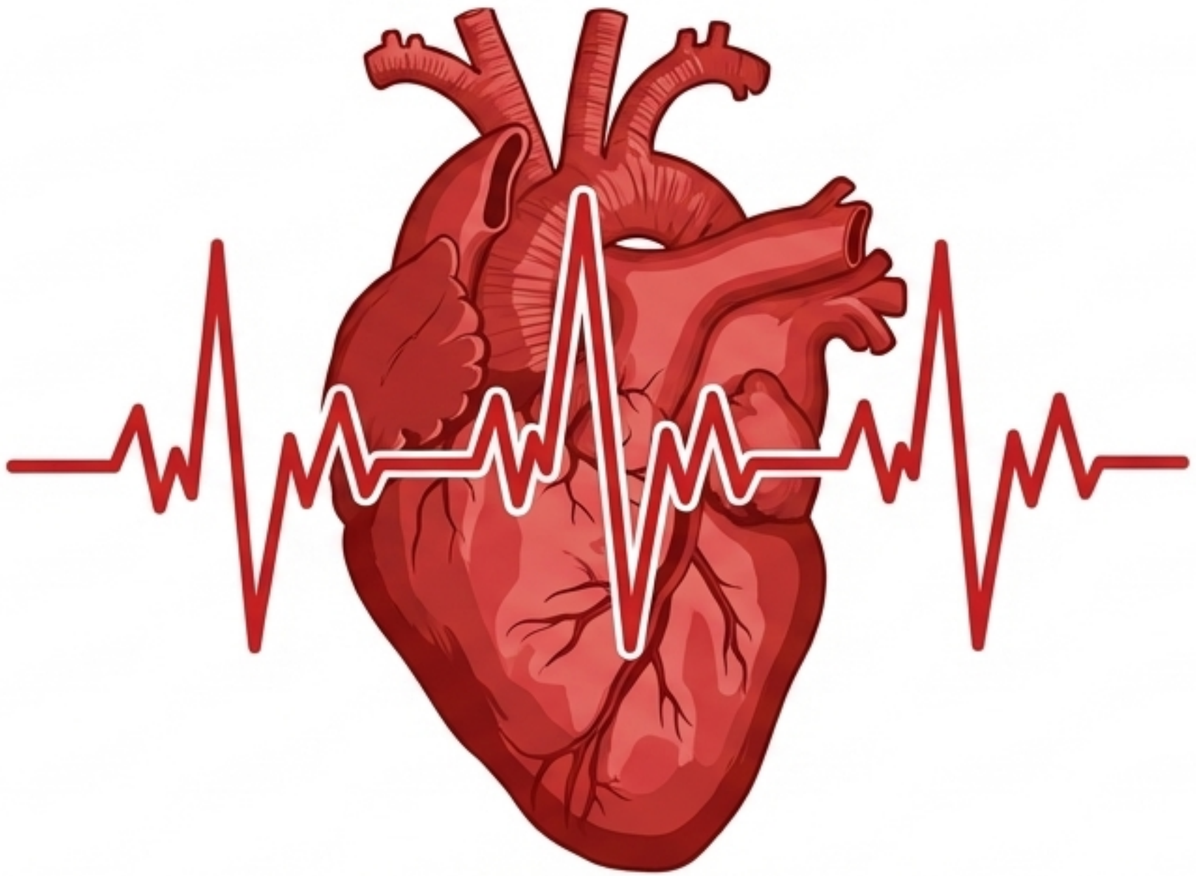
Foundations of Cardiovascular Risk Assessment: Tools and Applications

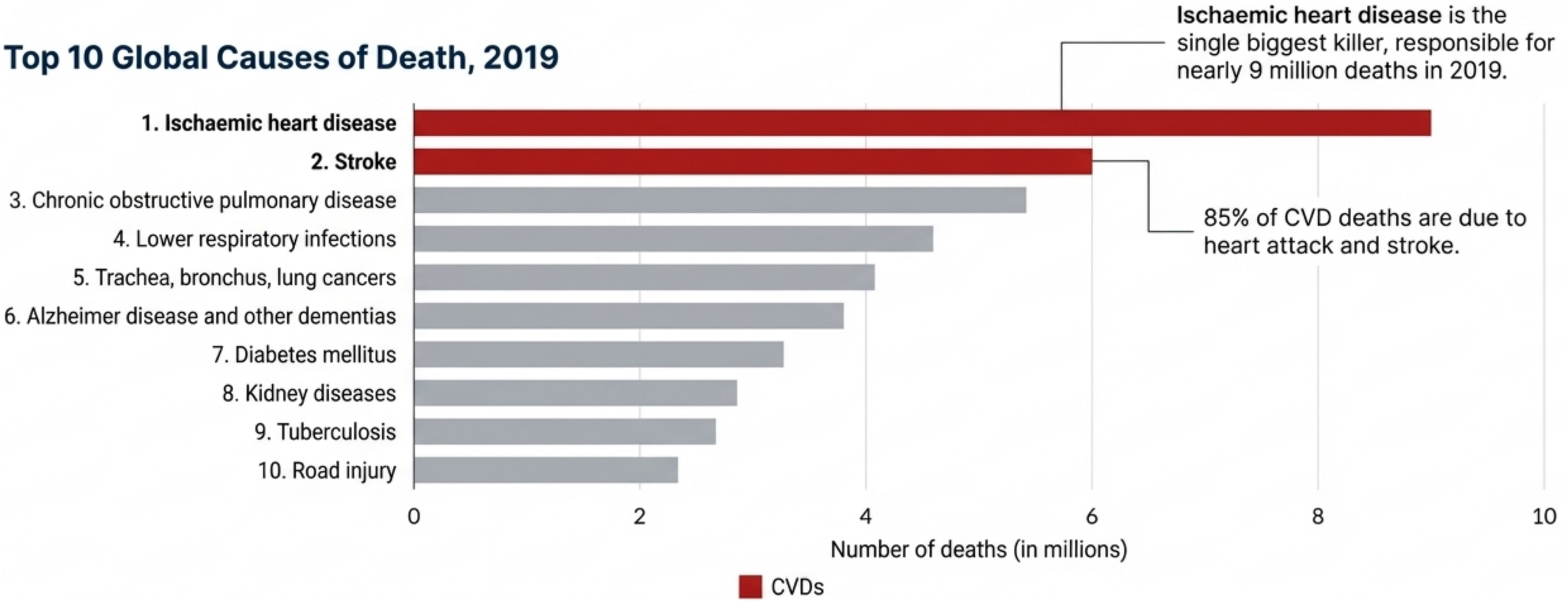
A Practical Guide for Clinical Practice



Cardiovascular Disease: The Undisputed Global Leader in Mortality

For over two decades, **Cardiovascular Diseases (CVDs)** have remained the **primary cause of death** worldwide. In 2019, they accounted for 17.9 million deaths, representing 32% of all global fatalities.

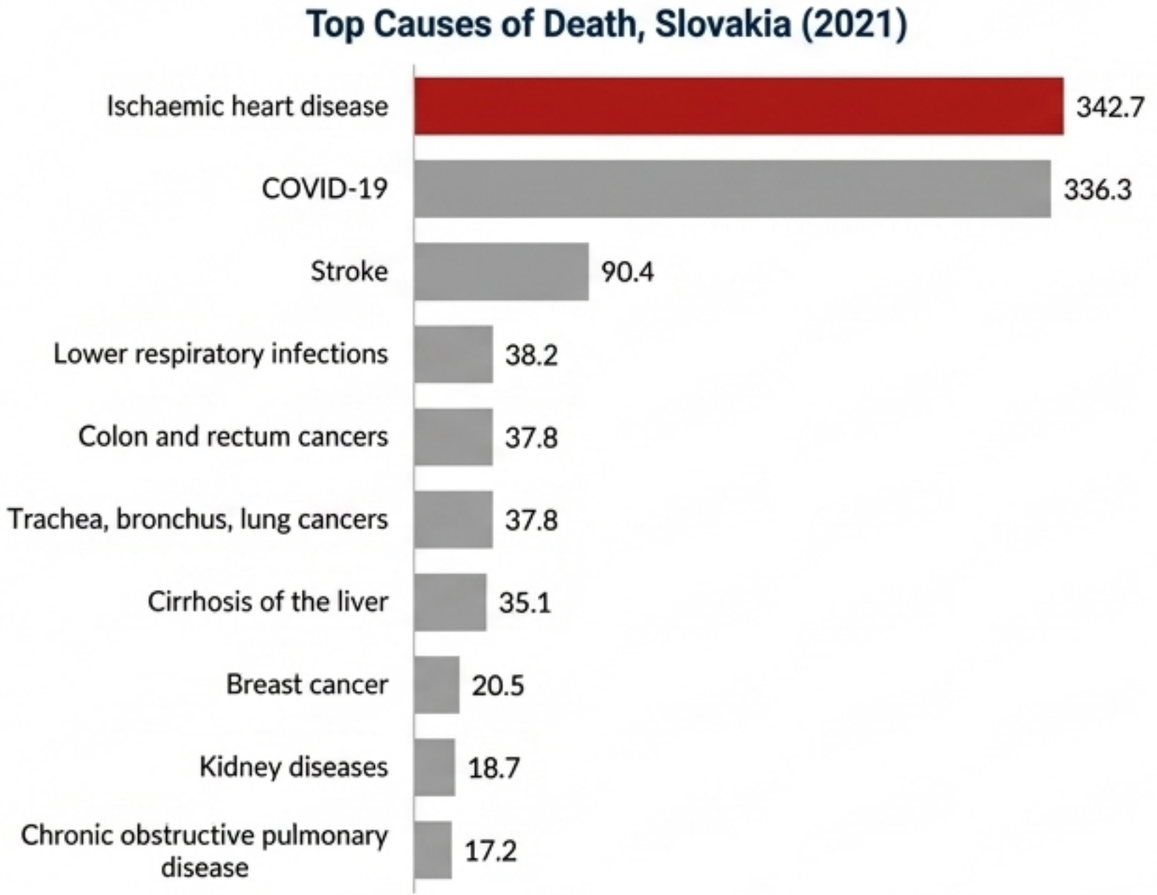
Top 10 Global Causes of Death, 2019

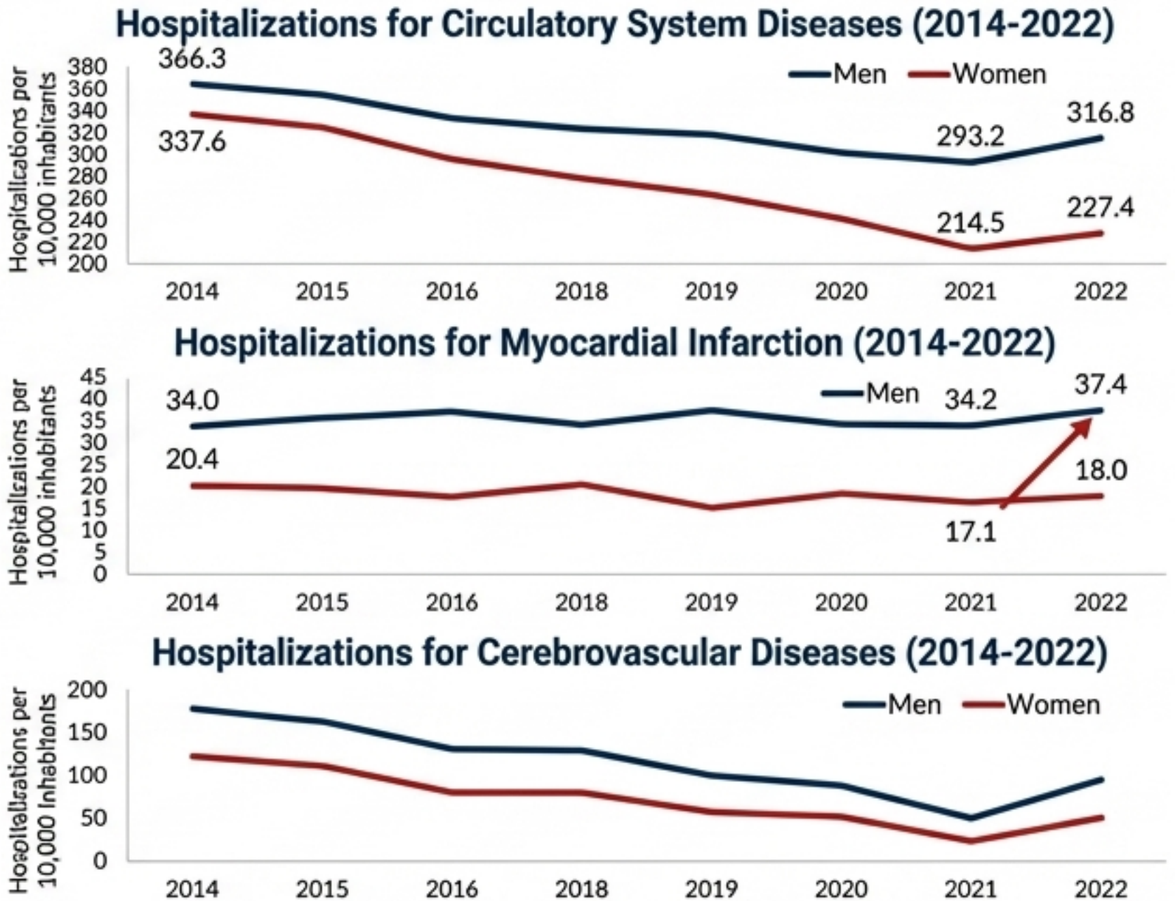


Footnote: 7 of the 10 leading causes of death are now noncommunicable diseases, a significant increase from 4 of 10 in the year 2000.

The Slovak Context: High Mortality and an Urgent Need for Action

Slovakia has a persistently high mortality rate from cardiovascular disease, ranking among the lowest-performing countries in the European Union with 641 deaths per 100,000 inhabitants.





Key Takeaway: While hospitalizations have trended down, mortality from key events like myocardial infarction has recently spiked, underscoring the severity of the issue in Slovakia.

The Power of Prevention: A Coordinated Strategy to Eliminate 80% of CVD

Prevention is a coordinated set of measures aimed at an entire population or individuals, with the goal of reducing the incidence of CVD and its adverse impacts. Eliminating risk behaviors would prevent at least 80% of CVD.

Primary Prevention

Target: Healthy individuals with risk factors.

Goal: Prevent disease onset.

Secondary Prevention

Target: Patients with established CVD (including subclinical).

Goal: Prevent disease progression.

Tertiary Prevention

Target: Symptomatic patients.

Goal: Reduce disease severity and consequences.

Quaternary Prevention

Target: Patients at risk of over-medicalization.

Goal: Protect from interventions likely to cause more harm than good.

Key Strategy Point

The most effective approach combines a **population strategy** (public health policy, environmental changes) with an **individual strategy** (clinical management of high-risk patients).

From Theory to Practice: Systematic Screening in Primary Care

Screening is the identification of unrecognized disease (subclinical CVD) or increased risk in asymptomatic individuals.

Opportunistic Screening

Description: Performed ‘ad hoc’ when a patient visits a GP for another reason.

Effectiveness: Effective at increasing detection rates but has an uncertain impact on clinical outcomes.

Systematic Screening

Description: A planned, organized program targeting specific populations (e.g., by age, family history).

Effectiveness: Leads to better risk factor control.

Spotlight on the Slovak National Program

Title: Systematic Monitoring of Cardiovascular Risk in Slovakia (effective July 1, 2022)

Objective: A primary prevention program combining risk factor monitoring, patient education, and effective management of smoking, obesity, dyslipidemia, and hypertension.

Target Population: Men (40-65 years), Women (50-65 years) during preventive check-ups.

Core Tool: Mandates the use of the **SCORE2** and **SCORE2-OP** systems for risk calculation.

The Dimensions of Risk: Quantifying a Patient's Future

Cardiovascular risk is the probability of a cardiovascular event occurring within a defined time period.

10-Year Risk

The probability of a fatal or non-fatal atherosclerotic event in the next decade.

The primary metric for immediate treatment decisions.

Lifetime Risk

The estimated age at which a person has a 50% probability of experiencing a CV event or death. Powerful for motivating younger patients.

Relative Risk

Compares an individual's risk to that of a person with an ideal risk factor profile. Highlights how a young person's "low" absolute risk can still be dangerously high.

Cardiovascular Age

The age of a person with the same risk level but ideal risk factors. A simple, powerful communication tool (e.g., "Your 40-year-old heart has the risk profile of a 65-year-old.").

While 10-year risk guides immediate pharmacotherapy, lifetime risk and cardiovascular age are crucial for communicating with and motivating younger individuals.

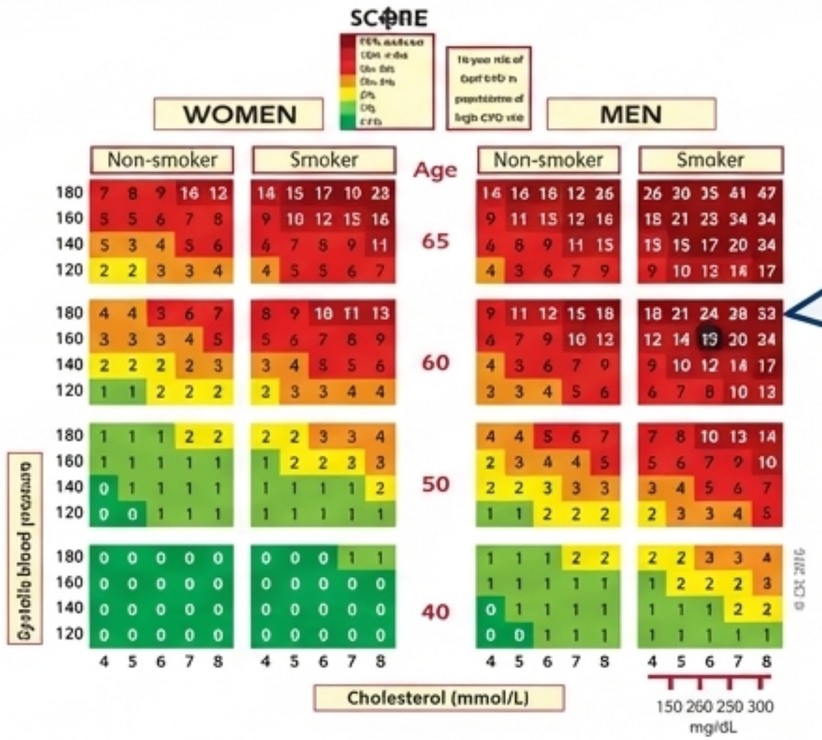
The Evolution of Risk Prediction: From Framingham to a Calibrated European Standard

Framingham Risk Score

Focus: 10-year risk of coronary heart disease events.
Limitation: Based on a US population; not calibrated for diverse European populations.

Original SCORE (Systematic COronary Risk Evaluation) - c. 2003

Focus: 10-year risk of **fatal** atherosclerotic events.
Innovation: Calibrated for high- and low-risk European regions, including Slovakia.
Key Limitation: Underestimated total cardiovascular burden by only focusing on fatal events.



A 60-year-old male smoker with SBP 160 and Cholesterol 6 has a 9% risk of a *fatal* event. The total event risk is approximately 3x higher (~27%).

The New Standard in European Risk Assessment: SCORE2 and SCORE2-OP (ESC 2021)

The latest models address the key limitations of the original SCORE system for more accurate, actionable risk prediction.

Feature	Original SCORE	SCORE2 / SCORE2-OP (Current Standard)
Risk Endpoint	10-Year **Fatal** CVD Events	10-Year **Total** (Fatal + Non-Fatal) CVD Events
Lipid Parameter	Total Cholesterol	**Non-HDL Cholesterol** (Better captures atherogenic particles)
Age Groups	Limited to 40-65 years	**SCORE2**: 40-69 years **SCORE2-OP**: ≥70 years (calibrated for competing risks)
Calibration	High/Low Risk Regions	**Four distinct European risk regions** for improved accuracy

Core Message: SCORE2 provides a more comprehensive picture of a patient's true 10-year risk, incorporates a better lipid marker (non-HDL-C), and extends reliable prediction to older adults.

The Building Blocks of Risk: Core Modifiable Factors

Hyperlipoproteinemia

Key Point
Causal role of Apo-B containing lipoproteins (especially LDL-C) is unequivocally proven. Non-HDL-C is the new standard input for SCORE2 as it captures all atherogenic lipoproteins.

Arterial Hypertension

Key Point
A leading cause of both atherosclerotic and non-atherosclerotic CVD. Risk increases linearly from SBP 90 mmHg and DBP 75 mmHg. Responsible for 9.4 million deaths globally.

Diabetes Mellitus

Key Point
Increases ASCVD risk approximately 2-fold. Patients often present with a cluster of risk factors (dyslipidemia, hypertension).

Cigarette Smoking

Key Point
Responsible for 50% of all preventable deaths in smokers. A smoker's 10-year fatal CVD risk is approximately double that of a non-smoker.

Obesity

Key Point
Increases CVD risk primarily through its influence on other factors like hypertension, dyslipidemia, and insulin resistance. Visceral (intra-abdominal) fat carries higher risk.

Beyond the Algorithm: Risk Modifiers and Comorbidities

A calculated score is the starting point. Clinical judgment is required to adjust risk based on factors not included in the model.

Key Risk Modifiers

Psychosocial Factors: Stress, depression, social isolation.

Socioeconomic Determinants: Deprivation significantly impacts risk.

Family History: Premature CVD in a first-degree relative (male <55, female <65).

Imaging & Biomarkers:

- Coronary Artery Calcium (CAC) Score
- Carotid Plaque on Ultrasound
- Ankle-Brachial Index (ABI)
- Elevated Lp(a) or hs-CRP

High-Impact Comorbidities

Chronic Kidney Disease (CKD)

Atrial Fibrillation

Heart Failure

Chronic Inflammatory Conditions (e.g., Rheumatoid Arthritis)

Obstructive Sleep Apnea

Cancer (Cardio-oncology considerations)

Clinical Application: The presence of these factors, especially in a patient near a treatment threshold, may justify reclassification to a higher risk category and more intensive management.

From Percentage to Priority: Stratifying Risk to Guide Treatment Intensity

SCORE2 Risk Categories (10-Year Risk of Total CVD Events)

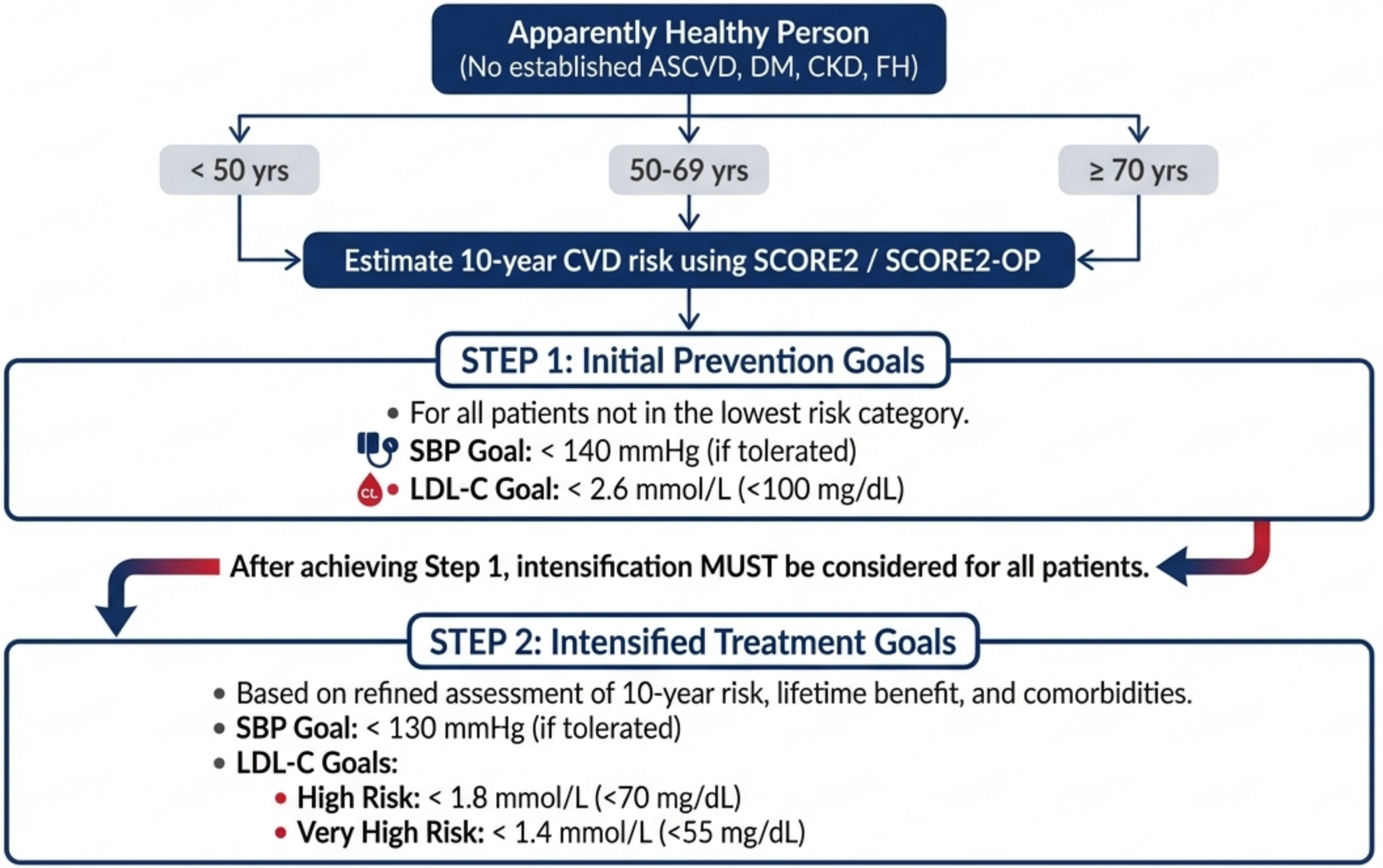
Age Group	Low to Moderate Risk	High Risk	Very High Risk
< 50 years	< 2.5%	2.5% to < 7.5%	≥ 7.5%
50 - 69 years	< 5%	5% to < 10%	≥ 10%
≥ 70 years (SCORE2-OP)	< 7.5%	7.5% to < 15%	≥ 15%

Automatic High/Very High Risk Categories

Certain patients do not require a SCORE2 calculation and are automatically considered at high or very high risk.

- Patients with documented ASCVD
- Diabetes Mellitus with target organ damage
- Severe Chronic Kidney Disease (eGFR < 30)
- Familial Hypercholesterolemia (FH) with ASCVD or another major risk factor

A Stepwise Treatment Algorithm for Apparently Healthy Individuals



Management in High-Risk Populations: Established ASCVD and Type 2 Diabetes

Patients with Established ASCVD

Immediate, Intensive Secondary Prevention

STEP 1 Goals

- SBP: < 140 mmHg
- LDL-C: **≥50% reduction AND < 1.8 mmol/L (<70 mg/dL)**
- Antithrombotic Therapy (Class I)

STEP 2 (Intensified) Goals

- SBP: < 130 mmHg
- LDL-C: **< 1.4 mmol/L (<55 mg/dL)**

For patients with a recurrent event within 2 years, an LDL-C goal of <1.0 mmol/L may be considered.

Patients with Type 2 Diabetes Mellitus

Risk Stratification is Key

Presence of ASCVD or severe Target Organ Damage (TOD)?

YES

Very High Risk

- Treat as Very High Risk
- LDL-C Goal: **< 1.4 mmol/L**
- Initiate SGLT2-i or GLP-1RA (Class I)

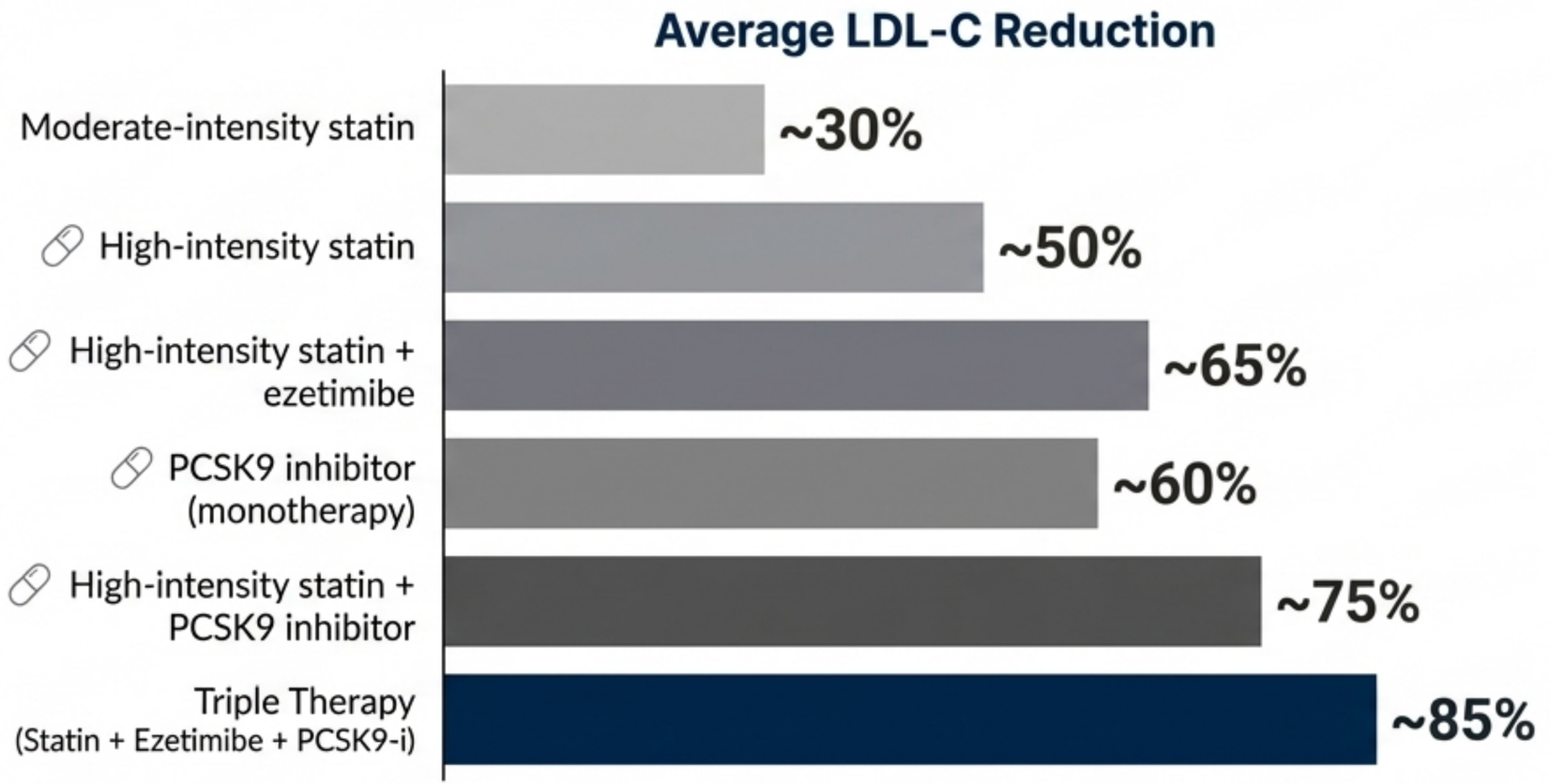
NO

Stratify Risk

- Stratify as 'High' or 'Moderate' risk
- Determine initial goals:
  - LDL-C < 1.8 mmol/L (High)
  - LDL-C < 2.6 mmol/L (Moderate)

Achieving LDL-C Goals: The Efficacy of Modern Lipid-Lowering Therapies

The absolute benefit of LDL-C reduction is proportional to the baseline absolute CVD risk and the absolute reduction in LDL-C. **A stepwise approach** is recommended.



→ Treatment Principle

1. Start with the maximum tolerated dose of a high-intensity statin.
2. If goal is not met, add ezetimibe.
3. For very-high-risk patients (secondary prevention or FH) still not at goal, add a PCSK9 inhibitor.

From Population Data to a Personalized Plan: A Case Study

Patient Profile

Patient:

- 50-year-old man

Risk Factors:

- Active Smoker, Hypertensive

Clinical Data:

- SBP 155 mmHg, non-HDL-C 5.2 mmol/L

Step 1: Initial Assessment

Patient is 50 years old, apparently healthy (no known ASCVD/DM).

Step 2: Risk Calculation (SCORE2)

Using the parameters (male, age 50, smoker, SBP 155, non-HDL-C 5.2), his calculated 10-year risk places him in the **High Risk** category (>5% to <10%).

Step 3: Consider Risk Modifiers

Does he have a family history of premature CVD? Socioeconomic factors? No overt modifiers noted, but smoking is a major driver.

Step 4: Set Treatment Goals (Stepwise Approach)

- **Lifestyle:** Immediate and intensive smoking cessation counseling is paramount. Dietary advice and physical activity plan.
- **Pharmacotherapy (Step 1):** Initiate treatment for hypertension (target SBP <140) and dyslipidemia (target LDL-C <2.6 mmol/L). A high-intensity statin would be appropriate.
- **Pharmacotherapy (Step 2 - To be considered after 3 months):** Intensify treatment to meet **High Risk** goals: SBP <130 mmHg and LDL-C <1.8 mmol/L. This may require combination therapy for both blood pressure and lipids.

Systematic risk assessment **transforms population-level data** into a powerful, personalized roadmap for preventing cardiovascular events in each individual **patient.**