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2025 ESC/EAS Dyslipidemia Guidelines Focused Update: Intensifying Prevention, Risk Stratification, and Therapy

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The 2025 Focused Update of the European Society of Cardiology and European Atherosclerosis Society (ESC/EAS) Guidelines for the management of lipid disorders marks a significant evolution in cardiovascular disease (CVD) prevention, reflecting contemporary evidence, advances in risk assessment, and the advent of novel therapeutic modalities. Dyslipidemia remains a primary modifiable risk for atherosclerotic cardiovascular disease, necessitating robust, evidence-driven strategies to optimize prevention. Notably, the update transitions from the traditional SCORE system to the more comprehensive SCORE2 and SCORE2-OP risk models for estimating 10-year atherosclerotic cardiovascular disease risk. These new models broaden applicability, encompassing both fatal and non-fatal cardiovascular events and extending risk calculation up to age 89, while recalibrating country-specific risk clusters and prioritizing non-HDL cholesterol over total cholesterol as a core indicator. The guidelines emphasize the intensification of therapy for individuals identified as being at higher risk, integrating recent clinical trial data and targeted drug selection, with a particular focus on individualized risk stratification. This focused update contrasts its recommendations against the 2019 standard, outlining the rationale for new strategies in both primary and secondary prevention through intensified lipid-lowering therapy. Comprehensive implementation of these recommendations is anticipated to drive further reductions in ASCVD events, aligning with global public health priorities. The 2025 guidelines thus serve as an essential tool for clinicians and researchers, supporting nuanced decision-making and reinforcing the central role of lipid management in contemporary cardiovascular risk reduction.

Dyslipidemia continues to be a primary modifiable risk factor for atherosclerotic cardiovascular disease (ASCVD). Following pivotal trial results and emerging therapies since 2019, the ESC/EAS has revised its recommendations regarding risk stratification, drug selection, and treatment intensity to maximize preventive benefit.

Cardiovascular Risk Stratification

Transition from SCORE to SCORE2: Redefining ASCVD risk assessment

The 2019 guidelines recommended estimation based on the SCORE (Systematic Coronary Risk Estimation) model, using total cholesterol, HDL, age, sex, and blood pressure; focused mainly on fatal CVD events and up to age 70.[1]

The major revision is the adoption of SCORE2 and SCORE2-OP risk models, replacing the previous SCORE system for estimating the 10-year risk of ASCVD events. SCORE2 is recommended for adults aged 70 years or younger, while SCORE2-OP is applicable for those aged 70 to 89 years (Class I, Level B). While the SCORE algorithm assessed the 10-year risk of fatal CVD in persons aged up to 70 years, the SCORE2/SCORE2-OP algorithms (accessible at) can also estimate the 10-year risk for both fatal and non-fatal CV events, including those in apparently healthy people aged 70 years or older (up to 89 years). The models are calibrated for 4 country risk clusters and use non-HDL cholesterol as a risk input, rather than total cholesterol.[2]

In this update, a 2× multiplier was applied to convert previous SCORE-based thresholds into SCORE2- or SCORE2-OP-based thresholds, defining different categories of total CVD risk.

Revised risk categories and modifiers for personalized care

Updated risk categories are provided for primary prevention, encompassing definitions of risk categories based on SCORE2/

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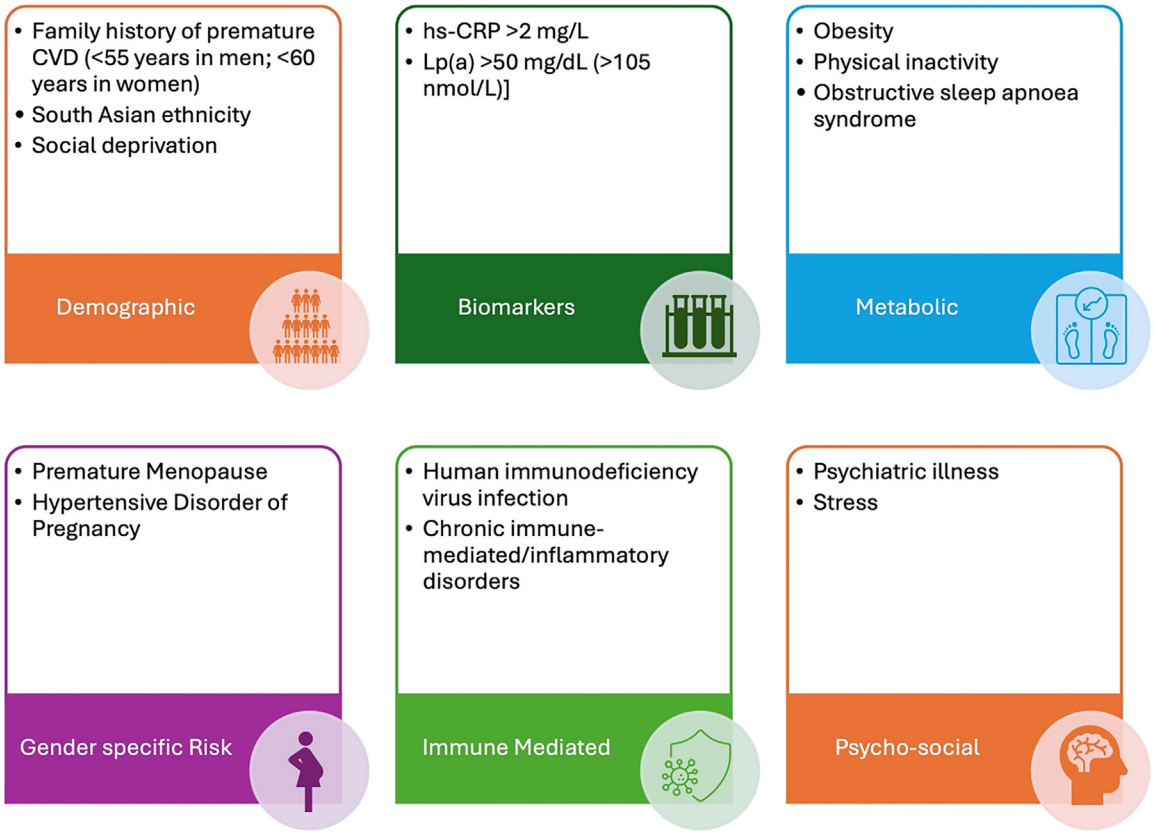

Figure 1. Risk modifiers for consideration beyond the risk estimation based on the SCORE2 and SCORE2-OP algorithms.[1]
Abbreviations: CVD = cardiovascular disease; hs-CRP = high sensitivity C-reactive protein; Lp(a) = lipoprotein(a).

SCORE2-OP thresholds. Figure 1 lists risk modifiers, including demographic, clinical, and biomarker-based variables such as family history, high-risk ethnicity, chronic inflammatory diseases, elevated hs-CRP, and Lp(a) levels of 50 mg/dL or above (≥105 nmol/L). The detection of subclinical atherosclerosis by imaging or an elevated coronary artery calcium (CAC) score should be regarded as a risk modifier, particularly for those at moderate risk or those near treatment thresholds (Class IIa, Level B). CAC scoring—very high scores (>300) in apparently healthy people may reclassify risk to an equivalent of secondary prevention. In contrast, a score of zero indicates lower risk, even in the presence of traditional risk factors (with caveats for statin-treated patients as the therapy is known to enhance calcium deposition in plaques).[3]

Premature menopause and hypertensive disorders of pregnancy (such as pre-eclampsia) as risk factors in the 2025 ESC/EAS lipid guidelines are supported by growing evidence that these conditions significantly increase a woman's lifetime risk of ASCVD.

- Premature menopause is associated with adverse changes in lipid profiles and a higher risk of cardiovascular disease due to the loss of protective estrogen earlier in life. This hormonal change leads to increased levels of LDL cholesterol and triglycerides, as well as changes in lipoprotein subfractions, which accelerate atherosclerosis.
- Hypertensive disorders of pregnancy, including pre-eclampsia, are recognized as significant risk markers for future cardiovascular disease. These disorders reflect endothelial dysfunction and systemic vascular damage during pregnancy, which increases long-term risk for hypertension, ischemic heart disease, and stroke.

Because traditional risk prediction models like SCORE2 and SCORE2-OP do not fully recognize the increased cardiovascular risk associated with these female-specific conditions, the guidelines include them as risk modifiers to enhance the accuracy of cardiovascular risk assessment and support more personalized preventive strategies, including lipid-lowering therapy.

Risk assessment algorithm: Integrating biomarkers and imaging into risk calculations

Risk stratification now involves a more nuanced approach, integrating imaging and biomarker data alongside traditional risk factors to facilitate personalized management strategies. Calculation of risk with SCORE2/SCORE2-OP should not be performed in those with established ASCVD, diabetes mellitus, chronic kidney disease, or those already on lipid-lowering therapies.

LDL-Cholesterol Targets and Therapeutic Strategy: Reinforcing Targets and Intensifying Risk-Based LDL-C Lowering

The 2025 update reaffirms the risk-based approach to lowering LDL-C, with the same treatment targets as the 2019 guideline. It re-emphasizes the use of both SCORE2/SCORE2-OP and baseline LDL-C for decision-making, particularly in primary prevention for non-statin candidates.

The LDL-C targets for each risk group are unchanged[1] (Table 1).

The initiation of pharmacological therapy is stratified based on risk assessment and baseline LDL-C levels. However, recent updates emphasize the importance of achieving both absolute and percentage reductions, with a decrease of ≥50% from baseline remaining pivotal

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Table 1
LDL-C treatment goals by risk categories

Risk category	LDL-C goal	Class
Low risk	<3.0 mmol/L (<116 mg/dL)	IIb
Moderate risk	<2.6 mmol/L (<100 mg/dL) and ≥50% reduction from baseline	IIa
High risk	<1.8 mmol/L (<70 mg/dL) and ≥50% reduction from baseline	I
Very high risk	<1.4 mmol/L (<55 mg/dL) and ≥50% reduction from baseline	Ia
Extreme risk	<1.0 mmol/L (<40 mg/dL) and ≥50% reduction from baseline	IIb

for patients classified as high- and very-high-risk. A stepwise approach, aligning LDL-C levels with overall cardiovascular risk, continues to underpin therapeutic decision-making.

Innovations In LDL-C Lowering Therapies: Bempedoic Acid, Inclisiran, Evinacumab, and Algorithmic Approaches

Both guidelines specify that statins are the primary treatment choice for the majority of patients.

In 2019, non-statin therapies, such as ezetimibe and PCSK9 inhibitors, were recommended for patients categorized as high or very high risk who are unable to tolerate statins or fail to achieve their target lipid levels. PCSK9 inhibitors were explicitly emphasized for those at very high risk, including individuals with a history of acute coronary syndrome (ACS) and familial hypercholesterolemia.[1]

Bempedoic acid

ATP-citrate lyase inhibitor bempedoic acid is now recommended for patients unable to tolerate statin therapy (Class I, Level B) and as an add-on to maximally tolerated statins (with or without ezetimibe) for high- or very-high-risk patients who are unable to achieve their LDL-C goal (Class IIa, Level C). The CLEAR Outcomes study showed a 13% decrease in major adverse cardiovascular events (MACE) compared to placebo in a statin-intolerant group. Safety considerations include reversible increases in uric acid, a higher risk of gout, and potential hepatic enzyme elevations.[4]

Evinacumab

For homozygous familial hypercholesterolemia (HoFH), evinacumab (an ANGPTL3 inhibitor) is recommended for patients aged 5 years or older who have not reached their LDL-C goal despite maximum conventional therapy (Class IIa, Level B).[5]

Inclisiran and other agents

Inclisiran, a siRNA targeting PCSK9 synthesis, administered biannually, achieves ~50% LDL-C lowering in Phase III trials; however, its routine use awaits the results of large cardiovascular outcome trials, expected in 2026 to 2027. PCSK9 monoclonal antibodies and ezetimibe remain integral to combination therapy for patients who do not achieve targets with statin monotherapy.[6]

Algorithmic, early combination therapy in ACS is explicitly endorsed.

Intensive Lipid-Lowering in Acute Coronary Syndromes: "Strike Early and Strong"

Patients with acute coronary syndromes (ACS) face the highest risk for recurrent cardiovascular events in the early postevent period. Yet, real-world studies repeatedly reveal under-treatment and clinical inertia after hospital discharge.

The 2025 Update, strengthened by evidence from trials like IMPROVE-IT[7], HUYGENS[8], PACMAN-AMI[9], SWEDEHEART[10] and AT-TARGET IT[11,12] recommends immediate, in-hospital initiation of intensive lipid-lowering therapy for all ACS patients, aiming for *"the sooner, the lower, the better."*

Protocol

- For all ACS patients, high-intensity statin therapy should be initiated promptly during the hospital stay.
- For those unlikely to achieve LDL-C targets with a statin alone (particularly patients already on a statin at admission), add-on non-statin agents (primarily ezetimibe) should be initiated before discharge.
- These recommendations are classified as Class I (statin intensification) and Class IIa (statin plus ezetimibe combination for those not previously treated).

The proactive approach ensures maximum early benefit, counteracts prescription inertia, and aims to shrink the post-ACS "risk window." The guidelines emphasize that aggressive LDL-C lowering is well tolerated and yields significant outcome benefits if initiated without delay.

The expert analysis emphasizes that systematized protocols, hospital-based lipid clinics, and robust discharge planning are essential to translating these recommendations into durable clinical benefits, thereby reducing the persistent care gap after ACS.

Lipoprotein(a): From Single Measurement to Pivotal Risk Modifier

The 2019 ESC/EAS guidelines recommended that Lp(a) levels should be measured at least once in a lifetime, if possible, to identify those with a significantly elevated inherited Lp(a) level of 180 mg/dL or more (430 nmol/L or more). These individuals have a significantly higher lifetime risk of ASCVD, similar to the risk linked to heterozygous familial hypercholesterolemia (HeFH).[1]

The 2025 update recommends that lipoprotein(a) [Lp(a)] be measured at least once in all adults, especially those with familial hypercholesterolemia, premature atherosclerotic cardiovascular disease (ASCVD), or at moderate risk or treatment thresholds. An Lp(a) level of ≥50 mg/dL (≥105 nmol/L) is now recognized as a significant risk modifier that may warrant reclassification and more aggressive LDL-C lowering strategies (Class IIa, Level B) based on current epidemiological and genetic evidence indicating increased risks of ASCVD and aortic valve stenosis at these levels. Furthermore, emerging RNA-based therapies targeting Lp(a) are currently being studied.[13] Measurement of Lp(a) is influenced by substantial structural heterogeneity in apolipoprotein(a) isoforms, particularly variability in Kringle-IV repeats, which may affect assay accuracy.[14] Therefore, the use of apo (a) isoform-insensitive immunoassays calibrated against international reference standards is recommended to ensure reliable quantification and comparability across studies.[15] The ESC/EAS 2025 update prefers reporting Lp(a) in nmol/L, as this reflects molar particle concentration and is less affected by isoform variability than mg/dL, which represents mass concentration; accordingly, routine conversion between units is discouraged due to assay-dependent variability. However, for clinical purposes, mg/dL remains acceptable and clinically interpretable when used with validated, standardized assays.

Hypertriglyceridemia: Targeted Therapies and Updated Indications-Icosapent Ethyl, Volanesorsen

Statins remain the first-choice drugs to reduce CV risk for those with high triglycerides.

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Icosapent ethyl (2 g twice daily) is now uniquely recommended —when added to statin—in high or very high risk patients if TG 135 to 499 mg/dL persists, based on REDUCE-IT results (Class IIa, Level B).[16]

Volanesorsen (antisense inhibitor of ApoC-III): Recommended for severe hypertriglyceridemia due to familial chylomicronemia syndrome (FCS) when refractory to standard therapy (EMA approval; not FDA approved) (Class IIa, Level B).[17]

Fibrates and combined (eicosapentaenoic acid and docosahexaenoic acid) n-3 PUFA (omega-3 polyunsaturated fatty acids) supplements are not broadly recommended for CV event reduction, given negative or neutral outcome data since 2019 (Class IIb).

Primary Prevention in HIV: Expanding Statin Indications

In 2019, statin therapy was considered for patients living with HIV (PLHIV) with dyslipidemia who are at high risk of cardiovascular disease; however, data in this regard remain limited.[1]

Following the REPRIEVE trial,[18] which demonstrated a 35% reduction in MACE, the 2025 Focused Update guidelines introduce a novel primary prevention strategy. This update recommends statin therapy for people with HIV (PWH) aged 40 years or older, irrespective of their baseline LDL-C level. Pitavastatin is recommended explicitly due to its minimal interaction with antiretroviral therapy.

Statins now stand as the only lipid-lowering class with proven outcome benefits in primary prevention for PWH, distinct from other agents such as ezetimibe or PCSK9 inhibitors.

Cancer Patients Receiving Anthracyclines: Statins in Oncologic Care

Statins ought to be considered for patients identified as having a high or very high risk of developing cardiovascular toxicity associated with chemotherapy, particularly with anthracycline-based regimens, to mitigate the risk of cardiac dysfunction (Class IIa, Level B) based on the STOP-CA trial and meta-analyses.[19]

There is no similar recommendation for nonstatin therapies due to a lack of evidence on outcomes. The 2019 update lacked any specific recommendations in this regard.

Dietary Supplements: Negative Recommendation

The guidelines explicitly discourage the use of dietary supplements or vitamins (including red yeast rice, phytosterols, and generic n-3 PUFAs) for reducing ASCVD risk, given the lack of robust efficacy and, in some cases, evolving safety concerns and regulatory restrictions. Yet, dietary supplements with proven LDL-C reduction efficacy and safety may be considered. High-dose, purified icosapent ethyl remains the exception with proven benefit in specific subgroups (Class III, Level B).[20]

Practical Implications

- *Shift to improved risk stratification:* Use of modernized, validated risk algorithms for primary prevention; encourage more personalized risk assessment.
- *Combination lipid-lowering:* Accelerated, more intensive post-ACS approach for high event-risk period.
- *Nonstatin therapy:* More robust recommendations and new agents for statin intolerance, familial hypercholesterolemia, and severe hypertriglyceridemia.
- *Special conditions:* HIV, oncology patients, and those with high Lp(a) are addressed more specifically and forcefully.
- *Supplements:* Clear advice against most supplements for ASCVD prevention.
- *Regarding ongoing/forthcoming therapies:* Guidance may evolve rapidly as trial data on inclisiran, new RNA drugs for TG and Lp(a), and others mature (Figure 2).

The South Asian Phenotype: Well Represented in the Update

The South Asian phenotype of dyslipidemia is characterized by a unique and distinct lipid profile contributing to their high risk of premature coronary heart disease (CHD). Key features include elevated triglycerides, low levels of high-density lipoprotein cholesterol (HDL-C), elevated lipoprotein(a) Lp(a) levels, and a higher burden of atherogenic particles despite relatively normal low-density lipoprotein cholesterol (LDL-C) levels compared to other ethnic groups. HDL

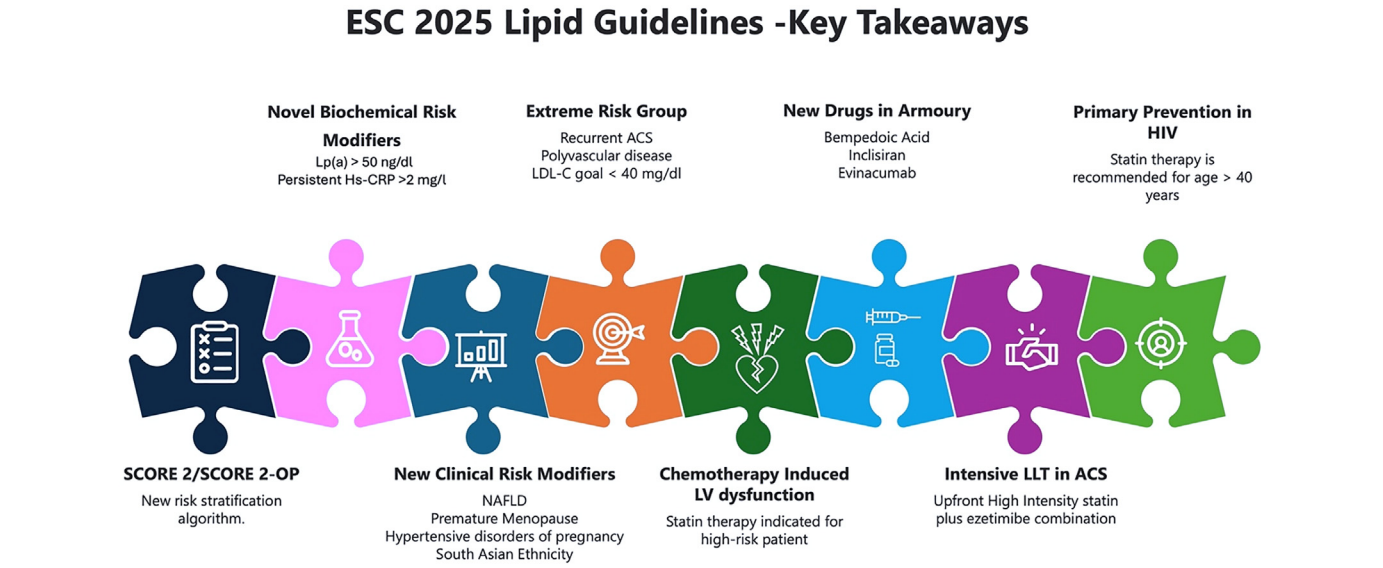

Figure 2. Key innovations from the 2025 ESC lipid guidelines: expanded risk modifiers, novel therapies, and intensified management strategies in ASCVD prevention and acute coronary syndromes.

Abbreviations: hs-CRP = high sensitivity C-reactive protein; Lp(a) = lipoprotein(a); ACS = acute coronary syndrome, LDL-C = low-density lipoprotein cholesterol; HIV= human immunodeficiency virus; NAFLD = non-alcoholic fatty liver disease; LLT = lipid-lowering therapy.

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Table 2
Key comparison of 2019 versus 2025 ESC/EAS dyslipidemia guidelines

Topic/section	2019 ESC/EAS guidelines	2025 Focused update
CV risk estimation tool	SCORE (fatal CVD, age 40 to 70 years)	SCORE2 (fatal & non-fatal CVD, <70 years); SCORE2-OP (≥70 to 89 years)
Risk modifiers	Emphasis on cholesterol, limited imaging	Now includes CAC, subclinical atherosclerosis, more modifiers
LDL-C treatment goals	Risk-category based, same targets	Unchanged, but re-emphasized and matched with new risk tools
Initial pharmacotherapy choice	Statin first-line	Still statin first-line, but more focus on early/intensive approach
Non-statin agents	Ezetimibe, PCSK9 inhibitors	Adds bempedoic acid (broadly), evinacumab (homozygous FH)
ACS		
(Initial therapy)	Stepwise postdischarge	Early/intensive combination therapy at index hospitalization encouraged
Hypertriglyceridemia	Fibrates & statins; omega-3 ambiguous	High-dose icosapent ethyl in high/very high risk; Volanesorsen for FCS
Lp(a) Measurement	Measure once/lifetime, risk enhancer	Now a Class IIa risk modifier for >50 mg/dL (105 nmol/L)
HIV infection	Consider statin if high LDL/dyslipidemia	Statin recommended (any LDL-C, age ≥40, regardless of risk)
Cancer (cardiotoxicity risk)	Less specific	Statins should be considered for high/very high risk patients
Dietary supplements	Not generally recommended	Explicitly not recommended for ASCVD prevention

particles in South Asians tend to be smaller, dysfunctional, and proatherogenic.

The 2025 ESC/EAS lipid-focused update addresses the South Asian phenotype of dyslipidemia by recognizing the high cardiovascular risk associated with this ethnic group due to their unique lipid profile. South Asian ethnicity is explicitly mentioned as a high-risk factor in cardiovascular risk estimation algorithms like SCORE2.

Key ways the ESC/EAS update addresses this include:

- Classifying South Asians as a high-risk ethnic group with often lower LDL-C but a higher burden of atherogenic particles, such as small dense LDL and elevated lipoprotein(a). This justifies earlier and more intensive lipid-lowering therapy.
- Emphasizing LDL-C as the primary treatment target with recommended lower LDL-C goals in very high-risk groups, such as <55 mg/dL, which aligns with the need for aggressive management in populations like South Asians with premature cardiovascular disease.
- Supporting non-HDL cholesterol and apolipoprotein B as alternative markers for risk assessment, particularly in patients with elevated triglycerides, a common feature in South Asians.
- Including recommendations for early risk screening and intensified statin therapy, often combined with ezetimibe, especially in patients presenting with acute coronary syndromes.
- Highlighting the relevance of lipoprotein(a) testing in patients with a family history of premature cardiovascular disease, although with some caveats on routine testing depending on population and lab validation.
- Recognizing the coexistence of insulin resistance and diabetes in the lipid management approach, recommending aggressive statin treatment in diabetic patients, reflecting the higher prevalence of diabetes in South Asians.

Conclusion

The 2025 ESC/EAS Focused Update implements substantial refinements in the management of lipid disorders, emphasizing individualized assessment of cardiovascular risk, evidence-based escalation of therapy, and the utilization of new pharmacological agents for challenging scenarios. These rigorous, consensus-driven recommendations set the contemporary benchmark for lipid management and ASCVD prevention in clinical practice (Table 2).

Rationale and Scope of the 2025 Update

The 2025 Focused Update of the European Society of Cardiology/European Atherosclerosis Society (ESC/EAS) Guidelines for the management of lipid disorders introduces substantive advances in risk assessment, therapeutic options, and evidence-based recommendations, reflecting the evolving landscape of cardiovascular disease (CVD) prevention. This review synthesizes the core changes and contextualizes them against the 2019 standard, with clinical implications for practice and research.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

CRediT authorship contribution statement

Akshyaya Pradhan: Writing – original draft, Resources, Formal analysis, Data curation, Conceptualization. **Prashant Thandi:** Writing – original draft, Resources, Formal analysis, Data curation, Conceptualization. **Kunal Mahajan:** Writing – original draft, Resources, Conceptualization. **Ferdinando Iellamo:** Writing – original draft, Methodology, Formal analysis. **Pasquale Perrone-Filardi:** Writing – original draft, Formal analysis, Conceptualization. **Marco Alfonso Perrone:** Conceptualization.

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