Supplementary appendix

This appendix is a part of the original manuscript

Supplement to: Yihun Mulugeta Alemu, Sisay Mulugeta Alemu, Nasser Bagheri, Kinley Wangdi, Dan Chateau “Discrimination and calibration performances of non-laboratory-based and laboratory-based cardiovascular risk predictions: a systematic review”

Alemu YM, *et al. Open Heart* 2025; 12:e003147. doi: 10.1136/openhrt-2024-003147

Discrimination and calibration performances of non-laboratory-based and laboratory-based cardiovascular risk predictions: a systematic review

Yihun Mulugeta Alemu, Sisay Mulugeta Alemu, Nasser Bagheri, Kinley Wangdi, Dan Chateau

Supplementary appendices

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Appendix A: Details of the search strategies

Systematic review search strategies
PubMed #1 "Models, Cardiovascular"[Mesh] =35,026 #2 “laboratory-based” OR “laboratory based” [tw] OR “non-laboratory-based” OR “nonlaboratory based” OR “risk score*” [tw] OR “cardiovascular risk score*”[tw] OR “cardiovascular risk equation*”[tw] OR “cardiovascular risk prediction*”[tw] OR “non-fatal stroke”[tw] OR “fatal stroke”[tw] OR “myocardial infarction”[tw] OR “nonfatal myocardial infarction”[tw] OR “nonfatal myocardial infarction”[tw] OR “ischemic heart disease”[tw] OR “cardiovascular death*”[tw] OR “congestive heart failure”[tw] OR “coronary bypass*”[tw] OR “percutaneous angioplasty*”[tw] OR “angina*”[tw] OR “coronary insufficiency*”[tw] OR “coronary heart disease death *”[tw] OR “transient ischemic attack*”[tw] OR “peripheral vascular disease*”[tw] OR “ischemic heart disease*”[tw] = 507,347 #3 #1 OR #2=547,129 #4 "Risk Factors"[Mesh] OR "Body Mass Index"[Mesh] OR "Cholesterol"[Mesh]= 1,219,627 #5 “10 year risk*”[tw] OR “5 year risk*”[tw] OR "comparison"[tw] = 1,586,134 #6 #4 AND #5= 54,030 #7 #3 AND #6=6,014
WEB of SCIENCE #1 "laboratory-based" OR " cardiovascular risk score*" OR "non-laboratory-based*" OR "cardiovascular risk equation*" OR "cardiovascular risk prediction*" OR "coronary heart diseases event*" OR "cardiovascular risk estimation" OR "body mass index cardiovascular" OR "cardiac risk factors " OR "coronary disease risk" OR "non-fatal stroke" OR "nonfatal myocardial infarction" OR "hypertensive ischemic heart disease" OR "Harvard NHANES equation" OR " Framingham 2008 risk score" OR " Framingham 1991 CVD score" OR " SCORE high-risk score" OR " SCORE low-risk score" OR " CUORE risk score" OR "pooled cohort equation " OR "pooled cohort equation " OR " Framingham non-laboratory-based algorithm" OR "office based cardiovascular score" OR " WHO/ISH cardiovascular score" OR " Globorisk score" OR " Swedish consultation-based method" OR " UK General Practice model" OR " UK GP model" (Topic) = 21,880 #2 "correlation" OR "comparison" OR "Spearman*" OR " Pearson" OR "association" OR "estimation" OR "agreement" OR "concordance" OR "kappa" OR "c index" OR "c statistics" OR "discrimination" OR "calibration" OR "external validation" OR "forecast" "probability" OR "mathematical model" (Topic)= 8,634,045 #3 #1 AND #2 = 7,581 #4 “risk score*” OR “risk equation*” OR “risk prediction” OR “risk model” (Topic)= 77,918

#5 "cardiovascular diseases*" OR " laboratory-based*" OR "non-laboratory-based *" OR "nonlaboratory based*" OR "cardiovascular risk" OR " clinical laboratory techniques " OR " cardiovascular model" OR "cholesterol" OR " lipid-based" OR " lipid-based" OR " blood-based" OR " non-blood based" (Topic)= 523,112

#6 "10-year risk*" OR "10-year risk*" OR "5-year risk*" OR "5-year risk*" OR "ten-year risk*" OR "five-year risk*" OR "stroke" OR "fatal stroke" OR "nonfatal stroke" OR "myocardial infarction" OR "fatal myocardial infarction" OR "non-fatal myocardial infarction" OR " cardiovascular death" OR "congestive heart failure" OR " coronary bypass " OR "angina" OR "percutaneous angioplasty" OR " coronary insufficiency " OR " coronary insufficiency " OR "coronary heart disease death" OR " transient ischemic attack" OR "transient ischemic attack*" OR "peripheral vascular disease" OR "hypertensive ischemic heart disease" (Topic) = 819,998

#7 #4 AND #5 AND #6= 3,495

#8 #3 OR #7= 10,572

Scopus

#1 TITLE-ABS-KEY (cardiovascular OR " risk prediction" OR "risk score" OR laboratory OR “laboratory-based” OR “non-laboratory-based” OR “non-blood-based” OR “blood-based” OR “lipid-based” OR “non-lipid-based” OR “fatal CVD event” OR “non-fatal CVD event” OR “non-fatal CHD” OR “PVD” OR “IHD” OR “TIA” OR “PTCA” OR “CHF” OR “CVD death” OR “MI”)= 3,361,581

#2 TITLE-ABS-KEY ("Harvard NHANES equation" OR " Framingham 2008 risk score" OR " Framingham 1991 CVD score" OR " SCORE high-risk score" OR " SCORE low-risk score" OR " CUORE risk score" OR "pooled cohort equation " OR "pooled cohort equation " OR " Framingham non-laboratory-based algorithm" OR "office based cardiovascular score" OR " WHO/ISH cardiovascular score" OR " Globorisk score" OR "Swedish consultation-based method" OR "UK General Practice model" OR "UK GP model")= 552

3 #1 AND #2=543

Google Scholar

#1 "laboratory-based" OR " cardiovascular risk score*" OR "non-laboratory-based*" OR "cardiovascular risk equation*" OR "cardiovascular risk prediction*" OR "coronary heart diseases event*" OR "cardiovascular risk estimation" OR "body mass index cardiovascular" OR "cardiac risk factors " OR "coronary disease risk" OR "non-fatal stroke" OR "nonfatal myocardial infarction" OR "hypertensive ischemic heart disease" OR "Harvard NHANES equation" OR "Framingham 2008 risk score" OR " Framingham 1991 CVD score" OR " SCORE high-risk score" OR " SCORE low-risk score" OR " CUORE risk score" OR "pooled cohort equation" OR "pooled cohort equation " OR "Framingham non-laboratory-based algorithm" OR "office based cardiovascular score" OR " WHO/ISH cardiovascular score" OR " Globorisk score" OR " Swedish consultation-based method" OR " UK General Practice model" OR " UK GP mode” = 56

ProQuest Dissertations & Theses Global
#1 ("laboratory-based risk score*" OR "non-laboratory-based risk score*" OR "cardiovascular risk equation*" OR "cardiovascular risk prediction*") AND ("comparison") AND ("Agreement") =348

Appendix B: PRISMA Checklist

Section and Topic	Item #	Checklist item	Reported (Yes/No)
TITLE			
Title	1	Identify the report as a systematic review.	Yes

BACKGROUND			
Objectives	2	Provide an explicit statement of the review's main objective(s) or question(s).	Yes
METHODS			
Eligibility criteria	3	Specify the inclusion and exclusion criteria for the review.	Yes
Information sources	4	Specify the information sources (e.g., databases, registers) used to identify studies and when each was last searched.	Yes
Risk of bias	5	Specify the methods used to assess the risk of bias in the included studies.	Yes
Synthesis of results	6	Specify the methods used to present and synthesize results.	Yes
RESULTS			
Included studies	7	Give the total number of included studies and participants and summarise relevant characteristics of studies.	Yes
Synthesis of results	8	Present results for main outcomes, preferably indicating the number of included studies and participants. Report the summary estimate and confidence/credible interval if a meta-analysis was done. If comparing groups, indicate the direction of the effect (i.e. which group is favored).	Yes
DISCUSSION			
Limitations of evidence	9	Provide a summary of the limitations of the evidence included in the review (e.g. study risk of bias, inconsistency, and imprecision).	Yes
Interpretation	10	Provide a general interpretation of the results and important implications.	Yes
OTHER			
Funding	11	Specify the primary source of funding for the review.	Yes
Registration	12	Provide the register name and registration number.	Yes

PRISMA checklist for abstract

PRISMA checklist for the main body

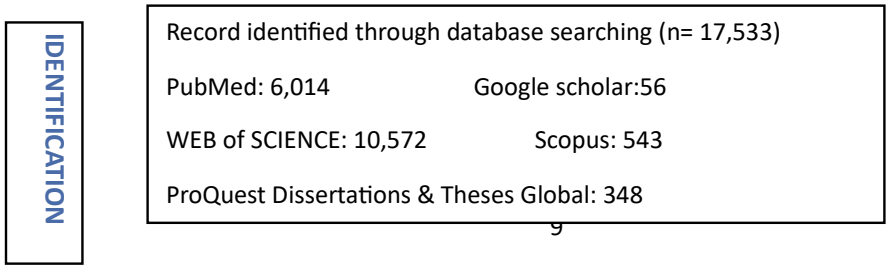
Section and Topic	Item #	Checklist item	The location where the item is reported
TITLE			
Title	1	Identify the report as a systematic review.	pp 1
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Completed
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	pp 3
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	pp 3
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	pp 4
Information sources	6	Specify all databases, registers, websites, organizations, reference lists, and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	pp 4
Search strategy	7	Present the full search strategies for all databases, registers, and websites, including any filters and limits used.	Appendix A
Selection process	8	Specify the methods used to decide whether a study met the review's inclusion criteria, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	pp 4,5
Data collection	9	Specify the methods used to collect data from reports, including how many	pp 4,5

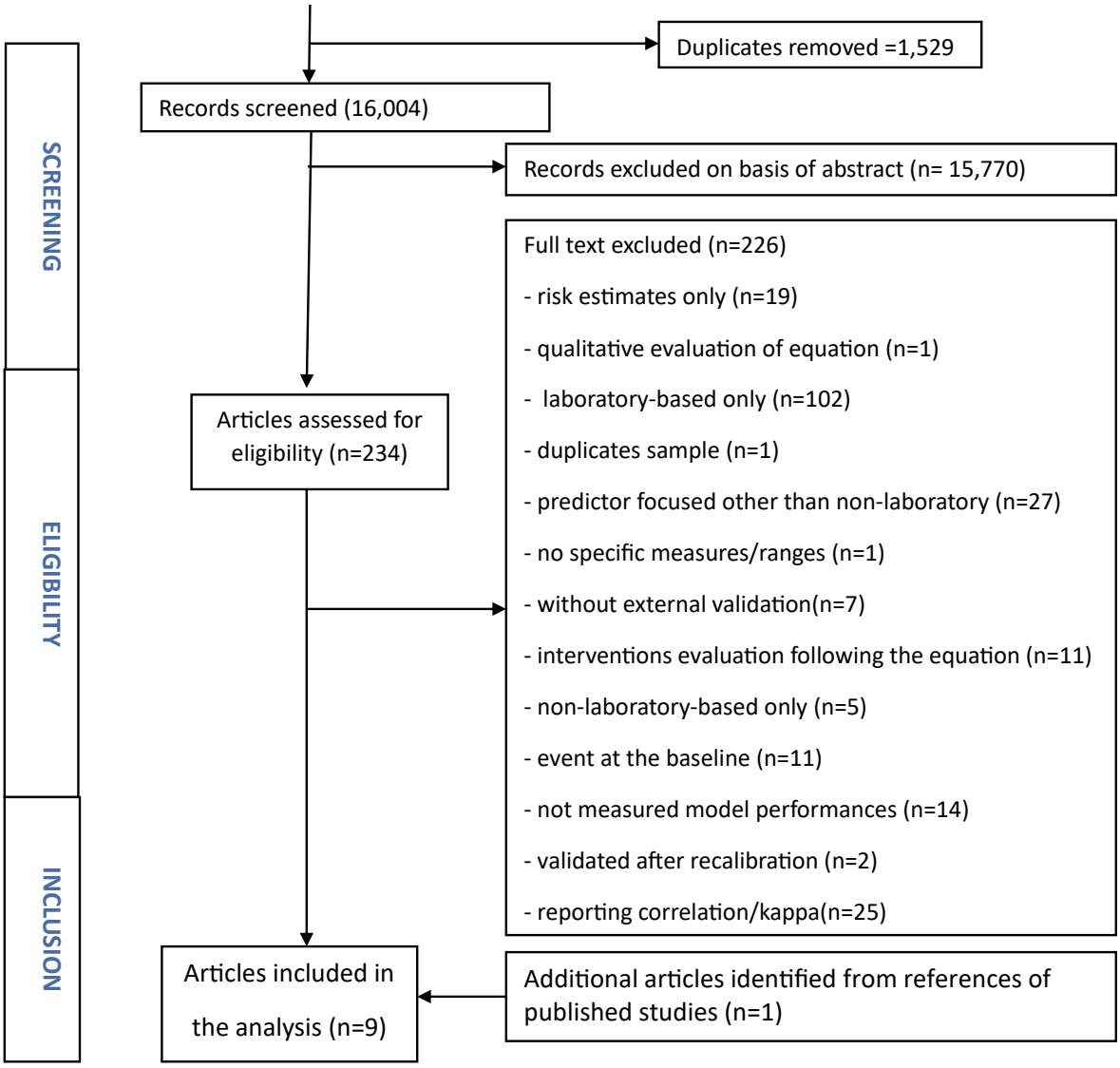
Section and Topic	Item #	Checklist item	The location where the item is reported
process		reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	pp 5
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	pp 5
Study risk of bias assessment	11	Specify the methods used to assess the risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study whether they worked independently, and if applicable, details of automation tools used in the process.	pp 4,5
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	pp 5,6
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	pp 5,6
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	pp 5,6
	13c	Describe any methods used to tabulate or visually display the results of individual studies and syntheses.	pp 5,6
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	pp 4,5
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g., subgroup analysis, meta-regression).	NA
	13f	Describe any sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting bias assessment	14	Describe any methods used to assess the risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Appendix C
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Appendix E

Section and Topic	Item #	Checklist item	The location where the item is reported
Study characteristics	17	Cite each included study and present its characteristics.	Table 1, pp 6,7
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Appendix D
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g., confidence/credible interval), ideally using structured tables or plots.	Figure 1,2, and Table 2, 3
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Table 1
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figure 1, 2, Table 2, 3
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	NA
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Figure 1,2
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	pp 8, 9
	23b	Discuss any limitations of the evidence included in the review.	pp 9
	23c	Discuss any limitations of the review processes used.	pp 9
	23d	Discuss the implications of the results for practice, policy, and future research.	pp 9
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including the register name and registration number, or state that the review was not registered.	pp 4
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	pp 4

Section and Topic	Item #	Checklist item	The location where the item is reported
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	pp 10
Competing interests	26	Declare any competing interests of review authors.	pp 10
Availability of data, code, and other materials	27	Report which of the following are publicly available and where they can be found template data collection forms; data extracted from included studies; data used for all analyses; analytic code; and any other materials used in the review.	pp 10

Appendix C: PRISMA Flowchart





Appendix: D Risk of Bias Assessment Tool

Predictive model risk of bias assessment tools (PROBAST) is used for risk of bias assessment.

List of domains and signaling questions used for PROBAST.

Domain	**Signaling question**

Participant selection	1. Were appropriate data sources used, e.g. cohort, RCT, or nested case-control study data?
	2. Were all inclusions and exclusions based on characteristics of participants appropriate (e.g. comorbidities, treatment)?
Predictors	1. Were predictors defined and assessed in a similar way for all participants?
	2. Were predictor assessments made without knowledge of outcome data?
	3. Are all predictors available at the time the model is used?
	4. Were predictors defined and assessed in the same way as in the original Framingham model?
Outcome	1. Was a pre-specified outcome definition used?
	2. Were predictors excluded from the outcome definition?
	3. Was the outcome defined and determined in a similar way for all participants?
	4. Was the outcome determined without knowledge of predictor information?
	5. Are you confident that the outcome has been correctly measured for all patients (e.g. no outcomes are missed)?
Sample size and participant flow	1. Were there a reasonable number of outcome events?
	2. Was the time interval between predictor assessment and outcome determination appropriate?
	3. Were all enrolled participants included in the analysis?
	4. Were participants with missing data handled appropriately?
Analysis	1. Were any complexities in the data (e.g. censoring, competing risks) accounted for appropriately?
	2. Was the model *not* recalibrated before validation?

Appendix: E Studies excluded for reasons

1. Sr.no.	Title	Reasons
2.	Comparability of total cardiovascular disease risk estimates using laboratory and non-laboratory-based assessments in urban-dwelling South Africans: The CRIBSA study	duplicate sample
3.	Evaluation of the Framingham risk score and pooled cohort risk equation for prediction of cardiovascular risk in low resource areas: Insights from Asian rural population	no full document is available
4.	10-Year Cardiovascular Disease Risk Estimation Based on Lipid Profile-Based and BMI-Based Framingham Risk Scores across Multiple Sociodemographic Characteristics: The Malaysian Cohort Project	compare risk estimates only
5.	Anthropometric measurements of general and central obesity and the prediction of cardiovascular disease risk in women: a cross-sectional study	predictors focused
6.	Correlation between the Framingham risk score and intima-media thickness: The Paroi Art´erielle et Risque Cardio-vascular (PARC) Study	carotid intima thickness
7.	Is lipid accumulation product a better cardiovascular risk predictor in elderly individuals than anthropometric measures?	anthropometric predictors
8.	Risk assessment in the prevention of cardiovascular disease in low-resource settings	review
9.	Comparative risk assessment for the development of cardiovascular diseases in the Hungarian general and Roma population	only laboratory-based
10.	Comparison of lab-and non-lab-based absolute cardiovascular disease risk scores in rural India	no full text is available
11.	Absolute cardiovascular risk scores and medication use in rural India: a cross-sectional study	compare laboratory-based only
12.	Factors influencing the implementation of cardiovascular risk scoring in primary care: a mixed-method systematic review	review
13.	Primary prevention of cardiovascular disease using validated risk scores: A systematic review	review
14.	Circulating Biomarkers for Predicting Cardiovascular Disease Risk; a Systematic Review and Comprehensive Overview of Meta-Analyses	review
15.	Global cardiovascular risk assessment in the primary prevention of cardiovascular disease in adults: systematic review of systematic reviews	review and review
16.	Cardiovascular risk factors, cardiovascular disease, and COVID-19: an umbrella review of systematic reviews	review
17.	Circulating Apolipoprotein E Concentration and Cardiovascular Disease Risk: Meta-analysis of Results from Three Studies	review

18.	A community-based cross-sectional study on the prevalence of dyslipidemias and 10 years cardiovascular risk scores in adults in Asmara, Eritrea	lipid predictor only
19.	Risk-factor profiles for chronic diseases of lifestyle and metabolic syndrome in an urban and rural setting in South Africa	risk profile only
20.	Cardiovascular risk assessment tools in Asia	equation evaluations (qualitative)
21.	Comparisons of the Framingham and Pooled Cohort Equation Risk Scores for Detecting Subclinical Vascular Disease in Blacks Versus Whites	compare laboratory-based only
22.	Comparative performance of cardiovascular risk prediction models in people living with HIV	compare laboratory-based only
23.	Cardiovascular risk prediction in HIV-infected patients: comparing the Framingham, atherosclerotic cardiovascular disease risk score (ASCVD), Systematic Coronary Risk Evaluation for the Netherlands (SCORE-NL) and Data Collection on Adverse Events of Anti-HIV Drugs (D: A:D) risk prediction models	compare laboratory-based only
24.	Comparison of four international cardiovascular disease prediction models and the prevalence of eligibility for lipid-lowering therapy in HIV-infected patients on antiretroviral therapy	compare laboratory-based only
25.	Comparison of ACC/AHA and ESC Guideline Recommendations Following Trial Evidence for Statin Use in Primary Prevention of Cardiovascular Disease: Results from the Population-Based Rotterdam Study	compare for initiation of intervention
26.	Ten-year cardiovascular risk among Bangladeshi population using non-laboratory-based risk chart of the World Health Organization: Findings from a nationally representative survey	non-laboratory-based only
27.	Estimation of total cardiovascular risk using the 2019 WHO CVD prediction charts and comparison of population-level costs based on alternative drug therapy guidelines	non-laboratory-based only
28.	Estimated total cardiovascular risk in a rural area of Bangladesh: a household level cross-sectional survey done by local community health workers	non-laboratory-based only
29.	Estimation of 10-Year Risk of Cardiovascular Diseases Using WHO Risk Prediction Charts: A Population-Based Study in Southern Iran	laboratory-based only
30.	Evaluation of cardiovascular diseases risk calculators for CVD prevention and management: scoping review	review
31.	Comparison of different cardiovascular risk score calculators for cardiovascular risk prediction and guideline-recommended statin uses	laboratory-based only
32.	Comparison of Application of the ACC/AHA Guidelines, Adult Treatment Panel III	laboratory-based only

	Guidelines, and European Society of Cardiology Guidelines for Cardiovascular Disease Prevention in a European Cohort	
33.	Recalibration of the Framingham risk score for predicting 10-year risk of cardiovascular events: A non-concurrent rural cohort study from Tamil Nadu	compare risk estimates only
34.	Comparison of Framingham Cardiovascular Risk Criteria and ASCVD Score in Iranian Obese Patients	laboratory-based only
35.	Comparison of Framingham Risk Scores (FRS), Joint British Society (JBS3), and American College of Cardiology/American Heart Association (ACC/AHA) Cardiovascular Risk Scores Among Adults With First Myocardial Infarction	laboratory-based only
36.	A cross-sectional validation study comparing the accuracy of different risk scores in assessing the risk of acute coronary syndrome among patients in a tertiary care hospital in Kerala	compare risk estimates
37.	Assessment of total cardiovascular risk using WHO/ISH risk prediction charts in three low- and middle-income countries in Asia	compare risk estimates
38.	Agreement between the SCORE and D'Agostino Scales for the Classification of High Cardiovascular Risk in Sedentary Spanish Patients	compare laboratory-based only
39.	Sedentary lifestyle and Framingham risk scores: a population-based study in Riyadh city, Saudi Arabia	CVD risk estimate and predictor-focused
40.	Comparison of Cardiac Risk Scores among the East Mediterranean and South Asian Population	laboratory-based only
41.	Cardiovascular Disease Risk Factors and 10-Year Risk of Cardiovascular Events among Women over the Age of 40 Years in an Urban Underprivileged Area of Bangalore City	risk estimate and predictors focused
42.	Agreement between 2017 ACC/AHA Hypertension Clinical Practice Guidelines and Seventh Report of the Joint National Committee Guidelines to Estimate Prevalence of Postmenopausal Hypertension in a Rural Area of Bangladesh: A Cross-Sectional Study	One risk factor /hypertension/ focused
43.	Variation among cardiovascular risk calculators in relative risk increases with identical risk factor increases	hypothetical data and compare laboratory-based only
44.	A Comparison of Statin Treatment Algorithms Based on the ACC/AHA and Philippine Guidelines for Primary Prevention of Dyslipidemia in Statin-Naive Filipino Patients	intervention based comparison
45.	Prediction of cardiovascular disease risk among low-income urban dwellers in metropolitan Kuala Lumpur, Malaysia	risk estimates and predictors
46.	Body Composition Indices and Predicted Cardiovascular Disease Risk Profile among Urban Dwellers in Malaysia	risk estimates and predictors

47.	Total cardiovascular risk for the next 10 years among the rural population of Nepal using the WHO/ISH risk prediction chart	risk estimates and predictors
48.	Comparison of three different methods of assessing cardiovascular disease risk in New Zealanders with Type 2 diabetes mellitus	compare laboratory-based only
49.	Comparing six cardiovascular Risk prediction models in Haiti: implications for identifying high-risk individuals for Primary prevention	range of correlation reported, but not the exact correlation values
50.	Prevalence of traditional cardiovascular risk factors and evaluation of cardiovascular risk using three risk equations in Nigerians living with human immunodeficiency virus	compare risk estimate
51.	World Health Organization (WHO) and International Society of Hypertension (ISH) risk prediction charts: assessment of cardiovascular risk for prevention and control of cardiovascular disease in low and middle-income countries	equation development and use of equations only, not for comparison
52.	Ten-year atherosclerosis cardiovascular disease (ASCVD) risk score and its components among an Iranian population	risk estimates only
53.	Body Weight, Cardiovascular Risk Factors, and Coronary Mortality	predictor focused
54.	A comparison of cardiovascular risk scores in native and migrant South Asian populations	laboratory-based only
55.	Assessing 10-year coronary heart disease risk in people with Type 2 diabetes mellitus: Framingham versus United Kingdom Prospective Diabetes Study	laboratory-based only
56.	Comparison of abdominal obesity measures in predicting 10-year cardiovascular risk in an Iranian adult population using ACC/AHA risk model: A population-based cross-sectional study	compare predictors
57.	Agreement Among Cardiovascular Disease Risk Calculators	review of laboratory equations
58.	The Ten-Year Risk Prediction for Cardiovascular Disease for Malaysian Adults Using the Laboratory-Based and Office-Based (Global Risk) Prediction Model	compare risk estimates only
59.	Cost-effectiveness of the non-laboratory-based Framingham algorithm in primary prevention of cardiovascular disease: A simulated analysis of a cohort of African American adults	compare sensitivity and specificity
60.	Ambiguity about Selection of Cardiovascular Risk Stratification Tools: Evidence from a North Indian Rural Population	non-laboratory based only
61.	Estimation of the 10-Year Risk of Cardiovascular Diseases: Using the SCORE, WHO/ISH, and Framingham Models in the Shahrekord Cohort Study in Southwestern Iran	compare laboratory-based only
62.	Estimation of the Cardiovascular Risk Using World Health Organization/International	compare risk estimates

	Society of Hypertension (WHO/ISH) Risk Prediction Charts in a Rural Population of South India	only
63.	Risk estimates of cardiovascular diseases in a Sri Lankan community	compare risk estimates only
64.	Agreement between Framingham, IraPEN, and non-laboratory WHO-EMR risk score calculators for cardiovascular risk prediction in a large Iranian population	compare non-laboratory-based equations
65.	Differences in the Cardiovascular Risk Assessment in Cardiology Outpatients in Mali: Comparison between Framingham Body Mass Index-Based Tool and Low-Information World Health Organization Chart	compare across equations
66.	Prediction of Cardiovascular Disease Mortality in a Middle Eastern Country: Performance of the Globo Risk and Score Functions in Four Population-Based Cohort Studies of Iran	compare laboratory-based equations
67.	The predicted 10-year risk of cardiovascular disease is influenced by the risk equation adopted:	compare risk estimates only
68.	An assessment of community health workers' ability to screen for cardiovascular disease risk with a simple, non-invasive risk assessment instrument in Bangladesh, Guatemala, Mexico, and South Africa: an observational study	compare the effectiveness of non-laboratory-based equation
69.	Cardiovascular risk assessment of South Asians in a religious setting: a feasibility study	compare across equations
70.	Feasibility of community-based screening for cardiovascular disease risk in an ethnic community: the South Asian Cardiovascular Health Assessment and Management Program (SA-CHAMP)	compare for targeted intervention
71.	Association of systolic blood pressure levels with cardiovascular events and all-cause mortality among older adults taking antihypertensive medication	predictor comparison
72.	Cardiometabolic risk factors and Framingham Risk Score in severely obese patients: Baseline data from DieTBra trial	predictor comparison
73.	Comparisons of the Framingham and ASCVD risk scores for coronary heart disease risk prediction in Chinese men	compare across equation type
74.	Agreement between cardiovascular disease risk assessment tools: An application to the United Arab Emirates population	compare laboratory-based only
75.	Cardiometabolic risk in a population of older adults with multiple co-morbidities in Rural South Africa: the HAALSI (Health and Aging in Africa: longitudinal studies of	predictors only

	INDEPTH communities) study	
76.	Place of cardiovascular risk prediction models in South Asians; agreement between Framingham risk score and WHO/ISH risk charts	Only kappa reported, no standard error, no poi, no PCI, no 2x2 or 3x3 risk category measures
77.	A high correlation between Framingham equations with BMI and with lipids to estimate cardiovascular risk score at baseline in HIV-infected adults in the Temprano trial, ANRS 12136 in CoÃte d'Ivoire	no sufficient information no standard error, no POI, no PCI, no 2x2 or 3x3 category measures
78.	Cardiovascular risk assessment in type 2 diabetes mellitus: comparison of the World Health Organization/International Society of Hypertension risk prediction charts versus UK Prospective Diabetes Study risk engine	laboratory-based comparison only
79.	WHO/International Society of Hypertension Risk Prediction charts versus the UK Prospective Diabetes Study risk engine for cardiovascular risk assessment among patients with type 2 diabetes: a comparative study	editorial notes
80.	Cardiovascular Risk Assessment in Diabetes Mellitus: Comparison of the General Framingham Risk Profile Versus the World Health Organization/ International Society of Hypertension Risk Prediction Charts in Arabs—Clinical Implications	compare laboratory-based only
81.	Cardiovascular disease risk profile and management among people 40 years of age and above in Bo, Sierra Leone: A cross-sectional study	focused on predictors for laboratory-based
82.	Concordance between Two Versions of the World Health Organization/International Society of Hypertension Risk Prediction Chart and Framingham Risk Score among Postmenopausal Women in a Rural Area of Bangladesh	merge risk categories into negative-risk (low risk) and positive-risk (moderate, high, very high)
83.	Prediction of 10-year atherosclerotic cardiovascular disease risk among community residents in Shanghai, China – a comparative analysis of risk algorithms	laboratory-based only
84.	Assessment of Short-Term Cardiovascular Risk Among 40 Years and Above Population in a Selected Community of Kathmandu, Nepal	risk estimates only
85.	The 10-year Absolute Risk of Cardiovascular (CV) Events in Northern Iran: a Population-Based Study	laboratory-based only
86.	Comparison of cardiovascular risk assessment tools and their guidelines in evaluation of 10-year CVD risk and preventive recommendations: A population-based study	laboratory-based only
87.	Cardiovascular disease risk prediction by the American College of Cardiology	laboratory-based only

	(ACC)/American Heart Association (AHA) Atherosclerotic Cardiovascular Disease (ASCVD) risk score among HIV-infected patients in sub-Saharan Africa	
88.	Coronary disease risk assessment in men: Comparison between ASCVD Risk versus Framingham	laboratory-based only
89.	Comparison of Predicted Cardiovascular Risk Profiles by Different CVD Risk-Scoring Algorithms between HIV-1-Infected and Uninfected Adults	compare risk estimates between the population
90.	A Comparison of Four Cardiovascular Risk Assessment Instruments in Saudi Patients	compare only risk estimates
91.	Comparison of cardiovascular risk assessment tools and their guidelines in evaluation of 10-year CVD risk and preventive recommendations: a population study	laboratory-based only
92.	Guideline-Based Statin Eligibility, Coronary Artery Calcification, and Cardiovascular Events	intervention-based comparison
93.	Level of agreement between frequently used cardiovascular risk calculators in people living with HIV	compare laboratory-based only
94.	High Concordance between D:A: Dr and the Framingham Risk Score in Brazilians Living with HIV	laboratory-based only
95.	Comparison of Three Cardiovascular Risk Scores among HIV-Infected Patients in Korea: The Korea HIV/AIDS Cohort Study	laboratory-based only
96.	Implications of Cardiovascular Disease Risk Assessment Using the WHO/ISH Risk Prediction Charts in Rural India	compare misclassification, does not compare agreements
97.	The "Five Risks Algorithm": an easy tool for cardiovascular risk estimation	compare based on laboratory-test
98.	Use of risk assessment tools to guide decision-making in the primary prevention of atherosclerotic cardiovascular disease circulation	laboratory-based only
99.	Performance of the Framingham risk models and pooled cohort equations for predicting 10-year risk of cardiovascular disease: a systematic review and meta-analysis	review
100.	Prediction models for cardiovascular disease risk in the general population: systematic review	review
101.	Comparisons of established risk prediction models for cardiovascular disease: systematic review	review
102.	Predicting the 10-Year Risks of Atherosclerotic Cardiovascular Disease in Chinese Population	compare laboratory-based only

103.	Comparison of the Framingham Risk Score, SCORE, and WHO/ISH cardiovascular risk prediction models in an Asian population	compare laboratory-based only
104.	Prediction of Cardiovascular Disease Mortality in a Middle Eastern Country: Performance of the Globorisk and Score Functions in Four Population-Based Cohort Studies of Iran	compare laboratory-based only
105.	Validation of the Framingham general cardiovascular risk score in a multiethnic Asian population: a retrospective cohort study	compare laboratory-based only
106.	Development and Validation of Improved Algorithms for the Assessment of Global Cardiovascular Risk in Women	require laboratory factors
107.	Performance of atherosclerotic cardiovascular risk prediction models in a rural Northern Chinese population: Results from the Fangshan Cohort Study	compare laboratory-based only
108.	Cardiovascular risk prediction tools for populations in Asia	low information, but require a total cholesterol test
109.	WHO cardiovascular disease risk prediction model performance in 10 regions, China	validate non-laboratory based only
110.	Cardiovascular disease risk prediction models in the Chinese population- a systematic review and meta-analysis	review
111.	Performance of the SCORE and Globo risk cardiovascular risk prediction models	compare non-laboratory only
112.	The additive EuroSCORE	review
113.	Review and evaluation of performance measures for survival prediction models in external validation settings	review
114.	Clinical Usefulness of the Framingham Cardiovascular Risk Profile Beyond Its Statistical Performance	laboratory-based only
115.	Evaluation of the Performance of Survival Analysis Models: Discrimination and Calibration Measures	method
116.	Derivation, internal validation, and recalibration of a cardiovascular risk score for Latin America and the Caribbean (Globorisk-LAC): A pooled analysis of cohort studies	internal validation only
117.	An office-based cardiovascular prediction model developed and validated in cohort studies of a middle-income country	cross-validation only and sample duplicate
118.	External validation of two Framingham cardiovascular risk equations and the Pooled Cohort equations: A nationwide registry analysis	compare laboratory-based only
119.	Equalization of four cardiovascular risk algorithms after systematic recalibration: an	compare laboratory-

	individual-participant meta-analysis of 86 prospective studies	based only
120.	Evaluation of the performance of existing non-laboratory Cardiovascular risk assessment algorithms	qualitative evaluation
121.	Nontraditional Risk Factors in Cardiovascular Disease Risk Assessment	scopes review
122.	Validation of the general Framingham Risk Score (FRS), SCORE2, revised PCE, and WHO CVD risk scores in an Asian population	compare laboratory-based only
123.	Prediction for cardiovascular diseases based on laboratory data: An analysis of random forest model	mix laboratory-based and non-laboratory predictor
124.	Anthropometric measures in cardiovascular disease prediction: comparison of laboratory-based versus non-laboratory-based model	no external validation
125.	Polygenic risk scores in cardiovascular risk prediction: A cohort study and modeling analyses	laboratory predictor only
126.	Cardiovascular Risk and Events in 17 Low-, Middle-, and High-Income Countries	risk estimates only
127.	Development and validation of a cardiovascular disease risk-prediction model using population health surveys: the Cardiovascular Disease Population Risk Tool (CVDPoRT)	no separate non-laboratory-based equation
128.	Assessing risk of myocardial infarction and stroke: new data from the Prospective Cardiovascular Münster (PROCAM) study	laboratory-based only
129.	Laboratory and non-laboratory-based risk prediction models for secondary prevention of cardiovascular disease: the LIPID study	the event at the baseline, modeled for secondary prevention
130.	Short-term predictive ability of selected cardiovascular risk prediction models in a rural Bangladeshi population: a case-cohort study	compare sensitivity, sensitivity, positive and negative predictive value
131.	A Novel Risk Score to the Prediction of 10-year Risk for Coronary Artery Disease Among the Elderly in Beijing Based on Competing Risk Model	mix laboratory and non-laboratory predictors
132.	Predictive Accuracy of a Polygenic Risk Score–Enhanced Prediction Model vs a Clinical Risk Score for Coronary Artery Disease	laboratory-based and gene-based
133.	A general cardiovascular risk profile: The Framingham study	laboratory-based only
134.	Validation of the pooled cohort risk score in an Asian population - a retrospective cohort study	laboratory-based only
135.	Who Needs Laboratories and Who Needs Statins? Comparative and Cost-Effectiveness Analyses of Non–Non-Non-Laboratory-Based, Laboratory-Based, and Staged	effectiveness study

	Primary Cardiovascular Disease Screening Guidelines	
136.	Predicting cardiovascular risk in England and Wales: prospective derivation and validation of QRISK2	laboratory-based only
137.	Derivation and validation of QRISK, a new cardiovascular disease risk score for the United Kingdom: prospective open cohort study	laboratory-based only
138.	An independent external validation and evaluation of QRISK cardiovascular risk prediction: a prospective open cohort study	laboratory-based only
139.	Development and validation of QRISK3 risk prediction algorithms to estimate future risk of cardiovascular disease: prospective cohort study	laboratory-based only
140.	Predicting the impact of population-level risk reduction in cardiovascular disease and stroke on acute hospital admission rates over 5 years—a pilot study	laboratory-based only
141.	Prediction of Coronary Heart Disease Using Risk Factor Categories	laboratory-based model development
142.	Recalibration and validation of the SCORE risk chart in the Australian population: the AusSCORE chart	validated after recalibration
143.	A consultation-based method is equal to SCORE and an extensive laboratory-based method in predicting the risk of future cardiovascular disease	no external validation
144.	Assessing 10-Year Cardiovascular Disease Risk in Malaysians With Type 2 Diabetes Mellitus: Framingham Cardiovascular Versus United Kingdom Prospective Diabetes Study Equations	laboratory-based only
145.	Predictive accuracy of the Framingham coronary risk score in British men	laboratory-based only
146.	The QRISK was less likely to overestimate cardiovascular risk than the Framingham or ASSIGN equations	laboratory-based only
147.	Cardiovascular/stroke risk predictive calculators: a comparison between statistical and machine learning models	laboratory-based only
148.	Performance of the QRISK cardiovascular risk prediction algorithm in an independent UK sample of patients from general practice: a validation study	laboratory-based only
149.	Independent external validation of cardiovascular disease mortality in women utilizing Framingham and SCORE risk models: a mortality follow-up study	laboratory-based only
150.	Recalibrating the Non-Communicable Diseases risk prediction tools for the rural population of Western India	recalibration study
151.	An independent and external validation of QRISK2 cardiovascular disease risk score	laboratory-based only
152.	Cardiovascular risk: Associated factors, assessment and agreement between WHO/ISH risk prediction chart and Framingham Scoring system among primary care patients in	predictors focus

	Kelantan, Malaysia	
153.	Framingham Risk Score for Prediction of Cardiovascular Diseases: A Population-Based Study from Southern Europe	compare laboratory-based only
154.	Predictive accuracy of the Framingham general CVD algorithm in a Middle Eastern population: Tehran lipid and glucose study	laboratory-based only
155.	Validation of continuous clinical indices of cardio-metabolic risk in a cohort of Australian adults	laboratory-markers
156.	Copyright 2014 American Medical Association. All rights reserved. Further Insight into the Cardiovascular Risk Calculator the Roles of Statins, Revascularizations, and Under Ascertainment in the Women's Health Study	Laboratory-based only
157.	Comparison of 3 risk estimators to guide initiation of statin therapy for primary prevention of cardiovascular disease	laboratory-based only
158.	Validation of the Pooled Cohort equations in a long-term cohort study of Hong Kong Chinese	laboratory-based only
159.	Calibration and discrimination of the Framingham Risk Score and the Pooled Cohort Equations	laboratory-based only
160.	Comparison of validation and application on various cardiovascular disease mortality risk prediction models in Chinese rural population	no external validation
161.	Validation of Risk Prediction Models for Atherosclerotic Cardiovascular Disease in a Prospective Korean Community-Based Cohort	laboratory-based only
162.	External validation of three atherosclerotic cardiovascular disease risk equations in rural areas of Xinjiang, China	laboratory-based only
163.	Re-estimation improved the performance of two Framingham cardiovascular risk equations and the pooled cohort equations: A nationwide registry analysis	laboratory-based only
164.	Predicting lifetime risk for developing atherosclerotic cardiovascular disease in Chinese population: the China-PAR project	laboratory-based only
165.	10-Year Coronary Heart Disease Risk Prediction Using Coronary Artery Calcium and Traditional Risk Factors: Derivation in the MESA (Multi-Ethnic Study of Atherosclerosis) With Validation in the HNR (Heinz Nixdorf Recall) Study and the DHS (Dallas Heart Study)	laboratory-based only
166.	Derivation of a Coronary Age Calculator Using Traditional Risk Factors and Coronary Artery Calcium: The Multi-Ethnic Study of Atherosclerosis	coronary age focus
167.	Ten-Year Coronary Heart Disease Risk Prediction Using Coronary Artery Calcium and Traditional Risk Factors: Derivation in the Multi-Ethnic Study of Atherosclerosis with	the alternative model requires a laboratory

	Validation in the Heinz Nixdorf Recall Study and the Dallas Heart	test
168.	Comparison of Novel Risk Markers for Improvement in Cardiovascular Risk Assessment in Intermediate-Risk Individuals	the alternative model requires a laboratory test
169.	Gaziano TA, Pandya A, Steyn K, Levitt N, Mollentze W, Joubert G, et al. Comparative assessment of absolute cardiovascular disease risk characterization from non-laboratory-based risk assessment in South African populations	report correlation/not prospective validation
170.	Comparison of Nonblood-Based and Blood-Based Total CV Risk Scores in Global Populations	report correlation/not prospective validation
171.	Pandya A, Weinstein MC, Gaziano TA. A Comparative Assessment of Non-Laboratory-Based versus Commonly Used Laboratory-Based Cardiovascular Disease Risk Scores in the NHANES III Population.	report correlation/not prospective validation
172.	Cost Effectiveness Of Non-Laboratory CVD Screening In Uzbekistan	report correlation/not prospective validation
173.	Agreement between the laboratory-based and non-laboratory-based WHO cardiovascular risk charts: a cross-sectional analysis of a national health survey in Peru	report kappa / not prospective validation
174.	Agreement between laboratory-based and non-laboratory-based Framingham risk score in Southern Iran	report kappa / not prospective validation
175.	WHO Non-Lab-Based CVD Risk Assessment: A Reliable Measure in a North Indian Population.	report kappa / not prospective validation
176.	Cardiovascular disease risk prediction in sub-Saharan African populations - Comparative analysis of risk algorithms in the RODAM study.	report kappa / not prospective validation
177.	Comparison of laboratory-based and non-laboratory-based WHO cardiovascular disease risk charts: a population-based study	report kappa / not prospective validation
178.	Pars cohort study of non-communicable diseases in Iran: protocol and preliminary results. International Journal of Public Health.	report kappa / not prospective validation
179.	African partnerships through the H3Africa Consortium bring a genomic dimension to longitudinal population studies on the continent	report kappa / not prospective validation
180.	Persistent Immune Activation and Carotid Atherosclerosis in HIV-Infected Ugandans Receiving Antiretroviral Therapy	report kappa / not prospective validation
181.	Performance of WHO updated cardiovascular disease risk prediction charts in a low-resource setting – Findings from a community-based survey in Puducherry, India	report kappa / not prospective validation
182.	Prevalence of cardiovascular risk factors by HIV status in a population-based cohort in South Central Uganda: a cross-sectional survey	report kappa / not prospective validation

183.	The Atherosclerosis Risk in Communities (ARIC) Study: design and objectives. The ARIC investigators	report kappa / not prospective validation
184.	Addressing geographical variation in the progression of non-communicable diseases in Peru: the CRONICAS cohort study protocol	report kappa / not prospective validation
185.	Framingham Ten-Year General Cardiovascular Disease Risk: Agreement between BMI-Based and Cholesterol-Based Estimates in a South Asian Convenience Sample.	report kappa / not prospective validation
186.	The Comparability of Lipid-based and Body Mass Index-based Cardiovascular Disease Risk Scores: Using the Rwanda 2012-2013 Non-communicable Diseases Risk Factors Survey Data	report kappa / not prospective validation
187.	Estimation of cardiovascular risk in a rural population of Lucknow district using WHO/ISH risk prediction charts.	report kappa / not prospective validation
188.	Application of two versions of the WHO/International Society of Hypertension Absolute Cardiovascular Risk Assessment Tools in a Rural Bangladeshi Population	report kappa / not prospective validation
189.	Total cardiovascular risk assessment and management using two prediction tools, with and without blood cholesterol	report kappa / not prospective validation
190.	Estimating the burden of cardiovascular risk in community dwellers over 40 years old in South Africa, Kenya, Burkina Faso, and Ghana.	report kappa / not prospective validation
191.	Using body mass index data in the electronic health record to calculate cardiovascular risk.	report kappa / not prospective validation
192.	Validation of the World Health Organization/ International Society of Hypertension (WHO/ISH) cardiovascular risk predictions in Sri Lankans based on findings from a prospective cohort study	report kappa / not prospective validation
193.	Lifestyle Change, Nutrition Transition and Cardiovascular Risk in Settat Region, Morocco	focus on risk estimates
194.	Healthy lifestyle, lipoprotein (a) levels, and the risk of coronary artery disease	focus on laboratory-based covariates
195.	Derivation of a Protein Risk Score for Cardiovascular Disease Among a Multiracial and Multiethnic HIV+ Cohort	laboratory-based only
196.	Cardiovascular Risk Prediction with cardio-ankle Vascular Index in the Malaysian Cohort Study	no comparison
197.	Application of deep neural survival networks to the development of risk prediction models for diabetes mellitus, hypertension, and dyslipidemia	laboratory-based only
198.	Recalibration of Framingham risk for a local population of Sri Lanka	adjusting the laboratory-based only

199.	Cost-effectiveness of home-based screening of the general population for albuminuria to prevent progression of cardiovascular and kidney disease	laboratory-based-effectiveness only
200.	Performance of the pooled cohort equations in cancer survivors: the Atherosclerosis Risk in Communities study	Laboratory-based only
201.	Adapting cardiovascular risk prediction models to different populations: the need for recalibration	laboratory-based only
202.	Estimated Lifetime Cardiovascular, Kidney, and Mortality Benefits of Combination Treatment with SGLT2 Inhibitors, GLP-1 Receptor Agonists, and Nonsteroidal MRA Compared With Conventional Care in Patients With Type 2 Diabetes and Albuminuria	Interventions using laboratory-based only
203.	Recommendations for statin management in primary prevention: disparities among international risk scores	compare interventions using laboratory-based only
204.	LDL cholesterol target attainment in cardiovascular high- and very-high-risk patients with statin intolerance: a simulation stud	Interventions assessment
205.	Impact of lifestyle-based interventions on absolute cardiovascular disease risk: a systematic review and meta-analysis	compare interventions using laboratory-based only
206.	Development and validation of a multicenter study on novel Artificial Intelligence-based Cardiovascular Risk Score (AICVD)	compare among laboratory-based only
207.	Framingham risk score based vascular outcomes in acute versus chronic HIV cohorts after 6 years of ART	Laboratory-based and immunity markers
208.	Evaluating the performance of a novel anthropometric index: weight adjusted for waist-to-height ratio (W-WHR) – for predicting cardiometabolic risk among adults in Addis Ababa	focus on predictor comparison
209.	Comparison of the performance of cardiovascular risk prediction tools in rural India: The Rishi Valley Prospective Cohort Study	Focus on five years of CVD risk
210.	Comparison of Laboratory and Non-Laboratory-Based 2019 World Health Organization Cardiovascular Risk Charts in the Bhutanese Population	discrimination and calibration of the model not compared
211.	Derivation and Internal Validation of a Disease-Specific Cardiovascular Risk Prediction Model for Patients with Psoriatic Arthritis and Psoriasis	traditional factors but not compared with non-laboratory-based
212.	BMI-based obesity classification misses children and adolescents with raised cardiometabolic risk due to increased adiposity	not modelled CVD risk

213.	Prediction models for cardiovascular disease risk among people living with HIV: A systematic review and meta-analysis	laboratory-based only
214.	A prediction model for left ventricular thrombus persistence/recurrence: based on a prospective study and a retrospective study	secondary CVD risk
215.	Temporal relationships between BMI and obesity-related predictors of cardiometabolic and breast cancer risk in a longitudinal cohort	not compare model performance
216.	Ten-Year Cardiovascular Disease Risk Score and Cognitive Function Among Older Adults: The National Health and Nutrition Examination Survey 2011 to 2014	focus on predictors
217.	Development and validation of a prediction model based on machine learning algorithms for predicting the risk of heart failure in middle-aged and older US people with prediabetes or diabetes	not compared with non-laboratory-based
218.	Comparison of LASSO and random forest models for predicting the risk of premature coronary artery disease	laboratory-based factors
219.	Development of new scores for atherosclerotic cardiovascular disease using specific medical examination items: the Suita Study	laboratory-based only
220.	Cardiovascular Risk Management in Persons with Dementia	focus on management
221.	30-Year High Cardiovascular Risk Incidence and its Determinants: CUME Study	no model comparison
222.	Blood pressure and 10-year all-cause mortality: Findings from the PERU MIGRANT Study	predictor focused
223.	External validation of a cardiovascular risk model for Omani patients with type 2 diabetes mellitus: a retrospective cohort study	not compared with non-laboratory-based separately
224.	Artificial intelligence modeling to assess the risk of cardiovascular disease in oncology patients	laboratory-based only
225.	Development of a Cardiovascular Disease Risk Prediction Model: A Preliminary Retrospective Cohort Study of a Patient Sample in Saudi Arabia	laboratory-based only
226.	Flexible addition of risk modifiers on top of SCORE2 to improve long-term risk prediction in healthy individuals	not compared with model performance / theoretical background