HUMANITAS
CARDIO CENTER

HUMANITAS UNIVERSITY

Milano, 16.10.2018

Progetto Prevenzione ALDAI

COME PREVENIRE LE ISCHEMIE CARDIOVASCOLARI: STILI DI VITA, DIAGNOSTICA E TERAPIA

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Potential Conflicts of Interest

I have the following potential conflicts of interest to report:

Receipt of grants/research support:
- Boston Scientific

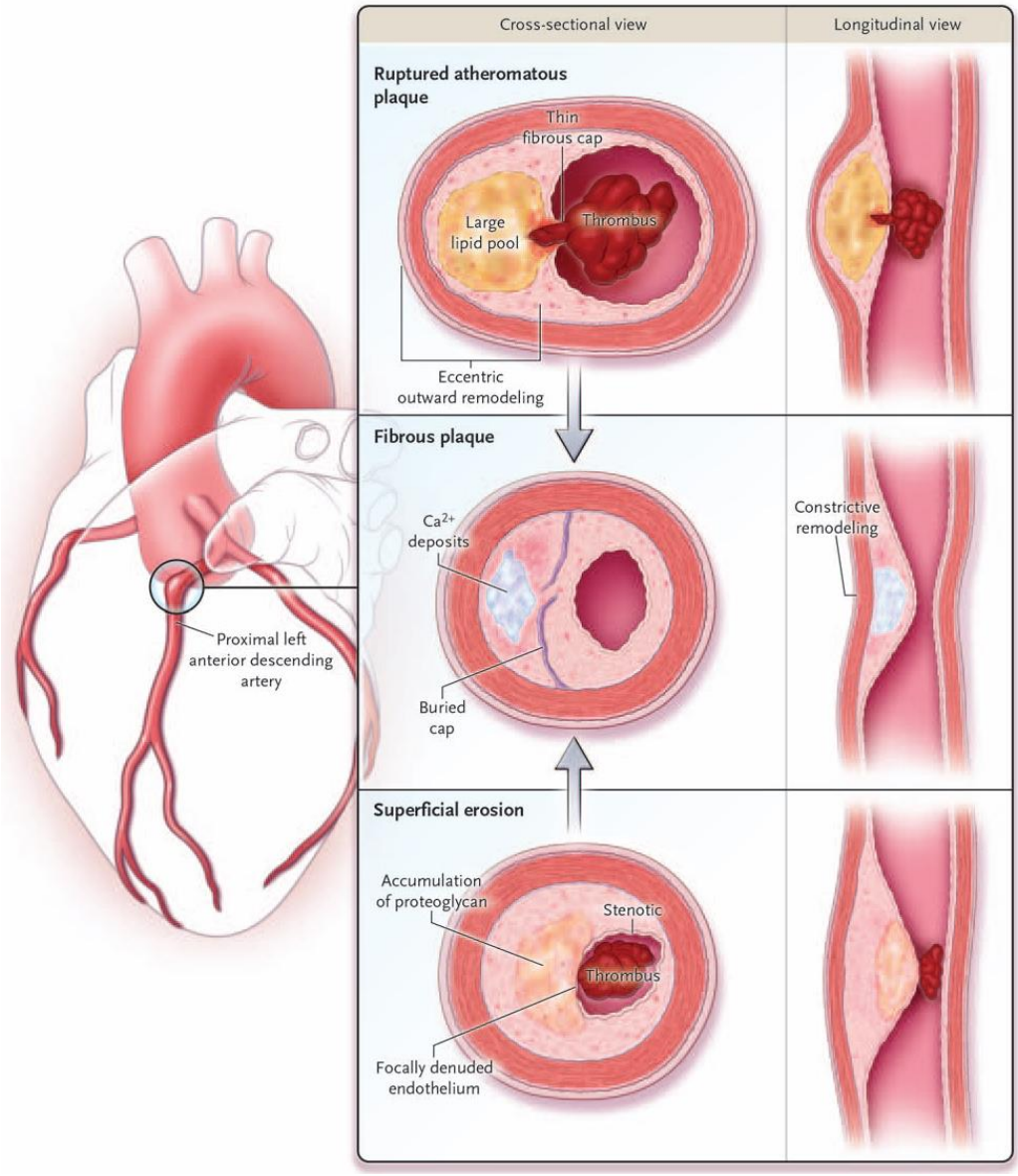
Receipt of honoraria or consultation fees:
- B.Braun, Biosensors, Boston Scientific

CORONARY ARTERY DISEASE

Libby P. *N Engl J Med* 2013;368:2004-13

Epidemiology

- **Leading cause of death** for both men and women (1 out of 4)
- **CAD is the most common** type of heart disease
- Approx. every 25 seconds an American will have a coronary event and approx. every minute someone will die of one
- CAD costs the US **$110 billion each year**

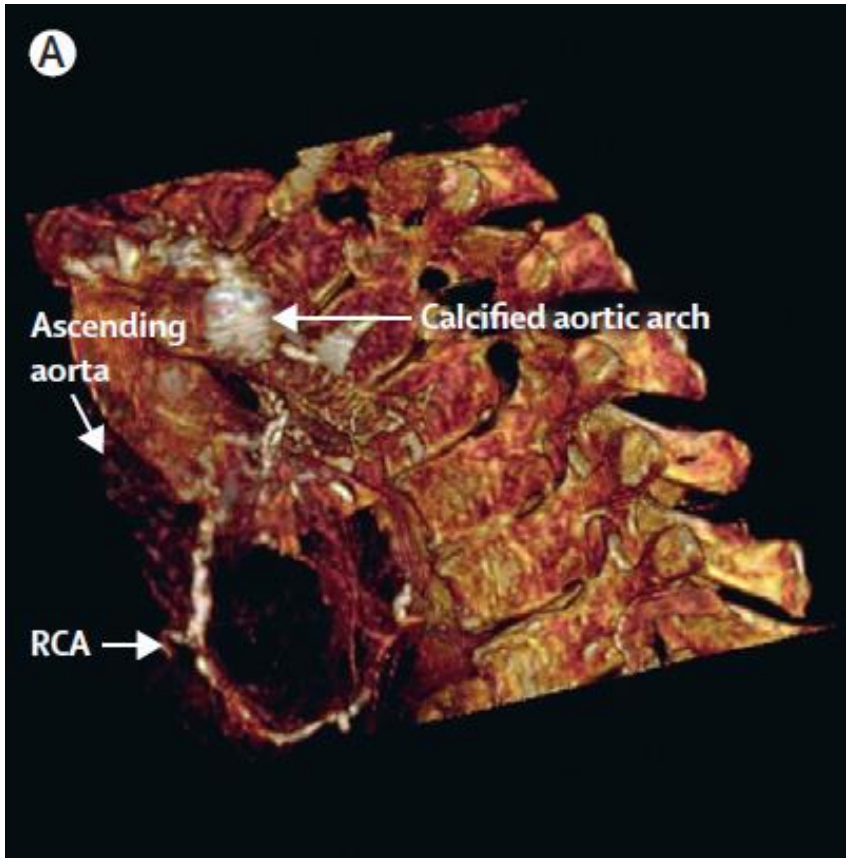


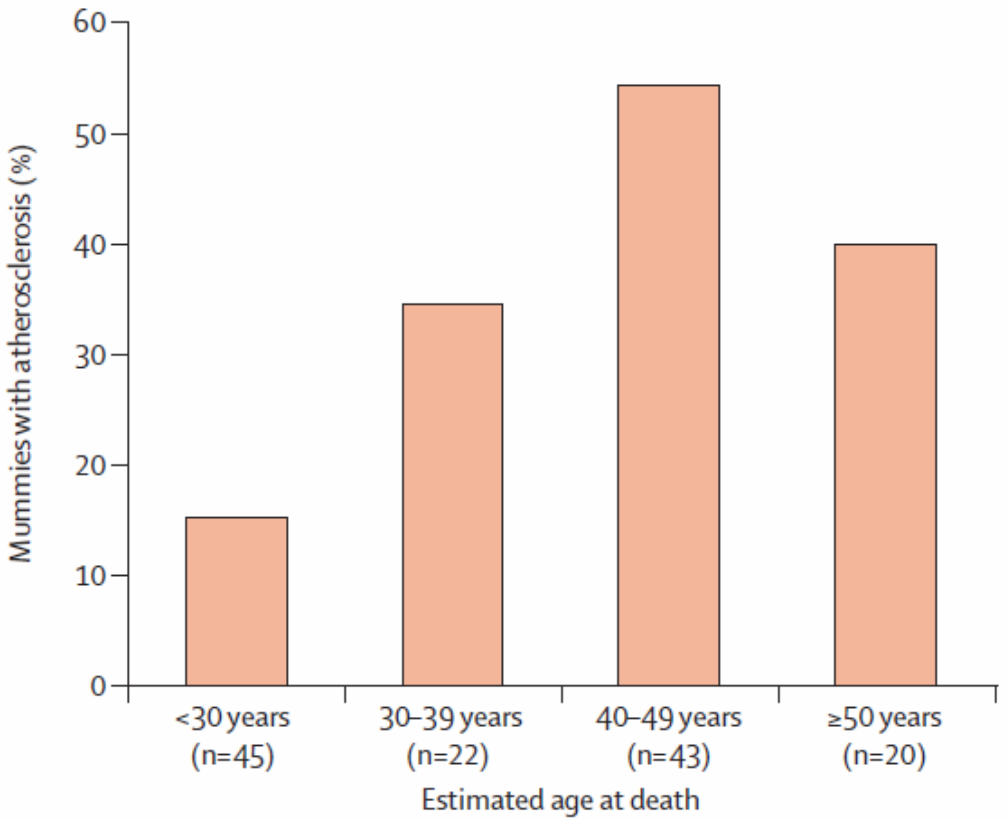
ATHEROSCLEROSIS: DEFINITION

- **Chronic disease** of the arterial wall
- Characterized by the **development of atherosclerotic plaques** in the inner lining of the arteries
- Plaques typically develop **during the course of years to decades**
- Leads to **narrowing of arteries** or complete blockage
- Key mechanisms are **endothelial dysfunction, lipid deposition, and inflammatory reaction** within the vascular wall

ATHEROSCLEROSIS IN ANCIENT CULTURES

Thompson RC et al. *Lancet* 2013

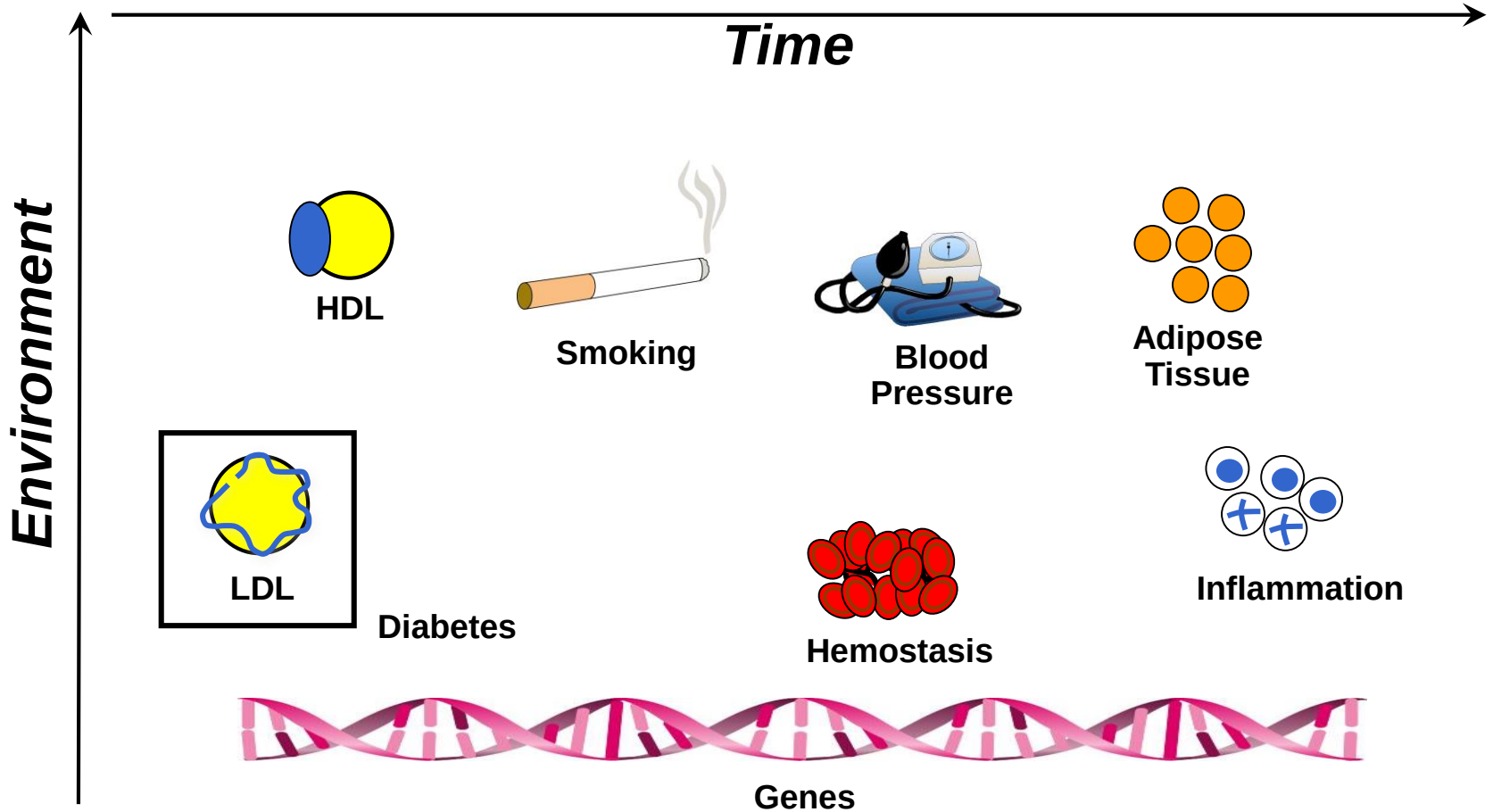




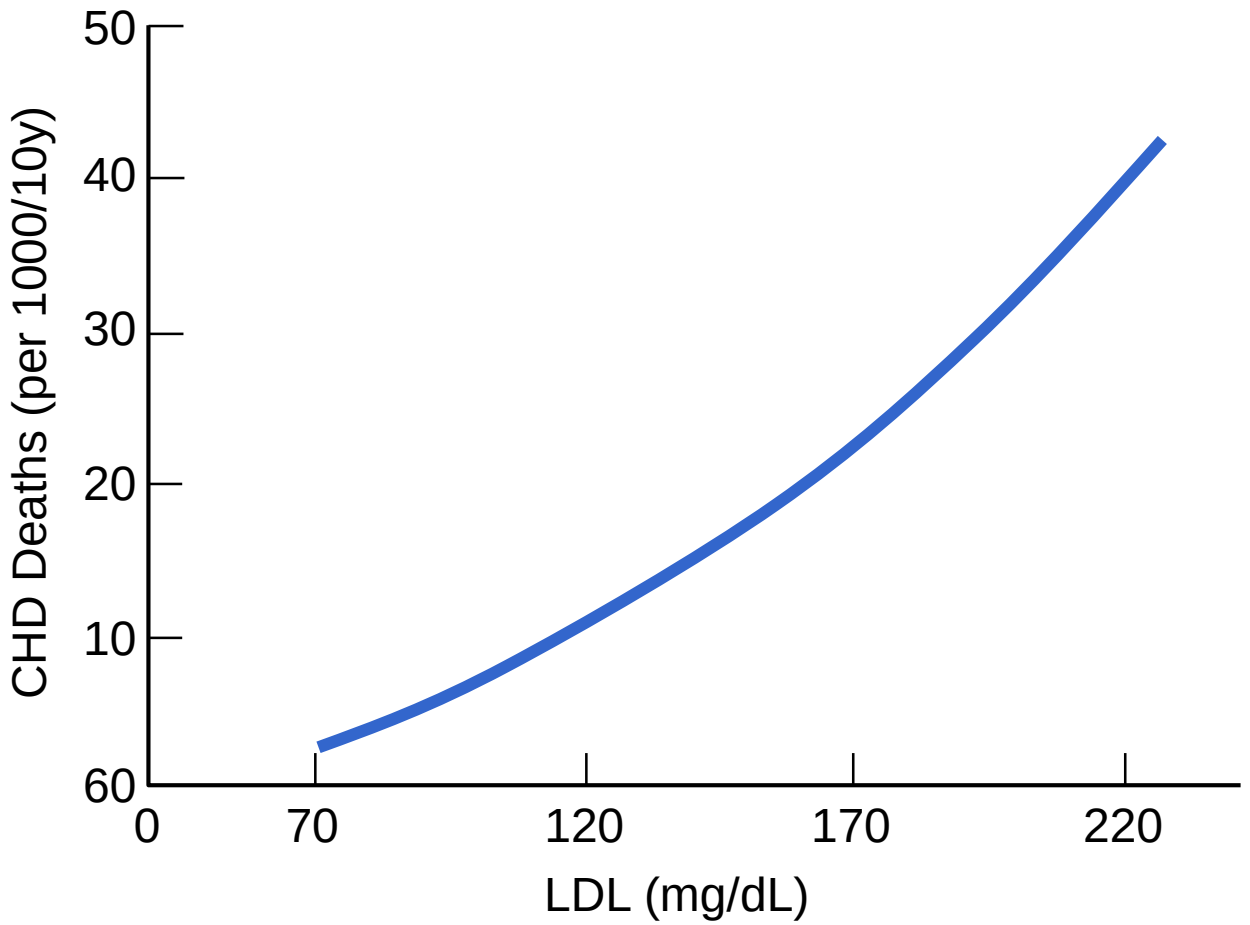
CT scans of 137 mummies spanning more than 4000 years

Individuals from ancient Egypt, ancient Peru, the Ancestral Puebloans of Southwest America, and the Unangan of the Aleutian Islands

ATHEROSCLEROSIS:
A MULTIFACTORIAL CHRONIC DISORDER

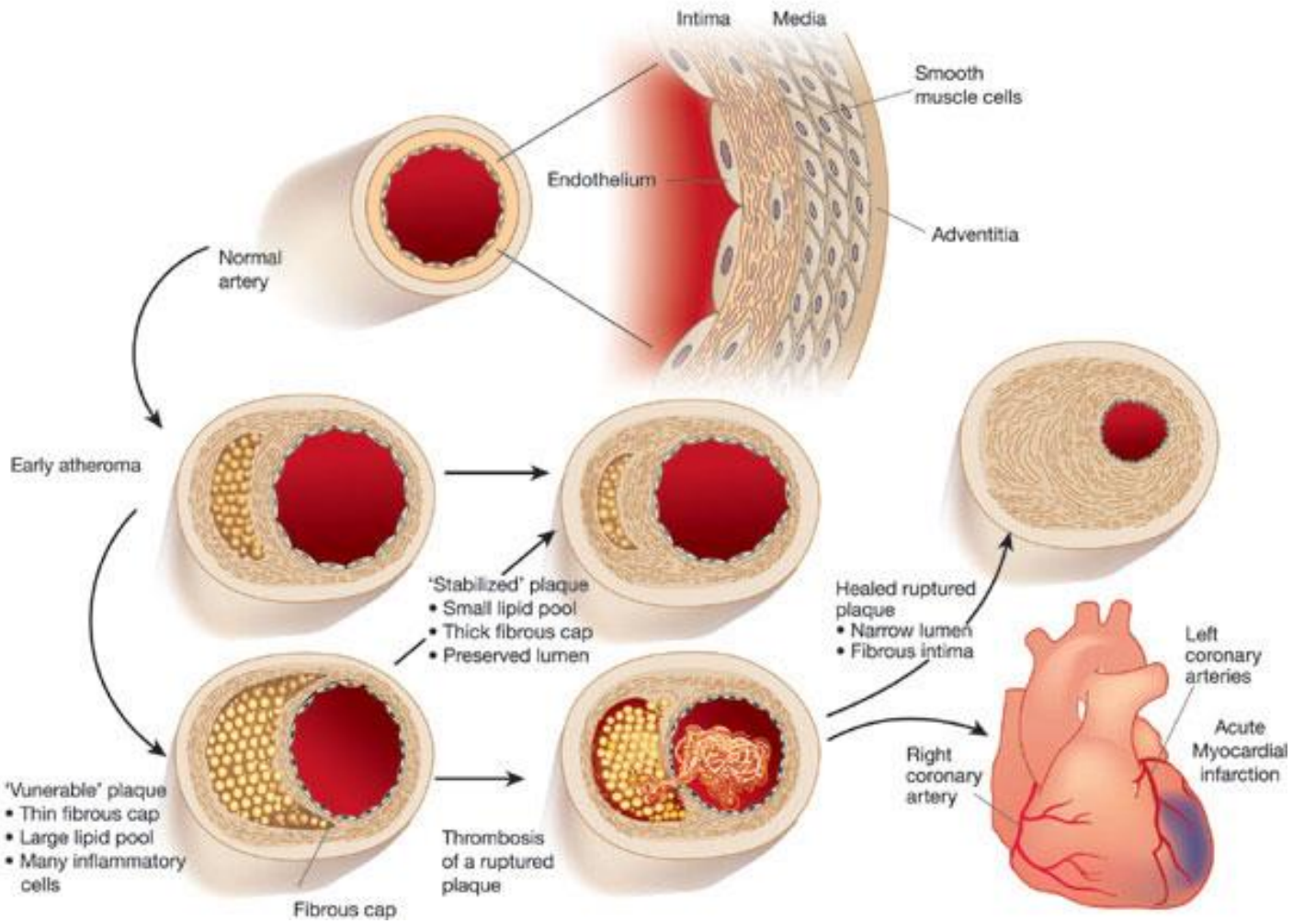


Relationship: LDL-Cholesterol & CAD Risk



Source: Helen H. Hobbs, UT Southwestern Med Center

DEVELOPMENT OF ATHEROSCLEROSIS

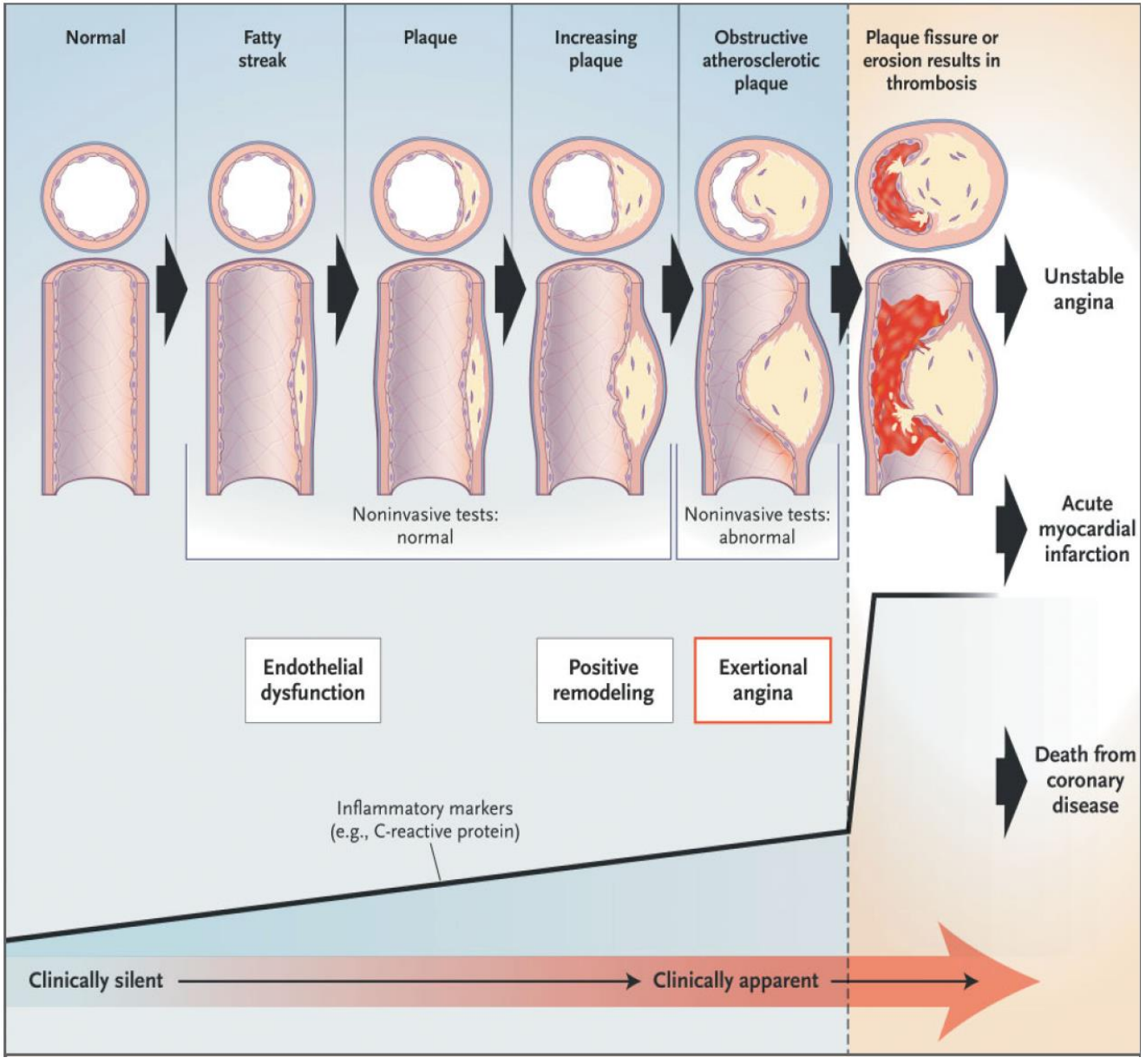


Clinical Manifestation of Atherosclerosis

- Coronary artery disease
  - Stable angina, acute myocardial infarction, sudden death, unstable angina
- Cerebrovascular disease
  - Stroke, TIAs
- Peripheral arterial disease
  - Intermittent claudication, increased risk of death from heart attack and stroke

CORONARY ARTERY DISEASE – RISK CONTINUUM

Abrams J. *N Engl J Med* 2005;352:2524-33

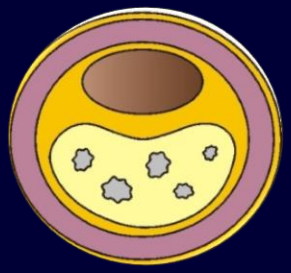


Coronary Artery Disease

Stable CAD

Silent ischemia

Stable angina



Acute Coronary Syndromes

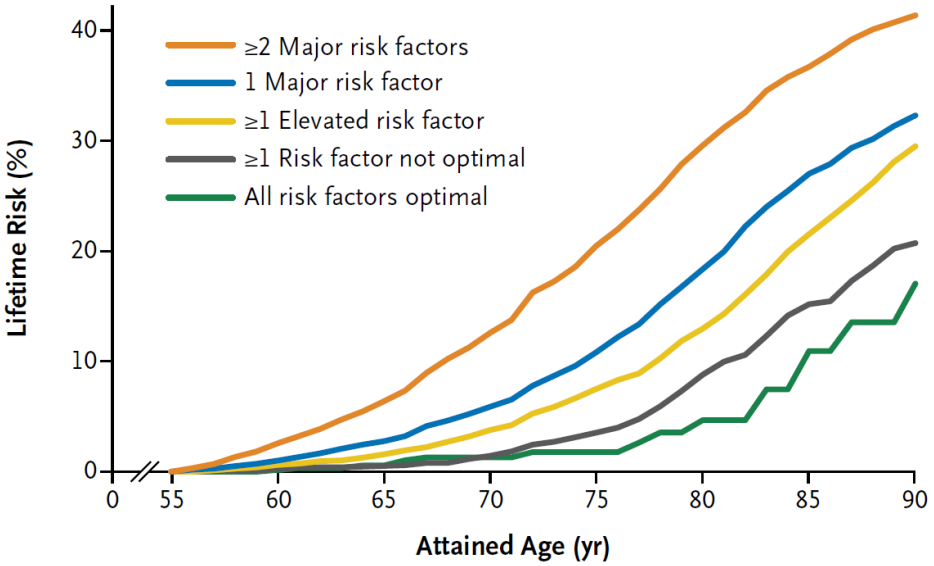
NSTE-ACS

STE-ACS

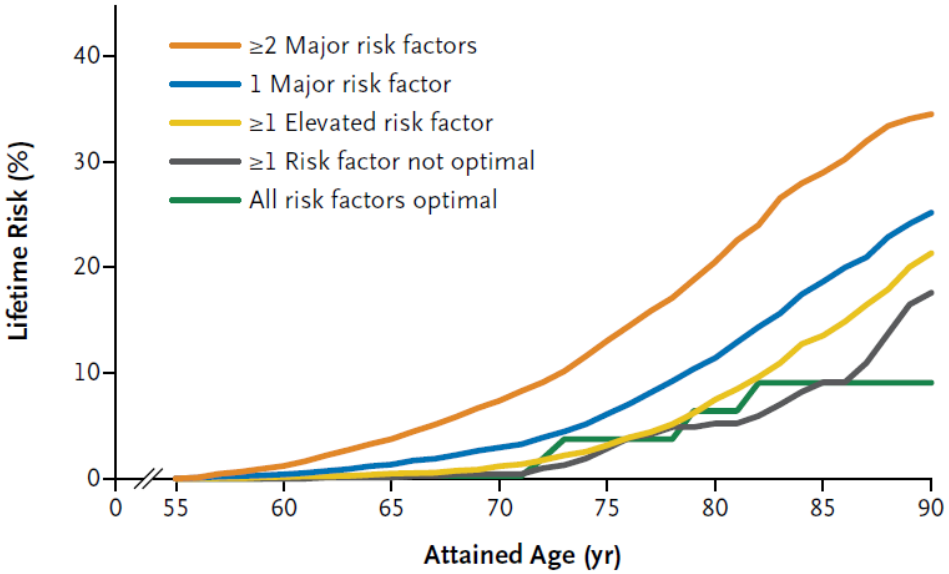
Lifetime Risk of Death from CV Disease

Berry JD et al. *N Engl J Med* 2012;366:321-9.

Men



Women



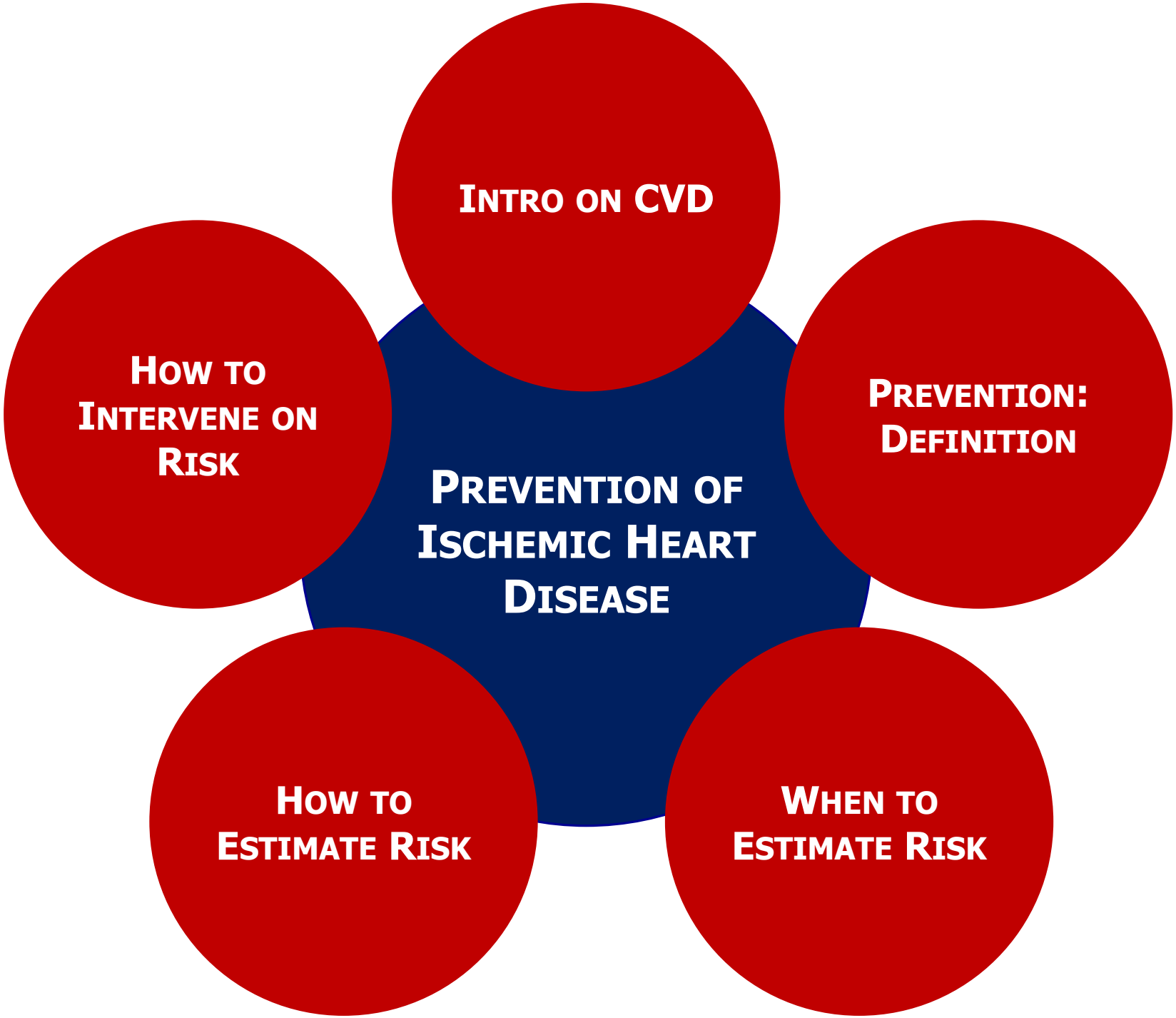
RISK FACTORS

Non-modifiable factors

- Age
- Gender
- Family history

Modifiable factors

- Smoking
- Lipids
- Blood pressure
- Diabetes
- Diet
- Body weight
- Physical activity


Intro on CVD
How to Intervene on Risk
Prevention: Definition
Prevention of Ischemic Heart Disease
How to Estimate Risk
When to Estimate Risk

PREVENTION

- Prevention is the **coordinated set of actions** aimed at eliminating or **minimizing the impact of disease** and their related disabilities

- Should be delivered at:
  - **Population** level
  - **Individual** level

- Should target patients:
  - At risk of disease (**primary prevention**)
  - With established disease (**secondary prevention**)

- Of note, **prevention is effective**: the elimination of health risk behaviours would make it possible to prevent at least 80% of CVDs and even 40% of cancers

European Heart Journal (2016) **37**, 2315–2381
doi:10.1093/eurheartj/ehw106

JOINT ESC GUIDELINES

2016 European Guidelines on cardiovascular disease prevention in clinical practice

The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts)

Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR)

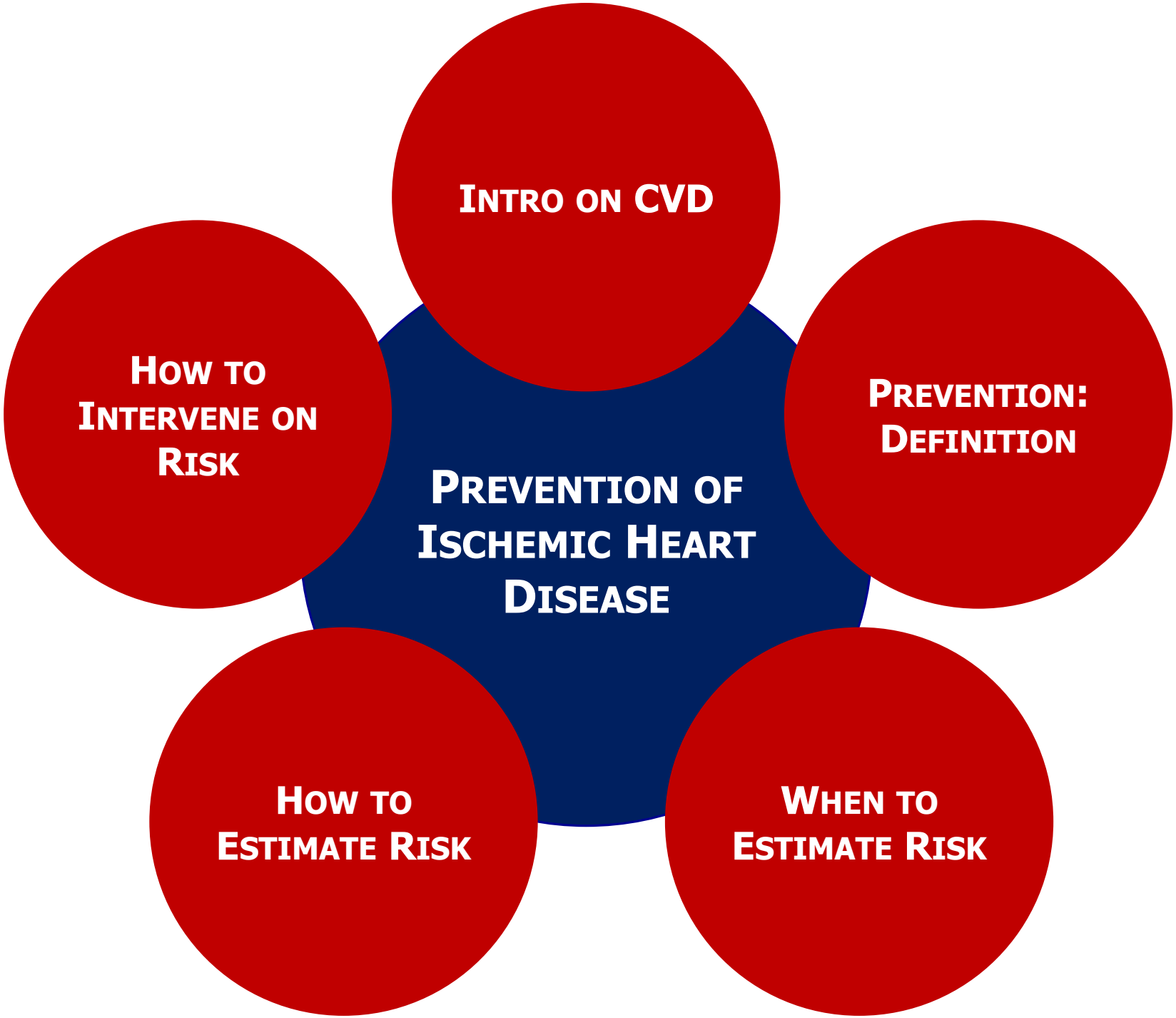
Classes of recommendations	Definition	Suggested wording to use
Class I	**Evidence and/or general agreement that a given treatment or procedure is beneficial, useful, effective.**	**Is recommended/is indicated**
Class II	**Conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of the given treatment or procedure.**	
Class IIa	***Weight of evidence/opinion is in favour of usefulness/efficacy.***	**Should be considered**
Class IIb	***Usefulness/efficacy is less well established by evidence/opinion.***	**May be considered**
Class III	**Evidence or general agreement that the given treatment or procedure is not useful/effective, and in some cases may be harmful.**	**Is not recommended**

Cost-Effectiveness of Prevention

- Prevention of CVD, either by implementation of lifestyle changes or use of medication, **is cost-effective** in many scenarios, including population-based approaches and actions directed at high-risk individuals

- Cost-effectiveness **depends on several factors**, including baseline CV risk, cost of drugs or other interventions, reimbursement procedures and implementation of preventive strategies

Recommendation	Class[a]	Level[b]
Measures aimed at promoting healthy lifestyles at the population level should be considered.	IIa	B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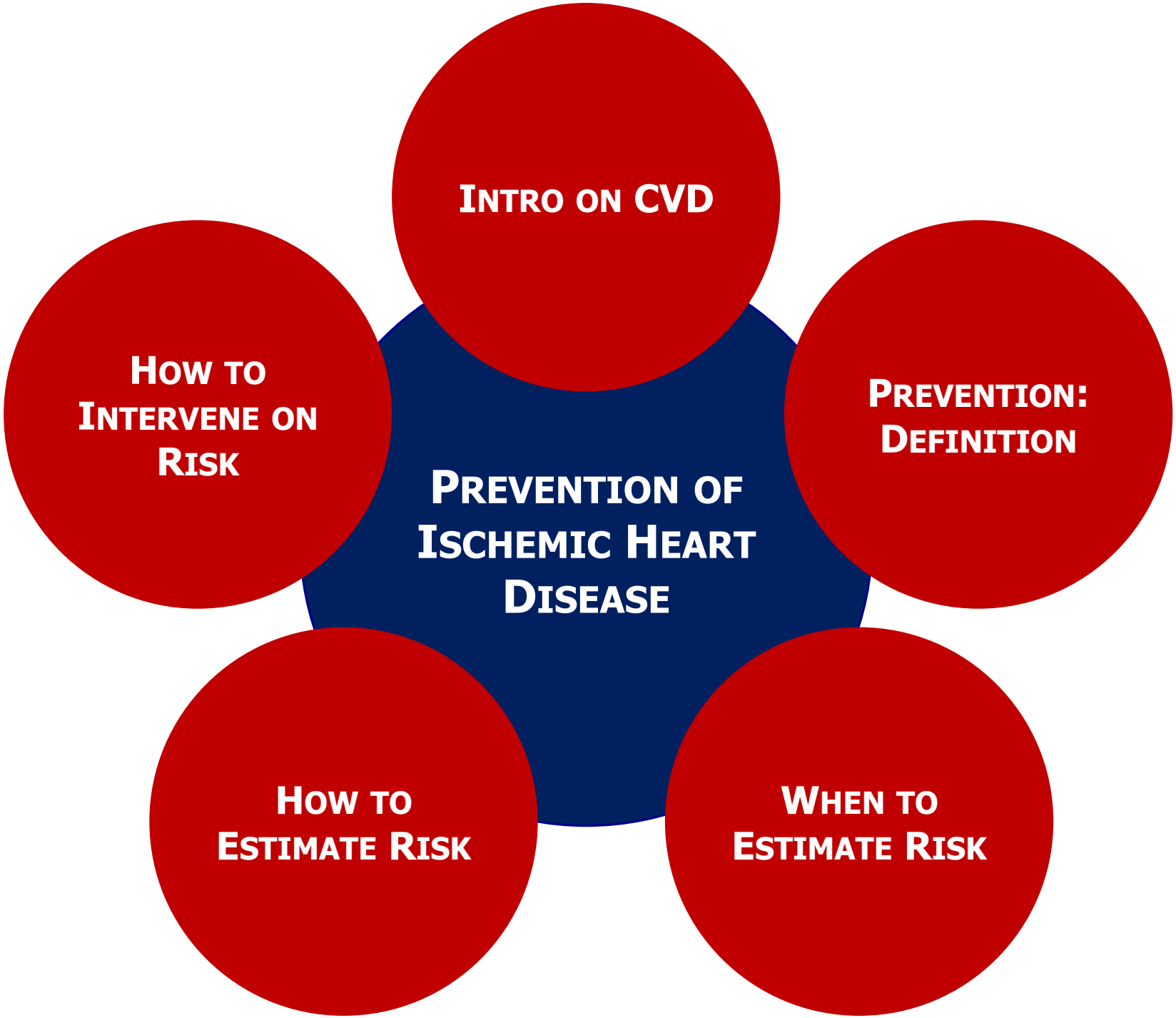
When to Estimate CV Risk ?

Recommendations	Class[a]	Level[b]
Systematic CV risk assessment is recommended in individuals at increased CV risk, i.e. with family history of premature CVD, familial hyperlipidaemia, major CV risk factors (such as smoking, high BP, DM or raised lipid levels) or comorbidities increasing CV risk.	I	C
It is recommended to repeat CV risk assessment every 5 years, and more often for individuals with risks close to thresholds mandating treatment.	I	C
Systematic CV risk assessment may be considered in men >40 years of age and in women >50 years of age or post-menopausal with no known CV risk factors.	IIb	C
Systematic CV risk assessment in men <40 of age and women <50 years of age with no known CV risk factors is not recommended.	III	C

YOUNG SUBJECTS (<50 YEAR-OLD)

- Some people <50 years of age have high relative or lifetime CV risk and should be offered lifestyle advice as a minimum
- Some younger people will have high single CV risk factors that, of themselves, warrant intervention, such as cholesterol levels >8 mmol/L or BP ≥180/110 mmHg
- The most important group of people, 50 years of age to identify are those with a family history of premature CVD, who should be tested for FH and treated accordingly
- Several obstetric complications (pre-eclampsia and pregnancy-related hypertension) are associated with a higher risk of CVD later in life. This higher risk is explained, at least partly, by hypertension and DM.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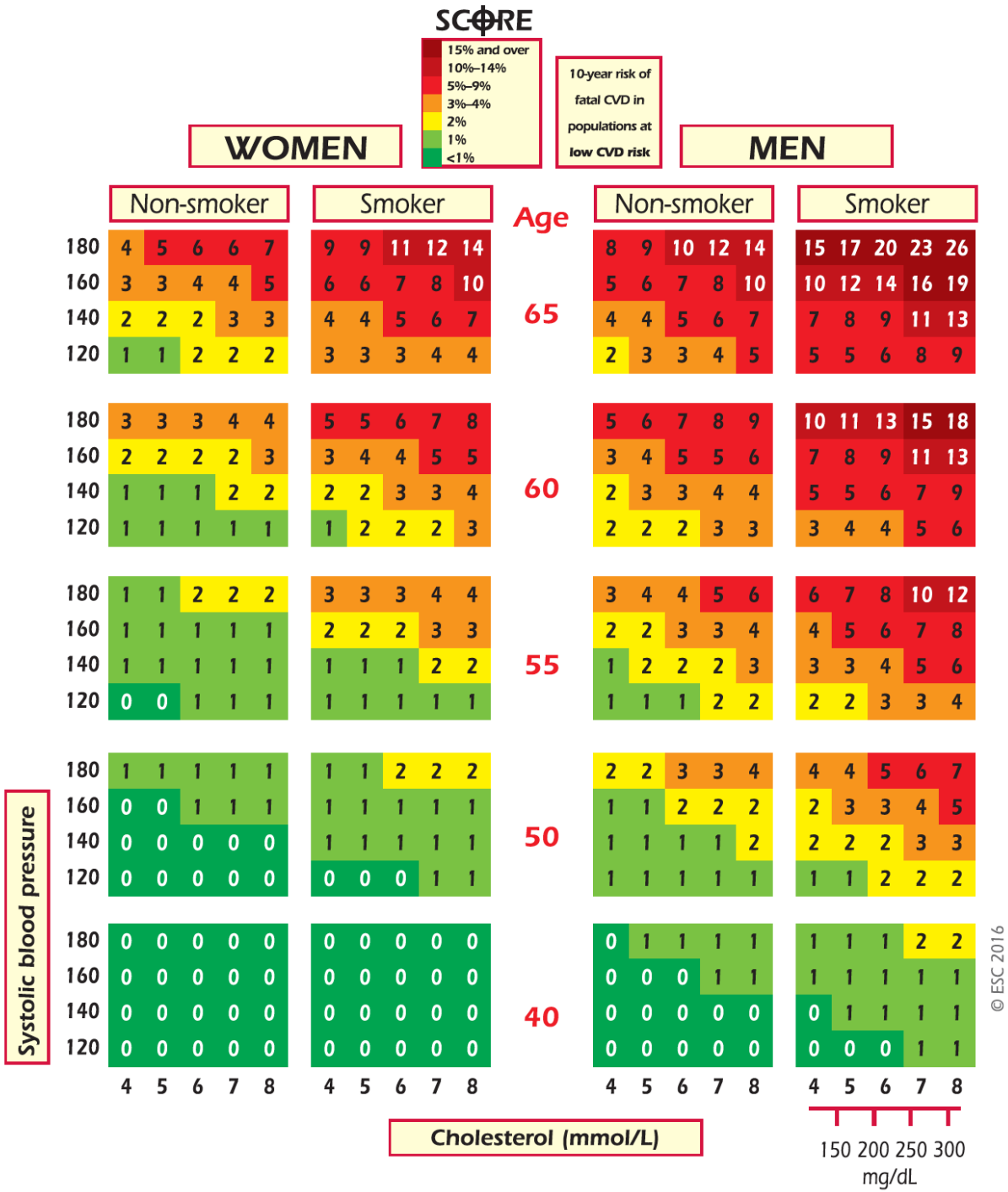
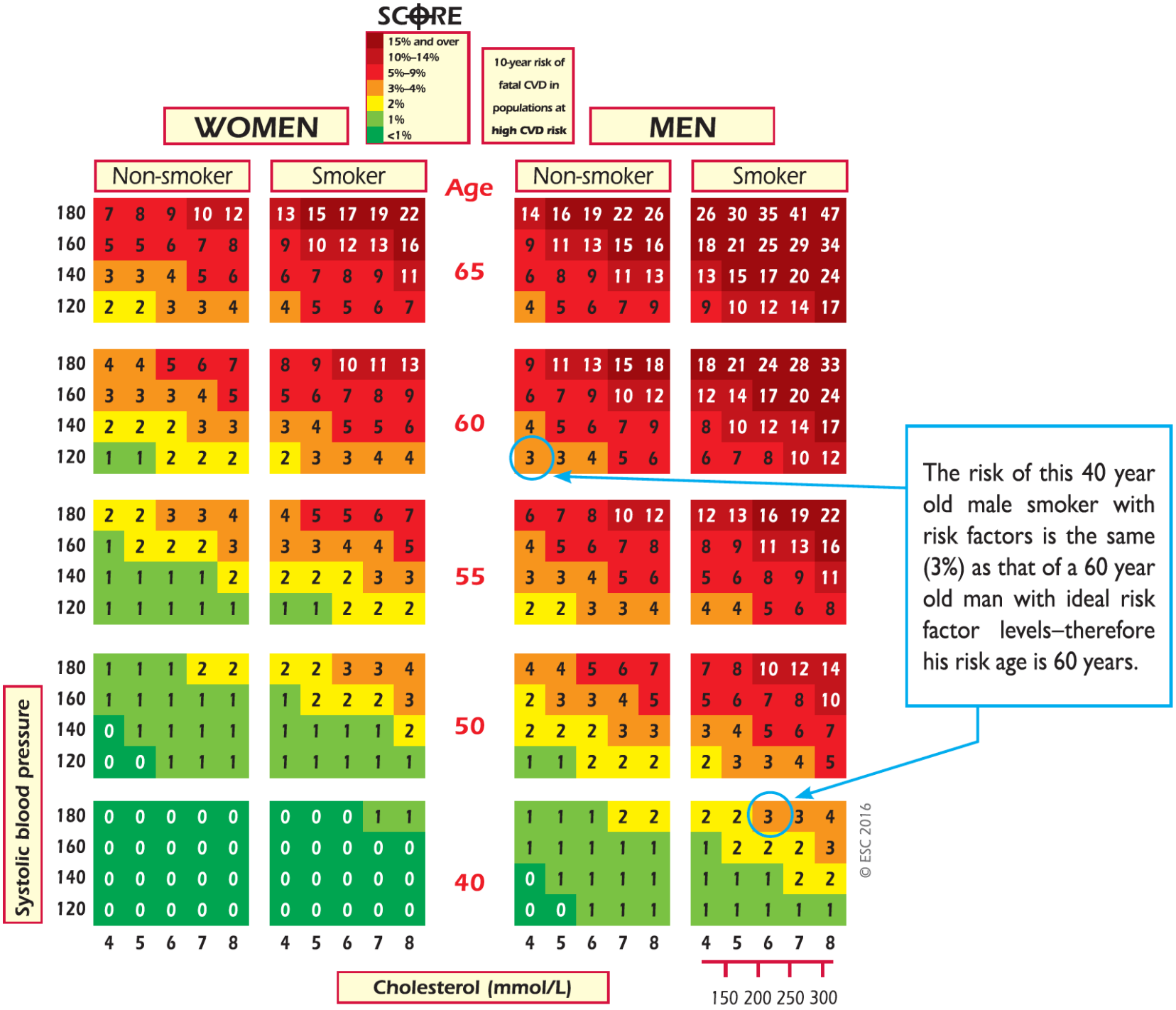
How to Estimate Total CV Risk

- In apparently healthy persons, CV risk in general is the result of **multiple, interacting risk factors**. This is the basis for the total CV risk approach
- **SCORE**, which estimates the 10 year risk of fatal CVD, is recommended for risk assessment
- Individuals automatically at **high to very high CV risk** do not need the use of a risk score and require immediate attention to risk factors
- In **younger persons**, a low absolute risk may conceal a very high relative risk and use of the relative risk chart or calculation of their "risk age" may help in advising them of the need for intensive preventive efforts
- While **women** are at lower CV risk than men, their risk is deferred by 10 years rather than avoided
- The **total risk approach allows flexibility**; if perfection cannot be achieved with one risk factor, trying harder with others can still reduce risk


SCORE
15% and over
10%–14%
5%–9%
3%–4%
2%
1%
<1%
10-year risk of fatal CVD in populations at low CVD risk
WOMEN
MEN
Non-smoker
Smoker
Non-smoker
Smoker
Age
65
60
55
50
40
Systolic blood pressure
180 160 140 120
4 5 6 7 8
Cholesterol (mmol/L)
150 200 250 300
mg/dL
© ESC 2016

CV Risk Categories According to SCORE

Very high-risk	Subjects with any of the following: • Documented CVD, clinical or unequivocal on imaging. Documented clinical CVD includes previous AMI, ACS, coronary revascularization and other arterial revascularization procedures, stroke and TIA, aortic aneurysm and PAD. Unequivocally documented CVD on imaging includes significant plaque on coronary angiography or carotid ultrasound. It does NOT include some increase in continuous imaging parameters such as intima–media thickness of the carotid artery. • DM with target organ damage such as proteinuria or with a major risk factor such as smoking or marked hypercholesterolaemia or marked hypertension. • Severe CKD (GFR <30 mL/min/1.73 m2). • A calculated SCORE ≥10%.
High-risk	Subjects with: • Markedly elevated single risk factors, in particular cholesterol >8 mmol/L (>310 mg/dL) (e.g. in familial hypercholesterolaemia) or BP ≥180/110 mmHg. • Most other people with DM (with the exception of young people with type 1 DM and without major risk factors that may be at low or moderate risk). • Moderate CKD (GFR 30–59 mL/min/1.73 m^2). • A calculated SCORE ≥5% and <10%.
Moderate-risk	SCORE is ≥1% and <5% at 10 years. Many middle-aged subjects belong to this category.
Low-risk	SCORE <1%.


SCORE
15% and over
10%–14%
5%–9%
3%–4%
2%
1%
<1%
10-year risk of fatal CVD in populations at high CVD risk
WOMEN
MEN
Non-smoker
Smoker
Non-smoker
Smoker
Age
65
60
55
50
40
180 7 8 9 10 12 13 15 17 19 22 14 16 19 22 26 26 30 35 41 47
160 5 5 6 7 8 9 10 12 13 16 9 11 13 15 16 18 21 25 29 34
140 3 3 4 5 6 6 7 8 9 11 6 8 9 11 13 13 15 17 20 24
120 2 2 3 3 4 4 5 5 6 7 4 5 6 7 9 9 10 12 14 17
180 4 4 5 6 7 8 9 10 11 13 9 11 13 15 18 18 21 24 28 33
160 3 3 3 4 5 5 6 7 8 9 6 7 9 10 12 12 14 17 20 24
140 2 2 2 3 3 3 4 5 5 6 4 5 6 7 9 8 10 12 14 17
120 1 1 2 2 2 2 3 3 4 4 3 3 4 5 6 6 7 8 10 12
180 2 2 3 3 4 4 5 5 6 7 6 7 8 10 12 12 13 16 19 22
160 1 2 2 2 3 3 3 4 4 5 4 5 6 7 8 8 9 11 13 16
140 1 1 1 1 2 2 2 2 3 3 3 3 4 5 6 5 6 8 9 11
120 1 1 1 1 1 1 1 2 2 2 2 2 3 3 4 4 4 5 6 8
180 1 1 1 2 2 2 2 3 3 4 4 4 5 6 7 7 8 10 12 14
160 1 1 1 1 1 1 2 2 2 3 2 3 3 4 5 5 6 7 8 10
140 0 1 1 1 1 1 1 1 1 2 2 2 2 3 3 3 4 5 6 7
120 0 0 1 1 1 1 1 1 1 1 1 1 2 2 2 2 3 3 4 5
180 0 0 0 0 0 0 0 0 1 1 1 1 1 2 2 2 2 3 3 4
160 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 2 2 2 3
140 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 2 2
120 0 0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 1 1 1
4 5 6 7 8 4 5 6 7 8 4 5 6 7 8 4 5 6 7 8
Systolic blood pressure
Cholesterol (mmol/L)
150 200 250 300
The risk of this 40 year old male smoker with risk factors is the same (3%) as that of a 60 year old man with ideal risk factor levels–therefore his risk age is 60 years.
© ESC 2016

Risk Factors Control Goals & Target Levels

Smoking	No exposure to tobacco in any form.
Diet	Low in saturated fat with a focus on wholegrain products, vegetables, fruit and fish.
Physical activity	At least 150 minutes a week of moderate aerobic PA (30 minutes for 5 days/week) or 75 minutes a week of vigorous aerobic PA (15 minutes for 5 days/week) or a combination thereof.
Body weight	BMI 20–25 kg/m^2. Waist circumference <94 cm (men) or <80 cm (women).
Blood pressure	<140/90 mmHg[a]
Lipids[b] LDL[c] is the primary target	**Very high-risk: <1.8 mmol/L (<70 mg/dL),** or a reduction of at least 50% if the baseline is between 1.8 and 3.5 mmol/L (70 and 135 mg/dL)[d] **High-risk: <2.6mmol/L (<100 mg/dL)**, or a reduction of at least 50% if the baseline is between 2.6 and 5.1 mmol/L (100 and 200 mg/dL) **Low to moderate risk: <3.0 mmol/L (<115 mg/dL).**
HDL-C	No target but >1.0 mmol/L (>40mg/dL) in men and >1.2 mmol/L (>45 mg/dL) in women indicate lower risk.
Triglycerides	No target but <1.7 mmol/L (<150 mg/dL) indicates lower risk and higher levels indicate a need to look for other risk factors.
Diabetes	HbA1c <7%. (<53 mmol/mol)

Family History of CVD

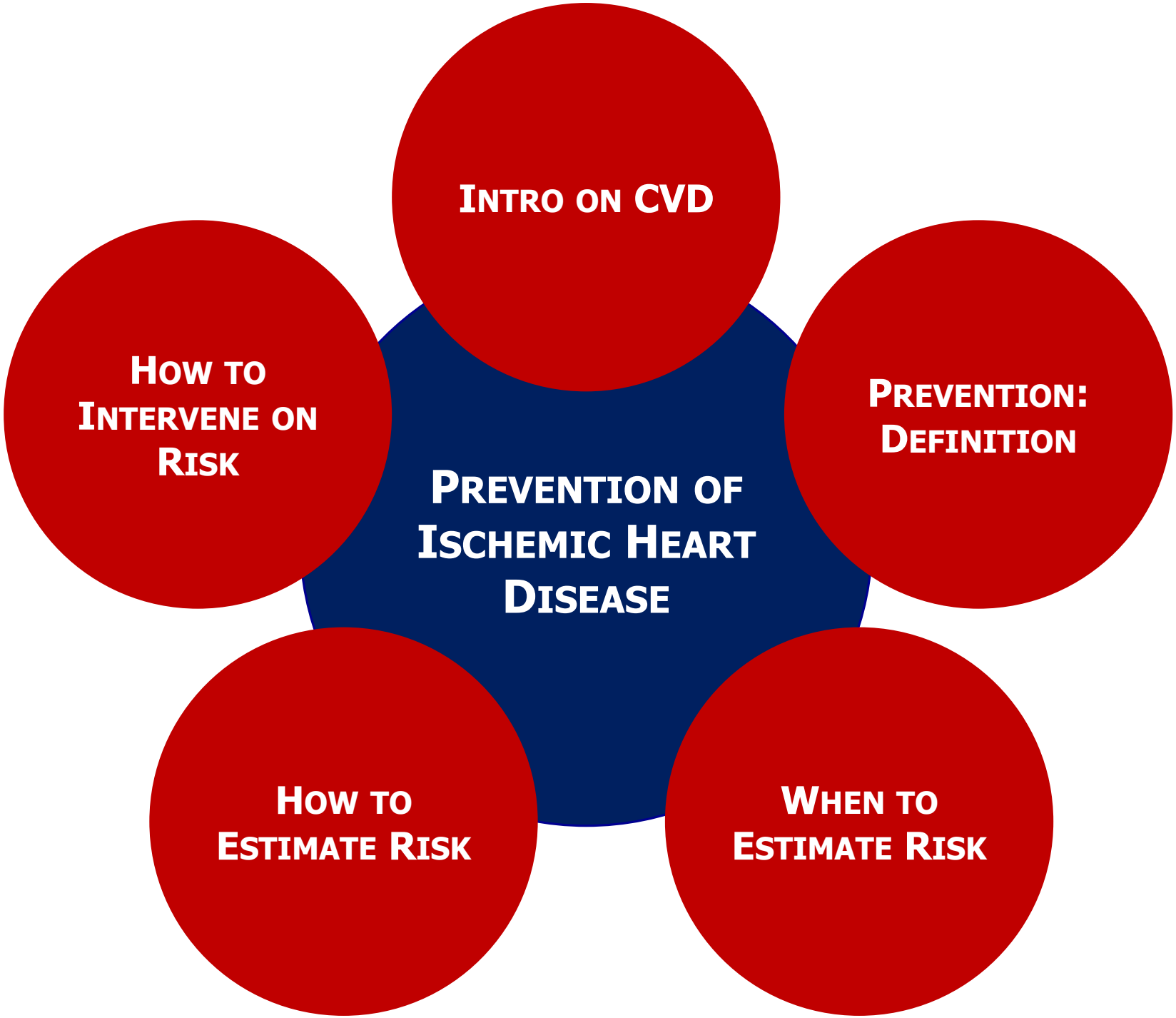
- Family history of premature CVD in first-degree relatives, before 55 years of age in men and 65 years of age in women, increases the risk of CVD
- Several genetic markers are associated with an increased risk of CVD, but their use in clinical practice is not recommended

Psychosocial Risk Factors

- Low socio-economic status, lack of social support, stress at work and in family life, hostility, depression, anxiety and other mental disorders contribute to the risk of developing CVD and a worse prognosis of CVD
- Absence of these items being associated with a lower risk of developing CVD and a better prognosis of CVD
- Psychosocial risk factors act as barriers to treatment adherence and efforts to improve lifestyle, as well as to promoting health in patients and populations

Assessment of Psychosocial Risk Factors

Low socio-economic status	• What is your highest educational degree? • Are you a manual worker?
Work and family stress	• Do you lack control over how to meet the demands at work? • Is your reward inappropriate for your effort? • Do you have serious problems with your spouse?
Social isolation	• Are you living alone? • Do you lack a close confidant? • Have you lost an important relative or friend over the last year?
Depression	• Do you feel down, depressed and hopeless? • Have you lost interest and pleasure in life?
Anxiety	• Do you suddenly feel fear or panic? • Are you frequently unable to stop or control worrying?
Hostility	• Do you frequently feel angry over little things? • Do you often feel annoyed about other people's habits?
Type D personality	• In general, do you often feel anxious, irritable, or depressed? • Do you avoid sharing your thoughts and feelings with other people?
Post-traumatic stress disorder	• Have you been exposed to a traumatic event? • Do you suffer from nightmares or intrusive thoughts?
Other mental disorders	• Do you suffer from any other mental disorder?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How to Intervene on CVD Risk

1. Individual level

a) Risk-factor interventions

b) Disease-specific interventions

2. Population level

Behavioral Changes

Principles of Effective Communication

- Spend enough time with the individual to create a therapeutic relationship – even a few more minutes can make a difference.
- Acknowledge the individual's personal view of his/her disease and contributing factors.
- Encourage expression of worries and anxieties, concerns and self-evaluation of motivation for behaviour change and chances of success.
- Speak to the individual in his/her own language and be supportive of every improvement in lifestyle.
- Ask questions to check that the individual has understood the advice and has any support he or she requires to follow it.
- Acknowledge that changing life-long habits can be difficult and that sustained gradual change is often more permanent than a rapid change.
- Accept that individuals may need support for a long time and that repeated efforts to encourage and maintain lifestyle change may be necessary in many individuals.
- Make sure that all health professionals involved provide consistent information.

10 Steps to Facilitate Behavioral Changes

1. Develop a therapeutic alliance.
2. Counsel all individuals at risk of or with manifest cardiovascular disease.
3. Assist individuals to understand the relationship between their behaviour and health.
4. Help individuals assess the barriers to behaviour change.
5. Gain commitments from individuals to own their behaviour change.
6. Involve individuals in identifying and selecting the risk factors to change.
7. Use a combination of strategies including reinforcement of the individual's capacity for change.
8. Design a lifestyle-modification plan.
9. Involve other healthcare staff whenever possible.
10. Monitor progress through follow-up contact.

LIFETIME RISK CALCULATOR: JBS3 WEB-BASED TOOL

An educational tool in terms of how changing risk factors might change the lifetime risk score as well as illustrate long-term CVD risk

Profile

Day / Month / Year

Date of Birth: 15 / 10 / 1968

Gender: (•) male ( ) female

Ethnic group: White or not stated

Height (m): 1.80 (5' 11" (71.0")) Weight (kg): 82.0 (12st 13 (181 lb)) BMI: 25.3

Townsend quintile (3 if unknown): 3: Average

Do you smoke? I smoke less than 10/day

Total Cholesterol: 220 mmol/L

HDL Cholesterol: 46

NonHDL Cholesterol: 174

Systolic Blood Pressure: 130 mm Hg

- [ ] Have you received blood pressure treatment?
- [ ] Do you suffer from diabetes?
- [ ] Does a close relative under 60 suffer from CVD?
- [ ] Do you have a chronic kidney disease?
- [ ] Have you suffered atrial fibrillation?
- [ ] Do you have rheumatoid arthritis?

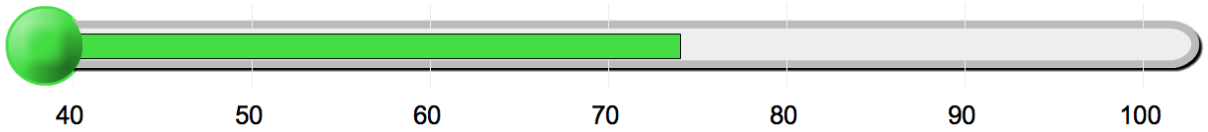
- [x] I have never suffered from Cardiovascular Disease
- [x] I have read the terms and conditions

Save | Load | Next

LIFETIME RISK CALCULATOR: JBS3 WEB-BASED TOOL

An educational tool in terms of how changing risk factors might change the lifetime risk score as well as illustrate long-term CVD risk

On average, expect
to survive to age 74
without a heart attack or stroke



expected life without a heart attack or stroke

Your risk of a heart attack or stroke
in the next 10 years is

2.0%

assuming you don't die of anything else

Interventions

Future smoking category

less than 10/day

Systolic Blood Pressure

130 → 130

Total Cholesterol

200 → 200

HDL Cholesterol

45 → 45

NonHDL Cholesterol: 155

BMI: 24.7

Reset

PSYCHOSOCIAL RISK FACTORS

Recommendations	Class	Level
Multimodal behavioural interventions, integrating health education, physical exercise and psychological therapy, for psychosocial risk factors and coping with illness are recommended in patients with established CVD and psychosocial symptoms in order to improve psychosocial health.	I	A
Referral for psychotherapy, medication or collaborative care should be considered in the case of clinically significant symptoms of depression, anxiety or hostility.	IIa	A
Treatment of psychosocial risk factors with the aim of preventing CAD should be considered when the risk factor itself is a diagnosable disorder (e.g. depression) or when the factor worsens classical risk factors.	IIa	B

PHYSICAL ACTIVITY

Recommendations	Class	Level
It is recommended for healthy adults of all ages to perform at least 150 minutes a week of moderate intensity or 75 minutes a week of vigorous intensity aerobic PA or an equivalent combination thereof.	I	A
For additional benefits in healthy adults, a gradual increase in aerobic PA to 300 minutes a week of moderate intensity, or 150 minutes a week of vigorous intensity aerobic PA, or an equivalent combination thereof is recommended.	I	A
Regular assessment and counselling on PA is recommended to promote the engagement and, if necessary, to support an increase in PA volume over time.	I	B
PA is recommended in low-risk individuals without further assessment.	I	C
Multiple sessions of PA should be considered, each lasting ≥10 minutes and evenly spread throughout the week, i.e. on 4–5 days a week and preferably every day of the week.	IIa	B
Clinical evaluation, including exercise testing, should be considered for sedentary people with CV risk factors who intend to engage in vigorous PAs or sports.	IIa	C

Classification of Physical Activity Intensity

Absolute intensity			Relative intensity		
Intensity	**MET**	**Examples**	**%HR max**	**RPE (Borg scale score)**	**Talk Test**
Light	1.1-2.9	Walking <4.7 km/h, light household work.	50-63	10-11	
Moderate	3-5.9	Walking briskly (4.8–6.5 km/h), slow cycling (15 km/h), painting/decorating, vacuuming, gardening (mowing lawn), golf (pulling clubs in trolley), tennis (doubles), ballroom dancing, water aerobics.	64-76	12-13	Breathing is faster but compatible with speaking full sentences.
Vigorous	≥6	Race-walking, jogging or running, bicycling >15 km/h, heavy gardening (continuous digging or hoeing), swimming laps, tennis (single).	77-93	14-16	Breathing very hard, incompatible with carrying on a conversation comfortably.

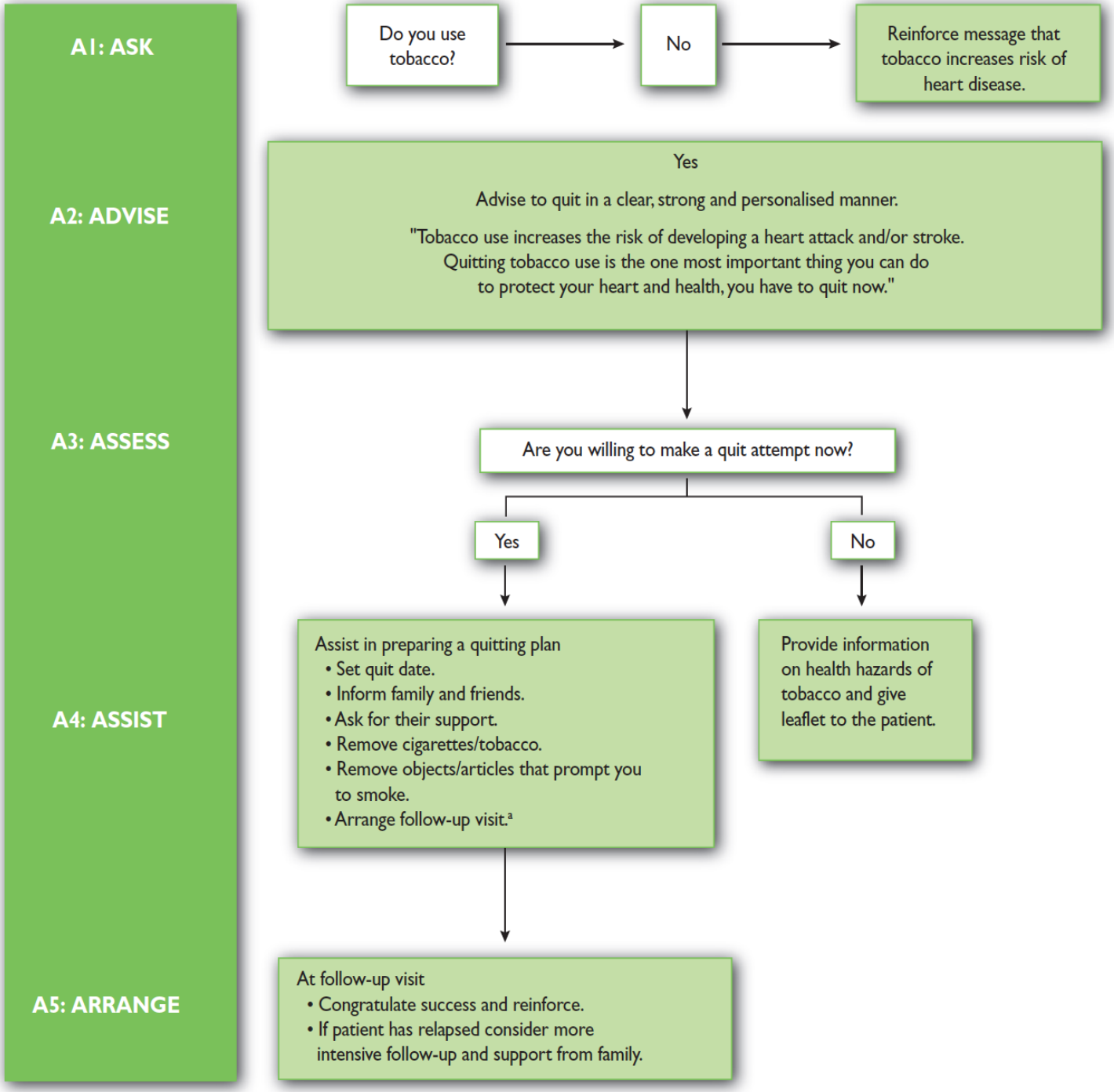
SMOKING INTERVENTIONS STRATEGIES

Recommendations	Class	Level
It is recommended to identify smokers and provide repeated advice on stopping with offers to help, by the use of follow up support, nicotine replacement therapies, varenicline, and bupropion individually or in combination.	I	A
It is recommended to stop all smoking of tobacco or herbal products, as this is strongly and independently causal of CVD.	I	B
It is recommended to avoid passive smoking.	I	B

Five "A" For Smoking Intervention Strategies

A–ASK:	Systematically inquire about smoking status at every opportunity.
A–ADVISE:	Unequivocally urge all smokers to quit.
A–ASSESS:	Determine the person's degree of addiction and readiness to quit.
A–ASSIST:	Agree on a smoking cessation strategy, including setting a quit date, behavioural counselling, and pharmacological support.
A–ARRANGE:	Arrange a schedule of follow-up.

SMOKING CESSATION ALGORITHM



Favoring Healthy Diet

Recommendations	Class	Level
A healthy diet is recommended as a cornerstone of CVD prevention in all individuals.	I	B

CHARACTERISTICS OF A HEALTHY DIET

• Saturated fatty acids to account for <10% of total energy intake, through replacement by polyunsaturated fatty acids.
• Trans unsaturated fatty acids: as little as possible, preferably no intake from processed food, and <1% of total energy intake from natural origin.
• <5 g of salt per day.
• 30–45 g of fibre per day, preferably from wholegrain products.
• ≥200 g of fruit per day (2–3 servings).
• ≥200 g of vegetables per day (2–3 servings).
• Fish 1–2 times per week, one of which to be oily fish.
• 30 grams unsalted nuts per day.
• Consumption of alcoholic beverages should be limited to 2 glasses per day (20 g/d of alcohol) for men and 1 glass per day (10 g/d of alcohol) for women.
• Sugar-sweetened soft drinks and alcoholic beverages consumption must be discouraged.

CONTROL OF BODY WEIGHT

Recommendations	Class	Level
It is recommended that subjects with healthy weight maintain their weight. It is recommended that overweight and obese people achieve a healthy weight (or aim for a reduction in weight) in order to reduce BP, dyslipidaemia and risk of developing type 2 DM, and thus improve the CV risk profile.	I	A

WHO Classification of Body Weight According to BMI

BMI = weight (Kg) / height^2 (m^2)

Adults (>18 years of age)	BMI (kg/m^2)
Underweight	<18.5
Normal	18.5–24.9
Overweight	25–29.9
Obese	≥30
Class 1	30–34.9
Class 2	35–39.9
Class 3	≥40

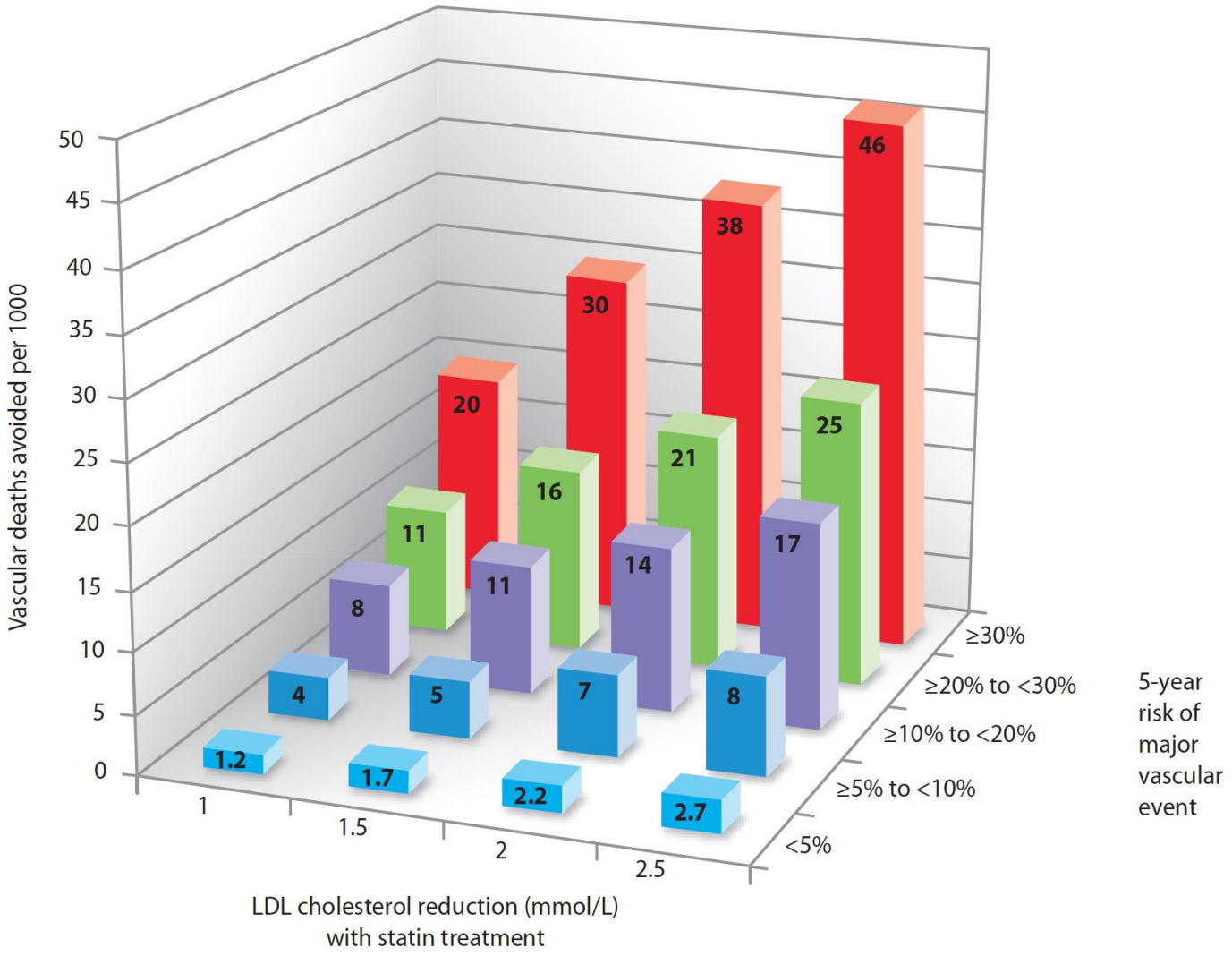
LIPID CONTROL

Recommendations	Class	Level
In patients at VERY HIGH CV risk, an LDL-C goal <1.8 mmol/L (<70 mg/dL), or a reduction of at least 50% if the baseline is between 1.8 and 3.5 mmol/L (70 and 135 mg/dL) is recommended.	I	B
In patients at HIGH CV risk, an LDL-C goal <2.6 mmol/L (<100 mg/dL), or a reduction of at least 50% if the baseline is between 2.6 and 5.2 mmol/L (100 and 200 mg/dL) is recommended.	I	B
In the remaining patients on LDL-C lowering treatment, an LDL-C goal <3.0 mmol/L (<115 mg/dL) should be considered.	IIa	C

Intervention Strategies for Lipid Control

Total CV risk (SCORE) %	LDL-C levels				
	<70 mg/dL <1.8 mmol/L	70 to <100 mg/dL 1.8 to <2.6 mmol/L	100 to <155 mg/dL 2.6 to <4.0 mmol/L	155 to <190 mg/dL 4.0 to <4.9 mmol/L	≥190 mg/dL ≥4.9 mmol/L
<1	Lifestyle advice	Lifestyle advice	Lifestyle advice	Lifestyle advice	Lifestyle advice, consider drug if uncontrolled
Class[a]/Level[b]	I/C	I/C	I/C	I/C	IIa/A
≥1 to <5	Lifestyle advice	Lifestyle advice	Lifestyle advice, consider drug if uncontrolled	Lifestyle advice, consider drug if uncontrolled	Lifestyle advice, consider drug if uncontrolled
Class[a]/Level[b]	I/C	I/C	IIa/A	IIa/A	I/A
≥5 to <10, or high-risk	Lifestyle advice	Lifestyle advice, consider drug if uncontrolled	Lifestyle advice and drug treatment for most	Lifestyle advice and drug treatment	Lifestyle advice and drug treatment
Class[a]/Level[b]	IIa/A	IIa/A	IIa/A	I/A	I/A
≥10 or very high-risk	Lifestyle advice, consider drug	Lifestyle advice and concomitant drug treatment	Lifestyle advice and concomitant drug treatment	Lifestyle advice and concomitant drug treatment	Lifestyle advice and concomitant drug treatment
Class[a]/Level[b]	IIa/A	IIa/A	I/A	I/A	I/A

Vascular Deaths Avoided over 5 Years from Lowering LDL-Cholesterol with Statins According to CVD Risk



Jackson R et al. *Circulation* 2013;127:1929–1931

Treatment of High Blood Pressure

Recommendations	Class[a]	Level[b]
Lifestyle measures (weight control, increased physical activity, alcohol moderation, sodium restriction, and increased consumption of fruits, vegetables, and low-fat dairy products) are recommended in all patients with hypertension and in individuals with high normal BP.	I	A
All major BP lowering drug classes (i.e. diuretics, ACE-I, calcium antagonists, ARBs, and ß-blockers) do not differ significantly in their BP-lowering efficacy and thus are recommended as BP lowering treatment.	I	A
In asymptomatic subjects with hypertension but free of CVD, CKD, and DM, total CV risk stratification using the SCORE model is recommended.	I	B
Drug treatment is recommended in patients with grade 3 hypertension irrespective of CV risk, as well as in patients with grade 1 or 2 hypertension who are at very high CV risk.	I	B
Drug treatment should be considered in patients with grade 1 or 2 hypertension who are at high CV risk.	IIa	B
In patients at low to moderate total CV risk and with grade 1 or 2 hypertension, lifestyle measures are recommended.	I	B
In patients at low to moderate total CV risk and with grade 1 or 2 hypertension, if lifestyle measures fail to reduce BP, drug treatment may be considered.	IIb	B
SBP <140 mmHg and DBP <90 mmHg are recommended in all treated hypertensive patients <60 years old.	I	B
In patients >60 years old with SBP ≥160 mmHg, it is recommended to reduce SBP to between 150 and 140 mmHg.	I	B
In fit patients <80 years old, a target SBP <140 mmHg may be considered if treatment is well tolerated. In some of these patients a target SBP <120 mmHg may be considered if at (very) high-risk and tolerate multiple BP lowering drugs.	IIb	B
In individuals >80 years and with initial SBP ≥160 mmHg, it is recommended to reduce SBP to between 150 and 140 mmHg, provided they are in good physical and mental conditions.	I	B
In frail elderly patients, a careful treatment intensity (e.g. number of BP lowering drugs) and BP targets should be considered, and clinical effects of treatment should be carefully monitored.	IIa	B
Initiation of BP lowering therapy with a two-drug combination may be considered in patients with markedly elevated baseline BP or at high CV risk. Combination of two drugs at fixed doses in a single pill may be considered because of improved adherence.	IIb	C
ß-blockers and thiazide diuretics are not recommended in hypertensive patients with multiple metabolic risk factors,[d] due to the increased risk of DM.	III	B

Classification of Blood Pressure Values

Category	Systolic BP (mmHg)		Diastolic BP (mmHg)
Optimal	<120	and	<80
Normal	120–129	and/or	80–84
High-normal	130–139	and/or	85–89
Grade 1 hypertension	140–159	and/or	90–99
Grade 2 hypertension	160–179	and/or	100–109
Grade 3 hypertension	≥180	and/or	≥110
Isolated systolic hypertension	≥140	and	<90

Measurement of Preclinical Vascular Damage

- **Routine screening** with imaging modalities to predict future CV events is generally not recommended
- Imaging methods may be considered as **risk modifiers** in CV risk assessment, i.e. in individuals with calculated CV risks based on the major conventional risk factors around the decisional thresholds

Recommendations	Class[a]	Level[b]
Coronary artery calcium scoring may be considered as a risk modifier in CV risk assessment.	IIb	B
Atherosclerotic plaque detection by carotid artery scanning may be considered as a risk modifier in CV risk assessment.	IIb	B
ABI may be considered as a risk modifier in CV risk assessment.	IIb	B

How to Intervene on CVD Risk

1. Individual level

a) Risk-factor interventions

b) Disease-specific interventions

2. Population level

Disease-specific Interventions: Coronary Artery Disease

- **Prevention is crucial** for short- and long-term outcomes and it should be started as soon as possible
- Apply a **multidimensional approach** that combines feasibility and efficacy
- An appropriate **discharge plan** should be considered

DISEASE-SPECIFIC INTERVENTIONS: CAD

	Recommendations	Class[a]	Level[b]
Patient assessment	Clinical history taking, including the conventional risk factors for the development of CAD (such as for example glycaemic state) with revision of the clinical course (uncomplicated or complicated) of ACS is recommended.	I	A
	Physical examination is recommended.	I	C
	The ECG is predictive of early risk: It is recommended to obtain a 12-lead ECG and to have it interpreted by an experienced physician. It is recommended to obtain an additional 12-lead ECG in case of recurrent symptoms or diagnostic uncertainty.	I	B
	Additional ECG leads (V3R,V4R,V7–V9) are recommended if on-going ischaemia is suspected when standard leads are inconclusive.	I	C
	A resting transthoracic echocardiogram is recommended in all patients for: a) exclusion of alternative causes of angina; b) regional wall motion abnormalities suggestive of CAD; c) measurement of LVEF for d) evaluation of diastolic function.	I	B
	Chest X-ray should be considered in patients with suspected HF.	IIa	C
	Arrhythmic burden assessment (ventricular arrhythmias, AF and other supraventricular tachy-arrhythmias, and bradycardia, AV block, and intra-ventricular conduction defects) is recommended.	I	A
	Ambulatory monitoring should be considered in patients in whom arrhythmias are suspected.	IIa	C
	Exercise stress testing should be considered to evaluate the efficacy of medical treatment or after revascularization, or to assist prescription of exercise after control of symptoms.	IIa	B
	Exercise capacity and ischaemic threshold assessment should be considered by exercise maximal stress test (ergospirometry if available) to plan the exercise training programme.	IIa	B
	An imaging stress test is recommended in patients with resting ECG abnormalities which prevent accurate interpretation of ECG changes during stress.	I	B
	An imaging stress test should be considered to assess the functional severity of intermediate lesions on coronary arteriography.	IIa	B

DISEASE-SPECIFIC INTERVENTIONS: CAD

Physical activity counselling	In the presence of exercise capacity >5 METs without symptoms, return to routine physical activity is recommended; otherwise, the patient should resume physical activity at 50% of maximal exercise capacity and gradually increase. Physical activity should be a combination of activities like walking, climbing stairs, cycling and supervised medically prescribed aerobic exercise training.	I	B
Exercise training	In low risk patients, at least 2 hours/week aerobic exercise at 55–70% of the maximum work load (METs) or heart rate at the onset of symptoms (≥1500 kcal/week) are recommended. In moderate to high-risk patients, an individualised programme is recommended, that starts with <50% maximum workload (METs), resistance exercise at least 1 hour/week, 10–15 repetitions per set to moderate fatigue. *(refer also to section 3a.3).*	I	B
Diet/nutritional counselling	Caloric intake is recommended to be balanced by energy expenditure (physical activity) to achieve and maintain healthy BMI. Diet poor in cholesterol and saturated fat is recommended. *(refer also to section 3a.5).*	I	C
Weight control management	Normal-weight CAD patients should be advised to avoid weight gain. On each patient visit, it is recommended to consistently encourage weight control through an appropriate balance of physical activity, caloric intake, and formal behavioural programmes when indicated to achieve and maintain a healthy BMI. If waist circumference is ≥80 cm in women or ≥94 cm in men, it is recommended to initiate lifestyle changes and consider treatment strategies as indicated *(refer also to section 3a.6).*	I	B
Lipid management	According to lipid profile, statin therapy is recommended. *(refer also to section 3a.7).*	I	B
	Annual control of lipids, glucose metabolism and creatinine are recommended.	I	C
BP monitoring	A structured approach is recommended. *(refer to section 3a.9).*	I	B
Smoking cessation	A structured approach is recommended. *(refer to section 3a.4).*	I	B
Psychosocial management	Psychosocial risk factor screening should be considered. *(refer to section 2.4.2).*	IIa	B
	Multimodal behavioural interventions is recommended. *(refer to section 3a.1 and 3a.2).*	I	A

Reasons for Medication Non-adherence

Category of non-adherence	Example
Health system	Poor quality of provider–patient relationship; poor knowledge on medication and/or low acceptance of guidelines; poor communication (e.g. limited, complex or confusing advice); lack of access to healthcare; lack of continuity of care.
Condition	Asymptomatic chronic disease (lack of physical cues); co-morbid mental health disorders (e.g. depression).
Patient	Physical impairments (e.g. vision problems or impaired dexterity); cognitive impairment; psychological/behavioural factors (e.g. lack of motivation, low self–efficacy, impulsivity); younger age.
Therapy	Complexity of regimen; side-effects.
Socio-economic	Low literacy; high medication costs; poor social support.

Source: WHO

How to Intervene on CVD Risk

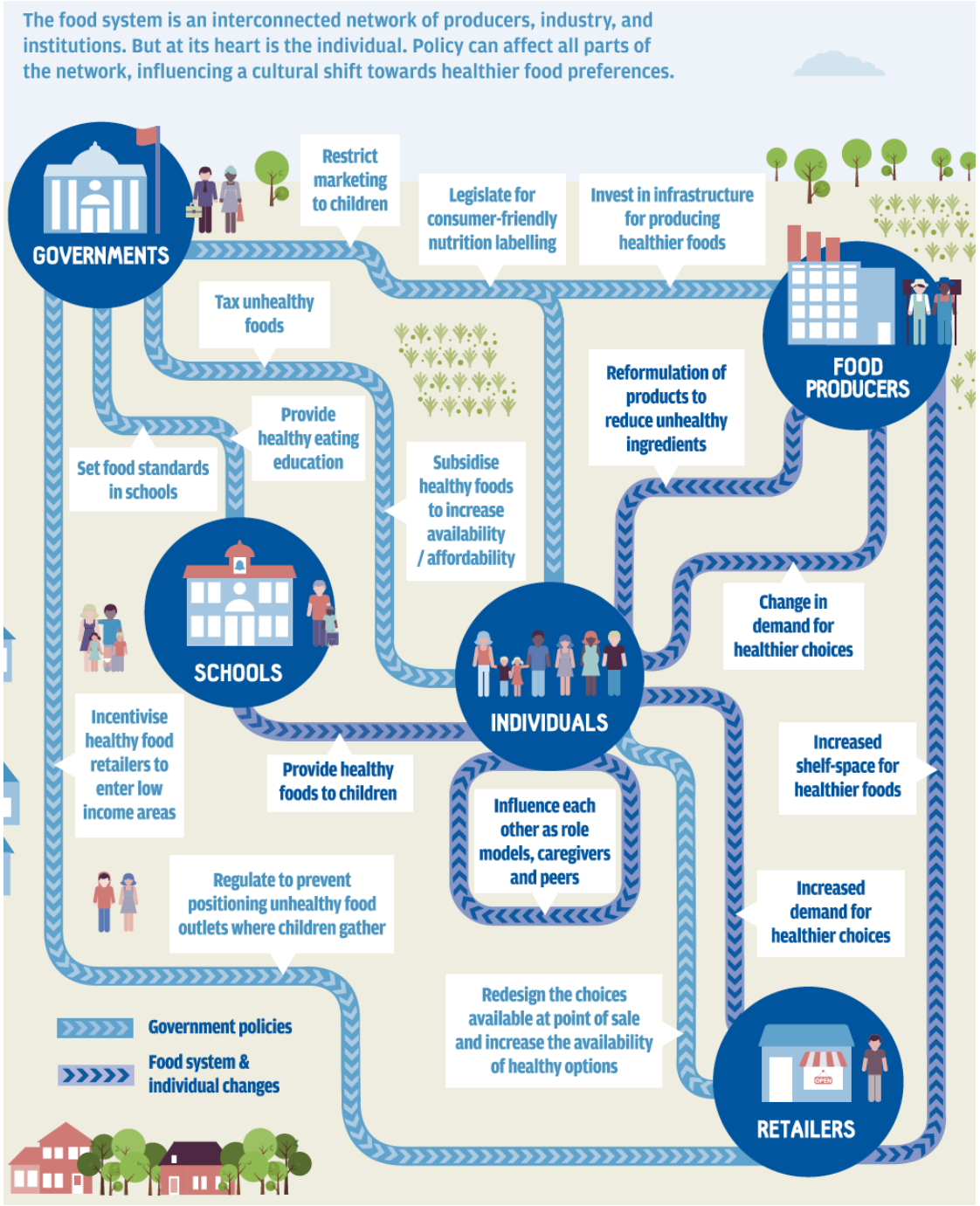
1. Individual level

a) Risk-factor interventions

b) Disease-specific interventions

2. Population level

How Can Governments Support Healthy Food Preferences?



Hawkes C et al. *Lancet* 2016

PROMOTING A HEALTHY DIET

	Recommendations	Class	Level
Governmental restrictions and mandates	Legislation on composition of foods to reduce energy density, salt and saturated fat, and (added) sugar content of foods and beverages, and to limit portion sizes is recommended.	I	B
	Elimination of industrially produced transfats is recommended.	I	A
	Facilitating an integrated and coherent policy and activities of the (local) governments, non-governmental organizations, food industry, retail, catering, schools, workplaces and other stakeholders to promote a healthy diet and to prevent overweight is recommended.	I	C
	Legislation restricting marketing aimed at children of foods that are high in fats, sugar and/or salt, less healthy options, junk foods, drinks with alcohol and non-alcoholic beverages rich in sugar (e.g. on TV, internet, social media and on food packages) is recommended.	I	C
Media and education	Reformulation of foods accompanied by educational information campaigns should be considered to create awareness on the nutrition quality of foods among consumers.	IIa	C
Labelling and information	Mandatory and harmonized simplified front-of-pack nutrition labelling is recommended.	I	C
	Independently and coherently formulated criteria for nutrient profiles should be considered in support of health and nutrition claims and front-of-pack logos (e.g. traffic lights, healthy choices, key-holes).	IIa	C
	Mandatory nutrition labelling for non-pre-packaged foods, including in restaurants hospitals and workplaces, should be considered.	IIa	C

PROMOTING A HEALTHY DIET

	Recommendations	Class	Level
Economic incentives	Pricing and subsidy strategies are recommended to promote healthier food and beverage choices.	I	B
	Taxes on foods and beverages rich in sugar and saturated fat, and on alcoholic drinks are recommended.	I	B
Schools	At all schools, pre-schools and daycare centres a multi-component, comprehensive and coherent policy is recommended to promote a healthy diet.	I	B
	Availability of fresh drinking water and healthy foods in schools, and in vending machines is recommended.	I	B
Workplaces	At all companies a coherent and comprehensive health policy and nutritional education are recommended to stimulate the health awareness of employees.	I	B
	Increased availability of fresh drinking water and improved nutritional quality of food served and/or sold in the workplace, and in vending machines should be considered.	IIa	C
Community setting	Regulation of location and density of fast food and alcohol purchasing outlets and other catering establishments should be considered.	IIa	C

PROMOTING PHYSICAL ACTIVITY

	Recommendations	Class	Level
Governmental restrictions and mandates	Consideration of PA when planning new landscaping/buildings or towns is recommended.	I	C
Media and education	Sustained, focused, media and educational campaigns, using multiple media modes (e.g. apps, posters, flyers and signage) may be considered to promote PA.	IIb	C
	Short term community-based educational programmes and wearable devices promoting healthy behaviours, such as walking should be considered.	IIa	C
Labelling and information	Point-of-decision prompts should be considered to encourage use of stairs.	IIa	B
	Exercise prescription for health promotion by physicians, especially GPs, similar to drug prescription should be considered.	IIa	C
Economic incentives	Increased fuel (gasoline) taxes should be considered to increase active transport/commuting.	IIa	C
	Tax incentives for individuals to purchase exercise equipment or health club/fitness memberships may be considered.	IIb	C
	Sustained individual financial incentives may be considered for increased activity/fitness or weight loss.	IIb	C
	Tax incentives to employers to offer comprehensive worksite wellness programmes with nutrition, PA, and tobacco cessation/prevention components may be considered.	IIb	C

PROMOTING PHYSICAL ACTIVITY

	Recommendations	Class	Level
Schools	Increased availability and types of school playground spaces and equipment for exercise activity and sports are recommended.	I	C
	Regular classroom PA breaks during academic lessons should be considered.	IIa	B
	Increasing active commuting to school should be considered e.g. a walking school bus programme with supervised walking routes to and from school for safety.	IIa	C
	Increased number and duration of PA classes, with revised PA curricula to implement at least moderate activity and trained teachers in exercise and sports may be considered.	IIb	B
Workplaces	Comprehensive worksite wellness programmes should be considered with nutrition and PA components.	IIa	B
	Structured worksite programmes that encourage PA and provide a set time for PA during work hours should be considered. Improving stairway access and appeal, potentially in combination with "skip-stop" elevators that skip some floors should be considered.	IIa	C
	Promoting worksite fitness centres should be considered.	IIa	C
Community setting	Health care providers should consider inquiring about PA in every medical encounter and adding it to the record. In addition, they should consider to motivate the individual and promote PA.	IIa	C
	Improved accessibility of recreation and PA spaces and facilities (e.g. building of parks and playgrounds, increasing operating hours, use of school facilities during non-school hours), improved walkability should be considered.	IIa	C
	Improved neighbourhood aesthetics (to increase activity in adults) should be considered.	IIa	C

FAVORING SMOKING CESSATION

	Recommendations	Class	Level
Governmental restrictions and mandates	Banning smoking in public places is recommended to prevent smoking and to promote smoking cessation.	I	A
	Banning smoking in public places, outside public entrances, workplaces, in restaurants and bars is recommended to protect people from passive smoking.	I	A
	Prohibit sales of tobacco products to adolescents are recommended.	I	A
	Banning of tobacco vending machines is recommended.	I	A
	Restrictions on advertising, marketing and sale of smokeless tobacco are recommended.	I	A
	Complete ban on advertising and promotion of tobacco products are recommended.	I	B
	Reduced density of retail tobacco outlets in residential areas, schools and hospitals is recommended.	I	B
	Harmonization of border sales and tax free sales of all tobacco products is recommended.	I	B
	Restrictions on advertising, marketing and sale of electronic cigarettes should be considered.	IIa	A
Media and education	Telephone and internet based lines for cessation counselling and support services are recommended.	I	A
	Media and educational campaigns as part of multicomponent strategies to reduce smoking and increase quit rates, reduce passive smoking and use of smokeless tobacco are recommended.	I	A
	Media and educational campaigns concentrating solely on reducing smoking, increasing quit rates, reducing passive smoking and the use of smokeless tobacco should be considered.	IIa	B

FAVORING SMOKING CESSATION

	Recommendations	Class	Level
Labelling and information	Cigarette package pictorial and text warnings are recommended.	I	B
	Plain packaging is recommended.	I	B
Economic incentives	Higher taxes and prices on all tobacco products are recommended.	I	A
Schools	Banning smoking in school, pre-school and child care to protect from passive smoking is recommended.	I	A
	Promotion and teaching of a healthy lifestyle including tobacco-free life should be considered in all schools.	IIa	B
Workplaces	Workplace specific bans on smoking to reduce passive smoking and increase quit rates are recommended.	I	A
	Workplace policy on healthy choices including tobacco cessation/ prevention is recommended.	I	A
Community setting	It is recommended that health personnel, caregivers and school personnel set an example by not smoking or using tobacco products at work.	I	A
	It is recommended to advise pregnant women to be tobacco-free during pregnancy.	I	A
	It is recommended to advise parents to be tobacco-free when children are present.	I	A
	It is recommended to advise parents to never smoke in cars and private homes.	I	A
	Residence-specific restrictions on smoking should be considered.	IIa	B

LIMITING ALCOHOL ABUSE

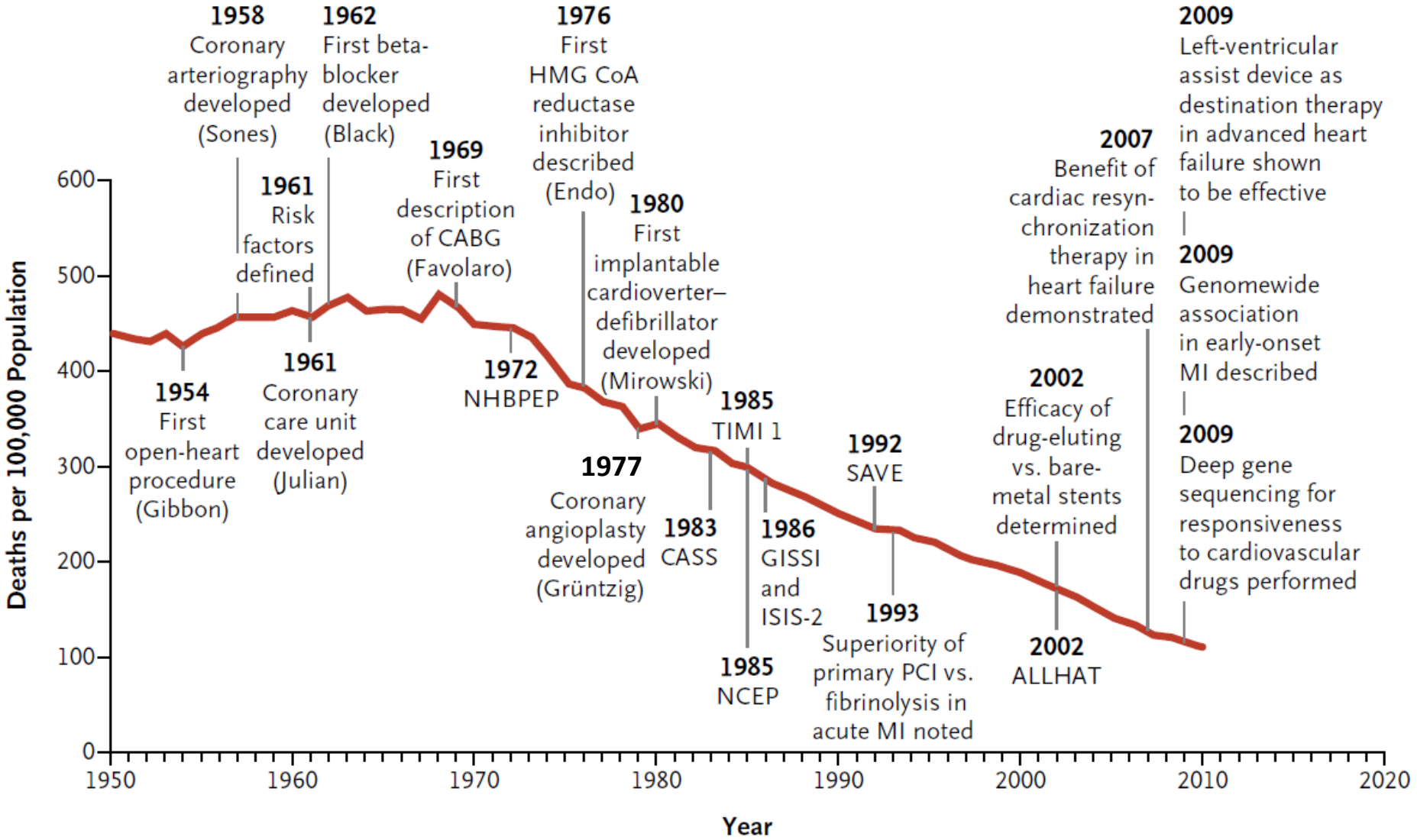
	Recommendations	Class[a]	Level[b]
Governmental restrictions and mandates	Regulating physical availability of alcoholic beverages is recommended, including minimum legal purchase age, restrictions on outlet density and time and place of sales, public health oriented licensing systems, and governmental monopolies of retail sales.	I	B
	Drink-driving countermeasures are recommended such as lowered blood alcohol concentration limits and "zero tolerance", random breath testing and sobriety check points.	I	B
	Implementing comprehensive restrictions and bans on advertising and promotion of alcoholic beverages is recommended.	I	C
Media and education	Educational information campaigns may be considered to create awareness on the hazardous effects of alcohol.	IIb	B
Labelling and information	Labelling alcohol with information on caloric content and health warning messages of the harmful effects of alcohol may be considered.	IIb	B
Economic incentives	Taxes on alcoholic beverages are recommended.	I	B
Schools	At every school, pre-school and day care a multi-component, comprehensive and coherent education may be considered to prevent alcohol abuse.	IIb	B
Workplaces	At every company a coherent and comprehensive health policy and nutritional education on stimulating the health of employees, including limiting excessive alcohol intake, are recommended.	I	B
Community setting	Measures to support and empower primary care to adopt effective approaches to prevent and reduce harmful use of alcohol are recommended.	I	B
	Enacting management policies relating to responsible serving of alcoholic beverages should be considered to reduce the negative consequences of drinking.	IIa	B
	Planning of location and density of alcohol purchasing outlets and other catering establishments should be considered.	IIa	C

Examples of Performance Measurements of Policies for CVD prevention

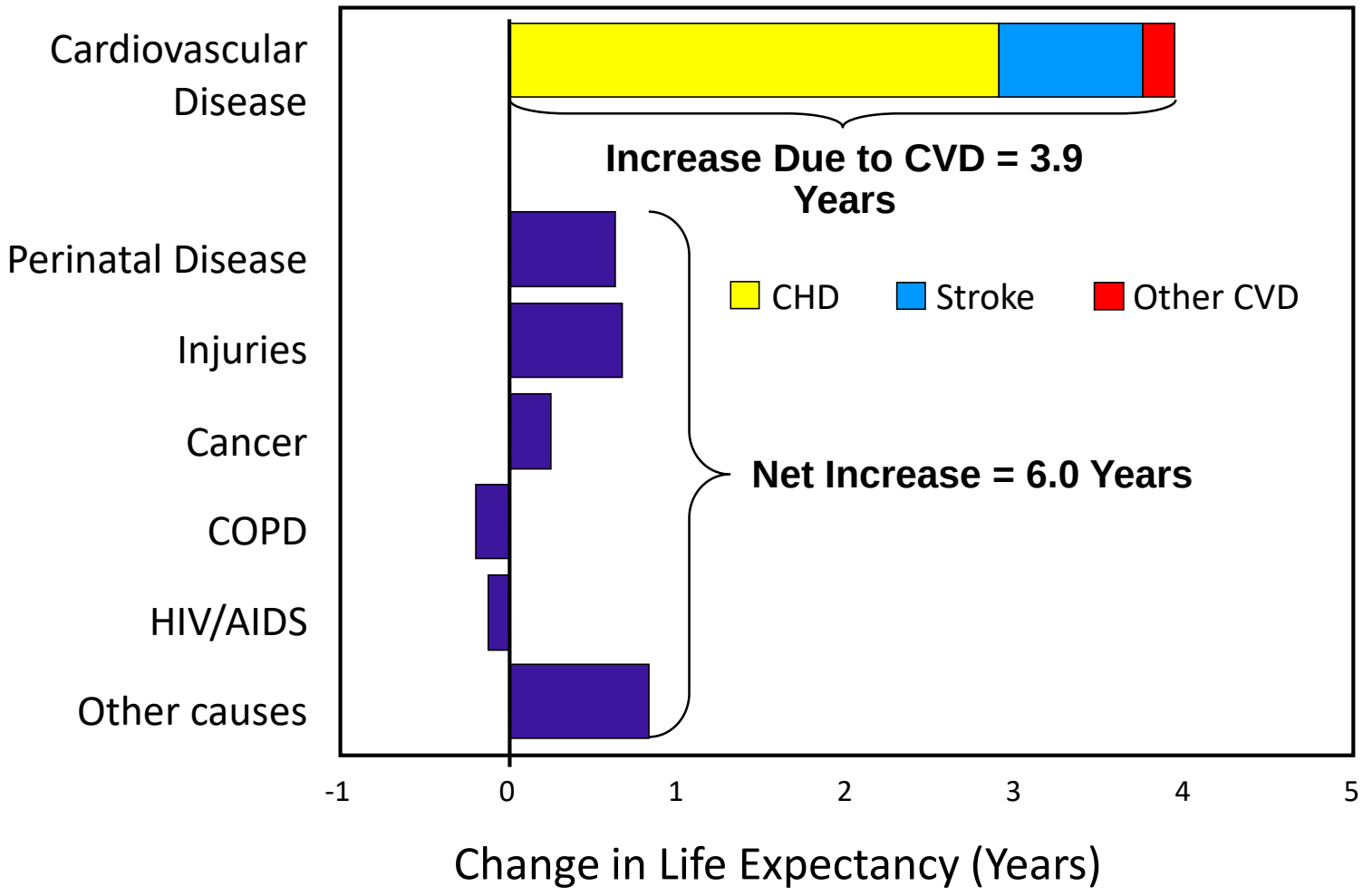
- Subjects identified as tobacco users who received cessation intervention.
- Subjects for whom sedentary habits have been recorded and are counselled to increase PA.
- Subjects for whom unhealthy diet/nutritional habits have been recorded and are counselled to improve diet.
- Subjects for whom weight and BMI and/or waist circumference is documented above normal limits and are counselled on weight management.
- Subjects >40 years old with at least one lipid profile performed within the past 5 years.
- Patients <60 years old and with hypertension (not DM) who had a recorded BP reading at their most recent visit of <140/90 mmHg.
- Patients with DM who had a recorded HbA1c <7.0% (<53 mmol/mol) at the most recent visit.
- Patients with a qualifying event/diagnosis who have been referred to an in-patient CR or out-patient CR programme before hospital discharge.

Scientific Advances and Cardiovascular Mortality

Nabel and Braunwald. *N Engl J Med* 2012;366:54-63



Impact of Disease Conditions on Changes in Life Expectancy United States, 1970-2000



Source: NIH

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