A Score to Predict Cardiovascular Disease (CVD) Risk After Early Stage Breast Cancer (ESBC)

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Background: There are no validated models for to predict general CVD risk after ESBC.

Methods: We used the Ontario Cancer registry to identify women diagnosed with ESBC between January 1, 2000 and December 31, 2011. Their data were linked across administrative databases. 2/3 of the cohort were randomly selected for risk score derivation; the remainder were reserved for its validation. We designed a composite outcome analogous to the Framingham general CVD risk score (hospitalization for acute myocardial infarction, unstable angina, transient ischemic attack, stroke, intermittent claudication, congestive heart failure, or death from circulatory disease). Non-CVD death was treated as a competing risk. Candidate variables were age, hypertension, diabetes, ischemic heart disease, atrial fibrillation, congestive heart failure, left-sided cancer, cerebrovascular disease, peripheral vascular disease, chronic obstructive pulmonary disease, chronic kidney disease, and prior malignancy.

Patients were followed to December 31, 2013. We used subdistribution hazard regression to model the association between candidate variables and CVD incidence in the derivation cohort. Statistically significant variables were selected for the final model. Their regression coefficients were multiplied by 10 and rounded to the nearest integer to develop the risk score. Model calibration was assessed by comparing predicted and observed CVD incidence in the validation cohort. Discrimination was assessed in the validation cohort using Wolber’s concordance index (c-index) for prognostic models with competing risks.

Results: The risk score was derived in 56,582 women, and validated in 27,961 women. The median age was 60 (IQR 50-71) years. Left-sided cancer and prior malignancy were not significantly associated with CVD incidence. The remaining variables were used to develop the risk score (Figs 1-2). Model calibration was good (Figs 3-4). The c-index was 81.3% (95% CI 80.3 - 82.3%) at 5 years and 79.0% (78.0 - 79.9%) at 10 years.

Conclusion: A risk score derived using routinely available data can predict long-term CVD risk after ESBC. This can aid decisions about cardiotoxic therapy, Cardio-Oncology referrals, and preventative therapy.
Figure 1: Score for predicting CVD risk among women with early stage breast cancer

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<td>≥80 years</td>
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Figure 2: Predicted risk of CVD at 5 and 10 years for each value of the risk score
Figure 3: Cumulative incidence of CVD (left) and death without CVD (right) among patients in the validation cohort divided by decile of total score

Figure 4: Observed and predicted CVD incidence at 5 years (left) and 10 years (right) in the validation cohort