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NEWS

Deep Learning Model Translates Imaging Biomarkers to Predict Future DCIS vs Invasive Breast Cancer Risk Across Races

PURPOSE

A deep learning (DL) algorithm was previously designed to predict a patient's risk of developing breast cancer at multiple time points using mammographic image biomarkers alone. The purpose of this study was to compare the predictive accuracy of DL image-only model to predict future DCIS vs invasive breast cancer across races.

METHODS AND MATERIALS

This retrospective, multisite study included consecutive patients 30 years undergoing routine bilateral screening mammography from 01/10/2009 to 01/10/2018 at five facilities with at least five years of follow-up. A DL 5-year model was used to assess risk. Women with a personal history of breast cancer were excluded. No mammograms included were used for model development. Patient demographics were retrieved from electronic medical records. Cancer outcomes were obtained through linkage to a regional tumor registry. DL model performance was compared using areas under the receiver operating characteristic curve (AUCs) with DeLong test ($p<0.05$).

RESULTS

83871 bilateral screening mammograms in 48984 patients met inclusion criteria. Mean patient age was 59y (IQR: 51-68y). 17013/83871 (20.3%) had a family history of breast cancer. 65660/83871 (78.3%) were in post-menopausal and 18211/83871 (21.7%) in pre-menopausal patients. 49686/83697 (59.4%) had non-dense and 34011/83697 (40.6%) had dense breasts. 68621/83871 (81.8%) of patients were White, 4376/83871 (5.2%) Asian, 4140/83871 (4.9%) Black and 5426/83871 (6.5%) were other races. The AUC of DL model in predicting DCIS was 0.71 (95% confidence interval [CI]: 0.65, 0.77) and invasive malignancy was 0.70 (95% CI: 0.67, 0.74) across all patients. The AUC in predicting DCIS was significantly higher in Black vs White patients (0.92, 95% CI: 0.87, 0.97 vs 0.70, 95% CI: 0.64, 0.77, respectively, $p<0.001$). There was no evidence of a significant difference in predicting DCIS in Asian vs White patients (0.66, 95% CI: 0.32, 1.00 vs 0.70, 95% CI: 0.64, 0.77, respectively, $p=0.798$). There was no evidence of a significant difference in predicting invasive disease in Black vs White (0.73, 95% CI: 0.63, 0.83 vs 0.71, 95% CI: 0.67, 0.74, respectively, $p=0.592$) or Asian vs White (0.68, 95% CI: 0.54, 0.83 vs 0.71, 95% CI: 0.67, 0.74, respectively, $p=0.988$) patients.

CONCLUSIONS

Mammograms contain highly predictive biomarkers of future cancer risk. A DL model using screening mammography alone can accurately discriminate patients at risk of developing DCIS and invasive disease across races.

CLINICAL RELEVANCE/APPLICATIONS

A DL image-only risk model can provide increased access to an equitable accurate risk assessment tool for both DCIS and invasive malignancy prediction across races.