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External validation of North American and European lung cancer risk prediction models in an Iranian population

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Introduction: Some lung cancer screening guidelines recommend using individualized risk models to refer ever-smokers for screening. However, different models select different screening populations. The leading risk models were developed and validated in Western populations, and almost exclusively in non-Hispanic whites. Hence, there is an almost complete lack of evidence to support the deployment of existing risk models in settings beyond individuals of white race in North America and Europe. Our objective was to assess the performance of North American and European lung cancer risk models in an Iranian population. Models included the Prostate Lung Colorectal Ovarian model 2012 (PLCOm2012), Liverpool Lung Project model (LLP), Bach model, Lung Cancer Risk Assessment Tool (LCRAT), and Lung Cancer Death Risk Assessment Tool (LCDRAT). We also evaluated the additive information from novel risk factors (such as hookah and opium use) to the models.

Methods: We analysed current and former smokers from the Golestan Cohort Study (N=8662).
Calibration and discrimination were quantified respectively by the ratio of expected to observed cases (E/O) and the area under the ROC curve. Hazard ratios were estimated to quantify the association between risk factors and lung cancer in the Iranian population. A Cox regression model more appropriate for the Iranian population model was developed and internally validated with 5-fold cross validation.

Results: All models were overcalibrated (E/O>1). The best calibrated model was the Bach model (E/O=1.7 95%CI [1.3;2.2]).
Some effects of smoking were attenuated in the Iranian population compared with the Western models (e.g. smoking status comparing current with former smokers had a smaller effect in the Golestan version of the model with estimate of 0.08 vs 0.26 in the original model). A new model including age, body mass index, smoking intensity, smoking duration, history of chronic obstructive pulmonary diseases and opium use was developed. It performed well in the dataset with a cross-validated E/O of 1.27 95% CI [0.97; 1.64].

Conclusion: This study showed the limits in transportability of risk prediction models and the need to tailor them to each demographic. Incorporating novel risk factors relating to opium into the risk equation yielded a satisfactory predictive ability and calibration, ensuring accuracy of estimated risk scores.

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