

Risk prediction models of breast cancer: a systematic review of model performances

Thunyarat Anothaisintawee, Yot Teerawattananon, Chollathip Wiratkapun, Viji Kasamesup, Ammarin Thakkinstian

Abstract

Background: The number of risk prediction models has been increasingly developed, for estimating about breast cancer in individual women. However, those model performances are questionable. We therefore have conducted a study with the aim to systematically review previous risk prediction models. The results from this review help to identify the most reliable model and indicate the strengths and weaknesses of each model for guiding future model development.

Method: We searched MEDLINE (PubMed) from 1949 and EMBASE (Ovid) from 1974 until October 2010. Observational studies which constructed models using regression methods were selected. Information about model development and performance were extracted.

Results: Twenty-five out of 453 studies were eligible. Of these, 18 developed prediction models and 7 validated existing prediction models. Up to 13 variables were included in the models and sample sizes for each study ranged from 550 to 2,404,636. Internal validation was performed in four models, while five models had external validation. Gail and Rosner and Colditz models were the significant models which were subsequently modified by other scholars. Calibration performances of most models was fair to good (expected/observe ratio: 0.87–1.12), but discriminatory accuracy was poor to fair both in internal validation (concordance statistics: 0.53–0.66) and in external validation (concordance statistics: 0.56–0.63).

Conclusion: Most models yielded relatively poor discrimination in both internal and external validation. This poor discriminatory accuracy of existing models might be because of a lack of knowledge about risk factors, heterogeneous subtypes of breast cancer, and different distributions of risk factors across populations. In addition the concordance statistic itself is insensitive to measure the improvement of discrimination. Therefore, the new method such as net reclassification index should be considered to evaluate the improvement of the performance of a newly developed model.

Keywords: breast cancer, risk prediction model, systematic review

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