CISNET Breast Model Characteristics: Key Differences and Similarities **Date: 2025/03/26**

Model Components	D (Dana-Farber)[1]	E (Erasmus)[2]	GE (Georgetown-Einstein)[3]	M (MD Anderson)[4]	S (Stanford)[5]	W (Wisconsin-Harvard)[6]
Type of model	Analytic	Simulation	Simulation	Bayesian	Simulation	Simulation
Modeling methods	Stochastic process, Time to event	Longitudinal, Likelihood optimization, Stochastic process, Time to event	Time to event	Longitudinal, Likelihood optimization, Stochastic process, Time to event	Longitudinal, Likelihood optimization, Stochastic process, Time to event	Longitudinal, Stochastic process, State transition
Natural history structure	State transition	Tumor growth leading to fatal metastasis	State transition	None	Tumor growth with stage shift	Tumor growth with some indolent and aggressive cases
Includes DCIS	Yes	Yes	Yes	Yes	No	Yes
ER/HER2 subtype distribution	Assigned based on BCSC data	Assigned based on BCSC data	Assigned based on BCSC data	Assigned based on BCSC data	Calibrated to BCSC data, then adjusted based on SEER data by stage, tumor size, and calendar year	Assigned based on BCSC data
Breast cancer incidence without screening	Gangnon 2021 APC Model[7]; used as-is	Age distribution of onset and cohort-specific probabilities estimated based on Holford APC,[8] adjusted based on Gangnon 2021 APC Model[7]; used as a calibration target	Holford APC[8] 1975-2000 adjusted by Gangnon 2021 APC[7] after 2000	Extended 1975 SEER rates; used as a linear model over years with an unknown slope parameter estimated by matching with SEER data	Jointly estimated APC model with postmenopausal hormone therapy effects based on Holford APC Model[8]	Holford APC[8] 1975-2000 adjusted by Gangnon 2021 APC[7] after 2000; APC used as a starting point of calibration to incidence
Breast density	Affects incidence in the absence of screening and mammography performance[a]	Affects incidence in the absence of screening and mammography performance[a]	Affects incidence in the absence of screening and mammography performance[a]	Affects incidence (both in presence and absence of screening) and mammography performance (specificity)	Not modeled	Affects incidence in the absence of screening and mammography performance[a]

Screening benefit mechanism[a]	Stage shift using stage distribution at diagnosis provided by BCSC	Detection at non-fatal (smaller) sizes based on screening sensitivity provided by the BCSC, which is a calibration target	Detection at earlier stages and at younger ages based on screening sensitivity provided by the BCSC, which is a calibration target	Stage shift and beyond stage shift, defined as better survival for screen-detected cases than clinically detected cases of the same stage	Smaller size, stage shift, age shift based on varying a parameter that quantifies the probability that screening will detect a tumor of a given size that matches BCSC sensitivity data	Stage and tumor size shift based on screening sensitivity provided by the BCSC, which is a calibration target
Stage distribution among diagnosed cancers	Assigned based on BCSC data for stage by mode of detection	Stage distribution results from: diameter of clinical detection estimated based on SEER data; threshold diameter of screen detection based on BCSC data; and tumor diameter distribution of invasive tumors linked to AJCC stages	Clinically detected tumors assigned a stage based on BCSC data. Stage of screen-detected tumors determined by Bayes' theorem with BCSC data as prior distribution, likelihood based on stage dwell time distributions, and achieved lead time	Assigned based on BCSC data	Based on tumor growth parameters and diameter of screen detection that are calibrated to BCSC data, diameter of clinical detection based on SEER data	Stage calibrated to SEER incidence with BCSC data as secondary calibration targets for screen-detected cancers
Treatment benefit mechanism	Hazard reduction	Cure fraction	Hazard reduction; ability to cure	Hazard reduction, cure fraction	Hazard reduction	Cure fraction[b]
Program	Mathcad	Python	C+	C#, R, SAS	Python	C+

Abbreviations: APC = age-period-cohort model; BCSC = Breast Cancer Surveillance Consortium; SEER = Surveillance, Epidemiology, and End Results.
[a] Screening performance includes sensitivity; stage distribution among screen-, interval-, and clinically-detected cases; false-positive recall (specificity); and benign biopsy rates.
[b] Calibrated to mortality for a subset of treatment related parameters after natural history parameters are calibrated to incidence.
Model Profiles are available at: https://cisnet.cancer.gov/breast/#profiles-registry.

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