Prediction of cardiovascular disease worldwide

Cardiovascular disease is the leading cause of death worldwide.1 Many national and international guidelines endorse the use of risk prediction models to guide individualised decision-making for lifestyle recommendations and medical treatments as part of primary and even secondary prevention. Well known examples are the Pooled Cohort Equations (PCE) of the American Heart Association, the SCORE model in various European countries, and QRisk in the UK. Risk scores to predict cardiovascular disease risk are abundant, as shown by a comprehensive review of the literature done in 2009, which identified more than 100 cardiovascular disease risk models.2 Although such a review has not been repeated since, based on the general increase in literature about risk models, this number is likely to have doubled over the past 6 years. The findings of the comprehensive review3 and others showed that most cardiovascular disease prediction models are never validated for predictive accuracy in individuals outside the population they were developed for.4 Moreover, most cardiovascular disease prediction models are developed from single-country cohort or registry studies, which are, generally, from North American or European countries. However, cardiovascular disease burden is also rapidly increasing in low-income and middle-income countries, including those in in Asia, Africa, and Latin America.1 Therefore, now is the time for either cardiovascular disease prediction models to be developed from and validated in datasets from these countries, or for existing cardiovascular disease prediction models to be tailored or recalibrated to these populations.

Such development, validation and recalibration is done comprehensively by Kaveh Hajifathalian and colleagues in The Lancet Diabetes & Endocrinology.4 At first glance, the investigators seem to have developed and validated yet another cardiovascular disease risk score—called Globorisk—using only eight North American cohort studies that include slightly more than 50,000 participants. QRisk, by contrast, was developed from data for more than 1 million participants. However, Hajifathalian and colleagues clearly aimed to rigorously develop and externally validate a novel prediction model that can easily be tailored to other countries around the world if some basic country-specific data are available (data for overall cardiovascular disease risk and population averages of the predictors used in the model). Nowadays, such data is available from many nationwide registries. The investigators demonstrate how to do this for 11 countries from different continents, including Africa, Asia, and Latin America. In addition to using rigorous methods for model development and validation, which were done according to the most recent guidelines in prediction research,5,6 the investigators also report their results in a way that is compliant with the recently launched TRIPOD statement for transparent reporting of prediction modelling research.7,8

Further aspects of the study4 are also worthy of consideration. The authors tailored their model to various countries based on individual participant data from recent national surveys. They developed country-specific 10 year cardiovascular disease burden (shown in their figure 4). How these predictions would compare with those of other well-known recalibrated cardiovascular disease prediction models such as SCORE, QRisk, and PCE would be interesting to know. The Globorisk model was developed such that country-specific recalibration was feasible with few data. However, if individual participant-level data from the target setting are available, existing models can often be similarly recalibrated, which would allow for head-to-head comparisons between models per country. Such direct comparisons will further help health-care professionals and policy-makers in these countries to decide which model to promote,9 which puts the findings of Hajifathalian and colleagues in an even broader perspective.

Recalibration of prediction models to other settings can be done by adjustment at three levels: the baseline cardiovascular disease risk, the average predictor values, and the predictor-outcome associations. Hajifathalian and colleagues recalibrated with respect to the first two and argued that major cardiovascular disease predictor-outcome associations are similar in Northern American, European, and Asian populations, although they recognise that more data are needed from Africa and Latin America. If individual participant
data were available for these countries, recalibration of the predictor-outcome associations would be possible, which might yield more precise country-specific risk charts and cardiovascular disease burden estimates. This recalibration would, in turn, allow for enhanced individualised prediction by the Globorisk model and thus improved guidance for administration of preventive CVD strategies.2

The country-specific predictions for estimated 10 year cardiovascular disease burden are striking, particularly the large proportion of high-risk individuals in China, Mexico, Czech Republic, and Iran. A next step would be to quantify the positive effects on a population level if the Globorisk model and subsequent risk-based preventative management were used in these countries. By use of so-called population-level linked-evidence models,10 estimates of country-specific 10 year cardiovascular disease-risk groups can be combined with known effect sizes from randomised trials of various treatments (eg, lipid-lowering and blood-pressure-lowering drugs), supplemented with treatment adherence figures, to quantify the expected decrease in cardiovascular disease burden per country within 10 years. These predictions might further help, and indeed convince, decision-makers across the world to decide on wide-scale introduction of risk-based management for cardiovascular disease.

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