Utility of Framingham general cardiovascular disease risk score for predicting 10-year cardiovascular risk in an inner Mongolian population: A prospective cohort study

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The use of risk assessment tools to predict cardiovascular disease has been recommended to help health care professionals identify "at-risk" individuals who could benefit from therapeutic interventions and identify those who may not receive treatment on the basis of any risk factor [1], ensuring the interventions are more cost-effective. The Framingham general CVD risk score (FGCRS) is a useful tool to predict the risk for global CVD [2]. However, most Framingham participants are of European descent. The usage of the FGCRS cannot be generalized to other non-European populations without first having its appropriateness evaluated. The utility of the FGCRS in predicting risk of CVD among Mongolians, whose genetic and environmental background is significantly different from those of European descent, [3] is unknown. This study aimed to assess whether baseline FGCRS could delineate the risk of CVD in a cohort of Mongolian population.

This prospective cohort study was conducted from June 2002 to July 2012 in Inner Mongolia, China. A total of 2589 individuals were included in this study. At baseline examination, participants underwent a physical examination, anthropometry, blood pressure determination, and phlebotomy for vascular risk factors. The global CVD risk score over a 10-year period was calculated using the FGCRS equation [2]. Up to 2012, 2583 individuals (99.8%) were successfully contacted and provided comprehensive health information. The present analysis was based on the baseline and follow-up examinations. All participants provided written informed consent. Additional details on the methods of study participant recruitment and baseline data collection have been detailed elsewhere [4]. This study was approved by Soochow University Ethics Committee.

CVD events were defined as a composite of coronary heart disease and stroke. Participants who did not have a CVD, who died from other causes or who were lost to follow-up were defined as censored. Trained staff interviewed either the participants or their relatives every two years to find new CVD cases. When a new case was found during follow-up, the staff reviewed the hospital records and completed a standard event form. A cardiovascular end point review committee adjudicated CVD events by evaluating all pertinent medical records.

After 23,292 person-years of follow-up, we observed 200 CVD events. Fig. 1 demonstrated the predicted and observed risk of CVD according to deciles of the baseline FGCRS. In each decile, the average predicted risk of CVD fell within the 95% confidence interval of the observed CVD risk. The modified Hosmer–Lemeshow "goodness-of-fit" test [5] showed that the FGCRS fitted Mongolians well ($X^2 = 9.22$, $P = 0.324$). In addition to the reasonably close agreement mentioned previously, this test further proved that the FGCRS had a good calibration in Mongolians. Also, the FGCRS had a good discrimination with a high C statistic [6] of 0.81 (95% CI: 0.78–0.84). These results indicated that the FGCRS had a good performance in predicting 10-year risk of CVD in Mongolians.

As shown in Table 1, attributable risk proportions of CVD for participants in the 5–9.9, 10–19.9, and ≥20 percent risk categories were 61.39%, 79.04% and 83.66% compared to the 0–4.9 percent risk category, respectively. These data indicated that at least 61% of individuals with an increased CVD risk would benefit from the FGCRS. In addition, decision-curve analysis [7] showed that the net benefit for the cut-off of 20% was 0.010. More specifically, 1 person per every 100 Mongolians who significantly need treatment to prevent a CVD event would be found by using the FGCRS.

The lifetime risk for CVD was substantial [8], and the condition was often silent or might strike without warning, underscoring the importance of prevention. Investigators have identified key risk factors and demonstrated the clustering and conjoint influences of multiple risk factors in mediating CVD risk. The estimation of global CVD risk can facilitate the matching of risk scores with the necessary amount of treatment, thereby rendering treatment most cost-effective [9]. The FGCRS is used to target preventive treatments to individuals at the highest risk to facilitate cost-effectiveness. Our investigation represents a crucial step in validating the simple office-based FGCRS in Mongolians, which has not been tested beyond the cohort from whom the scoring method was developed. Our results showed that the FGCRS could accurately predict the 10-year risk for CVD in Mongolians. This further justifies using the FGCRS in primary care practice to identify individuals at increased risk of developing CVD.
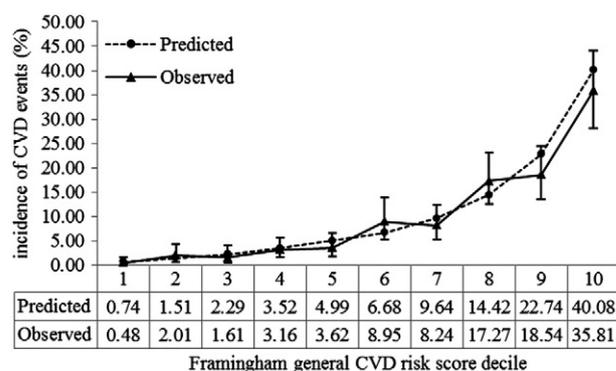
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	1	2	3	4	5	6	7	8	9	10
Predicted	0.74	1.51	2.29	3.52	4.99	6.68	9.64	14.42	22.74	40.08
Observed	0.48	2.01	1.61	3.16	3.62	8.95	8.24	17.27	18.54	35.81

Fig. 1. Predicted and observed incidence of CVD events by deciles of the Framingham general CVD risk score.

Table 1
Hazard ratios of CVD event among inner Mongolians by CVD risk category.

CVD risk category	CVD events/n	Un-adjusted		Adjusted	
		HR (95% CI)	AR%	HR (95% CI)	AR%
Risk < 5%	25/1422	1.00 (reference)		1.00 (reference)	
5% ≤ risk < 10%	35/494	4.26 (2.55–7.12)	76.53	2.59 (1.47–4.56)	61.39
10% ≤ risk < 20%	58/362	10.48 (6.56–16.75)	90.46	4.77 (2.64–8.61)	79.04
Risk ≥ 20%	82/311	19.17 (12.24–30.01)	94.78	6.12 (3.13–12.01)	83.66
P for trend		<0.001		<0.001	

Adjusted variables included age, alcohol consumption, family history of CVD, hypertension, and BMI. AR% was calculated as the proportion of additional risk of CVD compared with group of risk <5%.

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