| **Risk Score** | **Risk Factors Included in the Model** | **Outcomes and**  **Time Horizon** | **Population Derived/**  **Source Cohort** | **Validation Cohorts** | **Limitations** |
| --- | --- | --- | --- | --- | --- |
| ACC/AHA Pooled Cohort Equation, 201314 | 4 equations, sex- and race-specific  Other covariates:   * Age * Treated or untreated SBP * TC * HDL-C * Current smoking * Diabetes | 10-year risk for first hard ASCVD event (nonfatal MI, CHD death, fatal or nonfatal stroke) | **Source:** 4 NHLBI-sponsored longitudinal community-based cohort studies (ARIC, CHS, CARDIA, Framingham/Framingham Offspring); derivation cohort restricted to those 40-79, African American or White, no previous MI, stroke, HF, coronary revascularization, AF. ARIC, CARDIA, CHS contribute African American participants. White participants are from the same cohorts plus Framingham/Framingham-Offspring.  **Time period:**  **ARIC114:** Baseline examinations conducted between 1986 and 1989  **CARDIA115:** Recruitment conducted 1984-1985  **CHS116:** Baseline examinations conducted in 1989  **Framingham6:** Data collected 1968-1971 for original cohort; 1971-1975 or 1984-1987 for Offspring cohort  **Recruitment:**  **ARIC:** Random selection of approximately 4,000 subjects from each of 4 communities  **CARDIA:** Random selection from phone/address lists in 3 sites and random selection from health plan participant rosters in 1 site  **CHS:** Random sampling of Medicare eligibility lists  **Framingham:** Random sample of 2/3 of the adult population  **N:** White women: 11,240  White men: 9,098  African American women: 2,641  African American men: 1,647  **Age, years:** range for all, 40-79  White women: 56.8  White men: 56.2  African American women: 55.3  African American men: 55.4  **Risk characteristics:**  *BP meds:*  White women: 18.5%  White men: 16.9%  African American women: 40.8%  African American men: 31.2%  *TC, mg/dL:*  White women: 220.5  White men: 210.7  African American women: 214.8  African American men: 208.4  *HDL, mg/dL:*  White women: 58.2  White men: 44.4  African American women: 58.6  African American men: 51.0  *Smoking:*  White women: 24.9%  White men: 25.5%  African American women: 22.7%  African American men: 35.5%  *Diabetes:*  White women: 6.3%  White men: 8.8%  African American women: 17.4%  African American men: 15.9%  *Incident ASCVD events:*  White women: 902 (8.0%)  White men: 1,259 (13.8%)  African American women: 290 (11.0%)  African American men: 238 (14.4%)  All demographic characteristics calculated as weighted averages from Table 2 in Supplement | Munter, 2014: REGARDS cohort, a community-based cohort of adults 45 years or older in the US. Analyses restricted to participants 45-79 without CHD, stroke, HF, or AF; 5 year F/U. Additional analyses also further restricted to participants without diabetes, LDL 70-189 mg/dL and not taking statins (population considered for statin initiation under ATP IV guidelines). Analyses also made with Medicare-linked data for additional outcome ascertainment. When all participants were analyzed, calibration was poor for all groups and the C-index was above 0.7 for women and whites only. When analyses were restricted to those without diabetes, LDL 70-189 mg/dL and not taking statins, calibration was improved with Hosmer-Lemeshow χ2 less than 20.0 for all sex and race groups; discrimination was above 0.7 for women and whites only. Calibration additionally improved when additional events were ascertained through Medicare-linked data. Comparison of observed to predicted events shows marked overprediction in the >=10% risk category.  ACC/AHA, 2013: MESA cohort, restricted to those 40 to 79 years of age, free of MI, stroke, CHF, coronary revascularization, or AF and with complete data; 6 year F/U. Calibration poor for white and black men, calibration χ2 <20 for white women and black women (14.56 and 18.51); discrimination >0.7 for white women and men and black women. Overprediction in most race-sex groups and risk categories except for in white women, where observed events were greater than those predicted in risk categories <5% and 7.5 to <10% and observed and predicted events were closely matched in the 5% to <7.5% category.  ACC/AHA, 2013: Contemporary Cohort (ARIC visit 4; Framingham cycle 22 or 23; Framingham offspring cycle 5 or 6), restricted to those 40 to 79 years of age, free of MI, stroke, CHF, coronary revascularization, or AF and with complete data. Calibration χ2 <20 only for black women and men. Discrimination (C-index) >0.7 for all race-sex groups except white men (0.6843). When examining observed vs predicted events, overprediction greater in >10% risk group compared with lower risk groups for all race-sex groups except for black men, where overprediction was greatest in 5 to 7.5% risk group.  Kavousi, 2014: Rotterdam study, a prospective cohort study of adults 55 or older in the Netherlands, excludes individuals on statins at baseline, those with CVD, and those with LDL >190 mg/dL. This analysis also compared ATP III Framingham and SCORE models. χ2 statistics NR but calibration qualitatively described as poor for all 3 models examined; all models overestimated risk in men and women across all risk categories.  Ridker, Cook, 2013: Women’s Health Study, Physician’s Health Study, Women’s Health Initiative Observational Study. Systematic overestimation of observed risks by 75-150% in all three cohorts. | No equations for Hispanics or Asians; lack of large external datasets with needed covariate data to validate in these subpopulations. Archimedes external validation of Hispanics with data from MESA showed overprediction in women but not men; for ALLHAT, overprediction for men and women (observed to predicted ratios of 1.38 and 1.47, respectively). Not enough event data to validate in Asians.  Almost always large overprediction in >=10% risk group. General trend of overprediction in other risk groups, but some external validation cohorts show underprediction or well-matched observed to predicted events in the <5% group.  Small numbers events in validation cohorts, particularly in lower risk groups. |
| Framingham CHD – Wilson, 19988  ATP III modification of Wilson, 200215 | Wilson; sex-specific equations with the following covariates:   * Age * TC * HDL * BP * Diabetes * Smoking   ATP III modification of Wilson; sex-specific equations with the following covariates:   * Age * TC * HDL * SBP * Treatment for HTN * Smoking | 10-year risk of CHD (angina pectoris, ‘recognized and unrecognized’ MI, coronary insufficiency, sudden death); score sheets provide comparison with hard CHD (total CHD without angina pectoris)  ATP III version of Wilson: 10-year risk for hard CHD (MI and CHD death) | **Source:** Community-based cohort of adults free of CHD and 30-74 years old; Framingham, MA  **Time period:** Data collected 1971-1974; 12 years F/U  **Recruitment:** Random sample of 2/3 of the adult population in the community  **N:** 5,345 [11th exam of original Framingham cohort or 1st exam of Framingham offspring cohort]  **% male/female\*:** 46.4/53.6  **Age:** range, 30-74  Mean, men: 48.3  Mean, women: 49.6  **Risk characteristics:**  *BP >140/90 mm Hg:*  Men: 36%  Women: 29%  *TC >240 mg/dL, %:*  Men: 23  Women: 29  *HDL <45 mg/dL, %:*  Men: 55  Women: 19  *Smoking, %:*  Men: 40  Women: 38  *Diabetes, %:*  Men: 5  Women: 4  *Incident CHD events over 12 years F/U:*  Men: 383 (15.4%)  Women: 227 (7.9%)  **Race/ethnicity:** Predominately white (% NR) | External validation reported for a wide range of cohorts in the US, Europe and Australia, including community-based and occupational cohorts as well as among individuals with family history of CVD101  Landmark validation paper in multiethnic populations used 6 non-Framingham cohorts (D’Agostino 2001117)   * ARIC: 1987-1988 data; prospective cohort of 14,178 Black and White men and women ages 44-66; 26.5% Black * PHS: 1982 data; Prospective nested case-control study of 901 White male physicians ages 40-74 * HHP: 1980-1982 data; prospective cohort of 2,755 Japanese American men ages 51-81 * PR: 1965-1968 data; prospective cohort of 8,713 Hispanic men ages 35-74 * SHS: 1989-1991 data; prospective cohort of 3,782 Native American men and women ages 45-75 * CHS: 1989-1990 data; prospective cohort of 2,557 white men and women ages 65-74 | Tendency to over-estimate CHD risk in groups with low observed risk and under-predict risk in high-risk groups (diabetes, strong family history of premature CVD, regions with high incidence and SES deprived groups). Predicted to observed ratios for CHD range from underprediction of 0.43 in a study of people with a family history of CHD to overprediction of 2.87 in an occupational sample of women from Germany101  Among 6 nonFramingham US cohorts, the risk score is able to discriminate between subjects who develop CHD and those who do not reasonably well for white and black men and women, but overestimates risk for Japanese American men, Hispanic men, and Native American women117  No validation in populations <30 and >80 years (only validated in 1 cohort that includes subjects 80 years and above; most validation cohorts have an upper age range of 64 or 74) |
| Framingham-Anderson, 199116,25 | * Sex * Age * SBP * Smoking * TC/HDL-C * Diabetes * ECG-LVH | 1. MI (including silent and unrecognized) 2. CHD death 3. CHD (MI and CHD death, angina pectoris, coronary insufficiency) 4. Stroke (including transient ischemia) 5. CVD (1-4 plus CHF and PVD) 6. CVD death | **Source:** Community-based cohort of adults free of CHD and 30-74 years old; Framingham, MA  **Time period:** Data collected 1968-1975; 12 years F/U  **Recruitment:** Random sample of 2/3 of the adult population in the community  **N:** 5,573 [Original Framingham cohort examinations 10-12 and first examination of offspring cohort]  **% male/female:** 46.5/53.5  **Age:** range 30-74  **Risk characteristics:**  *Median BP, mm Hg:*  Men: 128/82  Women: 123/79  *Median TC, mg/dL:*  Men: 210  Women: 212  *Median HDL-C, mg/dL:*  Men: 43  Women: 56  *Smoking, %:*  Men: 41  Women: 39  *Diabetes, %:*  Men: 7  Women: 5  *ECG-LVH, %:*  Men: 1  Women: 0.5  *Incident CHD events over 12 years F/U:*  Men: 385 (15%)  Women: 241 (8%)  **Race/ethnicity:** Predominately white (% NR) | External validation reported for a wide range of cohorts in the US, Europe and New Zealand, including community-based and occupational cohorts as well as among participants of antihypertensive and lipid lowering intervention RCTs101,102  The number and location and external validation cohorts vary by the outcome investigated.  **CHD:** Most number of external validation studies are for this outcome, including US-based cohorts. Trend for underprediction in higher risk populations and overprediction in lower risk populations. Calibration reasonably accurate when baseline 10-year risk is 8 to 16%.102  **CVD:** External validation cohorts from Australia, New Zealand, UK, and Europe; additionally LIFE study which included US-participants in LIFE study, with limited reporting from poster presentation. Predicted to observed ratios for CVD range from underprediction of 0.67 in UK subjects with diabetes to overprediction of 2.60 in high risk hypertensives; two validations in Australia and New Zealand show concordance between predicted and observed events102  **Stroke:** Predicted risk of stroke close to actual risk for overall population; underprediction in higher-risk countries (Italy, Spain, Netherlands) and overprediction in lower-risk countries (France, Scandinavia). External validation for this outcome limited to 1 study of treated hypertensives in Europe/Israel118 | Limited US-based external validation for CVD outcome; no US-based external validation for stroke outcome  Historically dated derivation cohort (data collection 1968-1975)  Predominately white source population  Criticism about universally accepted criteria for LVH by ECG |
| Framingham CVD, 20086 | Sex-specific equations with the following covariates:   * Age * TC * HDL * SBP * Antihyperten-sive medication use * Smoking * Diabetes | 10-year risk of CVD (composite of CHD (coronary death, MI, coronary insufficiency, and angina), cerebrovascular  events (ischemic stroke, hemorrhagic stroke, and TIA), peripheral artery disease (intermittent  claudication), and heart failure) | **Source:** Community-based cohort of adults free of CVD and 30-74 years old; Framingham, MA  **Time period:** Data collected 1968-1971 for original cohort; 1971-1975 or 1984-1987 for Offspring cohort depending on 1st or 3rd exam; 12 years F/U  **Recruitment:** Random sample of 2/3 of the adult population  **N:** 8,491 [11th exam of original Framingham cohort or 1st or 3rd exam of Framingham offspring cohort]  **% male/female:** 46.7/53.3  **Age:** range, 30-74  Mean, men: 48.5  Mean, women: 49.1  **Risk characteristics:**  *Mean TC, mg/dL:*  Men: 212.5  Women: 215.1  *Mean HDL-C, mg/dL:*  Men: 44.9  Women: 57.6  *Mean SBP, mm Hg:*  Men: 129.7  Women: 125.8  *BP treatment, %:*  Men: 10.13  Women: 11.76  *Smoking, %:*  Men: 35.22  Women: 34.23  *Diabetes, %:*  Men: 6.5  Women: 3.76  *Incident CVD events over 12 years F/U:*  Men: 718 (18.09%)  Women: 456 (10.08%)  **Race/ethnicity:** Predominately white (% NR) | Not externally validated | Not limited to “hard’ outcomes |
| ARIC, 200317 | * Sex * Race * Age * Cigarette smoking * TC * HDL * SBP * Antihypertensive medication use * Diabetes   *Note: The risk factors above are described by the “Basic + Age model.” Additional models with nontraditional risk factors are included in Chambless et al 2003 and Folsom et al 2003* | 10-year risk for CHD event (validated definite or probable  hospitalized MI, definite CHD death, unrecognized  MI defined by ARIC ECG readings, or coronary revascularization | **Source:** Cohort of adults 45-64 years old and free of CVD from four U.S. communities (Minneapolis suburbs, MN; Forsyth County, NC; Washington County, MD; and black residents from Jackson, MS)  **Time period:** Baseline examinations conducted between 1987 and 1989; F/U is ongoing. The present analysis includes F/U through 1998 (median 10.2 years)  **Recruitment:** Random selection of approximately 4,000 subjects from each of 4 communities  **N:** 14,054  **% male/female:** 43.2/56.8  **Age:** range, 45-64  **Risk characteristics:**  *Mean TC, mg/dL:*  Men: 211  Women: 218  *Mean HDL-C, mg/dL:*  Men: 44  Women: 57  *Hypertension (>140/90 mm Hg or on meds), %:*  Men: 35  Women: 35  *Smoking, %:*  Men: 28  Women: 25  *Diabetes, n (%):119*  Men: 639 (10.5%)  Women: 861 (10.8%)  *Incident CHD events over 10.2 years F/U:*  Black women: 113 (4.9%)  White women: 232 (4.1%)  Black men: 133 (9.5%)  White men: 586 (12.5%)  **Race/ethnicity, %:**  Black: 26.3  White: 73.7 | Not externally validated23† | Model includes race, but race options are limited to Black and White  Not inclusive of ages <45 or >65 years |
| SCORE, 200318 | * Age * Sex * Smoking * TC or TC/HDL ratio * SBP * Smoking * High and low risk regions of Europe | 10-year risk of fatal CV event (MI, stroke, aortic aneurysm) | **Source:** Pooled data set of population-based and occupational cohort studies from 12 European countries  **Time period:** Earliest recruitment period was 1967-1972 for the Paris Prospective Study; latest recruitment period of 1977-1991 for Glostrup Population Studies  **Recruitment:** Varied based on cohort;recruitment included random sample, complete population, birth cohort and occupational cohort  **N:** 205,178  **% male/female:** 57.1/42.9  **Age:** age range heterogeneous by cohort; model fit limited to ages 45-64  **Risk characteristics:**  *Range of mean TC across cohorts, mg/dL:§*  Men: 216.6 (Italy) to 251.4 (Finland)  Women: 212.7 (Italy) to 251.4 (Scotland)  *Range of mean HDL-C across cohorts, mg/dL:*  Men: 44.5 (UK) to 53.0 (Scotland)  Women: 54.2 (Spain) to 65.0 (Scotland)  *Range of mean SBP across cohorts, mm Hg:*  Men: 129 (Denmark) to 149 (Sweden)  Women: 120 (Spain) to 140 (Finland)  *Range of prevalence across cohorts, %:*  Men: 39 (Germany) to 68 (France)  Women: 12 (Spain) to 47 (Denmark)  *Range of cumulative CVD death rate by age 65, %:*  Men: 2.81 (Spain) to 12.80 (Finland)  Women: 0.94 (Spain) to 2.66 (Finland) | Externally validated in European cohorts (11 evaluation studies)23  Not validated in US; validation results mixed in European cohort, including overestimation in Norway and Austria and underestimation in South Asians residing in the UK, a population with a higher burden of diabetes (21% prevalence in sample) | No nonfatal events  Diabetes not included as a risk factor because it was not uniformly collected in source cohort, but patients with diabetes included in source cohort; one validation study suggests underprediction in subjects with a high burden of diabetes120  Risk functions are based on single risk factor measurements and not ‘usual’ levels  Not validated in US |
| Reynolds, women, 200719 | * Age * SBP * Smoking * TC * HDL-C * hsCRP * Parental history of MI <60 years * HbA1c if diabetic | 10-year risk of CV events (MI, ischemic stroke, coronary revascularization, CV death) | **Source:** Women’s Health Study, a nationwide cohort of healthy US women (health professionals) 45 years and older and free of CVD and cancer at study entry; 2/3 of participants assigned to model derivation data set and 1/3 assigned to validation data set  **Time period:** 1992-2004; mean 10.2 years F/U  **Recruitment:** Female health professionals (76% RNs)  **N:** 16,400 in derivation cohort  **% male/female:** 0/100  **Age, median (IQR):** 52 (48-58)  **Risk characteristics:**  *Median TC, IQR, mg/dL*: 208 (183-235)  *Median HDL-C,IQR, mg/dL:* 51.9 (43.1-62.5)  *Median LDL-C, IQR, mg/dL:* 121.0 (100.1-144.1)  *Lipid-lowering therapy, %:* 3.2  *History of hypertension, %:* 24.8  *Menopausal, %:* 54.4  *Current smoking, %:* 11.6  *Diabetes, %:* 2.7  *Parental history of MI, %:* 12.9  *Incident CVD events over 10.2 years F/U:*  504 events (3.1%)  **Race/ethnicity, %**  White: 95.2  Black: 1.9  Hispanic: 1.0  Asian: 1.4  Other: 0.5 | Validated in same population from which it was derived  **Source:** Women’s Health Study, a nationwide cohort of healthy US women (health professionals) 45 years and older and free of CVD and cancer at study entry; 2/3 of participants assigned to model derivation data set and 1/3 assigned to validation data set  **Time period:** 1992-2004; mean 10.2 years F/U  **Recruitment:** Female health professionals (76% RNs)  **N:** 8,158 in validation cohort  **% male/female:** 0/100  **Age, median (IQR):** 52 (49-59)  **Risk characteristics:**  *Median TC, mg/dL:* 208 (184-235)  *Median HDL-C, mg/dL:* 52.2 (43.4-62.5)  *Median LDL-C, mg/dL:* 121.3 (100.9-143.8)  *Lipid-lowering therapy, %:* 3.2  *History of hypertension, %:* 25.3  *Menopausal, %:* 54.3  *Current smoking, %:* 11.4  *Diabetes, %:* 2.9  *Parental history of MI, %:* 12.7  *Incident CVD events over10.2 years F/U:*  262 events (3.2%)  **Race/ethnicity, %**  White: 95.3  Black: 1.9  Hispanic: 1.0  Asian: 1.5  Other: 0.3 | Not externally validated outside of source cohort  Primarily white  100% of sample is health professionals; health behaviors and SES may not be generalizable  Data on BP, obesity, and family history based on self-report |
| Reynolds, men, 200820 | * Age * SBP * Smoking * TC * HDL-C * hsCRP * Parental history of MI <60 years | 10-year risk of CV events (MI, stroke, coronary revascularization, CV death) | **Source:** Physicians Health Study II, nationwide cohort of healthy male physicians 50-80 years of age and free of CVD, DM, and cancer at study entry  **Time period:** 1995-2008; median 10.8 years F/U  **Recruitment:** Male physicians  **N:** 10,724  **% male/female:** 100/0  **Age, median (IQR):** 63 (57-70)  **Risk characteristics:**  *Mean TC, IQR, mg/dL:* 203 (180-227)  *Mean HDL-C,IQR, mg/dL:* 42.5 (24.4-52.4)  *Median SBP, IQR, mm Hg:* 128 (120-135)  *Lipid-lowering therapy, %:* 17.3  *Antihypertensive therapy, %:* 24.2  *Current smoking, %:* 3.2  *Parental history of MI before age 60, %:* 10.8  *Incident CVD events over 10.8 years F/U:*  1294 events (12.1%)  **Race/ethnicity:** Primarily white (% NR in risk score paper) | Not externally validated | Primarily white source population  100% of sample is health professionals; health behaviors, access to health care, and SES may not be generalizable  Data on BP, obesity, and family history based on self-report  Uncertain applicability in men <50 |
| QRISK2, 200821 | * Self-assigned ethnicity * Age * Sex * Smoking status * SBP * Ratio of TC/HDL-C * BMI * Family history of CHD in first degree relative <60 years * Townsend deprivation score * Treated HTN * Rheumatoid arthritis * Chronic kidney disease * Diabetes * Atrial fibrillation | 10-year risk of CHD (angina and MI), stroke, or TIA | **Source:** UK primary care database; subjects aged 35-74 years and free of cardiovascular or cerebrovascular disease and not taking statins at baseline; 2/3 of participants randomly allocated to derivation dataset and 1/3 assigned to validation data set  **Time period:** 1993-2008, mean F/U 7.3 years for women and 6.9 years for men  **Recruitment:** Patients registered at primary care practices in the UK  **N:** 1,535,583  **% male/female:** 49.6/50.4  **Age:** range, 35-74  Median (IQR), men: 48 (40-58)  Median (IQR), women: 49 (41-60)  **Risk characteristics:**  *Treated hypertension, %:*  Men: 5.59  Women: 7.12  *Current smoking, %:*  Men: 27.4  Women: 22.8  *Diabetes, %:*  Men: 2.24  Women: 1.70  *Atrial fibrillation, %:*  Men: 0.25  Women: 0.35  *Chronic kidney disease, %:*  Men: 0.15  Women: 0.16  *Incident CVD events:*  Men: 55,667 events (7.3%) over 6.9 years mean F/U  Women: 41,042 events (5.3%) over 7.3 years mean F/U  **White race/ethnicity, %:**  Men: 97.5  Women: 97.3 | Validated in same population from which it was derived  **Source:** UK primary care database; subjects aged 35-74 years and free of cardiovascular or cerebrovascular disease and not taking statins at baseline; 2/3 of participants randomly allocated to derivation dataset and 1/3 assigned to validation data set  **Time period:** 1993-2008, mean F/U 7.3 years for women and 6.9 years for men  **Recruitment:** Patients registered at primary care practices in the UK  **N:** 750,232  **% male/female:** 49.9/50.1  **Age:** range, 35-74  Median (IQR), men: 47 (40-57)  Median (IQR), women: 49 (41-59)  **Risk characteristics:**  *Treated hypertension, %:*  Men: 5.36  Women: 6.91  *Current smoking, %:*  Men: 28.0  Women: 23.6  *Diabetes, %:*  Men: 2.18  Women: 1.65  *Atrial fibrillation, %:*  Men: 0.58  Women: 0.33  *Chronic kidney disease, %:*  Men: 0.13  Women: 0.17  *Incident CVD events:* Reported as similar to derivation data set but data not shown  **White race/ethnicity, %:**  Men: 97.0  Women: 96.7 | Not externally validated  Only 3% from ethnic minority groups  Recording of family history of CHD may not be systematic  Townsend deprivation score is specific to UK |
| PROCAM, 200222 | * Age * LDL-C * HDL-C * TG * Smoking * Diabetes * Family history of MI <60 years * SBP | 10-year risk of a major coronary event (sudden cardiac death, definite fatal or nonfatal MI) | **Source:** Sample of men from prospective cohort study of Germans 35-65 without history of MI, stroke, angina, or ECG evidence of ischemic heart disease  **Time period:** recruitment from1979-1985 and 10 years F/U  **Recruitment:** Occupational sample from 52 companies and government agencies  **N:** 5,389  **% male/female:** 100/0  **Age, mean (SD):** 46.7 (7.5)  **Risk characteristics:**  *Mean LDL-C (SD), mg/dL:* 148.5 (37.6)  *Mean HDL-C (SD), mg/dL:* 45.7 (11.9)  *Mean SBP (SD), mm Hg:* 131.4 (18.4)  *Mean TG (SD), mg/dL:* 126.2 (65.9)  *Smoking, %:* 31.1  *Family history of MI before age 60, %:* 16.1  *Diabetes, %:* 6.7  *Incident CHD events over 10 years F/U:*  325 events (6.03%)  **Race/ethnicity:** NR | Externally validated in several European cohorts23  In external validation among a cohort of 798 subjects with diabetes in the UK, ages 35-74 and free of CVD, renal failure and family history of dyslipidemia, PROCAM showed poor discrimination and statistically significant underprediction of risk for CHD [O/E ratio 2.05 (95% CI, 1.82-2.31)]121  In external validation among a cohort of 9,758 men ages 50-59 living in Belfast and France and free of CHD, there was clear overestimation of events both in France, a lower risk population, and in the higher risk Belfast population122  In an external validation cohort of 2,732 healthy Caucasian men ages 50-64 years in UK general practices, statistically significant overestimation of risk for CHD [O/E ratio 0.46 (95% CI, 0.40-0.52)]123 | Excludes women  Not applicable to patients >65  Tendency for underprediction in diabetics and overprediction in healthy European populations |
| ASSIGN, 2007124 | * TC * HDL-C * SBP * Smoking * Cigarettes per day * Family history * Diabetes * Index of social status/ deprivation | 10-year risk for CV death, hospitalization for CHD or cerebrovascular disease, coronary artery interventions (CABG or PTCA) | **Source:** Nationally representative Scottish database of participants 30-74 who were free of CHD, stroke, or TIA [Scottish Heart Health Extended Cohort (SHHEC)].  **Recruitment:** SHHEC included data from two overlapping studies: Scottish Heart Health Study, a random sample of men and women 40-59 years in Scotland and the Scottish MONICA Project, which included participants 25-74 from Edinburgh and north Glasgow.  **Time period:** Scottish Heart Health Study: 1984-1987; MONICA: Edinburgh and north  Glasgow in 1986, north Glasgow in 1989 and 1995, ages 25–64 and 1992, ages 25–74; F/U ranged 10-21 years  **N:** 13,297  **% male/female:** 49.2/50.8  **Age, mean (SE):**  Men: 48.9 (0.1)  Women: 48.8 (0.1)  **Risk characteristics:**  *Mean TC (SE), mg/dL§:*  Men: 240.91 (0.39)  Women: 247.87 (0.77)  *Mean HDL-C (SE), mg/dL:*  Men: 52.20 (0.00)  Women: 63.03 (0.39)  *Mean SBP (SE), mm Hg:*  Men: 133.8 (0.2)  Women: 130.1 (0.3)  *Smoking, %:*  Men: 41.5  Women: 40.5  *Among smokers, cigarettes per day, mean (SE):*  Men: 19.2 (0.2)  Women: 15.9 (0.2)  *Family history of heart disease before age 60, %:*  Men: 26.4  Women: 32.6  *Diabetes, %:*  Men: 1.5  Women: 1.3  *Incident CVD events over 10 years F/U:*  Men: 743 (11.4%)  Women: 422 (6.2%)  **Race/ethnicity:** NR | When applied to UK general practice database of subjects 35-75 years of age, ASSIGN overpredicted risk by 36%. This UK database had a lower prevalence of risk factors (i.e., smoking, family history) and incident CVD than the ASSIGN source database.125 | Social deprivation index specific to Scotland  High prevalence of smoking and family history in source cohort |
| Framingham Stroke-Wolf, 1991 with 1994 update 126,127 | Sex-specific equations with the following covariates:   * Age * SBP * AntiHTN therapy * Diabetes * Smoking * Prior CVD (CHD, cardiac failure, intermittent claudication) * AF * LVH-ECG | Stroke (including atherothrombotic brain infarction, TIA, cerebral embolus, intracerebral hemorrhage, subarachnoid hemorrhage) | **Source:** Community-based cohort of adults age 55-84 and free of stroke; Framingham, MA  **Time period:** Data collection period 1965-1967║; 10 years F/U  **Recruitment:** Random sample of 2/3 of the adult population in the community  **N:** 5,734 [Framingham examination cycles 9 and 14]  **% male/female:** 41/59  **Age, mean years:**  Men: 65.4  Women: 66.1  **Risk characteristics:**  *Mean BP, mm Hg:*  Men: 139.3  Women: 142.8  *Antihypertensive therapy, %*  Men: 16.1  Women: 25.0  *Smoking, %*  Men: 33.8  Women: 26.4  *Diabetes, %*  Men: 10.6  Women: 7.9  *CVD, %*  Men: 22.2  Women: 14.2  *AF, %*  Men: 2.8  Women: 2.2  *LVH-ECG, %*  Men: 3.5  Women 2.9  *Incident stroke events over 10 years F/U*  Men: 213 (9.0%)  Women: 259 (7.7%)  **Race/ethnicity:** Predominately white (% NR) | Copenhagen City Heart Study, a prospective study of 19,698 men and women aged 20 years or older. The Copenhagen population included a much higher proportion of smokers and patients with LVH compared with the Framingham source cohort, and a lower proportion of individuals with diabetes or being treated with antiHTN therapy. The observed frequency of stroke was compatible with probability intervals based on the prediction model.128 | Derivation cohort includes participants with prior CVD (22.2% of men and 14.2% of women)  Not externally validated in US population  Historically dated derivation cohort (data collection 1965-1967  Predominately white source population |

\*Demographic characteristics of the source cohort reported in D’Agostino 2001

†A table of externally validated methods is available in Matheny, 2011, Table 5 (page 51)

‡Risk characteristics for TC through smoking reported at the ARIC website: http://www2.cscc.unc.edu/aric/system/files/CohortCharacteristics.pdf. Reported for the full cohort of 15,792 (not the model derivation cohort of 14,054).

§Units converted from source paper

║Reported in Beswick, 2008102

**Abbreviations:** ACC/AHA= American College of Cardiology/American Heart Association; AF= Atrial Fibrillation; ALLHAT= Anti=hypertensive and Lipid Lowering Treatment to Prevent Heart Attack; ARIC= Atherosclerosis Risk in Communities; ASCVD= Atherosclerotic Cardiovascular Disease; ATP= Adult Treatment Panel; BMI= Body Mass Index; BP= Blood Pressure; CABG= Coronary Artery Bypass Grafting; CARDIA= Coronary Artery Risk Development in Young Adults; CHD= Coronary Heart Disease; CHS= Cardiovascular Health Study; CVD= Cardiovascular Disease; ECG= Electrocardiogram; F/U= Followup; HbA1c= Hemoglobin A1c; HDL= High Density Lipoprotein; HDL-C= High Density Lipoprotein Cholesterol; HF= Heart Failure; HHP= Honolulu Heart Program; hsCRP= High Sensitivity C-Reactive Protein; HTN= Hypertension; IQR= Interquartile Range; LDL= Low Density Lipoprotein; LIFE= Life Style Interventions and Independence for Elders; LVH= Left Ventricular Hypertrophy; mg/dL= Milligrams per Deciliter; MA= Massachusetts; MD= Maryland; MESA= Multi Ethnic Study of Atherosclerosis; MI= Myocardial Infarction; mm Hg= Millimeter of Mercury; MN= Minnesota; MONICA= Multinational Monitoring; MS= Mississippi; NC= North Carolina; NHLBI= National Heart Lung and Blood Institute; NR= Not Reported; O/E= Observed to Expected; PHS= Physicians Health Study; PRHHP= Puerto Rican Heart Health Program; PROCAM= Prospective Cardiovascular Muenster Study; PTCA= Percutaneous Transluminal Coronary Angioplasty; PVD= Peripheral Vascular Disease; REGARDS= Reasons for Geographic and Racial Differences in Stroke; RCT= Randomized Controlled Trial; RN= Registered Nurse; SBP= Systolic Blood Pressure; SCORE= Systematic Coronary Risk Evaluation; SD=Standard Deviation; SE= Standard Error; SES= Socio=economic Status; SHS= Strong Heart Study; SHHEC= Scottish Heart Health Extended Cohort; TC= Total Cholesterol; TG= Triglycerides; TIA= Transient Ischemic Attack; US= United States; UK= United Kingdom