Breast Cancer Screening[1]

Disclaimer: *This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care. This algorithm should not be used to treat pregnant women.*

Note: This algorithm is not intended for women with a personal history of breast cancer[2]. Breast cancer screening may continue as long as a woman has a 10-year life expectancy and no co-morbidities that would limit the diagnostic evaluation or treatment of any identified problem. Women should be counseled about the benefits, risks and limitations of screening mammography.

RISK	AGE TO BEGIN SCREENING	SCREENING
Average risk[3]	Age 25 - 39 years	• Consider clinical breast exam every 1-3 years[4] • Breast awareness[5]
	Age greater than or equal to 40 years	• Annual clinical breast exam • Annual screening mammogram[6] ○ Consider tomosynthesis[7] • Breast awareness[5]
Increased risk Prior thoracic radiation therapy at ages 10-30 years	Age less than or equal to 24 years	• Annual clinical breast exam (begin 8-10 years after radiation therapy) • Breast awareness[5]
	Age greater than or equal to 25 years	• Clinical breast exam every 6-12 months (begin 8-10 years after radiation therapy) • Annual screening mammogram[6] (begin 8-10 years after radiation therapy but not prior to age 25 years) ○ Consider tomosynthesis[7] • Recommend annual MRI[8,9] (begin 8-10 years after radiation therapy but not prior to age 25 years) • Breast awareness[5]
5-year risk of invasive breast cancer by Gail model calculation greater than or equal to 1.7% in women greater than 35 years old		• Clinical breast exam every 6-12 months (begin at age identified as being at increased risk) • Annual screening mammogram[6] (begin at age identified as being at increased risk) ○ Consider tomosynthesis[7] • Consider risk reduction strategies (see Breast Cancer Risk Reduction Therapy algorithm) • Breast awareness[5]
• Women who have a lifetime risk greater than or equal to 20% as defined by models that are dependent on family history[10] • Genetic predisposition (see Appendix A) • Lobular Carcinoma In Situ (LCIS) • Atypical Ductal Hyperplasia (ADH)/Atypical Lobular Hyperplasia (ALH)		

See Page 2

[1] For transgender patients, recommend performing a breast cancer risk assessment and making individualized screening recommendations
[2] See the Breast Cancer Treatment or Survivorship algorithms for the management of women with a personal history of breast cancer
[3] Women who do not meet one of the increased risk categories
[4] Effectiveness of clinical breast exams has not been assessed in women 20-39 years of age
[5] Women should be familiar with their breasts and promptly report changes to their healthcare provider
[6] Augmented breasts need additional views for complete assessment
[7] Tomosynthesis improves cancer detection and decreases recall rates
[8] Risk of breast cancer begins to increase 8-10 years after thoracic exposure. The optimal age to begin MRI screening in this high risk population is not currently known.
[9] Current practice at MD Anderson is to alternate the mammogram and breast MRI every 6 months. While there is no data to suggest that this is the optimal approach, it is done with the expectation that interval cancers may be identified earlier. Other screening regimens, such as breast MRI performed at the time of the annual mammogram, are also acceptable.
[10] Risk models that are largely dependent on family history include Tyrer-Cuzick and Claus

Department of Clinical Effectiveness V7
Approved by The Executive Committee of Medical Staff on 01/29/2019

Breast Cancer Screening

Note: This algorithm is not intended for women with a personal history of breast cancer[2]. Breast cancer screening may continue as long as a woman has a 10-year life expectancy and no co-morbidities that would limit the diagnostic evaluation or treatment of any identified problem. Women should be counseled about the benefits, risks and limitations of screening mammography.

RISK	AGE TO BEGIN SCREENING	SCREENING
A		
Women who have a lifetime risk greater than or equal to 20% as defined by models that are dependent on family history[2]		• Clinical breast exam every 6-12 months (begin at age identified as being at increased risk; refer to genetic counselor, if not already done) • Annual screening mammogram[3] (begin 10 years before youngest case in the family but not prior to age 30 years) ◦ Consider tomosynthesis[4] • Recommend MRI[5] (begin 10 years before youngest family member but not prior to age 25 years) • Consider risk reduction strategies (see Breast Cancer Risk Reduction Therapy algorithm) • Breast awareness[6]
Increased risk — BRCA 1 or BRCA 2 genetic predisposition (for other predispositions see Appendix A)	Age less than or equal to 24 years	• Annual clinical breast exam • Breast awareness[6]
	Age greater than or equal to 25 years	• Clinical breast exam every 6-12 months (begin at the age identified as being at increased risk) • Annual screening mammogram[3] (begin 10 years before youngest case in the family but not prior to age 30 years) ◦ Consider tomosynthesis[4] • Recommend annual MRI[5] (begin 10 years before youngest case in the family but not prior to age 25 years) • Consider risk reduction strategies (see Breast Cancer Risk Reduction Therapy algorithm) • Breast awareness[6]
Women who have a lifetime risk greater than or equal to 20% based on: • LCIS • ADH/ALH		• Clinical breast exam every 6-12 months (begin at diagnosis of LCIS or ADH/ALH) • Annual screening mammogram[3] (begin at diagnosis of LCIS or ADH/ALH but not prior to age 30 years) ◦ Consider tomosynthesis[4] • Consider annual MRI[5,7] based on emerging data (begin at diagnosis of LCIS or ADH/ALH but not prior to age 25 years) • Begin risk reduction strategies (see Breast Cancer Risk Reduction Therapy algorithm) (begin at diagnosis of LCIS or ADH/ALH but not prior to age 35 years) • Breast awareness[6]

[1] See the Breast Cancer Treatment or Survivorship algorithms for the management of women with a personal history of breast cancer
[2] Risk models that are largely dependent on family history include Tyrer-Cuzick and Claus
[3] Augmented breasts need additional views for complete assessment
[4] Tomosynthesis improves cancer detection and decreases recall rates
[5] Current practice at MD Anderson is to alternate the mammogram and breast MRI every 6 months. While there is no data to suggest that this is the optimal approach, it is done with the expectation that interval cancers may be identified earlier. Other screening regimens, such as breast MRI performed at the time of the annual mammogram, are also acceptable.
[6] Women should be familiar with their breasts and promptly report changes to their healthcare provider
[7] Patient should be educated that insurance may not cover the MRI

Department of Clinical Effectiveness V7
Approved by The Executive Committee of Medical Staff on 01/29/2019

APPENDIX A: Breast Management based on Genetic Test Results[1,2]

ATM	Increased risk of breast cancer • Screening: annual mammogram with consideration of tomosynthesis and consider breast MRI with contrast starting at age 40 years[3,4] • RRM: evidence insufficient, manage based on family history
BARD1	Potential increase in breast cancer risk, with insufficient evidence for management recommendations
BRIP1	Unknown or insufficient evidence
CDH1	Increased risk of lobular breast cancer • Screening: annual mammogram with consideration of tomosynthesis and consider breast MRI with contrast starting at age 30 years[3,4] • RRM: evidence insufficient, manage based on family history
CHEK2	Increased risk of breast cancer • Screening: annual mammogram with consideration of tomosynthesis and consider breast MRI with contrast starting at age 40 years[3,4] • RRM: evidence insufficient, manage based on family history
MSH2, MLH1, MSH6, PMS2, EPCAM	Unknown or insufficient evidence for breast cancer risk[4] • Manage based on family history, as per Box A on Page 2
NBN	Increased risk of breast cancer • Screening: annual mammogram with consideration of tomosynthesis and consider breast MRI with contrast starting at age 40 years[3,4] • RRM: evidence insufficient, manage based on family history
NF1	Increased risk of breast cancer • Screening: annual mammogram with consideration of tomosynthesis starting at age 30 years and consider breast MRI with contrast from ages 30-50 years[3,4] • RRM: evidence insufficient, manage based on family history

RRM = risk-reducing mastectomy

[1] The following genes and others are found on some of the panels, but there is insufficient evidence to make any recommendations for breast MRI, or RRM: BARD1, FANCC, MRE11A, MUTYH heterozygotes, RECQL4, RAD50, RINT1, SLX4, SMARCA4, or XRCC2

[2] See Genetic Counseling algorithm

[3] May be modified based on family history (typically beginning screening 5-10 years earlier than the youngest diagnosis in the family but not later than stated in the table) or specific gene pathogenic/likely pathogenic variant

[4] For women with pathogenic/likely pathogenic variants who are treated for breast cancer and have not had bilateral mastectomy, screening should continue as described

Continued on next page

APPENDIX A: Breast Management based on Genetic Test Results - continued

PALB2	Increased risk of breast cancer • Screening: annual mammogram with consideration of tomosynthesis and breast MRI with contrast at age 30 years[1,2] • RRM: evidence insufficient, manage based on family history
PTEN	Increased risk of breast cancer • See NCCN Guidelines for Genetic/Familial High-Risk Assessment: Cowden Syndrome Management
RAD51C	Unknown or insufficient evidence for breast cancer risk
RAD51D	Unknown or insufficient evidence for breast cancer risk
STK11	Increased risk of breast cancer • Screening: see NCCN Guidelines for Genetic/Familial High-Risk Assessment: Colorectal • RRM: evidence insufficient, manage based on family history
TP53	Increased risk of breast cancer • See Li-Fraumeni Syndrome Screening algorithm

RRM = risk-reducing mastectomy

[1] May be modified based on family history (typically beginning screening 5-10 years earlier than the youngest diagnosis in the family but not later than stated in the table) or specific gene pathogenic/likely pathogenic variant
[2] For women with pathogenic/likely pathogenic variants who are treated for breast cancer and have not had bilateral mastectomy, screening should continue as described

SUGGESTED READINGS

Aisenberg, A. C., Finkelstein, D. M., Doppke, K. P., Koerner, F. C., Boivin, J., & Willett, C. G. (1997). High risk of breast carcinoma after irradiation of young women with hodgkin's disease. *Cancer, 79*(6), 1203-1210. doi:10.1002/(SICI)1097-0142(19970315)79:6<1203::AID-CNCR20>3.0.CO;2-2

Bhatia, S., Robison, L. L., Oberlin, O., Greenberg, M., Bunin, G., Fossati-Bellani, F., & Meadows, A. T. (1996). Breast cancer and other second neoplasms after childhood hodgkin's disease. *The New England Journal of Medicine, 334*(12), 745-751. doi:10.1056/NEJM199603213341201

Claus, E. B., Claus, E. B., Risch, N., Risch, N., Thompson, W. D., & Thompson, W. D. (1994). Autosomal dominant inheritance of early-onset breast cancer. implications for risk prediction. *Cancer, 73*(3), 643-651. doi:10.1002/1097-0142(19940201)73:3<643::AID-CNCR2820730323>3.0.CO;2-5

Gail, M. H., Gail, M. H., Brinton, L. A., Brinton, L. A., Byar, D. P., Byar, D. P., . . . Mulvihill, J. J. (1989). Projecting individualized probabilities of developing breast cancer for white females who are being examined annually. *Journal of the National Cancer Institute, 81*(24), 1879-1886. doi:10.1093/jnci/81.24.1879

Maglione, K. D., Margolies, L., Jaffer, S., Szabo, J., Schmidt, H., Weltz, C., & Sonnenblick, E. B. (2014). Breast cancer in male-to-female transsexuals: Use of breast imaging for detection. *American Journal of Roentgenology, 203*(6), W735-W740. doi:10.2214/AJR.14.12723

National Comprehensive Cancer Network. Breast Cancer Screening and Diagnosis (Version 2.2018). https://www.nccn.org/professionals/physician_gls/pdf/breast-screening.pdf. Accessed July 11, 2018.

National Comprehensive Cancer Network. Genetic/Familial High-Risk Assessment: Breast and Ovarian (Version 2.2019). https://www.nccn.org/professionals/physician_gls/pdf/genetics_screening.pdf. Accessed September 19, 2018.

Phillips, J., Fein-Zachary, V. J., Mehta, T. S., Littlehale, N., Venkataraman, S., & Slanetz, P. J. (2014). Breast imaging in the transgender patient. *American Journal of Roentgenology, 202*(5), 1149-1156. doi:10.2214/AJR.13.10810

Robson, M. E., Bradbury, A. R., Arun, B., Domchek, S. M., Ford, J. M., Hampel, H. L., . . . Lindor, N. M. (2015). American society of clinical oncology policy statement update: Genetic and genomic testing for cancer susceptibility. *Journal of Clinical Oncology, 33*(31), 3660-3667. doi:10.1200/JCO.2015.63.0996

Thomas, D. B., Gao, D. L., Ray, R. M., Wang, W. W., Allison, C. J., Chen, F. L., . . . Self, S. G. (2002). Randomized trial of breast self-examination in shanghai: Final results. *Journal of the National Cancer Institute, 94*(19), 1445-1457. doi:10.1093/jnci/94.19.1445

Tyrer, J., Duffy, S. W., & Cuzick, J. (2004). A breast cancer prediction model incorporating familial and personal risk factors. *Statistics in Medicine, 23*(7), 1111-1130. doi:10.1002/sim.1668

DEVELOPMENT CREDITS

This screening algorithm is based on majority expert opinion of the Cancer Prevention workgroup at the University of Texas MD Anderson Cancer Center. It was developed using a multidisciplinary approach that included input from the following:

Banu Arun, MD (Breast Medical Oncology)
Isabelle Bedrosian, MD, FACS (Breast Surgical Oncology)
Therese Bevers, MD (Cancer Prevention)[Ŧ]
Abenaa Brewster, MD, MHS (Cancer Prevention)
Powel Brown, MD, PhD (Cancer Prevention)
Elise Cook, MD (Cancer Prevention)
Robin Coyne, RN, MS, FNP-BC (Cancer Prevention)
Joyce Dains, DrPH, JD, RN, FNP-BC (Cancer Prevention)
Wendy Garcia, BS[♦]
Ernest Hawk, MD, MPH (Cancer Prevention)
Henry Kuerer, MD, PhD (Breast Surgical Oncology)
Marita Lazzaro, RN, MS, ANP (Cancer Prevention)
Jessica Leung, MD (Diagnostic Radiology-Breast Imaging)
Jennifer Litton, MD (Breast Medical Oncology)
Tiffiny McGowan, APRN, FNP-BC (Cancer Prevention)
Tanya Moseley, MD (Diagnostic Radiology-Breast Imaging)
Ana Nelson, RN, FNP, MSN (Cancer Prevention)
Lonzetta Newman, MD (Cancer Prevention)
Tilu Ninan, RN, ANP, MSN (Cancer Prevention)
Marion Scoggins, MD (Diagnostic Radiology-Breast Imaging)
Priya Thomas, MD (Cancer Prevention)
Sonal Yang, PharmD[♦]
Wei Yang, MD (Diagnostic Radiology)

[Ŧ] Development Lead
[♦] Clinical Effectiveness Development Team