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Can doctors and patients correctly estimate cardiovascular risk? A cross-sectional study in primary care

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ABSTRACT

Objective Accurate cardiovascular risk estimations by patients and doctors are important as these affect health behaviour and medical decision making. We aimed to determine if doctors and patients were accurately estimating the absolute cardiovascular risk of patients in primary care.

Methods A cross-sectional study was carried out in primary care clinics in Malaysia in 2014. Patients aged 35 years and above without known cardiovascular disease (CVDs) were included. Face-to-face interviews with a structured questionnaire were used to collect sociodemographic and clinical data as well as patients' perception and doctors' estimate of the patients' CVD risk. Associations were tested using χ^2, correlation and independent t-tests.

Results We recruited 1094 patients and 57 doctors. Using the Framingham Risk Score (FRS) alone, 508 patients (46.4%) were in the high-risk group. When diabetes was included as high risk, the number increased to 776 (70.9%). Only 34.4% of patients and 55.7% of doctors correctly estimated the patient's CVD risk in comparison with the reference FRS. Of the high-risk patients, 664 (85.6%) underestimated their CV risk. Factors associated with underestimation by patients included not having family history of CVD (adjusted OR (AOR): 2.705, 95% CI 1.538 to 4.757), smaller waist circumference (AOR: 0.979,95% CI 0.960 to 0.999) and ethnicity in comparison with the Malay as reference group (indigenous/others: AOR: 0.129, 95% CI 0.071 to 0.235). Doctors underestimated risk in 59.8% of the high-risk group. Factors associated with underestimation by doctors were patients factors such as being female (AOR: 2.232, 95% CI 1.460 to 3.410), younger age (AOR: 0.908, 95% CI 0.886 to 0.930), non-hypertensive (AOR: 1.731, 95% CI 1.067 to 2.808), non-diabetic (AOR: 1.931, 95% CI 1.114 to 3.348), higher high-density lipoprotein levels (AOR: 3.546, 95% CI 2.025 to 6.209), lower systolic blood pressure (AOR: 0.970, 95% CI 0.957 to 0.982), non-smoker (AOR: 2.246, 95% CI 1.354 to 3.726) and ethnicity in comparison with the Malay as reference group (Indian: AOR: 0.430, 95% CI 0.257 to 0.720; indigenous/others: AOR: 2.498, 95% CI 1.346 to 4.636).

Conclusions The majority of consultations occurring between doctors and patients are being informed by inaccurate cardiovascular risk estimation.

Strengths and limitations of this study

- ► This was a large cross-sectional study that took place in nine different clinics and covered over a thousand patient consultations.
- ► It captured the perceptions and practices occurring in actual consultations in primary care settings where medical decisions were being made.
- ► Participants' behaviour may have been affected due to awareness of the research being undertaken.

BACKGROUND

Despite international efforts, cardiovascular disease (CVD) remains the leading cause of death worldwide, killing more than 17 million people a year.[1] Affordable, feasible and effective global actions capable of averting millions of deaths from non-communicable diseases have been identified to tackle this continuing crisis.[2] Yet, the rate of non-communicable diseases, of which CVD is a major contributor, is increasing, and this increase is disproportionately greater in developing countries.[3] Out of five interventions identified as priority actions for the non-communicable disease crisis,[2] only one addressed individual clinical services, that is, access of essential drugs and technologies. This was deemed essential especially for those identified to be at high risk of CVD.

People at high risk of CVD can be identified using tools such as cardiovascular (CV) risk scores. These were designed to calculate an individual's risk of developing a CV event from risk factors obtained from history, physical examination or investigations. Most guidelines recommend the use of risk scores to predict global risk rather than focusing on single risk modification. The majority advocates the use of Framingham Risk Score or scores that have been calibrated from the Framingham study data.[4–6] A systematic review identified 21 risk scores for use in adults with

no history of previous CVD.[7] However, the use of the risk score is surprisingly limited. Studies have reported rates of use ranging from 17%–65%.[8–10] Studies have shown that subjective estimation of CV risk by doctors is inaccurate.[11–16] They tended to underestimate risk when the study used actual patients[11–16] and overestimate risk for case reports or vignettes.[12–15] Patients have also been found to be inaccurate in estimating their own CV risk.[8] About 40% of the general population underestimates their CV risk and 20% overestimated it.[11 17–19] In studies on those at established high CV risk, only about 40% were aware of their increased risk.[20] Higher CV risk perception has been shown to be associated with better acceptance towards medical management regardless of whether the perception accurately reflected actual CV risk or not.[21]

Accurate estimations of CV risk by both patients and doctors are important as these affect health behaviour and medical decision making. The proliferations of mobile health technology including online risk calculators and guidelines have shown potential in increasing awareness and use of CV risk scores in clinical consultations.[22] But has this led to a corresponding improvement in the use of CV risk scores in practice? Our study aimed to determine if doctors and patients were able to accurately estimate the absolute CV risk of patients in a primary care health setting.

METHODOLOGY

This was a cross-sectional study carried out in nine public primary care clinics in Malaysia in 2014 with the period of recruitment from 1 to 30 November 2014. The nine clinics were chosen conveniently from five regions of Malaysia: two clinics each from the northern (Ipoh), southern (Melaka) and western regions (Klang Valley) and one clinic from the eastern region (Kelantan) of Peninsular Malaysia and two clinics from East Malaysia (Sabah). All patients attending these clinics aged 35 years and above with CV risk assessments done within the past year were included. Patients with known CVD, for example ischaemic heart disease and strokes, were excluded.

Based on a study, which found that 40%–52% of patients correctly estimated their CV risk, we used 50% to calculate the sample size, giving a total of 384 participants.[17] After stratifying by regions, and taking into account a 30% non-responder rate, a sample size of 998 was needed. About 200 patients were recruited from each region.

A face-to-face interviews were conducted using a structured questionnaire to collect patients' data on sociodemography and CV risk factors including age, gender and family history of CVD. Patients were asked to rate their risk of having a heart attack or stroke within the next 10 years as being low, moderate or high. The doctors then filled in patients' data on smoking status in the last 1 month, history of diabetes and hypertension, lipid profile within the last 1 year, antihypertensive, statin and antiplatelet use and estimated patients' CVD risk in the next 10 years as per usual practice namely low (<10%), moderate (10%–20%) and high (>20%). Measurements were also taken for weight, height, waist circumference and blood pressure (BP) using a validated digital BP machine (OMRON HEM-7121). Doctors were also asked to fill up a questionnaire on their sociodemography, years of practice and the methods they used to estimate patients' CV risks, if any.

We used the D'Agostino 2008 Framingham General Cardiovascular Risk Score Score (FRS) as the reference CVD risk.[22] This has been validated for use in Malaysia without requiring adjustment for demographic variables such as ethnicity.[23 24] The 10-year CVD risk is classified into low (<10%), moderate (10%–20%) and high (>20%) risk. In this study, high CVD risk group was defined as FRS >20% and/or presence of diabetes mellitus. Estimations made by the patients and doctors were deemed to be correct when there was agreement with the Framingham score as calculated by the research team; underestimation occurred when estimations were low or moderate in those scored as high risk by the research team.

ANALYSIS

Data were entered and analysed using Statistical Program for Social Sciences (SPSS) V.22.0. Complete-case analysis was used, meaning those with missing values were excluded. Frequencies were reported using percentages and proportions. Associations between categorical data were tested using χ^2 tests, while continuous data were tested using independent t-test and correlation test. Kappa value was calculated to determine the agreement between CV risks estimated by patient and actual risk, and CV risks estimated by doctors and actual risk. Univariate and multivariate binary logistic analyses were used, with underestimation of those at high risk as the outcome of interest. The intracluster correlation coefficient (ICC) was calculated to determine the homogeneity of the clusters. Values of ICC that are close to 0 indicate that the design effect is 1 and that the clusters are homogenous.[25] The correlation estimates and the variant inflation factors (VIF) were used to determine multicollinearity among the explanatory variables.

RESULTS

Out of the 1107 patients approached, seven refused to participate and six did not fulfil the inclusion criteria, giving a total of 1094 patients recruited. The mean age was 57.2 years (SD 9.8) with a range of 35–86 years. There were 62.6% females, 60.8% had diabetes and 76.9% had hypertension (table 1). A total of 57 doctors participated in the study. The mean age of the doctors was 32.3 years (SD 5.5) with a mean duration of work experience of 6.5 years (SD 3.8). Women comprise 63.4% of the doctors.

Using the FRS alone, 508 patients (46.4%) were in the high-risk group. When diabetes was included, the number increased to 776 (70.9%). Of all the consultations, only

Table 1 Sociodemography and profile of the respondents

Demographic data and profile	Frequency (%)
Mean age±SD (years)	57.23±9.81
Mean income±SD (Ringgit Malaysia)	1824.34±2112.09
Mean body mass index±SD (kg/m^2)	28.02±13.17
Gender (female)	685 (62.6)
Ethnicity	
Malay	559 (51.1)
Chinese	234 (21.4)
Indian	161 (14.7)
Indigenous	112 (10.2)
Other	28 (2.6)
Smoker	185 (16.9)
Diabetes	665 (60.8)
Hypertension	840 (76.8)
Family history of stroke	165 (15.1)
Family history of cardiovascular disease	158 (14.4)

34.4% of patients and 55.7% of doctors correctly estimated the patient's CVD risk group.

The ICC values calculated for all the variables were small, ranging from 0.001 to 0.086, indicating that the clusters are homogenous. The highest correlation between the variables is <0.85 (the highest being 0.780), while the highest VIF is <5. Hence, there is no multicollinearity within the variables.

Patients' estimation

Table 2 shows patients' estimation of their CV risks. Among patients in high CV risk group, only 112 (14.4%) correctly estimated their risks. The remaining 664 (85.6%) underestimated their CV risk. The correlation between patients' perceived CV risk and their actual risk was kappa=−0.016. Factors associated with underestimation by patients included not having family history of CVD (adjusted OR (AOR): 2.747, 95% CI 1.566 to 4.818), smaller waist circumference (AOR: 0.980, 95% CI 0.960 to 0.999) and ethnicity in comparison with the Malay as reference group (indigenous/others; AOR: 0.129, 95% CI 0.071 to 0.235) (table 3).

Doctors' estimation

Table 4 shows doctors' estimation of patients' CV risks. Among patients in high CV risk group, doctors correctly estimated 40.2% and underestimated 59.8%. The correlation between doctors' estimation of patient's CV risk versus patient's actual CV risk was kappa=−0.084. Factors associated with underestimation of high CV risk by doctors were patients factors such as being female (AOR: 2.232, 95% CI 1.460 to 3.410), younger age (AOR: 0.908, 95% CI 0.886 to 0.930), non-hypertensive (AOR: 1.731, 95%

Table 2 Accurate estimation of high CV risk by patient, n=1094

Patient's estimation	Actual CV risk	
	High (n (%))	Low/moderate (n (%))
High	112 (14.4)	54 (17.0)
Low/moderate	664 (85.6)	264 (83.0)

CV, cardiovascular.

Table 3 Factors associated with underestimation of high CVD risk by patients

	Significance value	Adjusted OR	95% CI Lower	95% CI Upper
Age	0.550	1.009	0.981	1.037
Gender (female)	0.339	1.290	0.765	2.175
Smoker (non-smoker)	0.167	0.616	0.310	1.224
Income	0.280	1.000	1.000	1.000
Systolic BP	0.482	1.006	0.989	1.023
Diastolic BP	0.194	0.982	0.955	1.009
Waist circumference	**0.043**	0.980	0.960	0.999
Body mass index	0.230	0.981	0.952	1.012
Total cholesterol	0.211	0.770	0.512	1.160
LDL cholesterol	0.154	1.364	0.890	2.090
HDL cholesterol	0.252	1.484	0.755	2.917
Ethnicity				
Malay (reference)		1.0		
Chinese	0.430	1.335	0.651	2.738
Indian	0.533	1.252	0.671	2.539
Indigineous	**0.000**	0.129	0.071	0.235
Hypertension				
Yes (reference)	–	1.0		
No	0.370	1.335	0.709	2.514
Diabetes				
Yes(reference)	–	1.0		
No	0.596	1.230	0.572	2.644
Antiplatelet use				
Yes (reference)	–	1.0		
No	0.523	1.186	0.703	2.000
Statin use				
Yes (reference)	–	1.0		
No	0.739	0.905	0.504	1.626
Family history with stroke				
Yes (reference)	–	1.0		
No	0.198	1.494	0.811	2.753
Family history with CVD				
Yes (reference)	–	1.0		
No	0.001	2.705	1.538	4.757

BP, blood pressure; CVD, cardiovascular disease; HDL, high-density lipoprotein; LDL; low-density lipoprotein.
p-values <0.05 are in bold.

Table 4 Doctor's estimation of patient's CV risk versus patient's actual risk, n=1089

Doctor's estimation	Patient's actual risk	
	High (n (%))	Low/moderate (n (%))
High	310 (40.2)	20 (6.3)
Low/moderate	462 (59.8)	297 (93.7)

CV, cardiovascular.

CI 1.067 to 2.808), non-diabetic (AOR: 1.931, 95% CI 1.114 to 3.348), higher HDL levels (AOR: 3.546, 95% CI 2.025 to 6.209), lower systolic BP (AOR: 0.970, 95% CI 0.957 to 0.982), non-smoker (AOR: 2.246, 95% CI 1.354 to 3.726) and ethnicity in comparison with the Malay as reference group (Indian: AOR: 0.430, 95% CI 0.257 to 0.720; indigenous/others: AOR: 2.498, 95% CI 1.346 to 4.636) (table 5).

Table 6 summarises the methods used by doctors to estimate patients' CV risk. About half used online risk calculators, while a quarter each used risk factor counting or manual calculation. Risk scores used included FRS, QRISK and American College of Cardiology/American Heart Association risk scores.

DISCUSSION

Our findings indicate that both patients and doctors were underestimating the patient's CV risk. Of those at high CV risk, only one in seven patients could identify themselves as being at high risk. More worryingly, only two out of five doctors seeing these high CV risk patients could correctly identify them. This implies that medical decision making during these consultations were poorly informed due to inaccurate CV risk estimation.

How can this occur with the easy availability of online risk calculators and guidelines recommending use of risk estimation? It is likely that risk estimation for CVD is still poorly understood. Many CVD risk scores recommended using baseline levels of risk factors for risk calculation prior to the initiation of medication. For some risk scores such as the Adult Treatment Panel III risk calculator and the Pooled Cohort Risk score, diabetes is automatically taken as high CV risk without the need for calculation. However, new risk calculators such as QRISK and D'Agostino now consider the effect of treatment and incorporate variables such as present use of antihypertensive or lipid-lowering agents into the calculation.[26 27] Differences in the methods used by different risk scores and over time have led to misunderstandings, confusion and uncertainty by users.

A study that explored general practitioners' use of CV risk scores found that doctors had great uncertainty over the use of CVD scores in treated patients.[28] Use of patient's risk factor levels when patient is on treatment would lead to an underestimation of the true CVD risk. Prolonged exposure to previous high levels and the presence of established chronic changes would mean that

Table 5 Factors associated with doctor's underestimation of patients' actual risk

	Significance value	Adjusted OR	95% CI	
			Lower	Upper
Doctors' factors				
Age	0.771	0.988	0.911	1.071
Experience	0.055	1.120	0.998	1.257
Gender				
Male (reference)	_	1.0		
Female	0.096	1.416	0.940	2.131
Patients' factors				
Age	**0.000**	0.908	0.886	0.930
Income	0.052	1.000	1.000	1.000
Waist circumference	0.902	1.001	0.985	1.017
Body mass index	0.530	0.994	0.975	1.013
Systolic BP	**0.000**	0.970	0.957	0.982
Diastolic BP	0.121	1.017	0.996	1.038
Total cholesterol	0.471	0.899	0.672	1.202
HDL Cholesterol	**0.000**	3.546	2.025	6.209
LDL Cholesterol	0.059	0.747	0.552	1.012
Gender				
Male (reference)	_	1.0		
Female	**0.000**	2.232	1.460	3.410
Ethnicity				
Malay (reference)		1.0		
Chinese	**0.727**	0.916	0.560	1.499
Indian	**0.001**	0.430	0.257	0.720
Indigenous/others	**0.004**	2.498	1.346	4.636
Smoker				
Yes (reference)	_	1.0		
No	**0.002**	2.246	1.354	3.726
Hypertension				
Yes (reference)	_	1.0		
No	**0.026**	1.731	1.067	2.808
Diabetes				
Yes (reference)	_	1.0		
No	**0.019**	1.931	1.114	3.348
Family history with CVD				
Yes (reference)	–	1.0		
No	0.513	0.841	0.500	1.414
Family history with stroke				
Yes (reference)	–	1.0		
No	0.740	1.091	0.652	1.825
Antiplatelet use				
Yes (reference)	–	1.0		
No	0.385	1.192	0.802	1.772
Statin use				
Yes	–	1.0		
No	0.696	0.913	0.580	1.439

BP, blood pressure; CVD, cardiovascular disease; HDL, high-density lipoprotein; LDL, low-density lipoprotein.
p-values <0.05 are in bold.

Table 6 Methods used by the doctors to estimate CV risk

Methods of CV calculation	n	%
Risk factor counting	244	22.3
Paper/chart based	250	22.9
Online risk calculator	544	50.1
None	51	4.7

CV, cardiovascular.

maximal reduction may take longer than 5 years and may never reach the level of a treatment-naïve patient. However, doctors find it difficult to obtain pretreatment levels, and overestimation would occur if the patient's risk factor had been controlled over a long period of time.

Shared medical decision-making through proper risk communication ensures patients and doctors are able to weigh the risk and benefits of treatment options. The underestimation of risk as seen in this study population is likely to have significant impact on their management. Overoptimism has also been noted in other studies which described the tendency for people to be unrealistically optimistic about future life events.[29] The research showed that subjects tended to be optimistic of their chances for negative events when the event is perceived to be controllable. This appears to mirror our finding where patients and doctors perceived the risk for CVD as being low because of the availability of treatment and behavioural lifestyle modification steps that can be taken. The mainstay of treatment of risk factors is to prevent progression of disease. Yet, patients and doctors must understand that residual risk remains and that treatment should be continued for most despite normalisation of risk factor levels. This understanding is potentially jeopardised by optimism bias as adherence to medication and preventive behaviour have been shown to be associated with higher risk perception.[30–32]

The findings also suggest that patients and doctors estimated risk by risk factor profile or risk factor counting as opposed to absolute risk calculation. It appears that there is good awareness of some of the risk factors for CVD as risk perception was found to be associated with these factors namely age, gender, comorbidities and smoking. However, focusing on individual risk factors or risk factor counting tends to underestimate risk in those who may have slightly elevated levels of multiple risk factors that synergistically increased the overall absolute CV risk.[33] This is why most CVD guidelines advocate the use of risk calculators to estimate individual risk.[5 6 34 35] Patients appeared to be more aware of family history and having a higher waist circumference as conferring risk compared with other risk factors. Family history and obesity have been shown to be associated with increased self-perception of risk.[12] It is useful to identify factors that have greater meaning to patients. Otherwise, a mismatch between doctors' and patients' perception on the importance of particular risk factors can affect the communication of risk. The very low correlation between provider and patient estimates that we found in this study indicates that this mismatch is occurring.

Ethnicity also was found to be significantly associated with underestimation of risk. The AOR for underestimation of risk by doctors for patients of Indian ethnicity was 0.430, 95% CI 0.257 to 0.720 compared with the reference group (Malay patients). This indicates that in comparison with the Malay patients, underestimation of risk by doctors was less in patients of Indian ethnicity. It is possible that this is linked to training that those of South Asian ethnicity are at higher CVD risk.[36] This finding can be used to target those at greater risk of inaccurate estimations for intervention.

Strengths and limitations of the study

This is a cross-sectional study that examined the risk perceptions of individual patients by both the patients and the doctors seeing these patients. The study design allowed us to capture the perceptions and practice occurring in actual consultations in primary care settings where decisions on institution of management for CVD prevention and treatment are made. This study took place in nine different clinics and covered over a thousand patient consultations.

It is possible that the doctors involved in this study may have been prompted to assess patients' CV risk due to awareness of the research being undertaken as informed consent was obtained from all participants. However, we believe that this would only have prompted them to look up CV assessment. If knowledge of this study had introduced bias to the results, it would be likely that the direction of the bias would be towards more accurate estimation of risk. Hence, the rate of inaccurate risk estimation may actually be greater than was found.

This study used the validated FRS as the reference standard. Therefore, accuracy of estimations was based on agreement with the reference score and not to actual CV outcomes, which would require a cohort study design. We included patients aged 75 years and above, although the FRS is recommended for those aged 30–74 years of age. This decision was taken as it reflects the actual patient population that is seen in primary care. However, we understand that the risk score is less accurate when used outside the recommended age ranges.

Recommendations

In view of these findings, future studies should look at developing interventional strategies to implement formal CVD risk calculation into consultation and testing the strategies in actual consultations. Examples are system processes that incorporate risk calculators into electronic medical records or simple displays of risk charts on clinic desks.[32] Accurate risk estimations should then be conveyed to patients to allow them to be fully informed when making decisions regarding their management in clinical practice.

CONCLUSION

The majority of consultations occurring between doctors and patients are being informed by inaccurate CV risk estimation. Inaccuracy is mainly due to underestimation of patients' CVD risks. Interventions are required to improve CVD risk estimation in order to inform shared decision making in primary care consultations.

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Competing interests None declared.

Patient consent Obtained.

Ethics approval This study was registered in the National Medical Research Registry, Malaysia. (NMRR-13-962-17898) and approved by the Malaysian Research Ethics Committee. Potential participants were given verbal and written information regarding the study, and informed consent was obtained from those who were recruited.

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