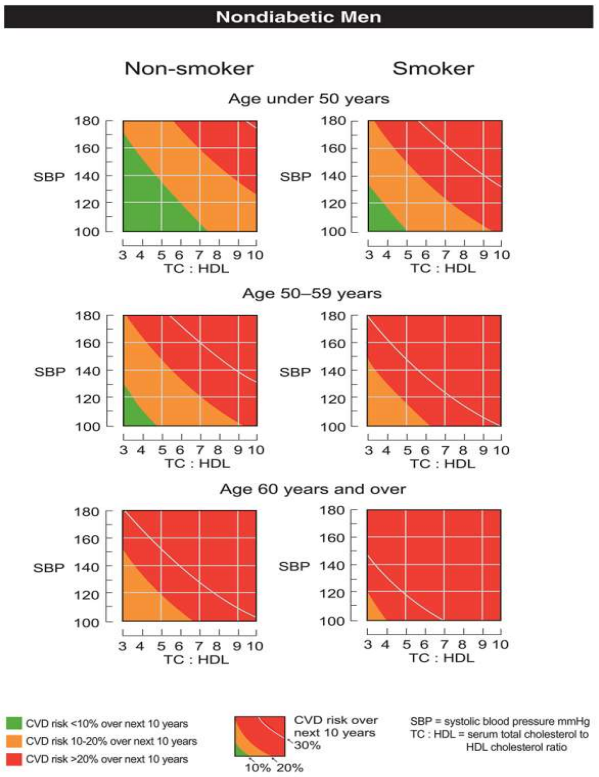


Figure 1 **Coronary risk chart for primary CHD prevention.** http://cvrisk.mvm.ed.ac.uk/calculator/calc.asp?framingham



BMJ helping doctors make better decisions

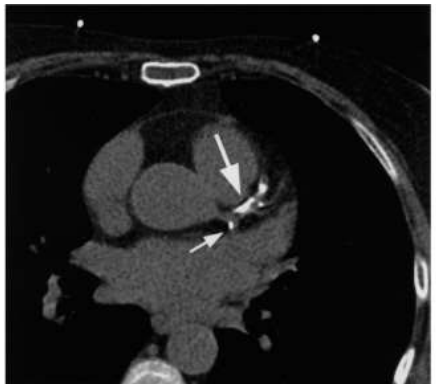
Predicting cardiovascular risk in England and Wales: prospective derivation and validation of QRISK

Julia Hippisley-Cox et al

BMJ 2008;336:1475

CT Calcium Scoring

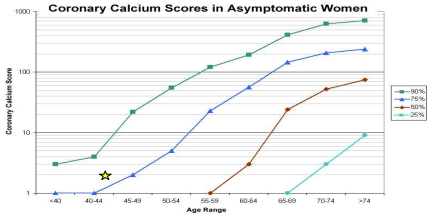
- Assessment of Coronary Calcification
  - A measure of the volume and extent of atheroma development



- The only modality to pick early atheroma development
- A measure of the extent and distribution of coronary atheroma
- Quantification provides prognostic information
- Powerful prognostic tool
- Limited over the age of 70?

INTERPRETATION OF CORONARY ARTERY ANALYSIS

The following graph shows the distribution of total calcium scores for each age group between 40 and 75 by percentiles (the star indicates the patient's total calcium score).



The American Journal of Cardiology Vol.87 Jun15, 2001 pg.1338
Age and Gender Distributions of Coronary Artery Calcium Detected by Electron Beam Tomography in 35,246 Adults

The total calcium score (1.81) is between the 75th and 90th percentile for women between the ages of 40 and 44. (Exact percentile calculated to be 79%; this means 78% of the population has lower calcium score and 21% of the population has a higher calcium score than you.)

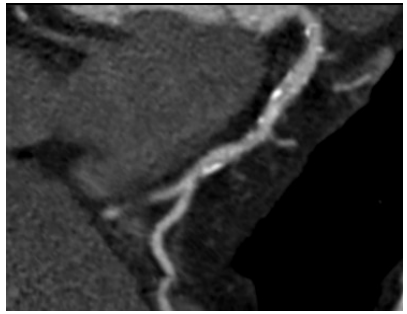
Interpretation of calcium score:

Total Score	Diagnosis	Clinical Interpretation
0	No identifiable atherosclerotic plaque. Very low cardio-vascular disease risk.	A 'negative' examination. Greater than 97% chance for absence of coronary artery disease.
1-10	Minimal plaque burden.	'Significant' coronary artery disease very unlikely.
11-100	Mild plaque burden.	Likely mild or minimal coronary stenosis.
101-400	Moderate plaque burden.	Moderate non-obstructive coronary artery disease highly likely.
Over 400	Extensive plaque burden.	High likelihood of at least one 'significant' coronary stenosis.

Calcium Scoring: Odds Ratio of Developing Symptomatic Disease

❑ High Cholesterol	1.8:1
❑ Low HDL	1.8:1
❑ Hypertension	1.2:1
❑ Smoking	3.6:1
❑ Calcium score >50	7:1
❑ Calcium score >100	20:1
❑ Calcium score >160	35:1

<10 score has a NPV 95-100% for >50% stenosis
>400 90% chance of having >70% stenosis



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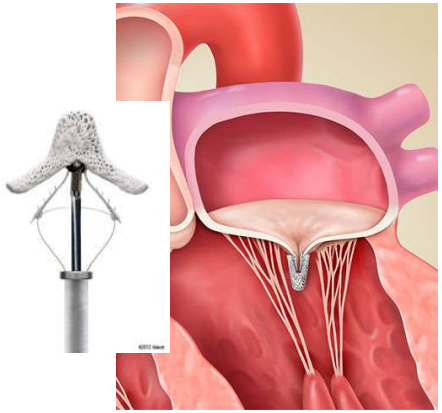
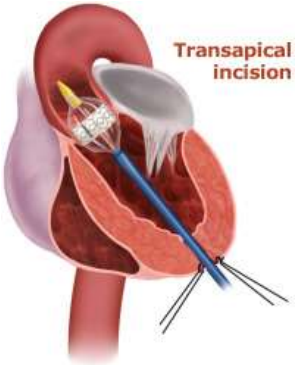
The future

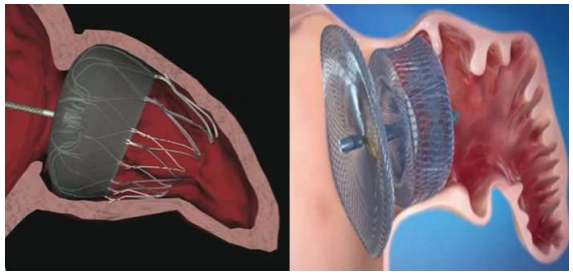
Mitral valve clips



TAVI



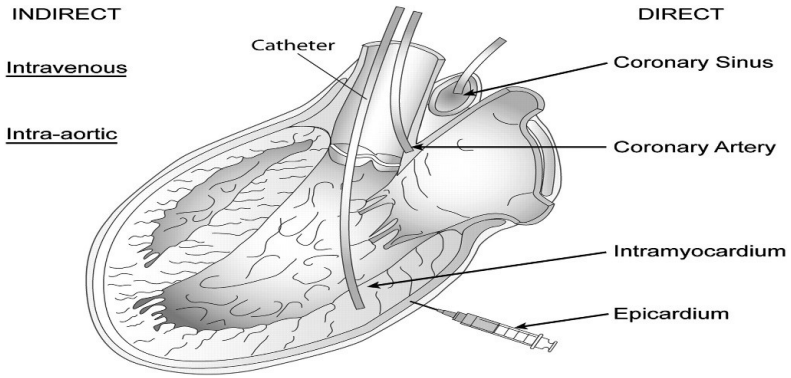
RDN

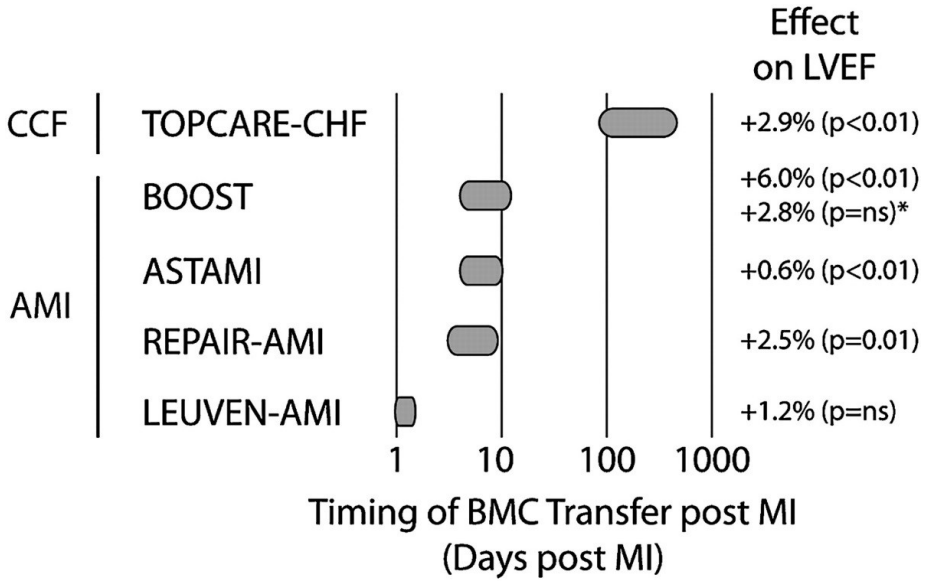


Left atrial Appendage Occlusion

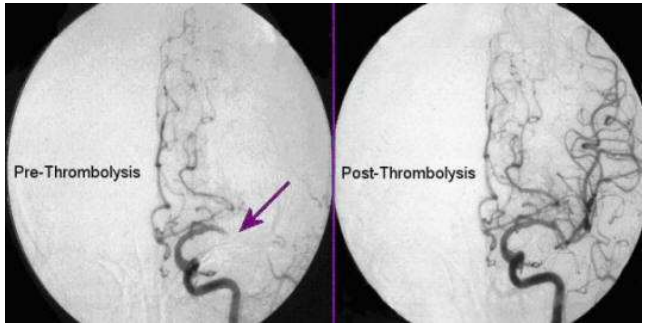
STEM CELLS
in
ISCHAEMIC CARDIOMYOPATHY

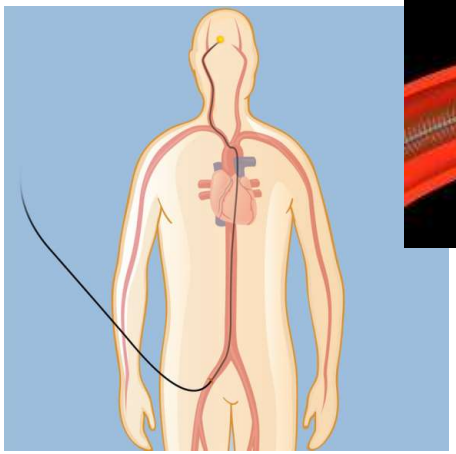
Routes for delivery of cell therapy

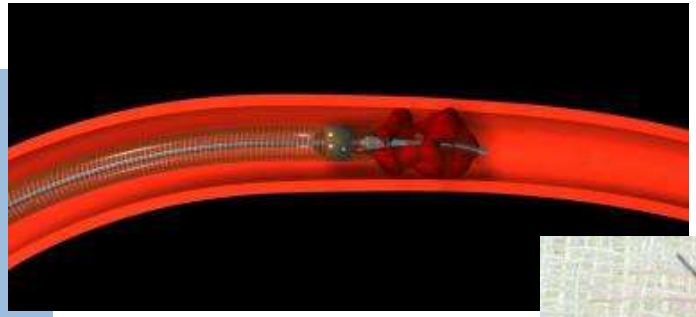


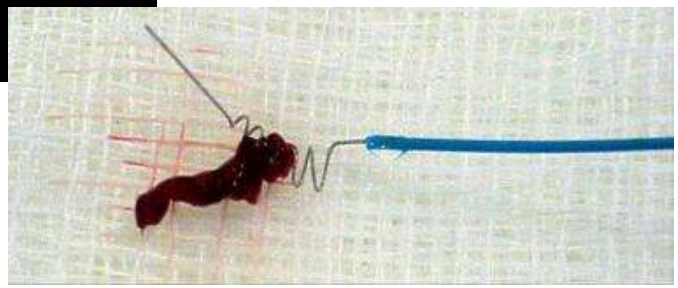


Management of Stroke









Thank you