The 2016 ESC/EAS Guidelines for the Management of Dyslipidemias

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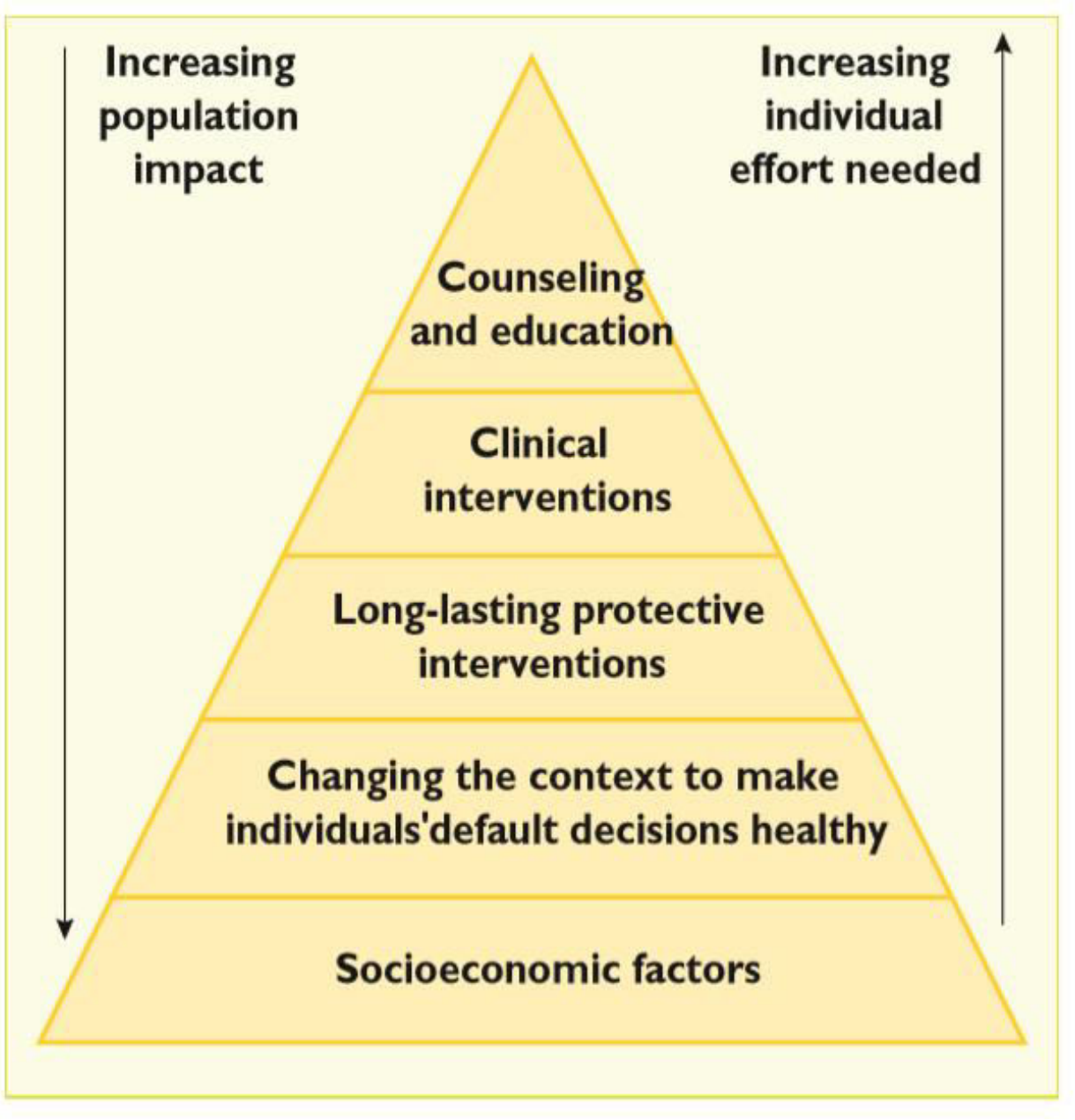
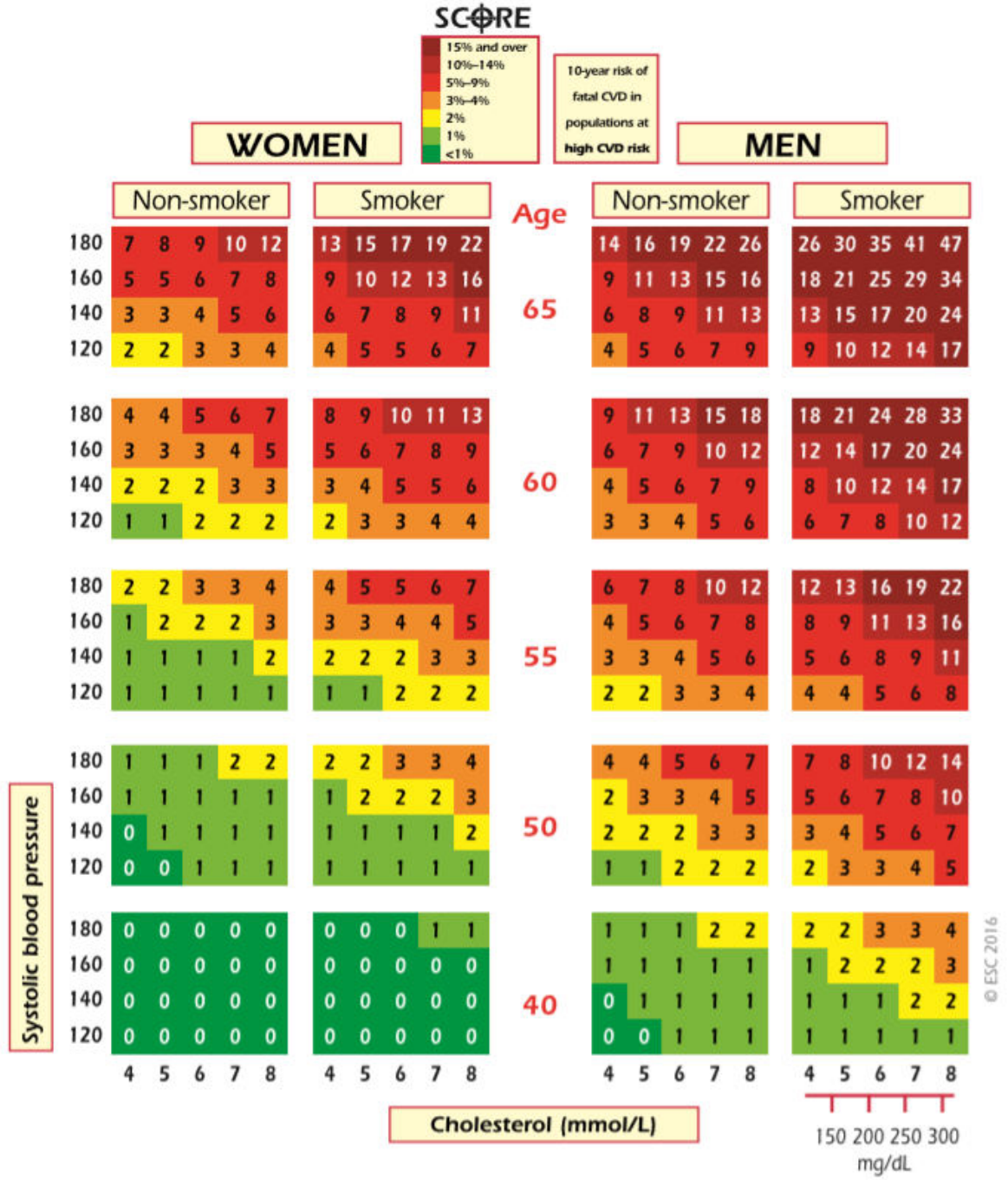
Classes of recommendations

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

Health impact pyramid

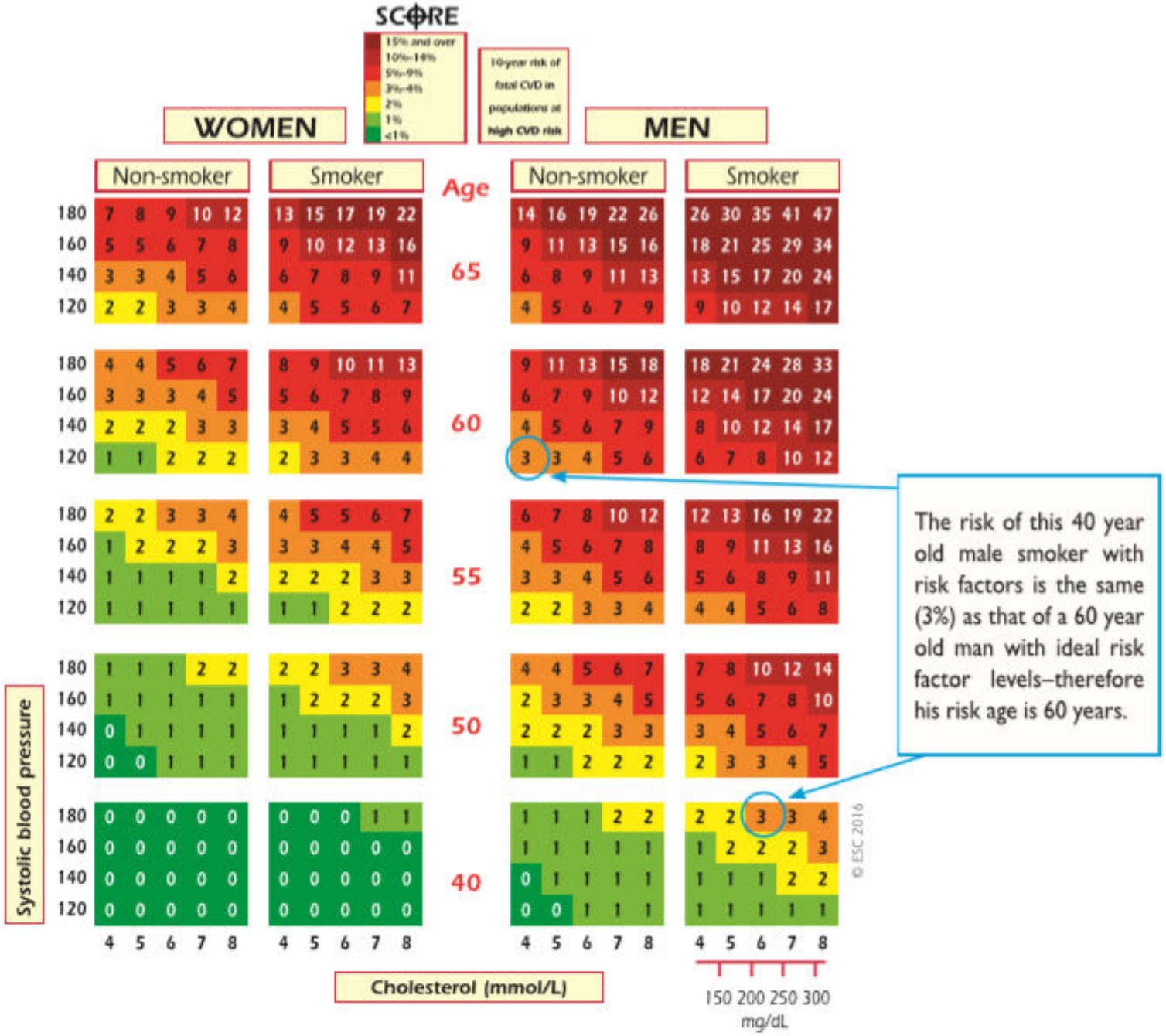


SCORE chart: 10- year risk of fatal cardiovascular disease (CVD) in population at CVD high risk



Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Illustration of the risk age concept



Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Risk categories

Very high-risk	Subjects with any of the following: • Documented cardiovascular disease (CVD), clinical or unequivocal on imaging. Documented CVD includes previous myocardial infarction (MI), acute coronary syndrome (ACS), coronary revascularisation (percutaneous coronary intervention (PCI), coronary artery bypass graft surgery (CABG)) and other arterial revascularization procedures, stroke and transient ischaemic attack (TIA), and peripheral arterial disease (PAD). Unequivocally documented CVD on imaging is what has been shown to be strongly predisposed to clinical events, such as significant plaque on coronary angiography or carotid ultrasound. • DM with target organ damage such as proteinuria or with a major risk factor such as smoking, hypertension or dyslipidaemia. • Severe CKD (GFR <30 mL/min/1.73 m^2). • A calculated SCORE ≥10% for 10-year risk of fatal CVD.
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 (some young people with type 1 diabetes may be at low or moderate risk). • Moderate CKD (GFR 30–59 mL/min/1.73 m^2). • A calculated SCORE ≥5% and <10% for 10-year risk of fatal CVD.
Moderate-risk	SCORE is ≥1% and <5% for 10-year risk of fatal CVD.
Low-risk	SCORE <1% for 10-year risk of fatal CVD.

ACS = acute coronary syndrome; AMI = acute myocardial infarction; BP = blood pressure; CKD = chronic kidney disease; DM = diabetes mellitus; GFR = glomerular filtration rate; PAD = peripheral artery disease; SCORE = systematic coronary risk estimation; TIA = transient ischaemic attack.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Intervention strategies as a function of total cardiovascular risk and LDL cholesterol level

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	No lipid intervention	No lipid intervention	No lipid intervention	No lipid intervention	Lifestyle intervention, consider drug if uncontrolled
Class[a]/Level[b]	I/C	I/C	I/C	I/C	IIa/A
≥1 to <5	No lipid intervention	No lipid intervention	Lifestyle intervention, consider drug if uncontrolled	Lifestyle intervention, consider drug if uncontrolled	Lifestyle intervention, consider drug if uncontrolled
Class[a]/Level[b]	I/C	I/C	IIa/A	IIa/A	I/A
≥5 to <10, or high-risk	No lipid intervention	Lifestyle intervention, consider drug if uncontrolled	Lifestyle intervention and concomitant drug intervention	Lifestyle intervention and concomitant drug intervention	Lifestyle intervention and concomitant drug intervention
Class[a]/Level[b]	IIa/A	IIa/A	IIa/A	I/A	I/A
≥10 or very high-risk	Lifestyle intervention, consider drug[c]	Lifestyle intervention and concomitant drug intervention	Lifestyle intervention and concomitant drug intervention	Lifestyle intervention and concomitant drug intervention	Lifestyle intervention and concomitant drug intervention
Class[a]/Level[b]	IIa/A	IIa/A	I/A	I/A	I/A

CV = cardiovascular; LDL-C = low-density lipoprotein cholesterol; SCORE = Systematic Coronary Risk Estimation.
[a]Class of recommendation.
[b]Level of evidence.
[c]In patients with myocardial infarction, statin therapy should be considered irrespective of total cholesterol levels

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for lipid analyses in CVD risk estimation

Recommendations	Class [a]	Level [b]
TC is to be used for the estimation of total CV risk by means of the SCORE system.	I	C
LDL-C is recommended to be used as the primary lipid analysis for screening, risk estimation, diagnosis and management. HDL-C is a strong independent risk factor and is recommended to be used in the HeartScore algorithm.	I	C
TG adds information on risk and is indicated for risk estimation.	I	C
Non-HDL-C is a strong independent risk factor and should be considered as a risk marker, especially in subjects with high TG.	I	C
ApoB should be considered as an alternative risk marker whenever available, especially in subjects with high TG.	IIa	C
Lp(a) should be considered in selected cases at high-risk, in patients with a family history of premature CVD, and for reclassification in subjects with borderline risk.	IIa	C
The ratio apoB/apoA1 may be considered as an alternative analysis for risk estimation.	IIb	C
The ratio non-HDL-C/HDL-C may be considered as an alternative but HDL-C used in HeartScore gives a better risk estimation.	IIb	C

Apo = apolipoprotein; CKD = chronic kidney disease; CVD = cardiovascular disease; HDL-C = high-density lipoprotein-cholesterol; LDL-C = low-density lipoprotein-cholesterol; Lp = lipoprotein; SCORE = Systemic Coronary Risk Estimation; TC = total cholesterol; TG = triglycerides.

[a]Class of recommendation.

[b]Level of evidence.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Treatment targets and goals for CVD prevention

Smoking	No exposure to tobacco in any form.
Diet	Healthy diet low in saturated fat with a focus on whole grain products, vegetables, fruit and fish.
Physical activity	2.5–5 h moderately vigorous physical activity per week or 30–60 min most days.
Body weight	BMI 20–25 kg/m^2, waist circumference <94 cm (men) and <80 cm (women).
Blood pressure	<140/90 mmHg[a]
Diabetes	HbA1c: <7% (<53 mmol/mol).

BMI = body mass index; HbA1C = glycated haemoglobin; HDL-C = high-density lipoprotein-cholesterol; LDL-C = low-density lipoprotein-cholesterol; TG = triglycerides.

[a]The BP target can be lower in some patients with type 2 diabetes127 and in some high-risk patients without diabetes who can tolerate multiple antihypertensive drugs.[70]

[b]The term "baseline LDL-C" refers to the level in a subject not taking any lipid lowering medication.

Lipids LDL-C is the primary target	**Very high-risk: LDL-C <1.8 mmol/L (70 mg/dL)** or a reduction of at least 50% if the baseline[b] is between 1.8 and 3.5 mmol/L (70 and 135 mg/dL).
	High-risk: LDL-C <2.6 mmol/L (100 mg/dL) or a reduction of at least 50% if the baseline[b] is between 2.6 and 5.2 mmol/L (100 and 200 mg/dL).
	Low to moderate risk: LDL-C <3.0 mmol/L (115 mg/dL).
	Non-HDL-C secondary targets are <2.6, 3.4 and 3.8 mmol/L (100, 130 and 145 mg/dL) for very high-, high- and moderate-risk subjects, respectively.
	HDL-C: no target, but >1.0 mmol/L (40 mg/dL) in men and >1.2 mmol/L (48 mg/dL) in women indicates lower risk.
	TG: 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.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Impact of specific lifestyle changes on lipid level

	Magnitude of the effect	Level of evidence	References
Lifestyle interventions to reduce TC and LDL-C levels			
Reduce dietary trans fat	+++	A	136, 139
Reduce dietary saturated fat	+++	A	136, 137
Increase dietary fibre	++	A	140, 141
Use functional foods enriched with phytosterols	++	A	142, 143
Use red yeast rice supplements	++	A	144–146
Reduce excessive body weight	++	A	147, 148
Reduce dietary cholesterol	+	B	149
Increase habitual physical activity	+	B	150
Use soy protein products	+/-	B	151
Lifestyle interventions to reduce TG-rich lipoprotein levels			
Reduce excessive body weight	+++	A	147, 148
Reduce alcohol intake	+++	A	152, 153
Increase habitual physical activity	++	A	150, 154
Reduce total amount of dietary carbohydrate	++	A	148, 155
Use supplements of n-3 polyunsaturated fat	++	A	156, 157
Reduce intake of mono- and disaccharides	++	B	158, 159
Replace saturated fat with mono- or polyunsaturated fat	+	B	136, 137
Lifestyle interventions to increase HDL-C levels			
Reduce dietary trans fat	+++	A	136, 160
Increase habitual physical activity	+++	A	150, 161
Reduce excessive body weight	++	A	147, 148
Reduce dietary carbohydrates and replace them with unsaturated fat	++	A	148, 162
Modest consumption in those who take alcohol may be continued	++	B	152
Quit smoking	+	B	163
Among carbohydrate-rich foods prefer those with low glycaemic index and high fibre content	+/-	C	164
Reduce intake of mono- and disaccharides	+/-	C	158, 159

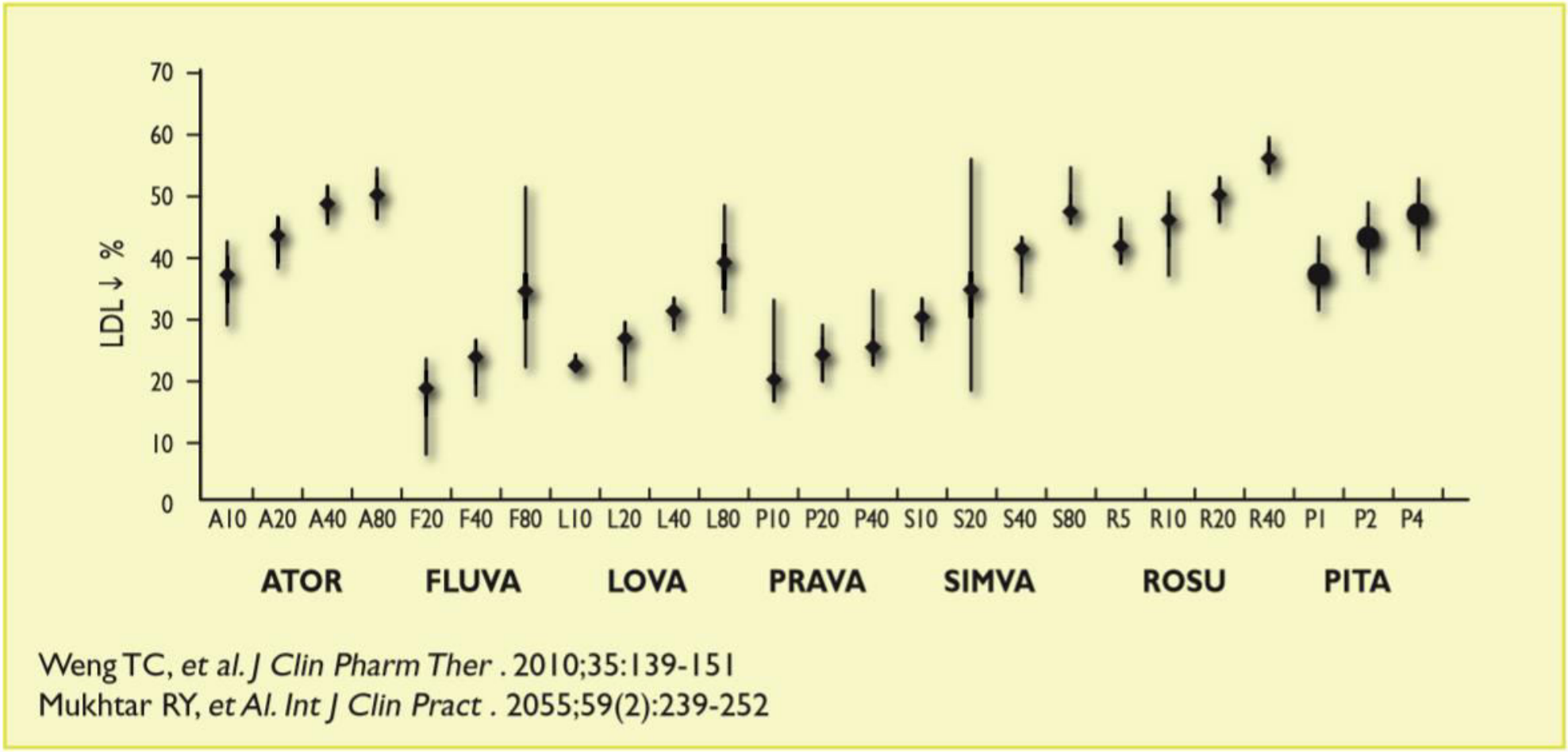
Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Dietary recommendations to lower LDL-c and improve the overall lipoprotein profile

	To be preferred	To be used with moderation	To be chosen occasionally in limited amounts
Cereals	Whole grains	Refined bread, rice and pasta, biscuits, corn flakes	Pastries, muffins, pies, croissants
Vegetables	Raw and cooked vegetables	Potatoes	Vegetables prepared in butter or cream
Legumes	Lentils, beans, fava beans, peas, chickpeas, soybean		
Fruit	Fresh or frozen fruit	Dried fruit, jelly, jam, canned fruit, sorbets, popsicles, fruit juice	
Sweets and sweeteners	Non-caloric sweeteners	Sucrose, honey, chocolate, candies	Cakes, ice creams, fructose, soft drinks
Meat and fish	Lean and oily fish, poultry without skin	Lean cuts of beef, lamb, pork or veal, seafood, shellfish	Sausages, salami, bacon, spare ribs, hot dogs, organ meats
Dairy food and eggs	Skim milk and yogurt	Low-fat milk, low-fat cheese and other milk products, eggs	Regular cheese, cream, whole milk and yogurt
Cooking fat and dressings	Vinegar, mustard, fat-free dressings	Olive oil, non-tropical vegetable oils, soft margarines, salad dressing, mayonnaise, ketchup	Trans fats and hard margarines (better to avoid them), palm and coconut oils, butter, lard, bacon fat
Nuts/seeds		All, unsalted (except coconut)	Coconut
Cooking procedures	Grilling, boiling, steaming	Stir-frying, roasting	Frying

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Drugs for treatment of hypercholesterolemia



A systematic review and meta-analysis of the therapeutic equivalence of statins. ATOR: atorvastatin; FLUVA: fluvastatin; LOVA: lovastatin; PRAVA: pravastatin; SIMVA: simvastatin; ROSU: rosuvastatin; PITA: pitavastatin.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Drugs potentially interacting with statins metabolized by CYP 3A4 leading to increased risk of myopathy and rhabdomyolysis

Anti-infective agents	Calcium antagonists	Other
Itraconazole	Verapamil	Ciclosporin
Ketoconazole	Diltiazem	Danazol
Posaconazole	Amlodipine	Amiodarone
Erythromycin		Ranolazine
Clarithromycin		Grapefruit juice
Telithromycin		Nefazodone
HIV protease inhibitors		Gemfibrozil

Adapted from Egan and Colman[232] and Wiklund *et al.*[233]

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for the pharmacological treatment of hypercholesterolaemia

Recommendations	Class [a]	Level [b]	Ref [c]
Prescribe statin up to the highest recommended dose or highest tolerable dose to reach the goal.	I	A	62, 64, 68
In the case of statin intolerance, ezetimibe or bile acid sequestrants, or these combined, should be considered.	IIa	C	239, 256, 257
If the goal is not reached, statin combination with a cholesterol absorption inhibitor should be considered.	IIa	B	63
If the goal is not reached, statin combination with a bile acid sequestrant may be considered.	IIb	C	
In patients at very high-risk, with persistent high LDL-C despite treatment with maximal tolerated statin dose, in combination with ezetimibe or in patients with statin intolerance, a PCSK9 inhibitor may be considered.	IIb	C	115, 116

LDL-C = low-density lipoprotein-cholesterol; PCSK9 = proprotein convertase subtilisin/kexin type 9.
[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting recommendations.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Possible causes of hypertriglyceridaemia

Genetic predisposition
Obesity
Type 2 diabetes
Alcohol consumption
Diet high in simple carbohydrates
Renal disease
Hypothyroidism
Pregnancy (physiological triglyceride concentrations double during the third trimester)
Paraproteinaemia and autoimmune disorders such as systemic lupus erythematosus
Multiple medications including: • Corticosteroids • Oestrogens, especially those taken orally • Tamoxifen • Antihypertensives: adrenergic beta-blocking agents (to a different degree), thiazides • Isotretinoin • Bile acid-binding resins • Ciclosporin • Antiretroviral regimens (protease inhibitors) • Psychotropic medications: phenothiazines, second generation antipsychotics

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for drug treatments of hypertriglyceridaemia

Recommendations	Class [a]	Level [b]	Ref [c]
Drug treatment should be considered in high-risk patients with TG >2.3 mmol/L (200 mg/dL).	IIa	B	261, 262
Statin treatment may be considered as the first drug of choice for reducing CVD risk in high-risk individuals with hypertriglyceridaemia.	IIb	B	263, 264
In high-risk patients with TG >2.3 mmol/L (200 mg/dL) despite statin treatment, fenofibrate may be considered in combination with statins.	IIb	C	261–264

CVD = cardiovascular disease; TG = triglycerides.
[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting recommendations.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Summary of the efficacy of drug combinations for the management of mixed dyslipidaemias

A combination of statins with fibrates can also be considered while monitoring for myopathy, but the combination with gemfibrozil should be avoided.
If TG are not controlled by statins or fibrates, prescription of n-3 fatty acids may be considered to decrease TG further, and these combinations are safe and well tolerated.

TG = triglycerides.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations if drug treatment of low HDL-c is considered

Recommendations	Class [a]	Level [b]	Ref [c]
Statins and fibrates raise HDL-C with a similar magnitude and these drugs may be considered.	IIb	B	262, 292
The efficacy of fibrates to increase HDL-C may be attenuated in people with type 2 diabetes.	IIb	B	261, 262

HDL-C = high-density lipoprotein cholesterol.
[a]Class of recommendation.
[b]Level of evidence.
[c]Reference(s) supporting recommendations.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Management of dyslipidaemia in different clinical settings

Dutch Lipid Clinic Network diagnostic criteria for familial hypercholesterolaemia

Criteria	Points
1) Family history	
First-degree relative with known premature (men: <55 years; women: <60 years) coronary or vascular disease, or	
First-degree relative with known LDL-C above the 95th percentile	1
First-degree relative with tendinous xanthomata and/or arcus cornealis, or	
children <18 years of age with LDL-C above the 95th percentile (see 9.1.2.3)	2
2) Clinical history	
Patient with premature (men: <55 years; women: <60 years) coronary artery disease	2
Patient with premature (men: <55 years; women: <60 years) cerebral or peripheral vascular disease	1
3) Physical examination	
Tendinous xanthomata	6
Arcus cornealis before age 45 years	4
4) LDL-C levels	
LDL-C ≥ 8.5 mmol/L (325 mg/dL)	8
LDL-C 6.5–8.4 mmol/L (251–325 mg/dL)	5
LDL-C 5.0–6.4 mmol/L (191–250 mg/dL)	3
LDL-C 4.0–4.9 mmol/L (155–190 mg/dL)	1
5) DNA analysis	
Functional mutation in the LDLR, apoB or PCSK9 gene	8
Choose only one score per group, the highest applicable Diagnosis (diagnosis is based on the total number of points obtained)	
A 'definite' FH diagnosis requires >8 points	
A 'probable' FH diagnosis requires 6–8 points	
A 'possible' FH diagnosis requires 3–5 points	

FH = familial hypercholesterolaemia; LDL-C = low-density lipoproteincholesterol.
[a]Exclusive of each other (i.e. maximum 6 points if both are present)

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for the detection and treatment of patients with heterozygous familial hypercholesterolaemia

Recommendations	Class [a]	Level [b]
FH is recommended to be suspected in patients with CHD before the age of 55 years for men and 60 years for women, in subjects with relatives with premature fatal or non-fatal CVD, in subjects with relatives having tendon xanthomas, and in subjects with severely elevated LDL-C [in adults >5 mmol/L (190 mg/dL), in children >4 mmol/L (150 mg/dL)].	I	C
Diagnosis is recommended to be confirmed with clinical criteria and, when available, with DNA analysis.	I	C
Family cascade screening is recommended to be performed when an index case of FH is diagnosed.	I	C
FH patients are recommended to be treated with intense-dose statin, often in combination with ezetimibe.	I	C

Recommendations	Class [a]	Level [b]
Treatment should be considered to aim at reaching an LDL-C <2.6 mmol/L (100 mg/dL) or in the presence of CVD <1.8 mmol/L (70 mg/dL). If targets cannot be reached, maximal reduction of LDL-C should be considered using appropriate drug combinations.	IIa	C
Treatment with a PCSK9 antibody should be considered in FH patients with CVD or with other factors putting them at very high-risk for CHD, such as other CV risk factors, family history, high Lp(a) or statin intolerance.	IIa	C
In children, testing is recommended from age 5 years, or earlier if homozygous FH is suspected.	I	C
Children with FH should be educated to adopt a proper diet and treated with statin from 8–10 years of age. Targets for treatment should be LDL-C <3.5 mmol/L (135 mg/dL) at >10 years of age.	IIa	C

CHD: coronary heart disease; CVD: cardiovascular disease; FH: familial hypercholesterolaemia; Lp(a): lipoprotein(a).

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Genetic disorders of lipoprotein metabolism

Disorder	Prevalence	Gene(s)	Effect on lipoproteins
HeFH	1 in 200–250	*LDLR* *APO B* *PCSK9*	↑LDL-C
HoFH	1 in 160 000–320 000	*LDLR* *APO B* *PCSK9*	↑↑LDL-C
FCH	1 in 100/200	*USF1 + modifying genes*	↑LDL-C ↑VLDL-C ↑apoB
Familial dysbetalipoproteinaemia	1 in 5000	*APO E*	↑↑ IDL and chylomicron remnants (βVLDL)
Familial lipoprotein lipase deficiency	1 in 10^6	*LPL* *APO C2*	↑↑ chylomicrons and VLDL-C
Tangier disease (analphalipoproteinaemia)	1 in 10^6	*ABCA1*	↓↓HDL-C
Familial LCAT deficiency	1 in 10^6	*LCAT*	↓HDL-C

Apo: apolipoprotein; FCH: familial combined hyperlipidaemia; HeFH: heterozygous familial hypercholesterolaemia; HoFH: homozygous familial hypercholesterolaemia; LCAT: lecithin cholesterol acyltransferase.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Children

- HoFH: as soon as possible for statins
- HeFH: after 8 years old

Recommendations for the treatment of dyslipidaemia in older adults

Recommendations	Class [a]	Level [b]	Ref [c]
Treatment with statins is recommended for older adults with established CVD in the same way as for younger patients.	I	A	334, 337
Since older people often have co-morbidities and have altered pharmacokinetics, lipid-lowering medication should be started at a lower dose and then titrated with caution to achieve target lipid levels that are the same as in younger subjects.	IIa	C	
Statin therapy should be considered in older adults free from CVD, particularly in the presence of hypertension, smoking, diabetes and dyslipidaemia.	IIa	B	62, 64, 65

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Summary of dyslipidaemia in metabolic syndrome and in type 2 diabetes

Dyslipidaemia in MetS represents a cluster of lipid and lipoprotein abnormalities including elevation of both fasting and postprandial TG, apoB, and small dense LDL and low HDL-C and apoA1.
Non-HDL-C or apoB are good surrogate markers of TRLs and remnants and are a secondary objective of therapy. Non-HDL-C <3.4 mmol/L (<130 mg/dL) or apoB <100 mg/dL is desirable in those at high-risk, and <2.6 mmol/L (<100 mg/dL) and <80 mg/dL, respectively, in those at very high-risk.
Increased waist circumference and elevation of TG seems to be a simple tool to capture the high-risk subjects with MetS.
Atherogenic dyslipidaemia is one of the major risk factors for CVD in people with type 2 diabetes.

apoB: apolipoprotein B; MetS: metabolic syndrome; TG: triglycerides; TRLs: triglyceride-rich lipoproteins.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for the treatment of dyslipidaemia in diabetes

Recommendations	Class [a]	Level [b]	Ref [c]
In all patients with type I diabetes and in the presence of microalbuminuria and/or renal disease, LDL-C lowering (at least 50%) with statins as the first choice is recommended irrespective of the baseline LDL-C concentration.	I	C	64, 357
In patients with type 2 diabetes and CVD or CKD, and in those without CVD who are >40 years of age with one or more other CVD risk factors or markers of target organ damage, the recommended goal for LDL-C is <1.8 mmol/L (<70 mg/dL) and the secondary goal for non-HDL-C is <2.6 mmol/L (<100 mg/dL) and for apoB is <80 mg/dL.	I	B	62, 64
In all patients with type 2 diabetes and no additional risk factors and/or evidence of target organ damage, LDL-C <2.6 mmol/L (<100 mg/dL) is the primary goal. Non-HDL-C <3.4 mmol/L (<130 mg/dL) and apoB <100 mg/dL are the secondary goals.	I	B	62, 64

apoB: apolipoprotein B; CKD: chronic kidney disease; CVD: cardiovascular disease; HDL-C: high-density lipoprotein-cholesterol; LDL-C: low-density lipoproteincholesterol; MetS: metabolic syndrome; TG: triglycerides.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for lipid-lowering therapy in patients with ACS and patients undergoing PCI

Recommendations	Class [a]	Level [b]	Ref [c]
It is recommended to initiate or continue high dose statins early after admission in all ACS patients without contra-indication or history of intolerance, regardless of initial LDL-C values.	I	A	64, 358–360
If the LDL-C target is not reached with the highest tolerable statin dose, ezetimibe should be considered in combination with statins in post-ACS patients.	IIa	B	63
If the LDL-C target is not reached with the highest tolerable statin dose and/or ezetimibe, PCSK9 inhibitors may be considered on top of lipid-lowering therapy; or alone or in combination with ezetimibe in statin intolerant patients or in whom a statin is contra-indicated.	IIb	C	115, 116
Lipids should be re-evaluated 4–6 weeks after ACS to determine whether target levels of LDL-C <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) have been reached and whether there are any safety issues. The therapy dose should then be adapted accordingly.	IIa	C	
Routine short pretreatment or loading (on the background of chronic therapy) with high-dose statins before PCI should be considered in elective PCI or in NSTE-ACS.	IIa	A	363–365

ACS: acute coronary syndrome; NSTE-ACS: non-ST elevation acute coronary syndrome; PCI: percutaneous coronary intervention; PCSK9: proprotein convertase subtilisin/kexin type 9.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendation for the treatment of dyslipidaemia in autoimmune diseases

Recommendation	Class [a]	Level [b]
The universal use of lipid-lowering drugs is not recommended	III	C

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for the treatment of dyslipidaemia in heart failure or valvular disease

Recommendations	Class [a]	Level [b]	Ref [c]
Cholesterol-lowering therapy with statins is not recommended (but is not harmful either) in patients with heart failure in the absence of other indications for their use.	III	A	373, 374
n-3 PUFAs 1 g/day may be considered for addition to optimal treatment in patients with heart failure.	IIb	B	376
Cholesterol-lowering treatment is not recommended in patients with aortic valvular stenosis without CAD in the absence of other indications for their use.	III	A	243, 377, 378

CAD: coronary artery disease; PUFAs: polyunsaturated fatty acids.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for lipid management in patients with moderate to severe chronic kidney disease

Recommendations	Class [a]	Level [b]	Ref [c]
Patients with stage 3–5 CKD have to be considered at high or very high CV risk.	I	A	388–392
The use of statins or statin/ezetimibe combination is indicated in patients with non-dialysis-dependent CKD.	I	A	393, 394, 397
In patients with dialysis-dependent CKD and free of atherosclerotic CVD, statins should not be initiated.	III	A	395, 396

Recommendations	Class [a]	Level [b]	Ref [c]
In patients already on statins, ezetimibe or a statin/ezetimibe combination at the time of dialysis initiation, these drugs should be continued, particularly in patients with CVD.	IIa	C	
In adult kidney transplant recipients treatment with statins may be considered.	IIb	C	

CKD: chronic kidney disease; CV: cardiovascular

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendations for the treatment of dyslipidaemia in transplant patients

Recommendations	Class [a]	Level [b]	Ref [c]
Global CV risk management strategies have to be developed in transplant patients.	I	C	
Statins should be considered as the first-line agents in transplant patients. Initiation should be at low doses with careful up-titration and with caution regarding potential drug–drug interactions, particularly for those on ciclosporin.	IIa	B	402
In patients who are intolerant of statins or those with significant dyslipidaemia and high residual risk despite a maximally tolerated statin dose, alternative or additional therapy may be considered: ezetimibe for whose where high LDL-C is the principal abnormality; or; fibrates for those where hypertriglyceridaemia and/or low HDL-C is the principal abnormality.	IIb	C	

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Recommendation for lipid-lowering drugs in HIV patients

Recommendation	Class [a]	Level [b]
Lipid lowering therapy (mostly statins) should be considered in HIV patients with dyslipidaemia to achieve the LDL-C goal as defined for high-risk subjects	IIa	C

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Summary of recommendations for monitoring lipids and enzymes in patients on lipid-lowering therapy

Testing lipids
How often should lipids be tested? • Before starting lipid-lowering drug treatment, at least two measurements should be made, with an interval of 1–12 weeks, with the exception of conditions where concomitant drug treatment is suggested such as ACS and very high-risk patients.
How often should a patient's lipids be tested after starting lipid-lowering treatment? • 8 (±4) weeks after starting treatment. • 8 (±4) weeks after adjustment of treatment until within the target range.
How often should lipids be tested once a patient has reached the target or optimal lipid level? • Annually (unless there is adherence problems or other specific reasons for more frequent reviews).
Monitoring liver and muscle enzymes
How often should liver enzymes (ALT) be routinely measured in patients on lipid-lowering drugs? • Before treatment. • Once 8–12 weeks after starting a drug treatment or after dose increase. • Routine control of ALT thereafter is not recommended during lipid-lowering treatment.
What if liver enzymes become elevated in a person taking lipid-lowering drugs? If ALT <3x ULN: • Continue therapy. • Recheck liver enzymes in 4–6 weeks. If value rises to ≥3x ULN • Stop lipid-lowering therapy or reduce dose and recheck liver enzymes within 4–6 weeks. • Cautious reintroduction of therapy may be considered after ALT has returned to normal. • If ALT remains elevated check for the other reasons.

ACS: acute coronary syndrome; CK: creatine kinase; ULN: upper limit of normal.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Summary of recommendations for monitoring lipids and enzymes in patients on lipid-lowering therapy (cont)

How often should CK be measured in patients taking lipid-lowering drugs?

Pre-treatment

- Before starting therapy.
- If baseline CK is 4x ULN, do not start drug therapy; recheck.

Monitoring:

- Routine monitoring of CK is not necessary.
- Check CK if patient develops myalgia.

Be alert regarding myopathy and CK elevation in patients at risk such as: elderly patients, concomitant interfering therapy, multiple medications, liver or renal disease or sport athletes.

What if CK becomes elevated in a person taking lipid-lowering drugs?

Re-evaluate indication for statin treatment.

If ≥4 x ULN:

- If CK >10x ULN: stop treatment, check renal function and monitor CK every 2 weeks.
- If CK <10x ULN: if no symptoms, continue lipid-lowering therapy while monitoring CK.
- If CK <10x ULN: if symptoms present, stop statin and monitor normalization of CK, before re-challenge with a lower statin dose.
- Consider the possibility of transient CK elevation for other reasons such as exertion.
- Consider myopathy if CK remains elevated.
- Consider combination therapy or an alternative drug.

If <4 x ULN:

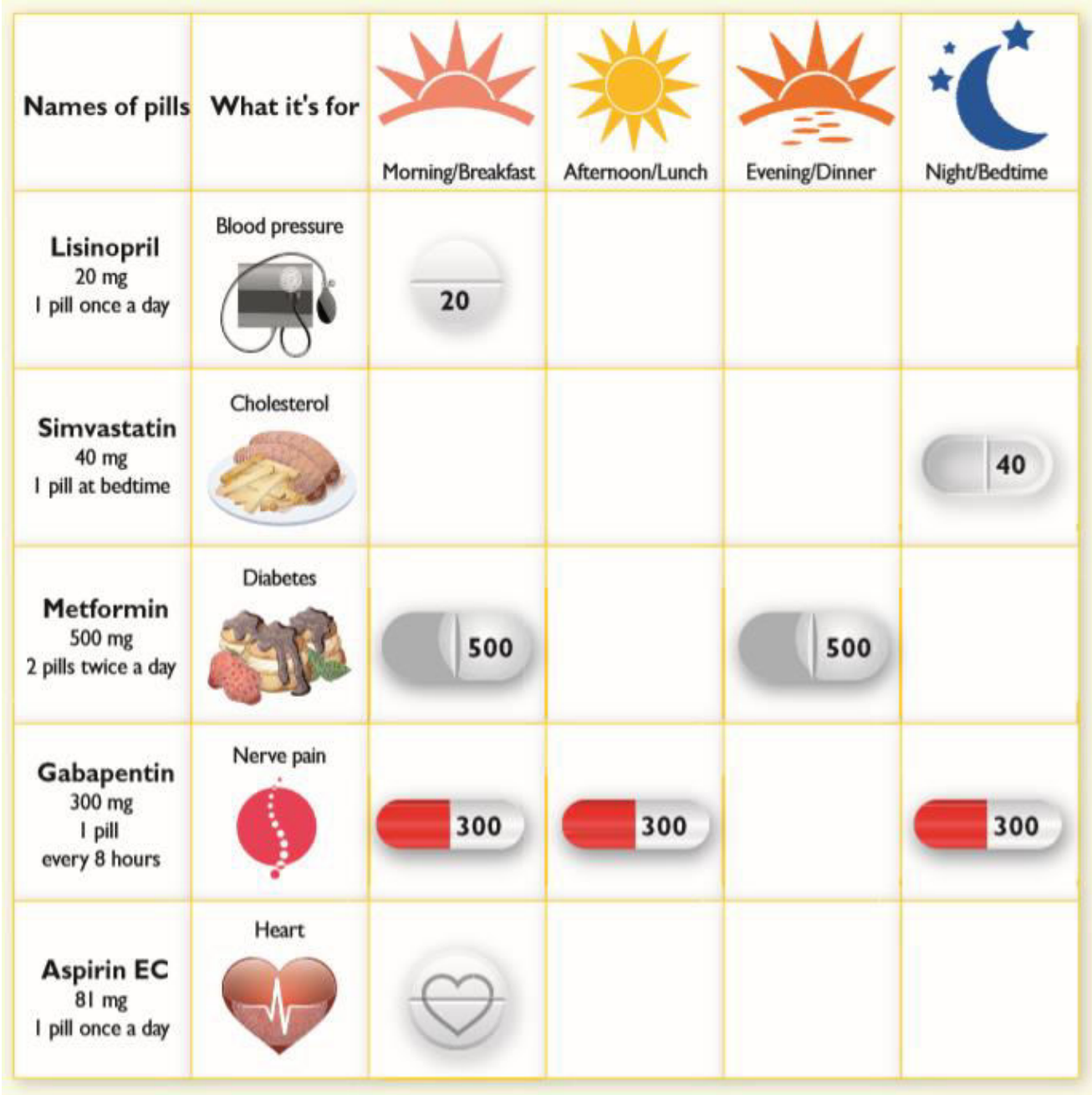
- If no muscle symptoms, continue statin (patient should be alerted to report symptoms; check CK).
- If muscle symptoms, monitor symptoms and CK regularly.
- If symptoms persist, stop statin and re-evaluate symptoms after 6 weeks; re-evaluate indication for statin treatment.
- Consider re-challenge with the same or another statin.
- Consider low-dose statin, alternate day or once/twice weekly dosing regimen or combination therapy.

For details on CK elevation and treatment of muscular symptoms during statin treatment see algorithm in supplementary figure C.

ACS: acute coronary syndrome; CK: creatine kinase; ULN: upper limit of normal.

Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

Images to improve recall



Source: Catapano AL, et al. 2016 ESC/EAS Guidelines for the Management of Dyslipidemias. Eur H J, Aug 27, 2016

AACE and EAS Lipid Guidelines

Atherosclerotic CVD Risk Categories and LDL-C Treatment Goals

	Risk Category	Risk factors[a]/10-Year risk[b]	Treatment goals: LDL-C (mg/dL)	Non-HDL-C (mg/dL)	apoB (mg/dL)
Extreme Risk	AACE	• Progressive ASCVD after achieving an LDL-C <70 mg/dL • Established clinical cardiovascular disease in patients with DM, CKD ¾ , or HeFH • History of premature ASCVD (<55 male, <65 female)	<55	<80	<70
	EAS	No recommendation made	-	-	-
Very High Risk	AACE	• Established or recent hospitalization for ACS, Coronary, carotid or peripheral vascular disease, 10-year risk >20% • Diabetes or CKD ¾ with 1 or more risk factor(s) • HeFH	<70	<100	<80
	EAS	• Established ASCVD • Severe CKD (GFR <30) • DM with target organ damage or major risk factor	<70	<100	<80
High Risk	AACE	• >2 risk factors and 10-year risk 10-20% • Diabetes or CKD ¾ with no other risk factors	<100	<130	<90
	EAS	• Diabetes, moderate CKD (GFR 30-50), 10-year Risk 5-10%, Familial hypercholesterolemia	<100	<130	<100
Moderate Risk	AACE	<2 risk factors and 10-year risk <10%	<100	<130	<90
	EAS	10-year risk 1-5%	< 115	-	-
Low Risk	AACE	No risk factors	<130	<160	NR
	EAS	10-year risk <1%	< 115	-	-

Abbreviations: ACS = acute coronary syndrome; ASCVD = atherosclerotic cardiovascular disease; CKD = chronic kidney disease; DM = diabetes mellitus; HDL-C = high-density lipoprotein cholesterol; HeFH = heterozygous familial hypercholes-terolemia; LDL-C = low-density lipoprotein cholesterol; NR = not recommended;

[a] Major independent risk factors are high LDL-C, polycystic ovary syndrome, cigarette smoking, hypertension (blood pressure ≥140/90 mm Hg or on hypertensive medication), low HDL-C (<40 mg/dL), family history of coronary artery disease (in male, first-degree relative younger than 55 years; in female, first-degree relative younger than 65 years), chronic renal disease (CKD) stage 3/4, evidence of coronary artery calcification and age (men ≥45; women ≥55 years). Subtract 1 risk factor if the person has high HDL-C.

[b] Framingham risk scoring is applied to determine 10-year risk.

Source: Baer J. AACE and EAS Lipid Guidelines. J Am Coll Cardiol, Aug 11, 2017.