European Guidelines on cardiovascular disease prevention - 2021

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The characteristics of people who tend to stay healthy:

- No use of tobacco
- Adequate physical activity, at least 30 min. five times a week
- Healthy eating habits
- No overweight
- Blood pressure below 140/90 mm Hg
- Blood cholesterol below 5 mmol/l
- Normal glucose metabolism
- Avoidance of excessive stress

European Guidelines on cardiovascular disease prevention in clinical practice – version 2021

- Frank L.J. Visseren et al.: ESC Guidelines on cardiovascular disease prevention in clinical practice (version 2021). Developed by Task Force for cardiovascular disease prevention in clinical practice with representatives of the European Society of Cardiology and 12 medical societies

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Screening of risk factors of CVD

- testing of risk factors should begin at age 40 years old in men and 50 years old in women or post-menopausal
- testing of risk factors should be made if the patient is smoker, overweight, there is a family history of premature CVD (women before 65 and men before 55 aears old), known hyperlipidaemia in family, chronic renal disease, diabetes mellitus type 2 and in some special cases
- special efforts should be made in socially deprives persons or persons personality D or mentally or socioeconomic problematic people

Screening of risk factors of CVD

It is not recommended in apparently healthy people, who are younger than 40 years

because of small risc of development of CVD in that age

Why is prevention of CVD needed?

- Atherosclerotic CVD remains the leading cause of premature death worldwide
- Prevention works - 60 % of the reduction relate to changes in risk factors and 40 % of the reduction relate to improved treatments
- Preventive efforts should be lifelong from birth (if nor before) to old age

The risk of cardiovascular fatal events in the future 10 years:

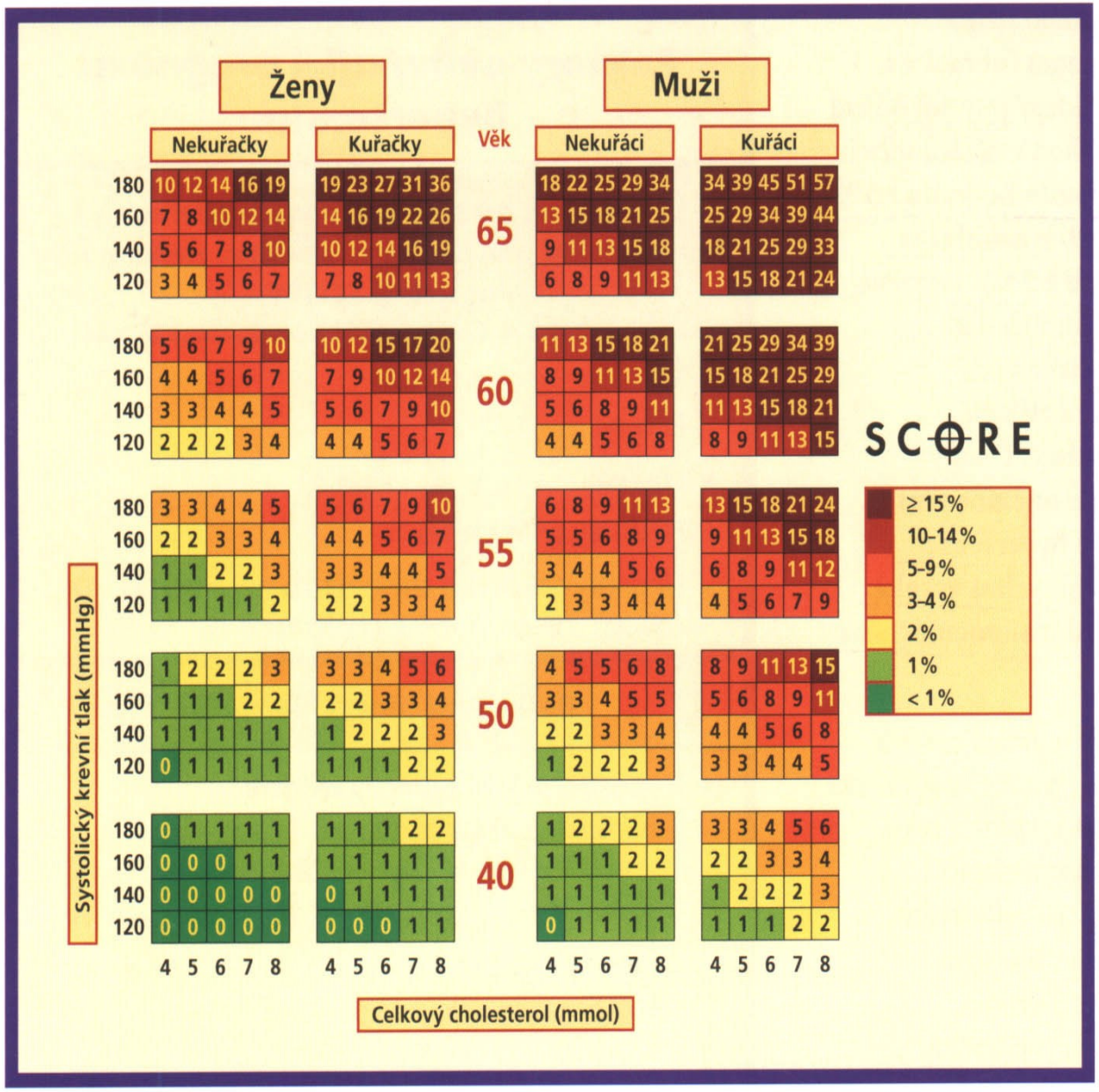
2016, 2019

Age, gender, smoking, systolic blood pressure level, **level of total CH**

(SCORE)

- help us to prevent cardiovascular events

2016


Ženy
Muži
Nekuřačky
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Věk
Nekuřáci
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180 10 12 14 16 19 | 19 23 27 31 36 | 18 22 25 29 34 | 34 39 45 51 57
160 7 8 10 12 14 | 14 16 19 22 26 | 13 15 18 21 25 | 25 29 34 39 44
140 5 6 7 8 10 | 10 12 14 16 19 | 9 11 13 15 18 | 18 21 25 29 33
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180 1 2 2 2 3 | 3 3 4 5 6 | 4 5 5 6 8 | 8 9 11 13 15
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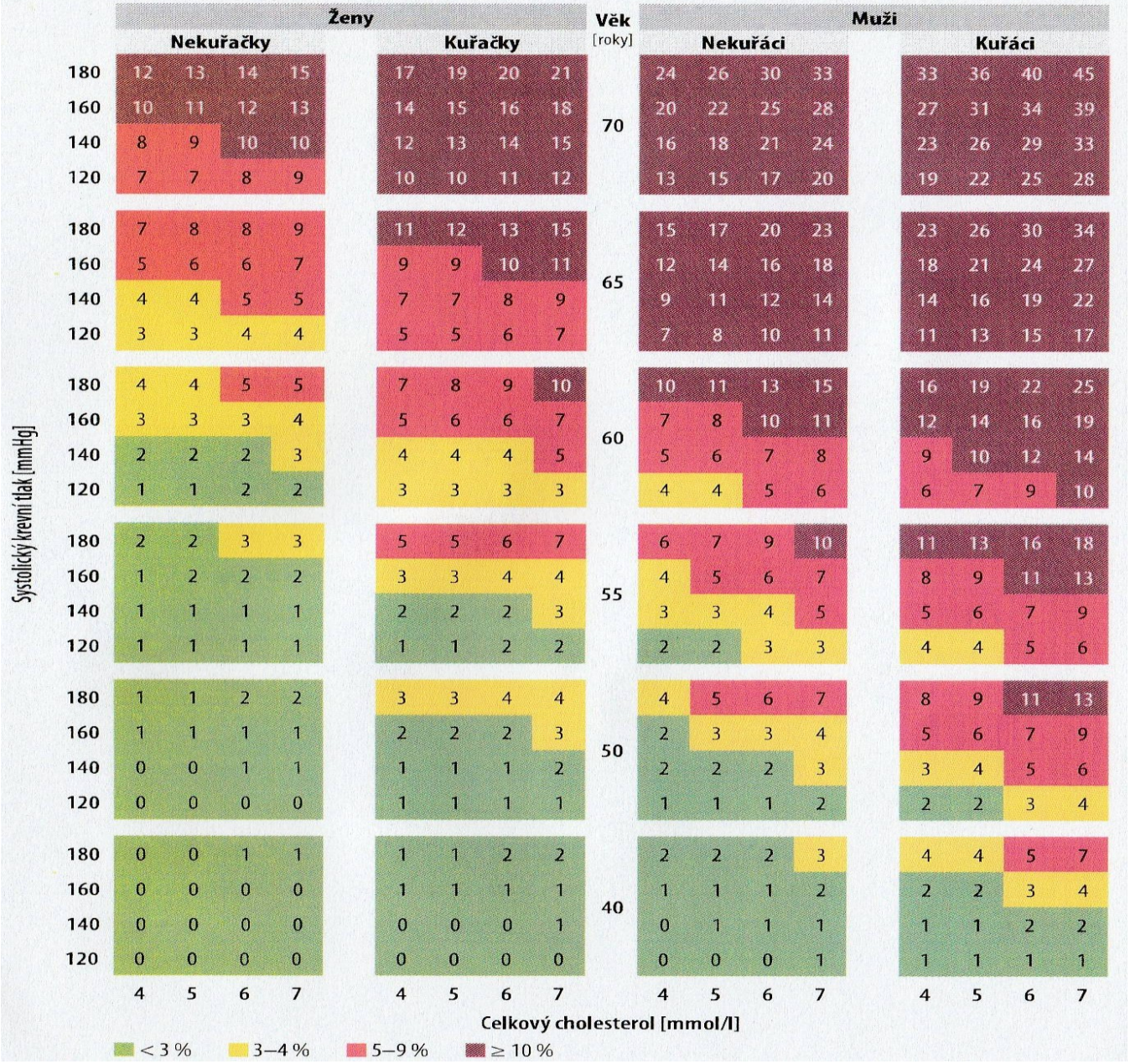
40
4 5 6 7 8 | 4 5 6 7 8 | 4 5 6 7 8 | 4 5 6 7 8
Systolický krevní tlak (mmHg)
Celkový cholesterol (mmol)
SCORE
≥ 15 %
10–14 %
5–9 %
3–4 %
2 %
1 %
< 1 %

2019

Tab. 1 – Tabulka SCORE ke zjištění absolutního rizika jedince pro fatální kardiovaskulární příhody (vysoké riziko ≥ 5 %)
Evropské regiony s vysokým rizikem KV chorob* – 10leté riziko fatální kardiovaskulární příhody



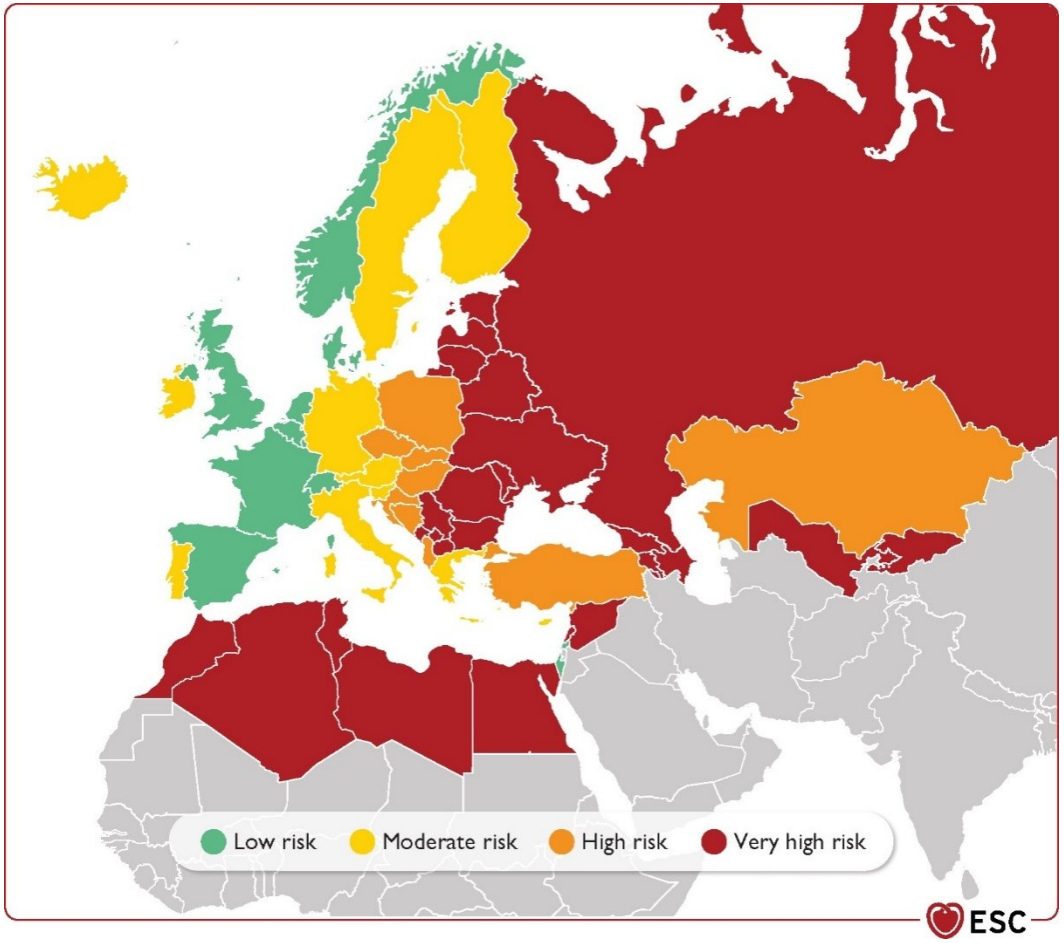
The risk of cardiovascular fatal and non-fatal events in the future 10 years:

2021

Age, gender, smoking, systolic blood pressure level, **level of non-HDL-CH and country (SCORE 2 and SCORE OP)**

- help us to prevent cardiovascular events

Figure 4 Risk regions based on World Health Organization cardiovascular mortality ...



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2021

- Low risk:

Andorra, Belgium, Denmark, France, Israel, Luxembourg, Monaco, the Nederlands, Norway, Spain, Switzerland, United Kingdom

- Moderate risk:

Austria, Cyprus, Finland, Germany, Greece, Iceland, Ireland, Italy, Malta, Portugal, San Marino, Slovenia, Sweden

2021

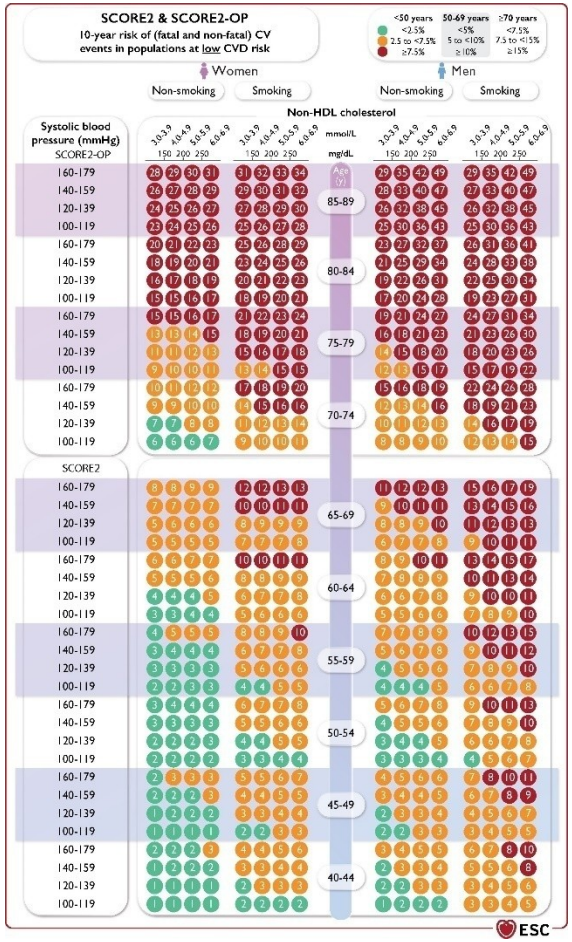
- High risk:

Albania, Bosnia and Herzegovina, croatia, Czech Republic, Estonia, Hungary, Kazaghstan, Poland, Slovakia, Turkey

- Very-high risk:

Algeria, Armenia, Azerbaijan, Belarus, Bulgaria, Egypt, Kyrgyzstan, Latvia, Lithuania, Libya, Montenegro, Morocco, Romania, Macedonia, Moldova, Russia, Ukraine, Uzbekistan, Georgia,Serbia, Syria, Macedonia, Tunisia,

Figure 3 Systematic Coronary Risk Estimation 2 and Systematic Coronary Risk Estimation 2-Older Persons risk charts for ...



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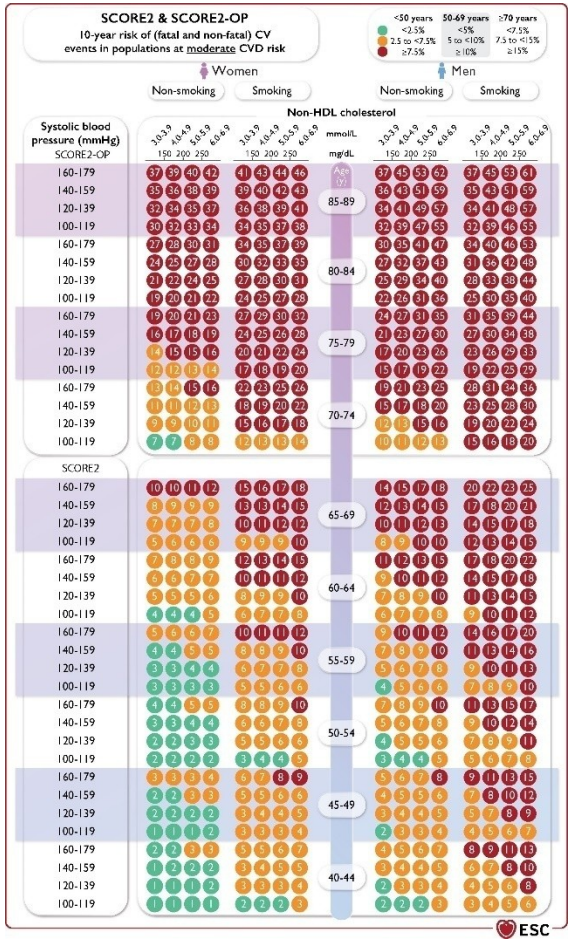

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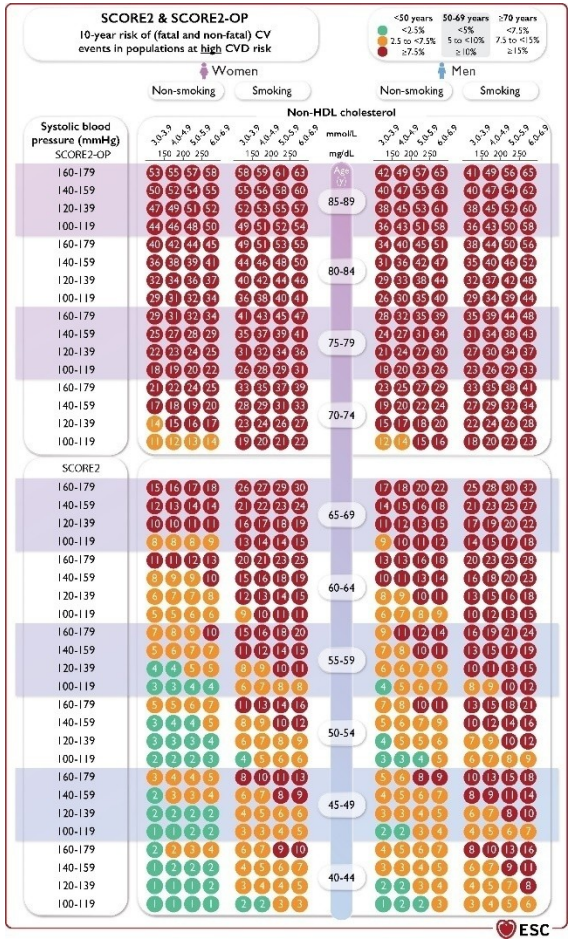

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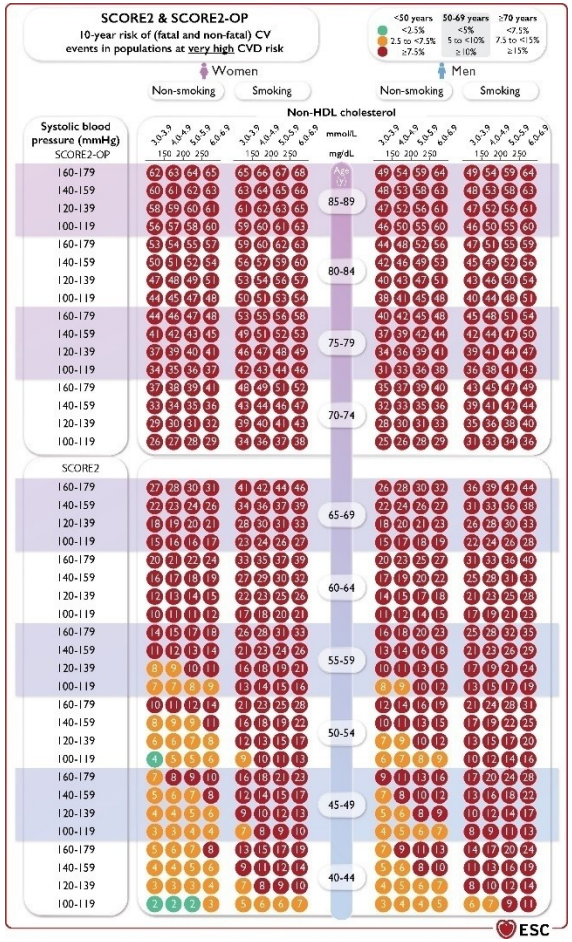

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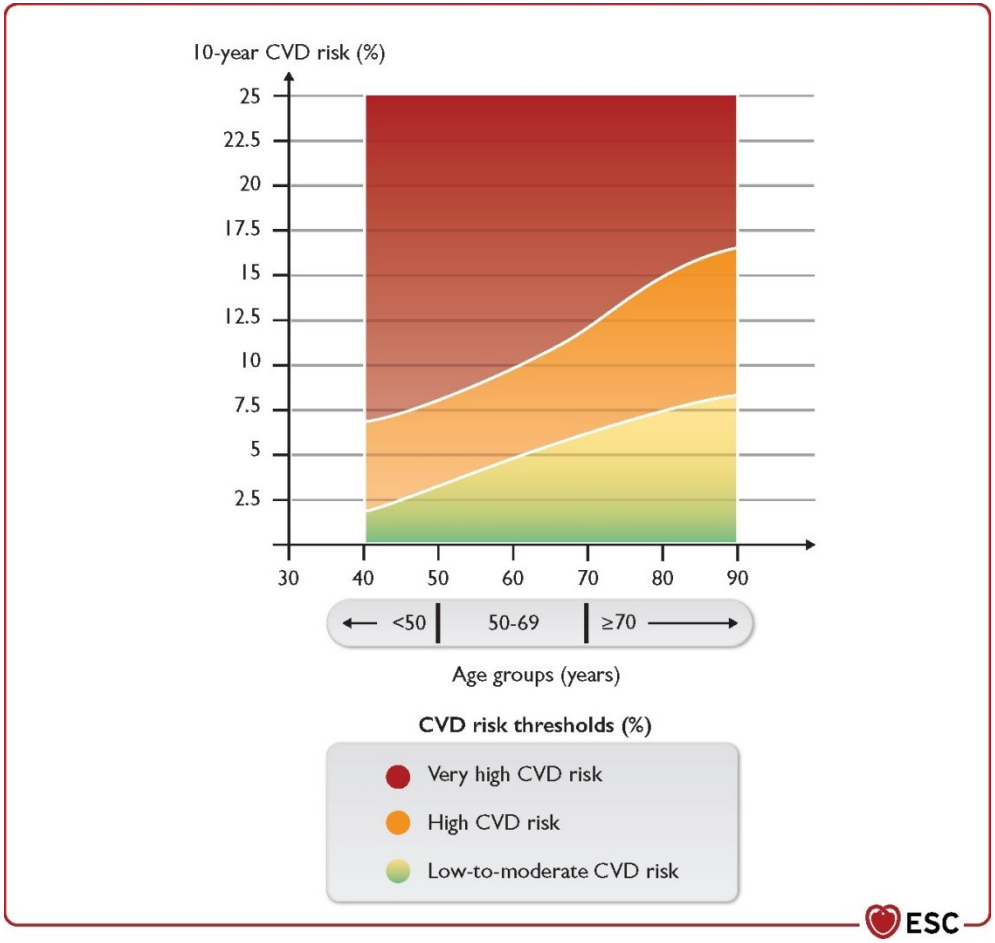
Figure 5 Schematic representation of increasing 10-year cardiovascular disease risk thresholds across age groups. CVD ...



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Apparently healthy people – no reccomended treatment

- SCORE 2 < 2,5% for age < 50
- SCORE 2 < 5% for age 50-69
- SCORE OP < 7,5% for age >70

Apparently healthy people – treatment should be reccomended

- SCORE 2 - 2,5-7,5% for age < 50
- SCORE 2 - 5-10% for age 50-69
- SCORE OP - 7,5-15% for age ≥ 70

Apparently healthy people – treatment is reccomended

- SCORE 2 ≥ 7,5% for age < 50
- SCORE 2 ≥ 10% for age 50-59
- SCORE OP ≥ 15% for age ≥ 70

;

Table 5

Cardiovascular disease risk categories based on SCORE2 and SCORE2-OP in apparently healthy people according to age

	<50 years	50–69 years	≥70 years[a]
Low-to-moderate CVD risk: risk factor treatment generally not recommended	<2.5%	<5%	<7.5%
High CVD risk: risk factor treatment should be considered	2.5 to <7.5%	5 to <10%	7.5 to <15%
Very high CVD risk: risk factor treatment generally recommended[a]	≥7.5%	≥10%	≥15%

CVD = cardiovascular disease.

a In apparently healthy people ≥70 years old, the treatment recommendation for lipid-lowering drugs is Class IIb ('may be considered').

The division of the population into three distinct age groups (<50, 50–69, and ≥70 years) results in a discontinuous increase in risk thresholds for low-to-moderate, high, and very high risk. In reality, age is obviously continuous, and a sensible application of the thresholds in clinical practice would require some flexibility in handling these risk thresholds as patients move towards the next age group, or recently passed the age cut-off. *Figure 5* illustrates how a continuous increase in age relates to increasing risk thresholds, and may be used as a guide for daily practice.

CVD Risk Calculator app

- https://www.escardio.org/Education/ESC-Prevention-of-CVD-Programme/Risk-assessment/esc-cvd-risk-calculation-app
- http://www.hearstscore.org
- http://www.u-prevent.com

People at very high total CV Risk (no use of SCORE)

Subjects with cardiovascular disease (heart or brain vessel disease, peripheral artery disease)

Subjects with very high levels of individual risk factors

Subjects with chronic kidney disease (CKD)

Subjects with Type 1 diabetes mellitus with microalbuminuria

Subjects with Type 2 diabetes mellitus

People at very high total CV Risk (no use of SCORE)

Atherosclerotic plaques in coronary or carotic vessels

Total CH > 8 mmol/l

Familial hypercholesterolaemia

Systolic blood pressure > 180/110 mm Hg

Several serious risk factors

Other important risk factors of CVD

- Other important risk factors:
  - high pulse rate

- Psychological risk factors
  - low socio-economic status
  - social isolation and low social support
  - stress at work and in family life
  - type D personality (feeling anxious, irritable or depressed, avoidance of sharing thouts and feeling with other people)

Other important risk factors of CVD

- Hypertension
- Obstructive sleep dyspnea, chronic obstructive pumonary disease, sleep disorders
- Erectile dysfunction in men
- Inflamatory conditions, infections (periodontitis, influenza), autoimmune diseases, antiretroviral therapy
- Smoking (also passive, all types-including light, pipes, waterpipes) – many other parts of smoking are harmful
- Cancer
- Migraine in women
- Obesity, sedentery lifestyle, non-alcoholic fatty liver disease
- Family history of premature CVD (before the age of 55 years in men and 65 years in women)
- Alcohol, dyslipidemia
- Heart failure, valvular heart disease, atrial fibrilation

Imaging methods in cardiovascular disease prevention

- Coronary artery calcium score as the most important examination
- Carotid ultrasound (no measurement of the intima-media thickness but the presence of plaques and their characteristics is important)

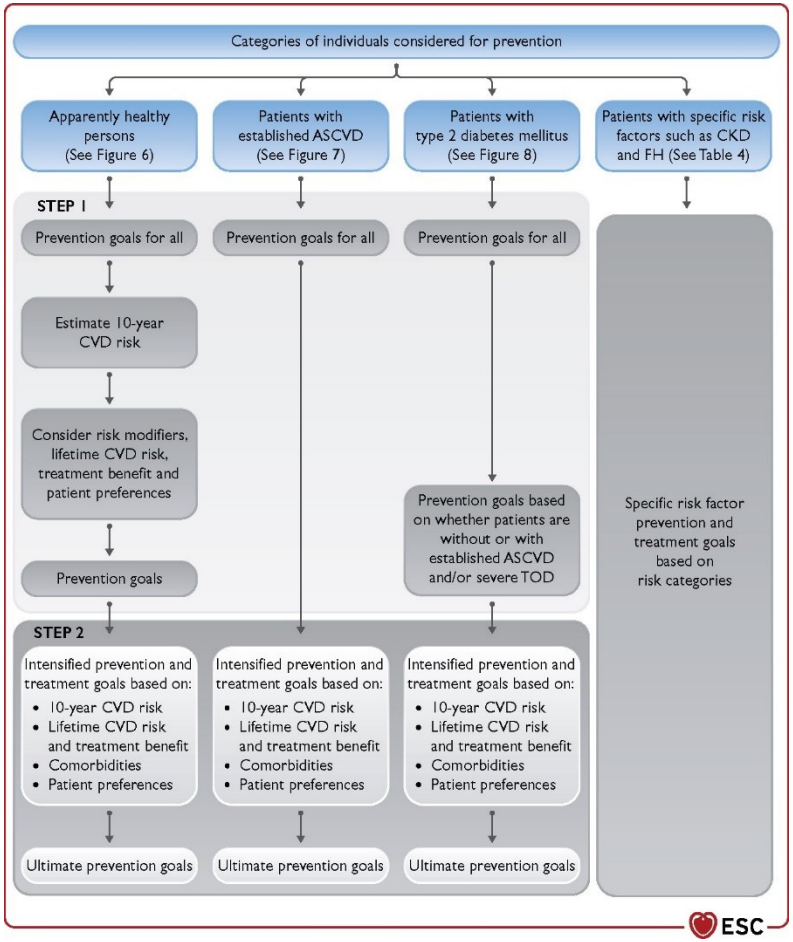
- Measurement of ankle-brachia index (ABI < 0,9) – not now recomended
- Exercise electrocardiography or echocardiography in men?
- Multislice computed coronary angiography ?
- Coronary wall magnetic resonance imaging ?

Other important risk factors of CVD-????? – not now recomended

- Other important risk factors in blood:
  - high CRP
  - high fibrinogen
  - high homocysteine

- Other important risk factors in lipids:
  - low HDL-CH
  - high Lipoprotein a
  - high non-fasting triglycerides
  - high Apo-B lipoproteins

Figure 2 Examples of a stepwise approach to risk stratification and treatment options. ASCVD = atherosclerotic ...



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Nutrition -2021

- Adopt a more plant- and less animal based food pattern
- Saturated fatty acids should acount for < 10% of total energy intake
- Trans-unsaturated fatty acids should be minimized as far as possible
- < 5 g of total salt intake per day
- 30-45 g og fibre per day (preferably wholegrain products)
- 200 g of fruit per day
- 200 g of vegetables per day
- 30 g unsalted nuts per day
- Fish at last twice a week, one of which to be fatty fish
- Red meat should be reduced to a maxium of 35-500 g a week, processed meat shiould be minimized
- Sugar – sweetened beverages, such as soft drinks and fruit juices, must be discouraged
- Alcohol consumption should be limited to a maximum of 100 g/week

„Mediterranean style eating patterns“ – preventin of CVD - greater adherence to a Mediterranean diet is associated with a 10% reduction in CV incidence or mortality and an 8% reduction in all-cause mortality.

- Olive oil
  - decreasing of blood pressure, decreasing of TG, antitrombogenic, decreasing of insulin rezistance, antioxidans
- Fish (omega-3 fatty acids)
  - salamon, sardine, trout, tuna
  - decreasing of TG, anti-inflammatory

„ Mediterranean style eating patterns“ – preventin of CVD - greater adherence to a Mediterranean diet is associated with a 10% reduction in CV incidence or mortality and an 8% reduction in all-cause mortality.

- Alcohol
  - increasing of HDL-CH, antiagregans, decreasing of fibrinogen, decreasing of insulinorezistence, antioxidans-flavonoidy (red wine)

- Walnuts
  - omega-3 fatty acids, fibres, potassium, magnesium, vitamin E

Nutrition - 2021

- Alcohol?
- Maximum 20g/day of alcohol for men and 10g/day of alcohol for women - 2016,

from 2021:

- Maximum 100g of alcohol/week

(…..↓ cardiovascular disese,

↑ cancers….)

- Coffee!? – 3-4 cups a day can be moderately benefical, about 9 cups harmful….
- Tea!?

- Regular physical aktivity!!

Coffee

- Studies – more than 400 000 persons:
  - 1 cup/day decreases mortality about 6 % in males and about 5 % in females
  - 2-3 cups/day decreases mortality about 10 % in males and about 13% in females
  - 4-5 cups/day decreases mortality about 12 % in males and about 16 % in females
  - 6 and more cups/day decreases mortality about 10 % in males and about 15 % in females

Ming Ding et al.: Caffeinated and Decaffeinated Coffee Consumption and Risk of Type 2 Diabetes (Diabetes Care, 37, 2014:569-585)

- Non-filtered coffee contains LDL-C-raising cafestol and kahweol, and may be associated with an up to 25% increased risk of ASCVD mortality by consumption of nine or more drinks a day.[446] Non-filtered coffee includes boiled, Greek, and Turkish coffee and some espresso coffees. Moderate coffee consumption (3–4 cups per day) is probably not harmful, perhaps even moderately beneficial.[447]

DM and coffee….

- increasing of insulin sensitivity
- includes potassium, magnesium, fibre
- includes antioxidants
- includes polyfenols – Chlorogen- acid – antioxidant + antiinflamatory efect
- includes niacin, B - vitamins B

Tea

- China Kadoorie Biobank
- 199 293 men + 288 082 women (30-79 let)

- drinking tea every day for several years leads to reduction of risk of ischaemic heart disease by about 8 %
    - Li X, Yu C, Guo et al.: Tea consumption and risk of ischaemic heart disease, Heart 2017, 103:783-789

Key Messages – recommendation 2021

- **Risk factors and risk classification**
- The major risk factors for ASCVD are cholesterol, BP, cigarette smoking, DM, and adiposity.
- Risk factors are treated in a stepwise approach to reach the ultimate treatment goals in apparently healthy people, patients with established ASCVD, and patients with DM.
- 10-year CVD risk is estimated in apparently healthy people aged 40–69 years with SCORE2, and in people aged ≥70 years with SCORE2-OP.
- Age-specific 10-year CVD risk thresholds—together with consideration of risk modifiers, frailty, comorbidities, lifetime CVD risk, treatment benefit, polypharmacy, and patient preferences—guide treatment decisions for lipid and BP treatment.
- There are various options of communicating the (residual) CVD risk, and this should be tailored to the individual patient.

Key Messages - recommendation 2021

- **Risk modifiers**
- Psychosocial stress is associated with risk of ASCVD.
- Current risk scores may under- or overestimate CVD risk in differing ethnic minority groups.
- CAC scoring is the best-established imaging modality to improve CVD risk stratification.
- Frailty is a functional risk factor of both CV and non-CV morbidity and mortality.
- Frailty assessment is not a method to determine eligibility for any particular treatment, but rather serves to build an individualized care plan with predefined priorities.
- Family history should be enquired about routinely, and a positive family history of premature ASCVD should be followed by comprehensive CVD risk assessment.
- Current data does not support the use of genomic risk scores in CVD risk assessment in primary prevention.
- ASCVD development and prognosis are linked to social gradients.
- Air pollution is strongly associated with ASCVD.
- Additional circulating and urine biomarkers should not be routinely measured.
- Assess CVD risk in persons with obesity.

- **Clinical conditions**
- CKD is an independent risk factor for ASCVD, and ASCVD is the leading cause of death in CKD.
- A short-term reduction in albuminuria by approximately 30% upon starting RAAS inhibition is associated with improved CV and kidney outcomes.
- Similarly, SGLT2 inhibitors are associated with long-term benefits in CV and renal risks.
- AF is associated with an increased risk of death and an increased risk of CVD.
- Ischaemic HF constitutes the most advanced clinical manifestation of atherosclerosis within the myocardium.
- The diagnosis of overt HF, as well as asymptomatic presentation with LV dysfunction, increases the risk of CVD events (myocardial infarction, ischaemic stroke, CV death).
- There is an overlap between cancer and CV risk factors; CV risk in patients with cancer depends on both the CV toxicity of treatments and patient-related factors.
- Signs or symptoms of cardiac dysfunction should be monitored before, periodically during, and after treatment.
- Exercise should be strongly advised, in particular aerobic exercise, to prevent cardiotoxicity.
- COPD is a major risk factor for CVD, especially ASCVD, stroke, and HF.
- COPD patients are prone to arrhythmias (AF and ventricular tachycardia) and sudden cardiac death.
- All COPD patients should be investigated for CVD.
- Common COPD medications are usually safe in terms of CV adverse events.
- Chronic inflammatory conditions increase CVD risk.
- Infection with HIV is associated with an increased risk of LEAD and CAD.
- There is an association between influenza and periodontitis infections and ASCVD.

- **Clinical conditions**
- Migraine, particularly migraine with aura, is an independent risk factor for stroke and ischaemic cardiac disease.
- The risk of ischaemic stroke in subjects with migraine with aura is magnified by the use of combined hormonal contraceptives and cigarette smoking.
- Non-restorative sleep and a sleep duration that varies significantly up or down from the optimum of 7 h are associated with increased CV risk.
- Mental disorders are common in the general population (12-month prevalence of 27%) and are associated with excess mortality.
- The onset of CVD increases the risk of mental disorders by 2.2-fold, leading to a worse prognosis.
- Some mental disorders—even symptoms of anxiety and depression—are associated with the development of CVD and with a worse prognosis in those with existing CVD (CHD, arterial hypertension, AF, HF).
- Excess mortality is mainly caused by behaviour-dependent risk factors (e.g. smoking addiction) and an impaired capacity for self-care (e.g. treatment adherence).
- NAFLD is associated with other cardiometabolic risk factors.
- Patients with NAFLD should be evaluated for other cardiometabolic risk factors.
- Sex-specific conditions:
    - Preeclampsia and pregnancy-related hypertension are associated with a higher risk of CVD.
    - Polycystic ovary syndrome confers a significant risk for future development of DM.
    - ED is associated with future CV events and mortality in men.
    - CVD risk should be assessed in men with ED.
    - Asking about ED should be a standard procedure in routine CV risk assessment in men.

Patient category	Subgroups	Risk categories	CVD risk and therapy benefit estimation
Apparently healthy persons			
Persons without established ASCVD, diabetes mellitus, CKD, Familial Hypercholesterolemia	<50 years	Low- to high-risk	10-year CVD risk estimation (SCORE2). Lifetime risk and benefit estimation of risk factor treatment (e.g. with the LIFE-CVD lifetime model) to facilitate the communication of CVD risk and treatment benefits.
	50-69 years	Low- to very high-risk	10-year CVD risk estimation (SCORE2). Lifetime benefit estimation of risk factor treatment (e.g. with the LIFE-CVD lifetime model) to facilitate the communication of treatment benefits.
	≥70 years	Low- to very high-risk	10-year CVD risk estimation (SCORE2-OP). Lifetime benefit estimation of risk factor treatment (e.g. with the LIFE-CVD lifetime model) to facilitate the communication of treatment benefits.
Patients with CKD			
CKD without diabetes or ASCVD	Moderate CKD (eGFR 30–44 mL/min/1.73 m^2 and ACR <30 **or** eGFR 45–59 mL/min/1.73 m^2 and ACR 30–300 **or** eGFR ≥60 mL/min/1.73 m^2 and ACR >300)	High-risk	N/A
	Severe CKD (eGFR<30 mL/min/1.73 m^2 **or** eGFR 30–44 mL/min/1.73 m^2 and ACR >30)	Very high-risk	N/A
Familial Hypercholesterolemia			
Associated with markedly elevated cholesterol levels	N/A	High-risk	N/A
Patients with type 2 diabetes mellitus			
Patients with type 1 DM above 40 years of age may also be classified according to these criteria	Patients with well controlled short-standing DM (e.g. <10 years), no evidence of TOD and no additional ASCVD risk factors	Moderate-risk	N/A
	Patients with DM without ASCVD and/or severe TOD, and not fulfilling the moderate risk criteria.	High-risk	Residual 10-year CVD risk estimation after general prevention goals (e.g. with the ADVANCE risk score or DIAL model). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. DIAL model).
	Patients with DM with established ASCVD and/or severe TOD:[87,93-95] • eGFR <45 mL/min/1.73 m^2 irrespective of albuminuria • eGFR 45-59 mL/min/1.73 m^2 and microalbuminuria (ACR 30 -300 mg/g) • Proteinuria (ACR >300 mg/g) • Presence of microvascular disease in at least 3 different sites (e.g. microalbuminuria plus retinopathy plus neuropathy)	Very high-risk	Residual 10-year CVD risk estimation after general prevention goals (e.g. with the SMART risk score for established CVD or with the ADVANCE risk score or with the DIAL model). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. DIAL model).
Patients with established ASCVD			
Documented ASCVD, clinical or unequivocal on imaging. Documented clinical ASCVD includes previous AMI, ACS, coronary revascularization and other arterial revascularization procedures, stroke and TIA, aortic aneurysm and PAD. Unequivocally documented ASCVD on imaging includes plaque on coronary angiography or carotid ultrasound or on CTA. It does NOT include some increase in continuous imaging parameters such as intima–media thickness of the carotid artery.	N/A	Very high-risk	Residual CVD risk estimation after general prevention goals (e.g. 10-year risk with the SMART risk score for patients with established CVD or 1- or 2-year risk with EUROASPIRE risk score for patients with CHD). Consider lifetime CVD risk and benefit estimation of risk factor treatment (e.g. SMART-REACH model; or DIAL model if diabetes).

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Table 6
Treatment goals for different patient categories

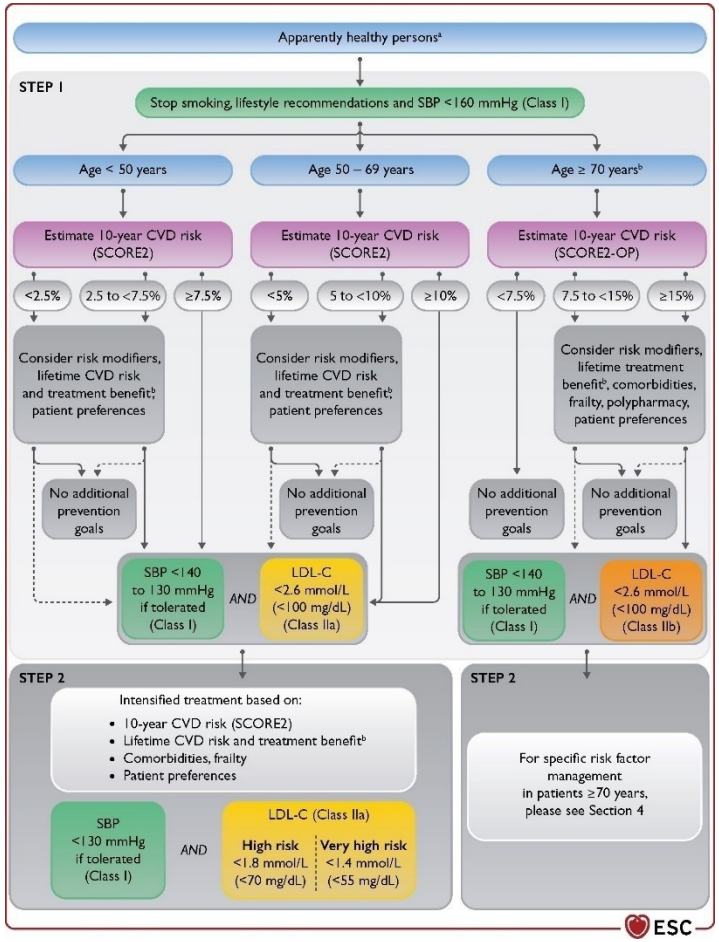
Patient category	Prevention goals (STEP 1)	Intensified/additional prevention goals[a] (STEP 2)
Apparently healthy persons	For BP and lipids: initiation of drug treatment based on CVD risk assessment (*Table 5*) or SBP >160 mmHg	
<50 years	Stop smoking and lifestyle optimization SBP <140 down to 130 mmHg if tolerated[b] LDL-C <2.6 mmol/L (100 mg/dL)	SBP <130 mmHg if tolerated[b] LDL-C <1.8 mmol/L (70 mg/dL) and ≥50% reduction in high-risk patients LDL-C <1.4 mmol/L (55 mg/dL) and ≥50% reduction in very-high-risk patients
50–69 years	Stop smoking and lifestyle optimization SBP <140 down to 130 mmHg if tolerated[b] LDL-C <2.6 mmol/L (100 mg/dL)	SBP <130 mmHg if tolerated[b] LDL-C <1.8 mmol/L (70 mg/dL) and ≥50% reduction in high-risk patients LDL-C <1.4 mmol/L (55 mg/dL) and ≥50% reduction in very-high-risk patients
≥70 years	Stop smoking and lifestyle optimization SBP <140 mmHg if tolerated[b] LDL-C <2.6 mmol/L (100 mg/dL)	For specific risk factor management in patients ≥70 years old, please see relevant sections in *section 4*.
Patients with CKD	Stop smoking and lifestyle optimization SBP <140 down to 130 mmHg if tolerated[b] LDL-C <2.6 mmol/L (100 mg/dL) and ≥50% LDL-C reduction Otherwise according to ASCVD and DM history	LDL-C <1.8 mmol/L (70 mg/dL) in high-risk patients and <1.4 mmol/L (55 mg/dL) in very-high risk patients (see *Table 4*)
Patients with FH	Stop smoking and lifestyle optimization SBP <140 down to 130 mmHg if tolerated[b] LDL-C <2.6 mmol/L (100 mg/dL) and ≥50% LDL-C reduction Otherwise according to ASCVD and DM history	LDL-C <1.8 mmol/L (70 mg/dL) in high-risk patients and <1.4 mmol/L (55 mg/dL) in very-high risk patients (see *Table 4*)
People with type 2 DM		
Well-controlled short-standing DM (e.g. <10 years), no evidence of TOD and no additional ASCVD risk factors	Stop smoking and lifestyle optimization	
Without established ASCVD or severe TOD (see *Table 4* for definitions)	Stop smoking and lifestyle optimization SBP <140 down to 130 mmHg if tolerated[b] LDL-C <2.6 mmol/L (100 mg/dL) HbA1c <53 mmol/mol (7.0%)	SBP <130 mmHg if tolerated[b] LDL-C <1.8 mmol/L (70 mg/dL) and ≥50% reduction SGLT2 inhibitor or GLP-1RA
With established ASCVD and/or severe TOD (see *Table 4* for definitions)	Stop smoking and lifestyle optimisation SBP <140 down to 130 mmHg if tolerated[b] LDL-C <1.8 mmol/L (70 mg/dL) HbA1c <64 mmol/mol (8.0%) SGLT2 inhibitor or GLP1-RA CVD: antiplatelet therapy	SBP <130 mmHg if tolerated[b] LDL-C <1.4 mmol/L (55 mg/dL) and ≥50% reduction SGLT2 inhibitor or GLP-1RA if not already on *May additionally consider novel upcoming treatments: DAPT, dual pathway inhibition,a colchicine, icosapent ethyl*
Patients with established ASCVD	Stop smoking and lifestyle optimization SBP <140 down to 130 mmHg if tolerated[b] Intensive oral lipid-lowering therapy aiming at ≥50% LDL-C reduction and LDL-C <1.8 mmol/L (70 mg/dL) Antiplatelet therapy	SBP <130 mmHg if tolerated[b] LDL-C <1.4 mmol/L (55 mg/dL) *May additionally consider novel upcoming treatments:* *DAPT, dual pathway inhibition, colchicine, icosapent ethyl, etc.*

ASCVD = atherosclerotic cardiovascular disease; BP = blood pressure; CKD = chronic kidney disease; CVD = cardiovascular disease; DAPT = dual antiplatelet therapy; DBP = diastolic blood pressure; DM = diabetes mellitus; EAS = European Atherosclerosis Society; ESC = European Society of Cardiology; FH = familial hypercholesterolaemia; GLP-1RA = glucagon-like peptide-1receptor agonist; HbA1c = glycated haemoglobin; LDL-C = low-density lipoprotein cholesterol; SBP = systolic blood pressure (office); SGLT2 = sodium-glucose cotransporter 2; TOD = target organ damage.

a Depending on 10-year (residual) risk and/or estimated lifetime benefit (see *Table 4* for details), comorbidities, and patient preference. Levels of evidence of intensified goals vary, see recommendation tables in *sections 4.6* and *4.7*. For CKD and FH, LDL-C targets are taken form the 2019 ESC/EAS Guidelines for the treatment of dyslipidaemias.[3]

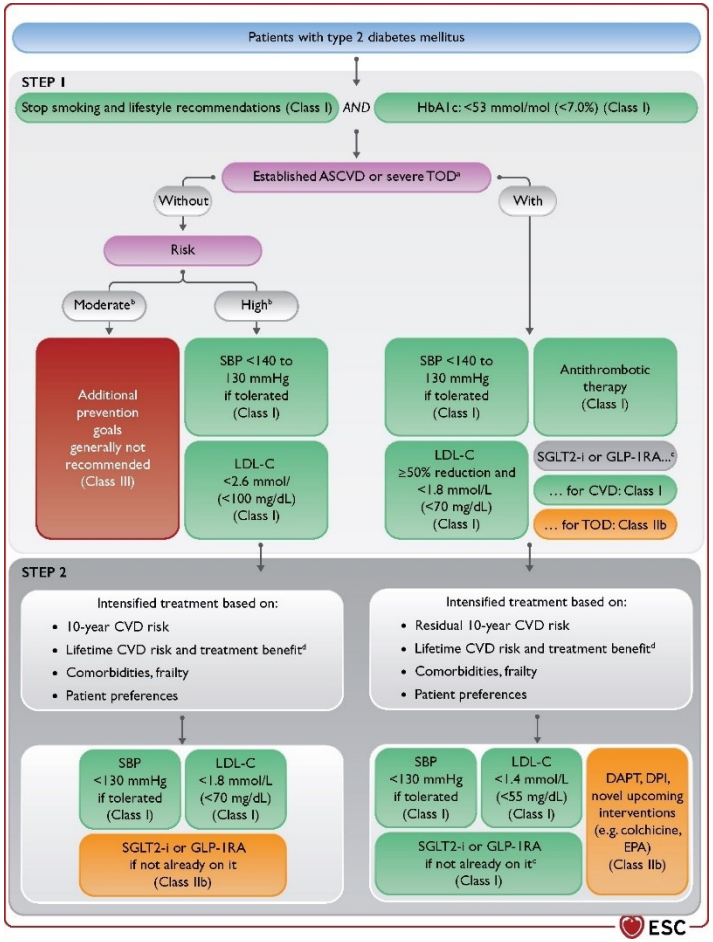
b Office DBP treatment target range <80 mmHg.

Figure 6 Flow chart of cardiovascular disease risk and risk factor treatment in apparently healthy persons. ASCVD = ...



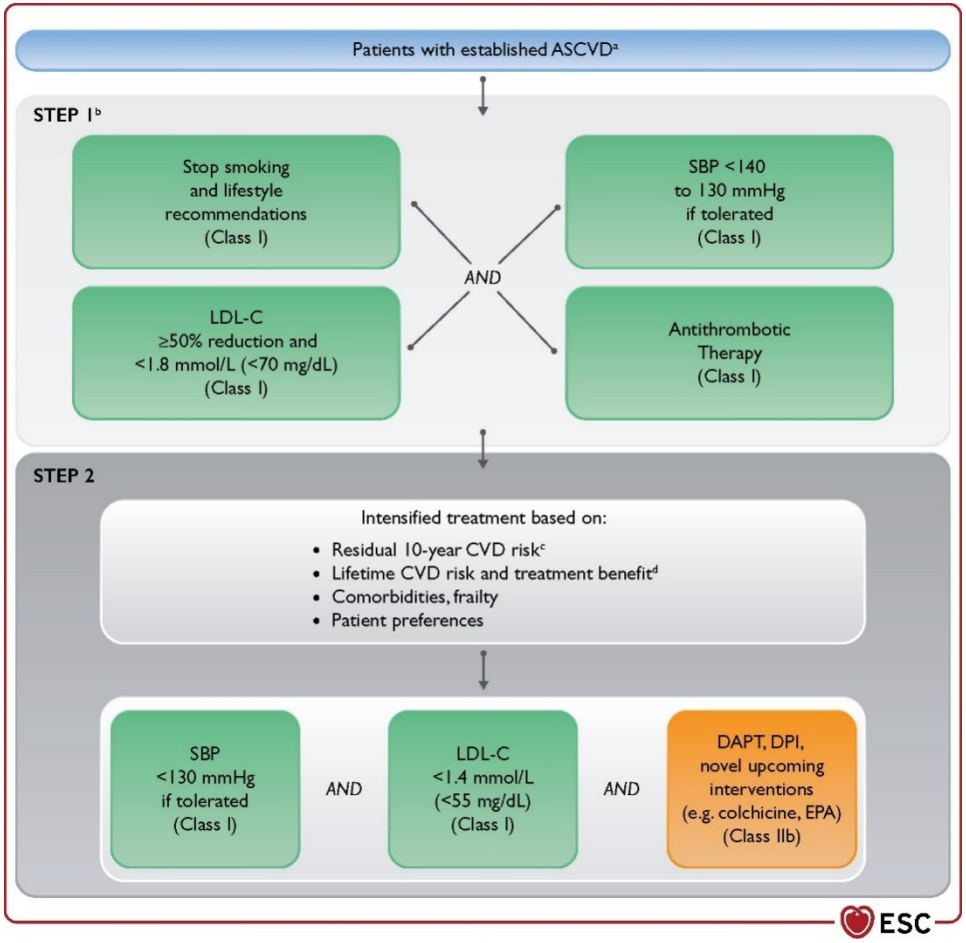
Eur Heart J, Volume 42, Issue 34, 7 September 2021, Pages 3227–3337, https://doi.org/10.1093/eurheartj/ehab484

Figure 8 Flow chart of cardiovascular risk and risk factor treatment in patients with type 2 diabetes mellitus. ...



Eur Heart J, Volume 42, Issue 34, 7 September 2021, Pages 3227–3337, https://doi.org/10.1093/eurheartj/ehab484

Figure 7 Flow chart of cardiovascular risk and risk factor treatment in patients with established atherosclerotic ...



Eur Heart J, Volume 42, Issue 34, 7 September 2021, Pages 3227–3337, https://doi.org/10.1093/eurheartj/ehab484

Dyslipidaemias

- **Main and the most important factor of developement of CVD**
- **No dyslipidaemia – no atherosclerosis**

Dyslipidaemias

- 25 % adult over 50 years of age and older in developed countries take statins
- statins reduce CV morbidity and mortality in primary and secondary prevention and in high doses also slow the progression or even promote regression of atherosclerosis
- atherosclerosis begins in 15 years of age
- recommended controls of levels of lipids in primary prevention: in 30?, 40, 50 a 60 years of age

- Match F, Baigent C, Catapano AL et al.:

ESC Scientific Document Group 2019 ESC/EAS Guidelines for the management of dyslipidaemias,

Eu Heart J 2019, pii:ehz455

DOI:<http://dx.doi.org/10.1093/eurheartj/ehz455>

Risk levels of a total CV risk

- **1) Very high risk** (documented CVD, Type 2 DM, Type 1 DM with target organ damage, patients with severe CKD, familial hypercholesterolemia)

- **2) High risk** (markedly elevated single risk factors, e.g. severe hypertension, patients with moderate CKD)

Risk levels of a total CV risk

- **3) Moderate risk** (+ modulated risk factors, e.g. obesity, family history of CVD, social class etc.)

- **4) Low risk**

Apparently healthy people **– now we use SCORE 2 and SCORE OP for CV risk calculation…**

Dyslipidaemias

- Hypercholesterolaemias
- Hypertriglyceridaemias (part of „metabolic syndrome“)
- Combined hyperlipidaemias

Target levels in „healthy persons“

- Total CH < 5,0 mmol/l
- LDL-CH < 3,0 mmol/l
- HDL-CH > 1,0 mmol/l
- TG < 2,0 mmol/l

Targets of LDL-C levels

- Very, very high risk (repeated CV event): 1,0 mmol/l
- Very high risk: 1,4 mmol/l or decrease 50 %
- High risk : 1,8 mmol/l or decrease 50%
- Moderate risk: 2,6 mmol/l or decrease o 50%
- Low risk: 3,0 mmol/l

Targets of non-HDL-CH

- LDL-CH 2,6 mmol/l – non-HDL-CH 3,4 mmol/l
- LDL-CH 1,8 mmol/l - non-HDL-CH 2,6 mmol/l
- LDL-CH 1,4 mmol/l - non-HDL-CH 2,2 mmol/l

Pharmacotherapy of dyslipidaemias

- **Statins** (reduce synthesis of cholesterol in the liver by competitively inhibiting HMG-CoA reductase activity)
- **Ezetimibe** (inhibits intestinal uptake of cholesterol)
- **Nicotinic acid** (intolerance) – not practically used
- **Fibrates** (agonists of PPAR-alfa)
- **Omega-3-fatty acids** (components of fish oil)
- **Bile acid sequestrants** (intolerance) – not practicelly used

Statins

- decrease CVD about 30-40 %
- decrease total mortality about o 20 %

- the main and only causal risk factor of atherosclerosis: LDL-CH
- (the others are only accelerators or markers („no LDL-CH, no atherosclerosis“)

- to give the patient most tolerable dosage (for example atorva 80-40 mg, rosuva 20 mg)

New hypolipidaemics

- Inhibitors PCSK9:

(proprotein convertase subtilisin/kexin type 9

a new class of cholesterol busters:

- crucial protein in LDL cholesterol (LDL-C) metabolism
- pivotal role in the degradation of the LDL receptor)

- Inhibitors PCSK9 increase effect of statins (HMG-CoA reductase inhibitors)

PCSK9 inhibitors

- monoclonaly antibodies against „paraprotein konvertáse subtilisin-kexin“ – this enzyme degradates LDL-rp
- evolocumab (Repatha), alirocumab (Praluent)
- - s.c. 1 x 2-4/weeks
- - ↓ LDL-Ch about 50 % and Lp(a) about 20-30%
- -↓ CV events about 53 %

Pharmacotherapy of hypertriglycaridemia

- High risk: Tg > 2,3 mmol/l …statin
- Very high risk: TG 1,5-5,6 mmol/l…statin + eicosapent. acid 2 x 2g/day
- Tg > 2,3 mmol/l and target level of LDL-CH… statin + fibrate

Dyslipidaemias in old people (age >70)

Start:

- Secondary prevention - always
- Primary prevention – only in High and Very High Risk

Pharmacotherapy of dyslipidaemia (in practice)

Statins!!

- **in combination:**
  - + **Fibrates** **(increased TG, decreased HDL-CH – as a first step: DM Type 2 with TG > 4 mmol/l**
  - + **Ezetimibe** **(increased LDL-C) – as a monotherapy: intolerance of statins**
  - + **PCSK9 inhibitors**

Secondary risk targets

- Lp (a) – only very risk persons, family history of premature CVD

- Apo-B - people vith metabolic syndrome, DM

Other effects of statins

- decrease vascular dysfunction
- decrease proliferation in vessel tissue
- decrease proliferative cytokins (TN alfa, PAI-1, Interleukin)
- decrease aggregation of trombocytes
- increase vitamin D levels

- increase of glucose levels?

Statins and the risk of development of diabetes (FDA 28.2.2012)

- mechanism is unknown (decreasing insulin sensitivity? decreasing insulin secretion in beta-cells?)

- frequency increses with the dose of statin (??)
- 8-13 % (simvastatin – atorvastatin – rosuvastatin)

Statins and the risk of development of diabetes (FDA 28.2.2012)

- the absolute reduction in the risk of CVD outweighs the posssible adverse effects of a very small increase in the incidence of diabetes

- 9:1 (save the life by reducing levels of cholesterol x development of DM Type 2)

Lipidy a COVID - 19

- Treatment of statin is safe and there is no reason for stoping it
- Can also leads to moderation of infection
- In combination with Remdesivir maybe it is ideal exchange atorvastatin, simvastatin and pravastatin to rosuvastatin

Děkuji vám za pozornost