Risk assessment decision aid, HeartScore & SMART Risk

Xavier Rossello

16 Nov 2019

ESC
European Society of Cardiology

Third phase of the ESC Prevention of Cardiovascular Disease Programme (WP3)

ESC European Society of Cardiology

Risk prediction tools in cardiovascular disease prevention: A report from the ESC Prevention of CVD Programme led by the European Association of Preventive Cardiology (EAPC) in collaboration with the Acute Cardiovascular Care Association (ACCA) and the Association of Cardiovascular Nursing and Allied Professions (ACNAP)

Xavier Rossello[1,2], Jannick AN Dorresteijn[3], Arne Janssen[4], Ekaterini Lambrinou[4,5], Martijn Scherrenberg[6,7], Eric Bonnefoy-Cudraz[8], Mark Cobain[9], Massimo F Piepoli[10], Frank LJ Visseren[2] and Paul Dendale[6,7]

This paper is a co-publication between *European Journal of Preventive Cardiology, European Heart Journal: Acute Cardiovascular Care and European Journal of Cardiovascular Nursing.*

European Journal of Preventive Cardiology

ESC European Society of Cardiology

European Heart Journal Acute Cardiovascular Care

ESC European Society of Cardiology

European Journal of Cardiovascular Nursing

ESC European Society of Cardiology

Rationale for the use of risk prediction tools

ESC European Society of Cardiology

Risk assessment and predicting survival are pivotal to the prevention of CVD by enhancing healthier lifestyles, pharmacological and other healthcare interventions and reducing risk factor prevalence (e.g. smoking)

Based on previous experience and personal beliefs, clinical judgment might be biased

Risk algorithms provide reliable and objective criteria to support clinical-decision making

How to use the tools with our patients

ESC European Society of Cardiology

Risk prediction tool use for clinicians

Aim – to assist healthcare professionals in their clinical decision-making

a) to provide objective risk estimates to assist health professionals in their subjective interpretations

b) to avoid both the overtreatment of low-risk individuals and the undertreatment of high-risk patients with the additional goal of promoting lifestyle changes in those at long-term risk

Risk prediction tool use for patients

Aim – to inform individuals about their risks of developing an outcome

a) to inform changes individuals' behaviour, self-management decisions and treatment decisions

b) to empower patients to take part in the decision-making process

Risk prediction tool assessment

ESC European Society of Cardiology

Risk algorithms development and performance assessment

Based on not too many, unambiguous, easy to measure, low cost and widely available and easy to understand (for healthcare provider and patient) factors

Clinical impact of prediction tools

The correct risk stratification of patients should improve clinical outcomes and resources allocation

Feature	Definition
Calibration	Degree of agreement between observed outcomes and predictions. It can be assessed graphically (i.e. plotting the observed proportions of the outcome for groups of patients with similar predicted risk, like deciles of predictions) or formally using the Hosmer–Lemeshow goodness of fit test.
Discrimination	Ability of the model to distinguish a patient with the outcome (i.e. death) from a patient without the outcome (i.e. alive). For a binary outcome, the concordance c-statistic can be interpreted similarly as the area under the receiver operating charactistic curve.
Internal validation	Assessment of the validity of claims for the underlying population where the data originated from ('reproducibility'). Common methods are cross-validation or bootstrap resampling.
External validation	Assessment of the validity of claims for 'plausibly related' populations ('generalisability'). A different cohort is needed to perform an external validation (i.e. using other temporal or geographical cohorts).
Decision-curve analysis	It offers insight into clinical consequences by determining the relationship between a chosen predicted probability threshold and the relative value of false-positive and false-negative results to obtain a value of net benefit of using the model at that threshold.
Net reclassification index	Measure if the net percentage of those who do and do not develop the outcome within the time period who are correctly reclassified to a different risk category when a new risk factor is added to the risk estimation system.

Predicting risk of cardiovascular events by patient groups

ESC European Society of Cardiology

Risk prediction in older patients

Estimations work well for middle-aged subjects (competing non-CV death in older)

Risk prediction in young individuals (<50 y.o.)

10-year prediction might be not enough in high lifetime risk subjects

Risk prediction in high-risk subjects

Need for risk stratification in subjects with diabetes or clinically established CVD

Compilation of online available prediction tools

ESC European Society of Cardiology

Overview of freely accessible online tools for estimation of cardiovascular prognosis

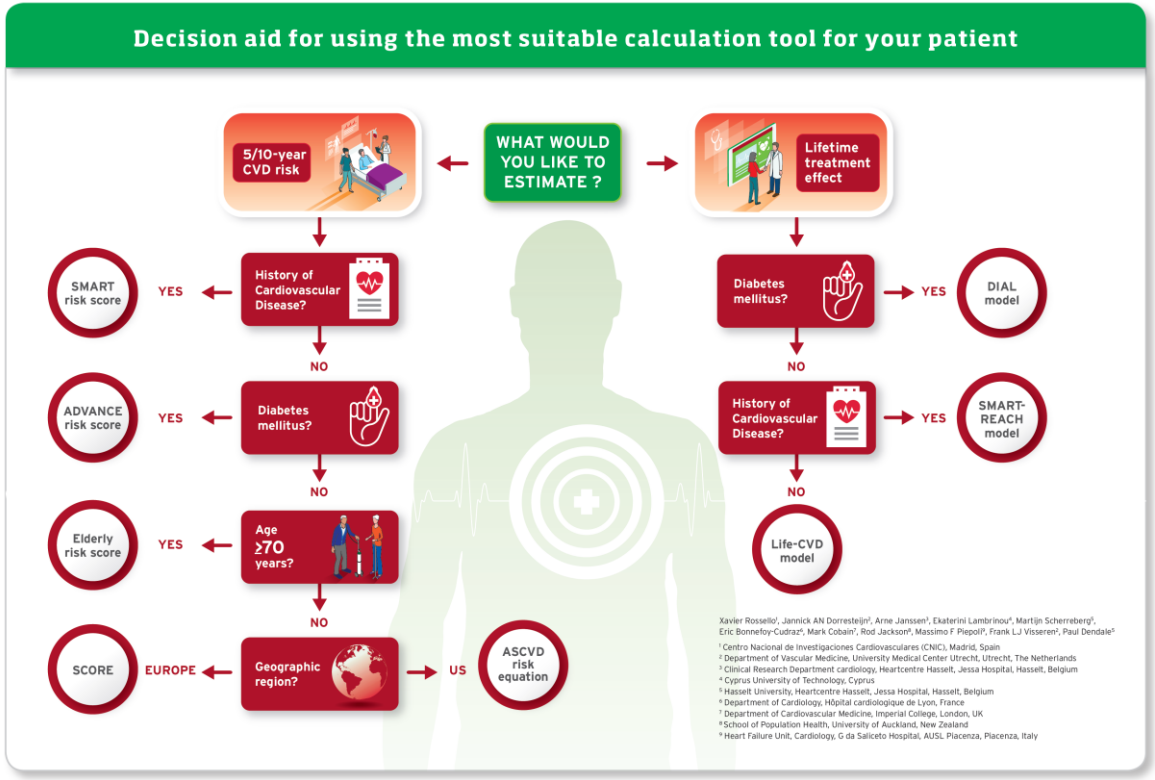
TOOL	Patient categories	Geographical region	Prediction outcomes	Additional features
SCORE www.heartscore.org	Healthy people	Europe high and low risk regions	10-year CVD risk	Personal health advice based on ESC-Guidelines Available in 17 languages Print option for patient handout Patient history and progress Calibrated versions
QRISK3 www.qrisk.org/three	Healthy people	United Kingdom	10-year CVD risk Relative risk Heart age	Infographics for patient communication
JBS-3 risk calculator www.jbs3risk.com	Healthy people	United Kingdom	10-year CVD risk Lifetime CVD risk Heart age CVD-free life-expectancy	Effect of risk factor optimisation Infographics for patient communication
ASSIGN score www.assign-score.com	Healthy people	Scotland	10-year CVD risk	Missing data filled in by population average/median Print option for patient handout
PROCAM score Various websites	Healthy people	Germany	10-year coronary event risk	
CUORE www.cuore.iss.it/sopra/calc-rischio_en.asp	Healthy people	Italy	10-year CVD risk	Also available in Italian language
ASCVD risk-estimator plus http://tools.acc.org/ASCVD-Risk-Estimator-Plus	Healthy people	United States	10-year CVD risk Lifetime CVD risk	Effect of risk factor optimisation Personal health advice based on ACC/AHA guidelines Print option for patient handout
Framingham risk score www.framinghamheartstudy.org	Healthy people	United States	10-year CVD risk 30-year CVD risk Heart age	Additional calculators for other vascular disease outcomes
Reynolds risk score www.reynoldsriskscore.org	Healthy people	United States	10-year CVD risk Relative risk	Effect of risk factor optimisation Projection of risk increase with advancing age Print option for patient handout
Globorisk www.globorisk.org	Healthy people	**Worldwide**	**10-year CVD risk**	Country adjusted risk charts available
UKPDS risk engine V2 www.dtu.ox.ac.uk/riskengine	Type 2 diabetes	United Kingdom	Fatal and non-fatal CVD risk for any risk interval	Print option for patient handout
ADVANCE risk engine www.advanceriskengine.com	Type 2 diabetes	Europe, Asia, Australasia and North America	4-year CVD risk	Missing data filled in by population average/median Additional calculator for kidney disease outcomes
SMART risk score www.escardio.org/Education/ESC-Prevention-of-CVD-Programme/Risk-assessment/SMART-Risk-Score	Vascular patients	Europe and United States	10-year CVD risk	Missing data filled in by population average/median
MAGGIC risk calculator www.heartfailurerisk.org	Heart failure patients	Worldwide	1 and 3-year mortality risk	
Seattle Heart Failure model www.SeattleHeartFailureModel.org	Heart failure patients	Northern-America	1, 2 and 5-year mortality risk	Effect of specific treatment options
U-Prevent www.U-prevent.com	Healthy people Type 2 diabetes patients Vascular patients Elderly	Europe and Northern-America	10-year CVD risk Lifetime CVD risk CVD free life expectancy	Also available in Dutch Effect of specific treatment options Effect of deferred treatment Infographics for patient communication Print option for patient handout Missing data filled in by population average/median Calculator selection aid

Seven considerations for selecting the best prediction tool for every patient

ESC European Society of Cardiology

1. Medical history (history of CVD and diabetes)
2. Calibration (geographic region)
3. Impact of clinical guidelines
4. Additional risk measures beyond 10-year CVD risk
5. Missing or unavailable values
6. Estimation of the individual effect of preventive treatment
7. User-friendly tools

Decision aid PDF



Xavier Rossello[1], Jannick AN Dorresteijn[2], Arne Janssen[3], Ekaterini Lambrinou[4], Martijn Scherrenberg[5], Eric Bonnefoy-Cudraz[6], Mark Cobain[7], Rod Jackson[8], Massimo F Piepoli[9], Frank LJ Visseren[2], Paul Dendale[5]

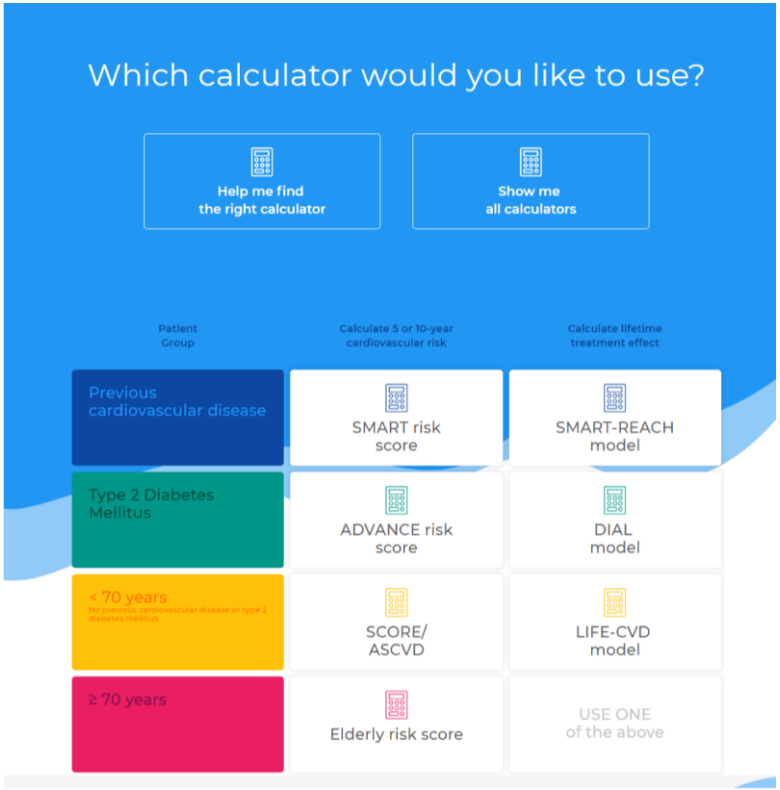
[1] Centro Nacional de Investigaciones Cardiovasculares (CNIC), Madrid, Spain
[2] Department of Vascular Medicine, University Medical Center Utrecht, Utrecht, The Netherlands
[3] Clinical Research Department cardiology, Heartcentre Hasselt, Jessa Hospital, Hasselt, Belgium
[4] Cyprus University of Technology, Cyprus
[5] Hasselt University, Heartcentre Hasselt, Jessa Hospital, Hasselt, Belgium
[6] Department of Cardiology, Hôpital cardiologique de Lyon, France
[7] Department of Cardiovascular Medicine, Imperial College, London, UK
[8] School of Population Health, University of Auckland, New Zealand
[9] Heart Failure Unit, Cardiology, G da Saliceto Hospital, AUSL Piacenza, Piacenza, Italy

Eur J Prev Cardiol. 2019;26:1534-1544

www.escardio.org/cvd-prevention

U-Prevent tool

ESC
European Society
of Cardiology

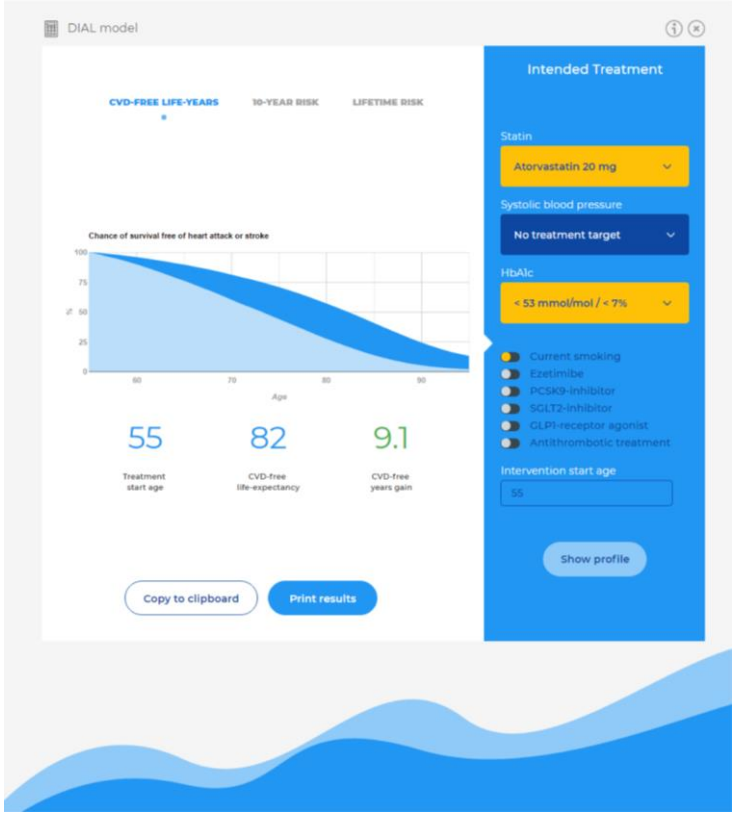


https://www.u-prevent.com

Recommendations

55-yo subject with T2DM whose current medication is atorvastatin 20 mg

Estimated CVD-free years gained with a combination of smoking cessation and a HbA1c target of less than 53 mmol/mol



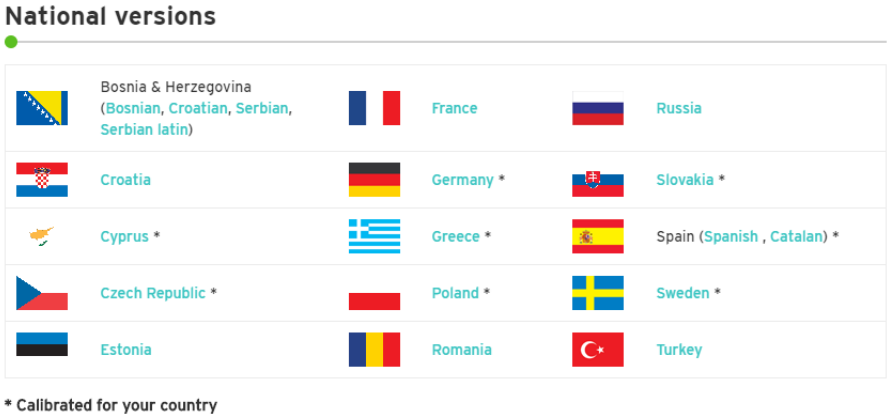
https://www.u-prevent.com

HeartScore

ESC European Society of Cardiology

- **HeartScore** is aimed at supporting clinicians in optimizing individual cardiovascular risk reduction
- It is the electronic and interactive version of the SCORE risk charts of the European Guidelines on CVD Prevention written by the Joint European Societies' Task Force on Cardiovascular Disease Prevention in Clinical Practice

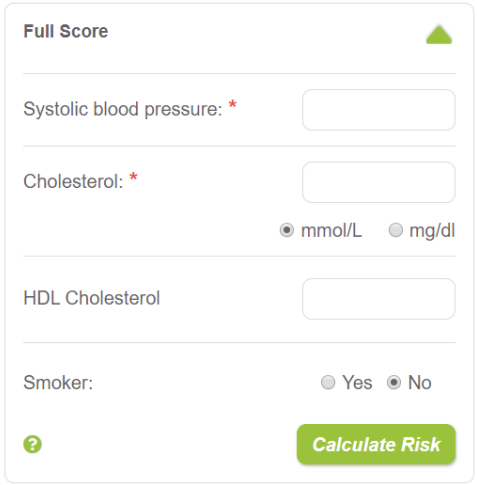
Outcome: 10-year risk of cardiovascular death (Europe low- or high-risk)

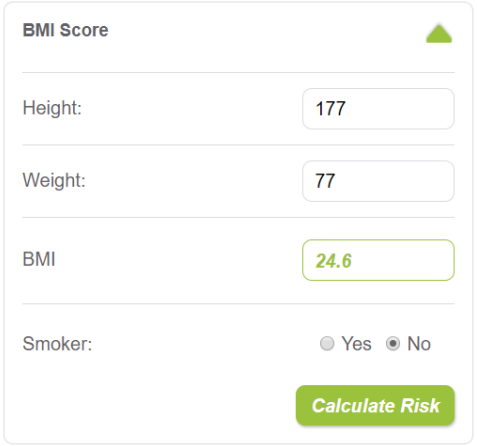


http://www.heartscore.org

HeartScore

ESC
European Society
of Cardiology





The **Patient Advice** tab consolidates the advices given to the patient at the date of the examination.

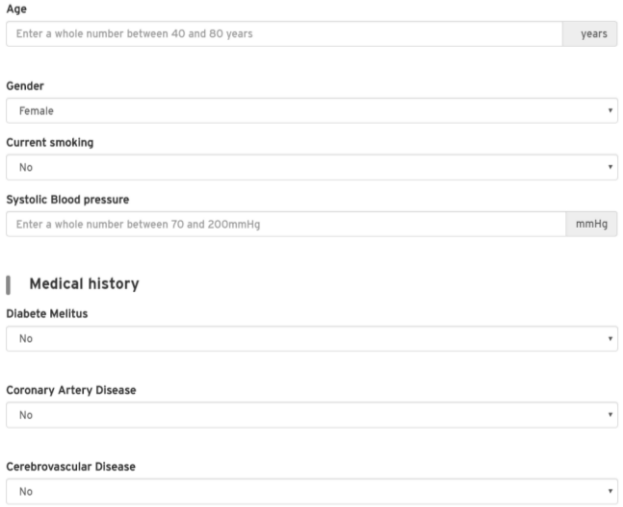
The **CVD Prevention Guidelines** tab includes recommendations from the European Guidelines on CVD Prevention.

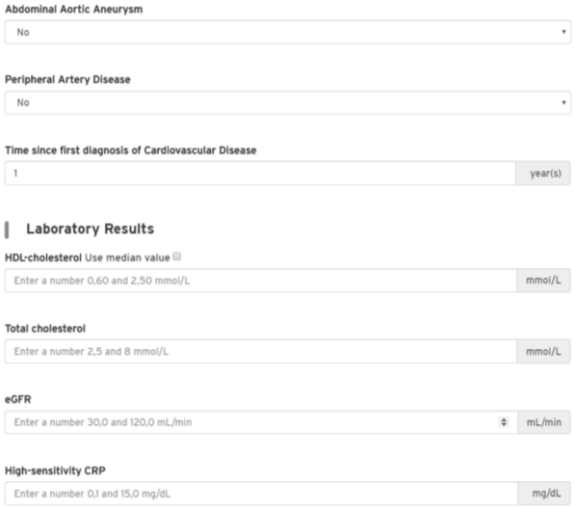
http://www.heartscore.org

SMART Risk

ESC European Society of Cardiology

The **SMART Risk Score** is a tool to estimate 10-year risk for recurrent vascular events in subjects with manifest cardiovascular disease (CAD, CVD, PAD, AAA PVD**)**





Outcome: 10-year risk for myocardial infarction, stroke or vascular death in individual patients with clinically manifest atherosclerotic vascular disease.

https://www.escardio.org/Education/ESC-Prevention-of-CVD-Programme/Risk-assessment/SMART-Risk-Score

Conclusions

For patient groups with different risk factor profiles and different baseline cardiovascular risk, different risk algorithms are to be used

The EAPC advises the use **HeartScore** for risk prediction in healthy people and the use of the **U-Prevent tool** developed by the University of Utrecht.

U-Prevent provides risk algorithms for all patient subgroups and ages, and it offers a lifetime perspective for each subgroup.

Acknowledgments

ESC
European Society
of Cardiology

ESC Prevention of Cardiovascular Disease Programme (WP3)

EAPC
European Association
of Preventive Cardiology

ACCA
Acute Cardiovascular
Care Association

ACNAP
Association of Cardiovascular
Nursing & Allied Professions