Cardiovascular Risk Assessment

Province-specific recalibration of CVD risk models using population-specific routine data for Chinese people is important

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Background: Cardiovascular diseases (CVD) are the leading causes of death in China. Since population CVD incidence and risk factor levels vary considerably across regions in China, geo-specific investment in the prevention of CVD could be advantageous. Risk prediction models are an integral part of CVD prevention guidelines and can be used to help guide intervention. However, there is no CVD model generalizable to the various incidence rates, risk-factor levels and composition of CVD in different regions of China.

Purpose: To construct a CVD risk estimation system, which is calibrated to CVD risk in different regions in China, and can be regularly updated in the future using routinely available aggregate level CVD incidence and risk factor data, in response to changing trends with time and divergent CVD rates.

Methods: The risk prediction model used was the WHO CVD score, initially calibrated to predict CVD mortality in the whole of mainland China. Further province-specific recalibration was then completed to give models tailored to the 31 provinces. The recalibration approach used aggregate level province, sex- and age group-specific levels of risk factors and CVD mortality. Risk factor values were estimated using 145 268 participants aged 40-80 years old from the China Chronic Disease and Risk Factors Surveillance, a nationally and provincially representative cross-sectional survey in 2015. Province-specific CVD mortality rates in 2017 were estimated based on published scientific reports, unpublished registry data, and health system administrative data.

Results: Compared with the province-specific models, the China-specific WHO score overestimated mortality risk in some provinces while underestimating risk in others. For example, while the predicted population risk of 10-year CVD mortality was 3.5% in male in both Shanghai and Hebei using the China-specific score (with province-specific observed risk factor values), the province-specific scores gave predicted population risks of 1.1% for Shanghai and 5.5% for Hebei. Accordingly, using the province-specific scores for an individual with the same combination of risk factors, the 10-year risk of CVD mortality differed substantially across provinces. For example, the estimated 10-year risk for a 60 year old, male smoker without diabetes and systolic blood pressure of 140 mmHg and total cholesterol 5 mmol/L ranged from 2.4% in Shanghai to 13.2% in Tibet. Similarly, the estimated 10-year risk for a female with the same risk factor profile ranged from 1.5% in Shanghai to 11.5% in Tibet.

Conclusion: We have developed a CVD risk estimation system, which is calibrated to CVD risk in different provinces of China, and can be regularly recalibrated in the future using routinely available information. Application of this approach should help accurately estimate CVD risk in individuals from China, and assist policy makers in making more appropriate decisions about allocation of preventative resources.

Abstract Figure. Predicted 10 year CVD mortality risk