Cardiovascular Risk and Risk-Factor Knowledge in Primary Care: Bridging Assessment, Awareness, and Prevention

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Abstract

Background: burden develops through modifiable exposures detectable years before a clinical event. Risk equations quantify future risk, whereas knowledge assessment reveals what patients understand about its drivers. A patient may recognize smoking or obesity as harmful while remaining unaware of hypertension, dyslipidemia, diabetes, or personal absolute risk.

Aim: To synthesize evidence on cardiovascular risk assessment, risk-factor knowledge, the knowledge-behavior relationship, and the family physician's role in integrating risk estimation with communication.

Review content: The Pooled Cohort Equations, SCORE2/SCORE2-OP, World Health Organization regional charts, and PREVENT equations estimate different outcomes in different populations and are not interchangeable. Knowledge instruments such as the Heart Disease Fact Questionnaire provide structured measurement, but studies consistently identify weak understanding of dyslipidemia, diabetes-related risk, and sustained risk-factor control. Egyptian evidence also shows incomplete cardiovascular knowledge and substantial hypertension unawareness. Knowledge alone does not reliably change behavior. A 2024 meta-analysis of 62 randomized trials found that risk communication improved perceived-risk accuracy and produced a small improvement in overall risk scores, while effects on individual behaviors were inconsistent.

Conclusion: Prevention should link objective risk measurement, identification of knowledge gaps, understandable communication of absolute benefit, feasible shared actions, and longitudinal reassessment. Family medicine is the natural setting for this iterative approach.

Keywords: cardiovascular risk; cardiovascular knowledge; risk communication; primary prevention; family medicine

Introduction

Cardiovascular diseases (CVDs) remain the leading cause of death worldwide. The World Health Organization estimates that they account for approximately 17.9 million deaths annually, with myocardial infarction and stroke responsible for most fatal events. The burden falls disproportionately on low- and middle-income countries, where delayed detection and limited access to sustained preventive care compound high exposure to tobacco, unhealthy diet, physical inactivity, obesity, hypertension, diabetes, and dyslipidemia.[1] Global Burden of Cardiovascular Diseases and Risks Collaborators[2] showed that total CVD burden continued to rise through 2022 despite improvements in age-standardized rates in some regions, largely because population growth, aging, and persistent metabolic risks outweighed therapeutic gains.

The Egyptian context makes primary prevention particularly urgent. The World Health Organization country strategy for Egypt reports that noncommunicable diseases account for more than 86% of deaths and that CVD alone accounts for 44% of all deaths. It also describes substantial exposure to tobacco, inadequate fruit and vegetable intake, and insufficient physical activity, alongside a health system in which preventive care receives a small share of total expenditure.[3] Without stronger prevention, global projections indicate that high blood pressure, dietary risks, and high cholesterol will remain dominant drivers of CVD through 2050, while obesity will contribute an increasing share of disease in many regions.[4]

Preventing CVD therefore depends on more than listing risk factors. Clinicians must estimate an individual's probability of future events, recognize when standard equations may misclassify risk, and help the patient understand what the estimate means. Cardiovascular knowledge, health literacy, perceived susceptibility, and objective absolute risk are related but not synonymous. This review examines how these concepts can be integrated in family medicine to convert risk detection into informed and sustained preventive action.

Cardiovascular Risk as a Cumulative Continuum

Cardiovascular risk is the probability that an individual will develop a defined cardiovascular outcome over a specified period. It reflects the combined influence of non-modifiable characteristics, modifiable exposures, comorbid disease, and the duration of exposure. Age, sex, and family history shape baseline susceptibility, while smoking, elevated blood pressure, atherogenic lipids, diabetes, adiposity, unhealthy diet, and inactivity accelerate vascular injury. Risk factors frequently cluster, and their effects are not adequately represented by considering each one in isolation.[5]

Evidence from the Global Cardiovascular Risk Consortium illustrates the magnitude of this clustering. Magnussen et al.[5] pooled individual-level data from 112 cohorts across 34 countries and found that body mass index, systolic blood pressure, non-high-density lipoprotein cholesterol, current smoking, and diabetes together accounted for an estimated 57.2% of incident CVD in women and 52.6% in men over 10 years. These estimates do not imply that all events are preventable or that the five factors capture every causal pathway. They do, however, demonstrate why primary care should assess major risks concurrently rather than through isolated, problem-specific visits.

Short-term and lifetime risk can diverge. A younger adult with severe hypercholesterolemia, smoking, or longstanding diabetes may have a modest 10-year estimate because age exerts a strong influence on most equations, yet still face high cumulative lifetime risk. Conversely, an older adult may cross a treatment threshold primarily because of age despite otherwise favorable values. Contemporary prevention guidance therefore combines calculated risk with clinical judgment, risk-enhancing conditions, expected treatment benefit, comorbidity, frailty, and patient preference.[6,7]

From Risk-Factor Detection to Absolute Risk Estimation

Absolute risk estimation converts multiple variables into a probability of a defined event. This supports proportionate treatment: patients at higher baseline risk usually obtain greater absolute benefit from blood-pressure reduction or lipid-lowering therapy than patients with the same single risk-factor value but lower global risk. Risk calculation also creates a concrete starting point for shared decision-making, provided that the selected model matches the patient's population and the clinical outcome being discussed.[6,7]

Four families of tools are especially relevant to primary care. The World Health Organization charts were recalibrated for 21 global regions and include both laboratory and non-laboratory models, which makes them useful where cholesterol testing is unavailable.[8] The Pooled Cohort Equations estimate 10-year risk of a first atherosclerotic cardiovascular disease event in selected US adults.[9] SCORE2 and SCORE2-OP estimate fatal and non-fatal CVD in European populations using region-specific calibration and age-specific interpretation.[10] PREVENT estimates 10- and 30-year risks of total CVD, atherosclerotic CVD, and heart failure among US adults aged 30–79 years without known CVD; it incorporates cardiovascular-kidney-metabolic variables and does not include race.[11]

Table 1. Major cardiovascular risk-estimation tools relevant to primary care

Tool	Intended population	Main outcome and horizon	Core variables	Principal caution
WHO regional CVD risk charts	Adults in 21 global regions; laboratory and non-laboratory options	10-year fatal or non-fatal myocardial infarction or stroke	Age, sex, smoking, systolic blood pressure, diabetes; total cholesterol in laboratory model	Use the chart calibrated for the correct region; categories are not interchangeable with US or European thresholds.[8]
ACC/AHA Pooled Cohort Equations	US adults, conventionally 40–79 years, without clinical ASCVD	10-year first hard ASCVD event	Age, sex, race in the original equation, total and HDL cholesterol, systolic blood pressure and treatment, diabetes, smoking	May overestimate or underestimate risk in populations that differ from derivation cohorts; requires clinician-patient discussion.[9]
SCORE2/SCORE2-OP	Apparently healthy European adults; SCORE2-OP for older persons	10-year fatal and non-fatal CVD	Age, sex, smoking, systolic blood pressure, non-HDL cholesterol	Requires European risk-region calibration and age-specific thresholds; not validated as an Egyptian population equation.[10]
AHA PREVENT	US adults aged 30–79 years without known CVD	10- and 30-year total CVD, ASCVD, and heart failure	Age, sex, systolic blood pressure, lipids, BMI, diabetes, eGFR, smoking, antihypertensive and lipid therapy; optional HbA1c and albuminuria	Contemporary and race-free, but transportability and treatment thresholds require validation outside the United States.[11]

No equation should be treated as a diagnosis. Calibration can drift as event rates, treatment patterns, and population characteristics change. The relevant question is not which calculator is universally best, but which model predicts the intended outcome in a population sufficiently similar to the patient. In Egypt and comparable settings, regionally calibrated WHO charts may offer greater practical relevance than directly importing thresholds from US or European models, although local outcome-based validation remains a major need.[8]

Risk-enhancing information becomes important when the calculated estimate is near a decision threshold or appears inconsistent with clinical concern. Premature family history, chronic kidney disease, albuminuria, markedly elevated low-density lipoprotein cholesterol, inflammatory disease, premature menopause, and elevated lipoprotein(a) can support reclassification. In a collaborative meta-analysis of 637,315 participants without prior CVD, adding estimated glomerular filtration rate and albuminuria improved prediction beyond traditional factors, with albuminuria providing particularly useful information for cardiovascular mortality and heart failure.[12] Coronary artery calcium scoring can further refine selected borderline or intermediate-risk decisions, but it should resolve a genuine therapeutic uncertainty rather than replace basic assessment.

Cardiovascular Knowledge, Health Literacy, and Risk Perception

Cardiovascular knowledge refers to factual understanding of disease, risk factors, preventive actions, and sometimes warning symptoms. Health literacy is broader: it includes the ability to obtain, interpret, appraise, and use health information. Risk perception is the person's subjective judgment of personal susceptibility. A patient may correctly know that hypertension causes stroke yet remain unaware of having hypertension, underestimate the danger of an asymptomatic reading, or overestimate the protection offered by medication while continuing to smoke. Measuring only one construct can therefore provide a misleading picture of preventive readiness.[13,14]

The distinction matters clinically. General knowledge may support informed choices, but behavior is also shaped by numeracy, cost, access to healthy food or safe exercise, treatment burden, beliefs about medication, social norms, trust, competing priorities, and self-efficacy. Health education that ignores these constraints can raise test scores without changing exposure. The goal of counseling is not to transfer facts alone; it is to develop an accurate personal model of risk and connect that model to feasible action.

Measuring Cardiovascular Risk-Factor Knowledge

The Heart Disease Fact Questionnaire (HDFQ) is one of the most frequently used instruments. Wagner et al.[13] developed the 25-item true/false questionnaire to assess knowledge of major coronary risk factors, with approximately half of its original items addressing diabetes-related coronary risk. The instrument is brief and easy to score, but investigators should not assume that a total score has identical meaning in every language, culture, or population. Translation, cultural adaptation, assessment of content validity, and transparent reporting of any item modification are essential.[13,14]

Instrument choice should follow the study population and purpose. A systematic review by Opoku-Acheampong et al.[15] found marked heterogeneity among non-clinical tools used to assess CVD risk factors in underserved young adults, limiting direct comparison across studies. For secondary prevention, Bernal-Jiménez et al.[16] developed and validated a scale focused on cardiovascular risk factors and lifestyle after a coronary event. Such an instrument may be appropriate for post-event education but should not be substituted uncritically for a general-population tool.

Knowledge scoring also requires caution. Cutoffs such as poor, moderate, or good knowledge are useful for description only when they are prespecified and supported by the instrument or study protocol. A percentage correct cannot establish that a patient can interpret an absolute risk estimate, distinguish relative from absolute benefit, or act on the information. For primary-care research, a stronger assessment pairs factual knowledge with personal risk awareness, numeracy-sensitive comprehension, and objectively measured risk factors.

Evidence on Knowledge Gaps

Egyptian data demonstrate that substantial knowledge gaps persist despite the high national burden. Ramadan et al.[17] studied 591 Egyptian adults with and without CVD and reported a mean cardiovascular knowledge score of 21 ± 7 out of 40 (52.5%). Participants with CVD had lower average knowledge, attitudes, and physical activity than those without CVD, while employment in health care strongly predicted a higher knowledge score. Because recruitment included social media distribution and hospital-clinic interviews, the estimate should not be interpreted as nationally representative, but it provides contemporary evidence of incomplete understanding.

Studies from other settings show a recurring pattern: familiar risks are better recognized than less visible metabolic risks. Taiek et al.[18] used the HDFQ in 744 Moroccan adults and reported a mean score of 64.36 ± 21.86; 47.4% had scores above 70%, whereas 25.6% scored below 50%. Smoking, overweight, and aging were commonly identified, but low HDL cholesterol and several diabetes-lipid relationships were poorly understood. Bashatah et al.[19] similarly found that Saudi adults frequently recognized hypertension, inactivity, smoking, and exercise, although 44.2% had inadequate overall knowledge and scores varied by age, sex, education, and chronic disease.

Knowledge gaps can coexist with a heavy measured risk burden. In Central Tanzania, Gibore et al.[20] assessed 749 adults: 43.4% were hypertensive and 63.5% were overweight or obese, yet only 35.4% had adequate knowledge of modifiable CVD risk factors. Among 287 Ethiopian outpatients with established cardiovascular conditions, Negesa et al.[21] found that 46% had suboptimal HDFQ knowledge; education and residence predicted knowledge, but knowledge was not significantly associated with cumulative risk behavior. These findings caution against treating knowledge as a reliable proxy for healthy behavior.

Table 2. Selected recent studies linking cardiovascular knowledge, awareness, and measured risk

Study	Setting and population	Knowledge approach	Key finding	Interpretation
Ramadan et al., 2024[17]	Egypt; 591 adults with and without CVD	Validated CVD knowledge questionnaire	Mean knowledge 21 ± 7/40 (52.5%); health-care employment predicted higher knowledge	Contemporary Egyptian evidence of incomplete knowledge, but mixed recruitment limits national generalization
Taiek et al., 2024[18]	Morocco; 744 adults	HDFQ	Mean 64.36%; 47.4% good and 25.6% poor knowledge	High recognition of smoking/obesity coexisted with weak understanding of HDL and diabetes-lipid links
Bashatah et al., 2023[19]	Saudi Arabia; 362 adults	24-item questionnaire	55.8% had strong knowledge; 44.2% inadequate	Broad awareness does not eliminate domain-specific or sociodemographic gaps
Gibore et al., 2023[20]	Central Tanzania; 749 community adults	Modified heart-disease knowledge items	Only 35.4% had adequate knowledge despite hypertension in 43.4% and overweight/obesity in 63.5%	Illustrates the coexistence of high objective risk and low knowledge
Negesa et al., 2020[21]	Ethiopia; 287 cardiovascular outpatients	HDFQ	46% had suboptimal knowledge; no significant association with cumulative risk behavior	Knowledge alone was insufficient to explain behavior
Liu et al., 2023[22]	Guangzhou, China; community adults	Awareness of diagnosed risk factors among those at high calculated ASCVD risk	Standardized high-risk prevalence was 13.8%, with incomplete awareness, treatment, and control	Objective risk assessment should be paired with active disclosure and follow-up

The gap is not confined to questionnaire knowledge. Liu et al.[22] found that 13.8% of adults in Guangzhou had high 10-year atherosclerotic cardiovascular risk, while awareness, treatment, and control of major component risks remained incomplete. In Egypt, Soliman et al.[23] analyzed adults meeting measured criteria for hypertension in the 2015 Egyptian Health Issues Survey and found that more than half were unaware of their condition. Younger age, male sex, lower education, and an apparently healthier profile were associated with unawareness. This is clinically important: an individual cannot act on a risk factor that has never been detected or disclosed.

Why Objective Risk and Knowledge Diverge

The first cause of divergence is the silent nature of risk. Hypertension, dyslipidemia, early diabetes, and kidney disease may produce no symptoms for years, encouraging the belief that absence of illness equals absence of risk. Screening converts a hidden biological state into actionable information, but disclosure must include meaning and next steps. Simply stating that a value is “high” rarely communicates time horizon, competing risks, or the potential benefit of treatment.[6,23]

Second, education and health literacy affect access to and interpretation of information. The American Heart Association scientific statement by Magnani et al.[24] describes limited health literacy as a barrier across prevention, medication use, informed consent, and navigation of cardiovascular care. Clinicians should use plain language universally rather than attempt to identify who “looks” health literate. Short explanations, a small number of prioritized actions, and confirmation of understanding reduce the cognitive load of a risk consultation.

Third, knowledge is filtered through perceived susceptibility and feasibility. People may accept that smoking or obesity is harmful in general but view their own exposure as insufficient to matter, believe that family history makes prevention futile, or face costs and environments that limit change. This explains why cross-sectional associations between higher knowledge and healthier behavior are inconsistent and why education-only programs may show early gains that fade when reinforcement and structural support are absent.[21]

Communicating Risk Effectively

Risk communication should begin with absolute risk using a clearly stated outcome and time frame, followed by the expected absolute benefit of realistic options. Natural frequencies, consistent denominators, and simple icon arrays are usually easier to interpret than relative risk alone. Presenting “10 of 100 people may experience an event over 10 years, compared with 7 of 100 with treatment” is more informative than saying treatment provides a “30% relative reduction.” The clinician should also explain uncertainty and avoid framing a low short-term estimate as immunity from lifetime risk.[7,24]

The evidence supports communication as part of care, while showing that its effects are modest rather than transformative. Bakhit et al.[25] included 62 randomized trials in a 2024 systematic review and meta-analysis. Risk communication improved the accuracy of perceived risk (odds ratio 2.31, 95% confidence interval 1.63–3.27) and produced a small improvement in overall CVD risk scores at 6–12 months (mean difference −0.27, 95% confidence interval −0.45 to −0.09). It increased self-reported dietary modification in primary prevention but did not consistently improve smoking cessation or physical activity. Thus, communication is necessary, but usually insufficient without follow-up and behavior-specific support.

Earlier evidence is consistent with this restrained interpretation. Karmali et al.[26] concluded that providing risk scores may slightly improve risk-factor levels and preventive prescribing, although study quality and heterogeneity limited certainty. In a randomized primary-care trial, the Statin Choice decision aid improved accurate risk perception and decisional quality among patients with diabetes but did not improve statin adherence.[27] These findings distinguish an informed decision from a predetermined decision: good communication should improve understanding and alignment with patient values, not merely increase treatment uptake.

Teach-back is a practical safeguard. After discussing risk and options, the clinician asks the patient to explain, in their own words, what the risk means and what action they plan to take. A systematic review by Ha Dinh et al.[28] found that teach-back could improve disease-specific knowledge, adherence, and self-management in chronic disease, although the underlying studies were heterogeneous. In cardiovascular prevention, teach-back should verify three points: the patient's main drivers of risk, the agreed intervention, and when reassessment will occur.

Translating Knowledge into Preventive Action

Education is most effective when linked to a specific behavior, a feasible plan, and repeated measurement. Tobacco counseling should connect quitting with rapid cardiovascular benefit and offer pharmacologic and behavioral support. Dietary advice should identify concrete substitutions rather than deliver broad prohibitions. Physical-activity counseling should start from current capacity and define frequency, intensity, and progression. Blood-pressure, lipid, and diabetes discussions should pair lifestyle advice with medication when indicated, because knowledge should not become a reason to delay effective therapy.[6,7]

Recent Egyptian interventional evidence illustrates both the potential and the limitation of education. Ahmed et al.[29] assessed 214 administrative staff at Ain Shams University and enrolled 79 in a health-belief-model educational program. Knowledge-related constructs improved, but gains declined somewhat over time and preventive behavior showed no meaningful change at nine months (effect size 0.010; P=0.390). The study was quasi-experimental and involved a selected workforce, yet its message is valuable: educational improvement does not automatically translate into sustained behavior change.

Follow-up should therefore be designed at the first visit. Each encounter can close one part of the prevention loop: verify measurements, estimate risk, identify the patient's priority, agree on one or two actions, address barriers, and schedule reassessment. Team-based care allows nurses, pharmacists, dietitians, and community health workers to reinforce the plan. Digital reminders can support continuity, but they should complement rather than replace clinician-patient communication, particularly for patients with limited digital access or health literacy.

A Family-Medicine Framework

Family medicine offers longitudinal contact, familiarity with the household and social context, and repeated opportunities to identify risk before symptoms develop. A practical consultation can be organized into six linked actions: screen, estimate, elicit, explain, agree, and reinforce. Screening identifies biological and behavioral exposures; estimation converts them to absolute risk; elicitation assesses knowledge, perceived susceptibility, goals, and barriers; explanation uses plain-language absolute benefit; agreement produces a feasible plan; and reinforcement repeats measurements and teach-back over time.[6,25]

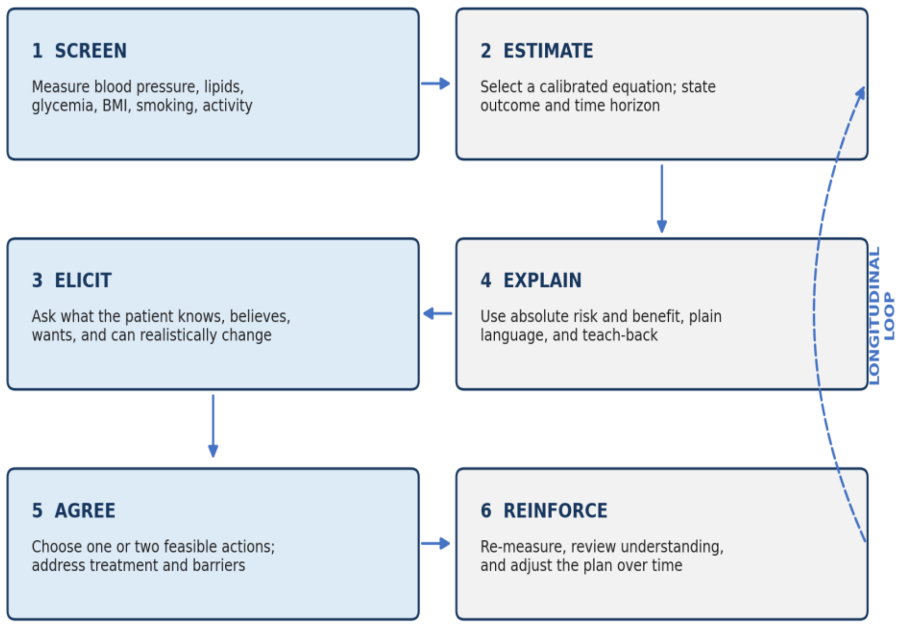

Figure 1. Integrated family-medicine pathway for cardiovascular risk and knowledge. Objective risk estimation and knowledge assessment are performed together, followed by understandable communication, shared planning, and longitudinal reassessment. Adapted as an original framework from contemporary prevention guidelines and risk-communication evidence.[6,7,25]

This framework also prevents common errors. A knowledge score should not substitute for clinical screening; a risk score should not substitute for conversation; and a single educational session should not substitute for longitudinal support. Documentation should record the calculator used, the outcome and time horizon, major risk drivers, the patient's understanding, the agreed intervention, and the date of review. These elements make risk communication reproducible rather than incidental.

Priorities for Practice and Research

Primary-care systems in Egypt need locally validated risk models or robust recalibration studies that connect baseline measurements with prospective cardiovascular outcomes. Until such data are available, researchers should specify why a selected model is appropriate, report its eligible age range and outcome definition, and avoid importing treatment categories from another region without qualification. Studies should also distinguish estimated risk from diagnosed risk factors and from self-perceived risk.

Knowledge research requires similar rigor. Instruments should undergo Arabic translation and cultural validation, with transparent reporting of item changes, scoring, reliability, and prespecified categories. Future studies should measure not only factual knowledge but also personal risk awareness, numeracy, treatment beliefs, behavior, and objective risk-factor control. Prospective designs are needed to determine whether changes in knowledge precede and predict changes in blood pressure, lipids, smoking, activity, or calculated absolute risk.

Intervention studies should move beyond one-time education. Useful trials would compare tailored risk communication plus structured follow-up against routine counseling, incorporate teach-back and shared decision aids, and report sustained outcomes at 6–12 months or longer. Equity should be built into design through literacy-sensitive materials, low-cost delivery, inclusion of rural and lower-education populations, and assessment of whether an intervention narrows or widens disparities.[24,25]

Strengths and Limitations

This review integrates contemporary risk equations, validated knowledge instruments, recent Egyptian data, and randomized evidence on risk communication within a family-medicine framework. Its narrative design does not provide the reproducibility or pooled effect estimation of a systematic review. The cited knowledge studies used different instruments, thresholds, populations, and recruitment strategies, so their percentages should not be compared as if they measured an identical construct. Several studies were cross-sectional and cannot determine whether knowledge changes behavior or risk. Risk calculators described here were developed for specific populations, and their transportability to Egyptian adults remains uncertain.

Conclusion

Cardiovascular prevention is strongest when objective risk and patient understanding are assessed together. Contemporary equations can identify who is most likely to benefit from intervention, but their output must be interpreted within the correct population and clinical context. Knowledge questionnaires reveal important gaps, yet knowledge alone does not ensure accurate personal risk perception or sustained behavior change. Family physicians should link screening, absolute risk estimation, plain-language communication, teach-back, shared decisions, and scheduled reassessment. This longitudinal, patient-centered process turns cardiovascular knowledge from a descriptive score into a practical component of prevention.

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