SCORE-2 as a collaborative model to tackle multimorbidity

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Type 2 diabetes is a major public health problem

- 537 million adults (20-79 years) are living with diabetes (i.e., 1 in 10).
- Predicted to rise to 643 million by 2030 and 783 million by 2045.
- Diabetes is responsible for 6.7 million deaths in 2021 1 every 5 seconds.



Type 2 diabetes is a major risk factor for CVD

- Individuals with diabetes, have, on average, 2-fold higher risk of developing CVD compared to counterparts without diabetes.
- More likely to have multiple CVD risk factors (including dyslipidaemia and hypertension), each of which mediates an increase in risk

	Number of cases	HR (95% CI)				
Coronary heart disease*	26 505		2·00 (1·83–2·19)			
Coronary death	11 556	_ 	2·31 (2·05–2·60)			
Non-fatal myocardial infarction	14 741	B	1.82 (1.64–2.03)			
Stroke subtypes*						
Ischaemic stroke	3799		2·27 (1·95–2·65)			
Haemorrhagic stroke	1183		1·56 (1·19–2·05)			
Unclassified stroke	4973	_	1·84 (1·59–2·13)			
Other vascular deaths	3826	_	1.73 (1.51–1.98)			
		1 2				

Type 2 diabetes and life expectancy

On average, type 2 diabetes reduces life expectancy by ~6 years



NEJM 2011

Diabetes-specific risk prediction models

- Several guidelines recommends use of risk prediction models to evaluate risk of CVD
- Risk models may refine risk estimates and illustrate the impact of treatments
- Generally include duration of DM, glycated haemoglobin (HbA1c) level, and presence of TOD
- Examples are: ADVANCE predicts 4 year of UKPDS predicts Limitations: based on older cohort data, not UKPDS predicts Limitations: based on older cohort data, not DIAL prediction of Limitations: based on older cohort data, not UKPDS predicts Limitations: based on older cohort data, not

Discrimination and calibration of 22 CVD risk prediction tools in T2DM

Type 2 diabetes population							
DARTS [25]	IN						
UKPDS 56 [26]	IH						
UKPDS 68 C-HF [27]	101						
UKPDS 68 Stroke [27]	101						
UKPDS 82 CHD [28]	н						
UKPDS 82 C-HF [28]	IH						
RECODE [24]	HH						
CHS Basic [29]	101						
CHS Advanced [29]	iei						
General population							
Finrisk CVD [31]	101						
Finrisk Stroke [31]	Iel						
Finrisk CHD [31]	Iel						
Framingham 1991 CVD [22]	101						
Framingham 1991 fatal CHD [22] 🛏						
Framingham 1991 Stroke [22]	HHI.						
Framingham 1998 [23]	Iel						
QRISK2 [32]	101						
QRISK3 [33]	101						
ASCVD [1]	Iel						
Reynolds Risk [34,35]	101						
SCORE CVD [30]	iei						
SCORE CHD [30]	Iel						

0.600

0.650

C statistic

0.700

0.750

0.800

0.500

0.550

C statistic (95% Cl) 0.651 (0.647, 0.655) 0.639 (0.635, 0.643) 0.644 (0.640, 0.648) 0.644 (0.640, 0.648) 0.619 (0.614, 0.623) 0.633 (0.628, 0.638) 0.640 (0.636, 0.645) 0.660 (0.656, 0.663)





Dziopa, K. et al, Diabetologia 2022

Calibration plots after recalibrating



Dziopa, K. et al, Diabetologia 2022

Transferability and longevity of CVD risk models

Relative risks are similar across populations and stable with time

discrimination across different populations and time points

Baseline risk varies with population and time

iation not completely explained by risk predictors in the model pends on many population characteristics: Healthcare, economics, genetics etc. wodel derived in one population may over or underestimate risk in new populations

More typically derived in cohort studies

resent a past period of time and a subset of the population

Relative risks OK, but baseline risk often not representative of target population Recalibration of risk prediction models using nationally

representative incidence data is needed

General process for CVD risk score development



Development process, key features and illustrative example of the SCORE2 risk prediction algorithms



SCORE2 Risk charts for the moderate/high risk regions

(mm Hg)

pressure

Systolic blood



				SCO	DRE2						< 50	vears	50-69	e vears			
		10-ye	ear ris	k of (fa	atal ar	nd nor	n-fata	1)	1	<2.5% <5%							
		c	V eve	nts in	popul	ations	at	100		2.5 to <7.5% 5 to <10%				<10%			
				high (VD ris	sk				≥7.5% ≥10%							
				Wo	men					Men							
		Non-smoking Smok				oking		Age	Non-smoking					Smoking			
160-179	15	16	17	18	26	27	29	30		17	18	20	22	25	28	30	32
140-159	12	13	14	14	21	22	23	24	65 60	14	15	16	18	21	23	25	27
120-139	10	10	11	11	16	17	18	19	05-09	11	12	13	15	17	19	20	22
100-119	8	8	8	9	13	14	14	15		9	10	11	12	14	15	17	18
160-179	11	11	12	13	20	21	23	25		13	14	16	18	20	23	25	28
140-159	8	9	9	10	15	16	18	19	60 . 64	10	11	13	14	16	18	20	23
120-139	6	7	7	8	12	13	14	15	60 - 64	8	9	10	11	13	15	16	18
100-119	5	5	6	6	9	10	11	11		6	7	8	9	10	12	13	15
160-179	7	8	9	10	15	16	18	20		9	11	12	14	16	19	21	24
140-159	5	6	7	7	11	12	14	15	55 - 59	7	8	10	11	13	15	17	19
120-139	4	4	5	5	8	9	10	11		6	6	7	9	10	11	13	15
100-119	3	3	4	4	6	7	8	8		4	5	6	7	8	9	10	12
160-179	5	5	6	7	11	13	14	16		7	8	10	11	13	15	18	21
140-159	3	4	4	5	8	9	10	12	E0 E4	5	6	7	9	10	12	14	16
120-139	3	3	3	4	6	7	8	9	9 50 - 54	4	5	5	6	7	9	10	12
100-119	2	2	2	3	4	5	6	6		3	3	4	5	6	7	8	9
160-179	3	4	4	5	8	10	11	13	2	5	6	8	9	10	13	15	18
140-159	2	3	3	4	6	7	8	9	45 40	4	5	6	7	8	9	11	14
120-139	2	2	2	2	4	5	6	6	43 - 49	3	3	4	5	6	7	8	10
100-119	1	1	2	2	3	3	4	5		2	2	3	4	4	5	6	7
160-179	2	3	3	4	6	7	9	10		4	5	6	7	8	10	13	16
140-159	1	2	2	2	4	5	6	7	40 - 44	3	3	4	5	6	7	9	11
120-139	1	1	1	2	3	4	4	5	40 - 44	2	2	3	4	4	5	7	8
100-119	1	1	1	1	2	2	3	3	0	1	2	2	3	3	4	5	6
	3.0-	4.0-	5.0-	6.0-	3.0-	4.0-	5.0-	6.0-		3.0-	4.0-	5.0-	6.0-	3.0-	4.0-	5.0-	6.0-
	3.9	4.9	5.9	6.9	3.9	4.9	5.9	6.9		3.9	4.9	5.9	6.9	3.9	4.9	5.9	6.9
Non-HDL cholesterol (mmol/L)										1	150 200 250						
															m	g/dL	

Development of SCORE2-Diabetes



in preparation

Discrimination of SCORE2-Diabetes in European countries

Cohort (risk region)	Individuals	Cases	Risk model		C-index (95% CI)	Difference in C-index SCORE2 Diabetes – SCORE2 (95% CI)
SIDIAP (low risk)	10768	1282	SCORE2 SCORE2-Diabetes	#_ _	0.650 (0.636, 0.665) 0.660 (0.646, 0.675)	ref 0.010 (0.004, 0.016)
MALTA* (moderate risk)	3876	239	SCORE2 SCORE2-Diabetes	B	0.630 (0.592, 0.668) 0.661 (0.622, 0.699)	ref 0.031 (0.011, 0.050)
SNDR (moderate risk)	119813	30175	SCORE2 SCORE2-Diabetes	•	0.651 (0.648, 0.654) 0.666 (0.663, 0.669)	ref 0.015 (0.014, 0.017)
CROATIA* (high risk)	22821	947	SCORE2 SCORE2-Diabetes	_ + _ _ + _	0.675 (0.659, 0.692) 0.688 (0.672, 0.705)	ref 0.013 (0.006, 0.021)
				I I 5 .6 .7 C-index	l .8	

in preparation

Summary

- Assessing CVD risk is key to enhance CVD prevention in individual with type 2 diabetes.
- There is the need to develop new risk prediction models that are robust and able to predict contemporary CVD risk more accurately in different regions.
- SCORE2 have been derived using a diverse cohorts and allows efficient recalibration procedure which can be applied in the future with new incidence and risk factor data
- SCORE2 risk prediction models will be extended to include diabetes-specific factors (ie, SCORE2-Diabetes) to allow reliable risk prediction in individual with type 2 diabetes.