

QRISK[®] 2016
Annual Update
Information

Revision History

Revision date	Document Version	Summary of Changes
02/01/2016	V1.0	First issue.

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1 Purpose of document

This document details the annual update for QRISK2-2016 10-year cardiovascular risk prediction algorithms derived from the QResearch® database.

The annual update is released each April on the QRISK2 related websites www.qrisk.org and www.qintervention.org.

We recommend that those who integrate QRISK®2 into their own systems move to the 2016 score by the autumn -- this means that they have the freedom to schedule the work needed into a convenient point of their release cycle

2 Rational for annual updates of QRISK

Annual updates are required because of:

- **Changes in population characteristics** - for example, incidence of cardiovascular disease (CVD) is falling; obesity is rising; smoking rates are falling;
- **Changes in requirements** for how the risk prediction scores can be used eg changes in age ranges.
- **Improvements in data quality** - for example the recording of exposures and also clinical outcomes becomes more complete over time. This is especially true for recording of ethnicity data which is becoming more complete. All 1243 practices in England currently contributing to the QResearch database (version 40) now have data linked at patient level to the Hospital Episode Statistics (HES) database¹. This means it is possible to identify patients who have been admitted to hospital for cardiovascular disease where this information is not already recorded on the GP record or linked mortality record from the Office of National Statistics (ONS). Both HES and ONS mortality data linkages extend back to 1997.

These factors require us to remodel the QRISK2 algorithm to the latest version of the QResearch® database each year to ensure the algorithm keeps up to date. If the algorithm is not re-calculated, then its performance would gradually decay and its clinical value would diminish as a result. We have therefore re-fitted the algorithm using a three quarter random sample of the QResearch® practices and incorporated this into the annual update of the software

3 Summary of Changes to QRISK2-2016

The main changes to QRISK2-2016 10 year risk score are:

3.1 Re-calculation of coefficients

We have updated the coefficients for the 10 year QRISK2 (2016) algorithm using the latest version of the QResearch database.

The appendix shows details of how risk factor recording and CVD incidence rates have changed over time. In summary, CVD rates are declining and there has been a marked improvement in recording of self-assigned ethnicity over time.

The improvement in recording of ethnicity (see appendix) has resulted in more accurate estimation of risk for the different ethnic groups as it's based on a much larger sample size. The practical result is an increase in the weighting applied to the non-white ethnic groups which will result in a small increase to the corresponding risk scores.

3.2 Postcode table

We have included the annual update to the postcode-deprivation table.

4 Appendix1: baseline characteristics

The QResearch database version 40 was used for the 2016 update. This version of the database contains data from 1243 general practices. We identified an open cohort of patients registered with the practices from 01 Jan 1998 until 31 Jan 2015. There were 8.2 million patients in the derivation cohort and 2.7 million in the validation cohort which reflects the expansion of the database over the last few years. Risk factor recording has increased over time. Self-assigned ethnicity is now recorded in 58% of all patients which is more than twice the level recorded for QRISK2 2008.

Table 1: Baseline characteristics of patients aged 25-84 years in the derivation and validation cohorts.

	Derivation cohort	validation cohort
female	4040656 (50.9)	1342788 (50.8)
male	3899609 (49.1)	1302922 (49.2)
25-34 years	2978676 (37.5)	933302 (35.3)
35-44 years	1936586 (24.4)	649135 (24.5)
45-54 years	1272615 (16.0)	442422 (16.7)
55-64 years	845823 (10.7)	298839 (11.3)
65-74 years	556855 (7.0)	197893 (7.5)
75+ years	349710 (4.4)	124119 (4.7)
Ethnicity recorded	4590703 (57.8)	1520413 (57.5)
White/not recorded	7091838 (89.3)	2410242 (91.1)
Indian	150174 (1.9)	47288 (1.8)
Pakistani	82469 (1.0)	20699 (0.8)
Bangladeshi	78629 (1.0)	11527 (0.4)
Other Asian	92667 (1.2)	30664 (1.2)
Caribbean	70712 (0.9)	17670 (0.7)
Black African	143274 (1.8)	41301 (1.6)
Chinese	51213 (0.6)	13863 (0.5)
Other	179289 (2.3)	52456 (2.0)
smoking recorded	7183880 (90.5)	2402793 (90.8)
non smoker	4008771 (50.5)	1336616 (50.5)
Ex-smoker	1253900 (15.8)	422236 (16.0)
light smoker	1049162 (13.2)	344675 (13.0)
moderate smoker	521455 (6.6)	175716 (6.6)
heavy smoker	350592 (4.4)	123550 (4.7)
Family history heart disease under 60	816560 (10.3)	276618 (10.5)
type 1 diabetes	19547 (0.2)	6828 (0.3)
type 2 diabetes	135497 (1.7)	44541 (1.7)
rheumatoid arthritis	65647 (0.8)	21930 (0.8)
chronic renal disease	14436 (0.2)	4799 (0.2)
treated hypertension	334820 (4.2)	119333 (4.5)
atrial fibrillation	36063 (0.5)	12721 (0.5)
BMI recorded	6268093 (78.9)	2109339 (79.7)
SBP recorded	6848440 (86.2)	2303124 (87.1)
cholesterol recorded	503696 (6.3)	177603 (6.7)
HDL cholesterol recorded	3002087 (37.8)	1045284 (39.5)
cholesterol/HDL ratio recorded	2678035 (33.7)	946781 (35.8)
mean age (SD)	43.1 (14.9)	43.8 (15.0)
mean Townsend (SD)	.6 (3.6)	0 (3.5)
mean BMI(SD)	26 (4.9)	26 (4.8)
mean cholesterol ratio (SD)	4 (1.3)	4 (1.3)
mean SBP (SD)	127.9 (19.1)	128.4 (19.3)

5 Appendix2: CVD incidence rates

The next table shows the incidence rates for patients in the derivation cohort by sex, ethnic group and calendar year between 1998 and 2015. The crude rates are per 10,000 per year and include patients aged 25-84 years registered with practices in England. Patients with CVD are identified either from a CVD diagnosis recorded in the GP record, or their linked mortality or linked hospital admission record.

Table 2: CVD incidence rates per 10,000 in patients aged 25-84 years. Note mortality data are not yet available for 2014.

	women	women	women	women	men	men	men	men
	cases	Person years	Rate	95% CI	cases	Person years	Rate	95% CI
total	164705	26559966	62.0	(61.7 to 62.3)	205264	25487056	80.5	(80.2 to 80.9)
White/not recorded	157799	24533140	64.3	(64.0 to 64.6)	194783	23572264	82.6	(82.3 to 83.0)
Indian	1719	378159	45.5	(43.4 to 47.7)	2747	376638	72.9	(70.3 to 75.7)
Pakistani	986	191701	51.4	(48.3 to 54.7)	1671	214619	77.9	(74.2 to 81.7)
Bangladeshi	716	172372	41.5	(38.6 to 44.7)	1581	207165	76.3	(72.6 to 80.2)
Other Asian	552	203576	27.1	(24.9 to 29.5)	901	182234	49.4	(46.3 to 52.8)
Caribbean	1336	272725	49.0	(46.4 to 51.7)	1425	211889	67.3	(63.8 to 70.8)
Black African	504	303958	16.6	(15.2 to 18.1)	712	286926	24.8	(23.1 to 26.7)
Chinese	162	104186	15.5	(13.3 to 18.1)	214	80929	26.4	(23.1 to 30.2)
Other	931	400149	23.3	(21.8 to 24.8)	1230	354391	34.7	(32.8 to 36.7)
1998	6570	1062415	61.8	(60.4 to 63.4)	8269	1030920	80.2	(78.5 to 82.0)
1999	7628	1174733	64.9	(63.5 to 66.4)	9063	1138822	79.6	(78.0 to 81.2)
2000	8157	1299469	62.8	(61.4 to 64.1)	9396	1258271	74.7	(73.2 to 76.2)
2001	12083	1437974	84.0	(82.5 to 85.5)	14659	1392626	105.3	(103.6 to 107.0)
2002	11541	1531324	75.4	(74.0 to 76.8)	13787	1487000	92.7	(91.2 to 94.3)
2003	11203	1595099	70.2	(68.9 to 71.5)	13483	1552199	86.9	(85.4 to 88.3)
2004	10487	1619149	64.8	(63.5 to 66.0)	12636	1574470	80.3	(78.9 to 81.7)
2005	10882	1639573	66.4	(65.1 to 67.6)	13329	1591838	83.7	(82.3 to 85.2)
2006	10238	1661441	61.6	(60.4 to 62.8)	12803	1608494	79.6	(78.2 to 81.0)

2007	9832	1677581	58.6	(57.5 to 59.8)	12670	1619909	78.2	(76.9 to 79.6)
2008	10021	1701842	58.9	(57.7 to 60.0)	12539	1635441	76.7	(75.3 to 78.0)
2009	10159	1726791	58.8	(57.7 to 60.0)	13209	1647331	80.2	(78.8 to 81.6)
2010	10047	1757700	57.2	(56.1 to 58.3)	12528	1673221	74.9	(73.6 to 76.2)
2011	9867	1775110	55.6	(54.5 to 56.7)	12857	1679661	76.5	(75.2 to 77.9)
2012	9965	1787746	55.7	(54.7 to 56.8)	12965	1681610	77.1	(75.8 to 78.4)
2013	8697	1597641	54.4	(53.3 to 55.6)	11479	1493237	76.9	(75.5 to 78.3)
2014	6789	1404017	48.4	(47.2 to 49.5)	8910	1318153	67.6	(66.2 to 69.0)
2015	539	110359	48.8	(44.9 to 53.1)	682	103854	65.7	(60.9 to 70.8)

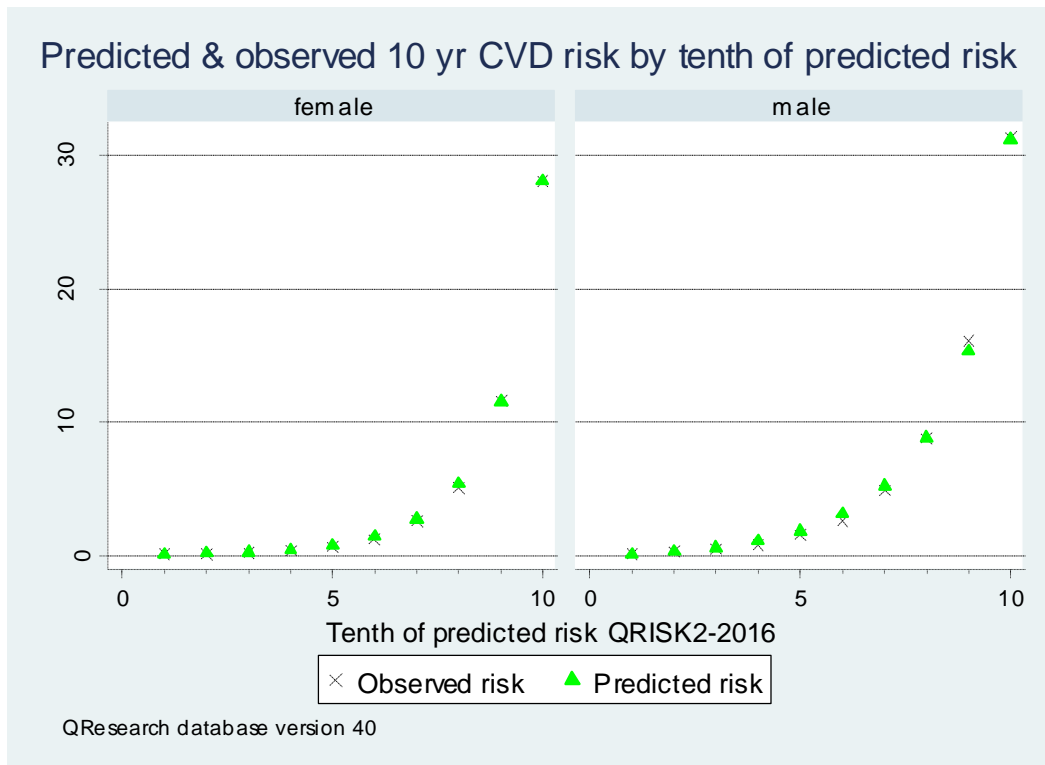
6 Appendix3: validation information

We validated the QRISK®2 2016 algorithm using a one quarter sample of practices in the QResearch® database. The table shows measures of the performance of the scores applied to the relevant age range i.e. how accurate the scores are at identifying patients who have a CVD event and distinguishing them from patients who don't and how much of the 'variation' in risk is explained by the scores themselves. High values for these measures are better than low values. The models for QRISK2-2016 showed comparable performance with QRISK2-2015 applied to the same validation data.

Table 3: Validation statistics for QRISK2 (2008-2012) for patients aged 30-84yrs. QRISK2 (2013-16) are validated in patients aged 25-84 yrs.

		Women			Men		
		Mean	95% LCL	95% UCL	Mean	95% LCL	95% UCL
QRISK2 (2008)	R ²	0.509	0.504	0.514	0.460	0.455	0.466
	D statistic	2.083	2.063	2.104	1.890	1.870	1.910
	ROC value	0.853	0.851	0.855	0.830	0.828	0.832
QRISK2 (2010)	R ²	0.514	0.509	0.519	0.459	0.454	0.464
	D statistic	2.106	2.085	2.127	1.885	1.866	1.905
	ROC value	0.853	0.851	0.855	0.830	0.828	0.833
QRISK2 (2011)	R ²	0.519	0.515	0.524	0.467	0.463	0.472
	D statistic	2.128	2.109	2.147	1.917	1.900	1.934
	ROC value	0.856	0.854	0.858	0.836	0.834	0.838
QRISK2 (2012)	R ²	0.520	0.515	0.525	0.463	0.459	0.468
	D statistic	2.131	2.109	2.153	1.902	1.885	1.919
	ROC value	0.856	0.854	0.859	0.836	0.834	0.837
QRISK2 (2013)	R ²	0.560	0.555	0.564	0.510	0.506	0.515
	D statistic	2.306	2.286	2.326	2.090	2.073	2.107
	ROC value	0.881	0.880	0.883	0.861	0.860	0.862
QRISK2(2014)	R ²	0.588	0.584	0.591	0.533	0.529	0.537
	D statistic	2.443	2.423	2.463	2.188	2.171	2.205
	ROC value	0.893	0.892	0.895	0.871	0.869	0.873
QRISK2(2015)	R ²	0.579	0.576	0.583	0.526	0.522	0.531
	D statistic	2.401	2.383	2.419	2.157	2.138	2.176
	ROC value	0.888	0.887	0.890	0.864	0.862	0.865
QRISK2(2016)	R ²	0.579	0.575	0.582	0.527	0.523	0.531
	D statistic	2.400	2.383	2.417	2.159	2.143	2.176
	ROC value	0.888	0.887	0.890	0.864	0.862	0.865

Figure 1 shows QRISK2-2016 is well calibrated with close correspondence between observed and predicted values



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