Appendix A: Evaluation Table

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| **Citation** | **Design/Method/**  **Measure** | **Sample & Setting** | **Variables Studied and Their Definitions** | **Data Analysis** | **Findings** | **Appraisal: Worth to Practice** |
| Magnus et al., 2011 | A meta-analysis evaluating BCS mortality for women aged 39-49. Sources reviewed (August 2009-December 2009) using the Cochrane, Educational Resources Information Center, Medline, Ovid, and PubMed databases. Quality of evidence evaluated by two, independent reviewers. | Nine randomized controlled trials included | IV: Age  DV: Breast cancer diagnosis and mortality | DerSimonian and Laird random effects model using the STATA statistical software version 10.1. | Breast cancer mortality reduction found with women aged 39-49 receiving routine mammography. | Implications: Evidence suggests that women younger than 50 years-old experience a reduced incidence of breast cancer mortality with mammogram screening.  Limitations: All studies evaluated were conducted >10 years ago reflecting possible outdated imaging modality and treatment options.  LOE: I A |
| Myers et al., 2015 | Systematic review of available evidence on the harms and benefits of BCS. Sources reviewed (September 2013 and March 2014) using CINAHL, PyschINFO, and PubMed databases. Quality of evidence evaluated using the Grading of Recommendations Assessment, Development, and Evaluation framework. | Ten randomized controlled trials, 72 observational studies, one modeling study, and seven reviews | IV: Age, mammography, clinical breast examinations  DV: Breast cancer mortality, overdiagnosis, life expectancy, quality-adjusted life expectancy | Summary estimates, qualitative synthesis | “Moderate” quality of evidence that mammography screening is correlated with mortality reduction for women ages 40-69 and an increase in false-positive results with recommendation for biopsy over 10 years in the United States. “Low” evaluation of evidence found between the best intervals of screening, overdiagnosis, quality-adjusted life expectancy, and association with clinical breast examinations and mortality. | Implications: Based on variability and the quality of available evidence it is difficult to determine which BCS recommendation should be followed.  Limitations: No publication date limit, level of evidence, varying screening methods, advancements in treatment technology since studies conducted  LOE: III A |
| Nelson et al., 2016a | Update on the 2009 USPSTF systematic review with meta-analysis on the effectiveness of BCS. Sources analyzed (June, 2015) using MEDLINE and Cochrane databases. | Thirty-eight articles included (Eight randomized controlled trials) | IV: Age, imaging modalities utilized  DV: Breast cancer mortality, stage of diagnosis outcomes, and all-cause mortality | Random effects modeling, profile-likelihood modeling, Cochran chi-square tests, *I*2 statistic, short and long case accrual methods, absolute rate reduction, Poisson modeling, and Stata/IC version 13.1 (StataCorp) | Increased breast cancer mortality reduction found as one aged with routine mammogram screening in randomized control trials, however different indications indicated with two observational studies. All cause-mortality was not found to be significant among any age. Advanced breast cancer reduction indicated to reduce for women ages 50 and over. | Implications: Further research is necessary to help guide screening practices  Limitations: No publication date limit, advancements in treatment and imaging technology since studies conducted  LOE: I A |
| Nelson et al., 2016b | Update on the 2009 USPSTF systematic review on the harms of BCS. Sources analyzed (December 2014) using MEDLINE and Cochrane databases. | Fifty-nine studies included | IV: Age  DV: False-positives, overdiagnosis, radiation exposure, pain, anxiety | Qualitative synthesis | False-positive rates observed similarly for women in the 40 and 50 ages, but overall higher with women ages 40-49 especially with dense breast tissue. Varying range of overdiagnosis found among all modeling studies. Women with false-positive findings found with more anxiety than women with negative mammography results. Pain associated with mammography varied. No studies found a direct association with radiation induced breast cancer from mammography screening. | Implications: Women with more breast dense tissue and are receive mammography annually are more likely to receive false-positive results leading to additional imaging. Overdiagnosis is difficult to determine because there is no standard of measurement. Psychological impact is a subjective finding, and the effects on each women differs.  Limitations: Differing screening practices, patient populations, modeling parameters (i.e. DCIS diagnosis, BC incidence)  LOE: III A |
| Oeffinger, et al., 2015 | Systematic review of current BCS literature conducted by the Duke University Evidence Synthesis Group. Quality of evidence evaluated using the Grading of Recommendations Assessment, Development, and Evaluation framework by the ACS’s guideline development group. | Not clearly delineated | IV: Age of diagnosis  DV: Breast cancer mortality, life expectancy, false positives, overdiagnosis, quality of life, tumor burden | Qualitative synthesis | High quality strength for breast cancer mortality reduction in women receiving mammography screening younger than 50 years. False positives found higher with screening annually than biennially. The quality of evidence estimating overdiagnosis, life expectancy with screening, and quality-adjusted life expectancy was considered low. | Implications:  Grading of outcomes vary between studies and weigh harms versus benefits differently. Recommendations by ACS are a guidance, but shared-decision making is vital between the provider and the patient.  Limitations: Many factors of each individual study affecting outcomes (i.e. comparison of age-groups, imaging modality utilized, type of screening, patient population risk factors), and outcomes of evidence were evaluated differently to determine recommendation (i.e. modeling estimates, empirical comparisons)  LOE: III A |
| Pace & Keating, 2014 | Systematic review of harms and benefits of BCS. Sources analyzed using Medline database and manual search of reference lists and current practice recommendations. Quality of evidence evaluated using the American Heart Association guidelines. | Five meta-analyses included to evaluate BCS and mortality reduction, | IV: Age, individual risk factors of high risk patients  DV: Breast cancer mortality, harms of mammography screening (false-positives and recommendation for biopsy, overdiagnosis), and how to support patients in making informed decisions about their breast health | Qualitative synthesis | Mammography found to decrease BC mortality and found significant for women in their 40 through 60 year ages. Evidence shows there is a risk of false-positives that is higher the younger the age. Overdiagnosis estimates vary between studies and reports may be over or underestimated. Clinical decision models can be used to help best navigate best clinical outcomes and informed patient decisions. | Implications: Further high, rigorous studies needed to understand true benefit/harm of mammography. BCS ought to be individualized based on risk factors and patient priorities.  Limitations: Publication date of sources vary up to >10 years ago, advancements in treatment and imaging technology since studies conducted.  LOE: III B |
| Shen et al., 2011 | A 10-year retrospective chart review through the Cancer Registry Database at an unidentified institution for women ages 40-49 treated for BC that followed the Commission on Cancer Programs Standards. | 1,581 females treated for BC, 311 ages 40-49 | IV: Age, annual mammography detected cancer, non-mammography detected cancer  DV: Breast cancer diagnosis, tumor size/sentinel lymph node involvement at diagnosis, disease-free rate, survival rate | Descriptive, statistical analysis | Women with mammography detected cancer were found to have at diagnosis smaller tumor size, less sentinel lymph node involvement, higher disease-free and better overall survival rates compared with women with non-mammography detected cancer | Implications: Multiple benefits of annual mammography for women starting at age 40 exhibited.  Limitations: Study conducted >10 years ago  LOE: III B |
| Van den Ende et al., 2017 | Systematic review of the harms and benefits of BCS for women ages 40-49. Sources analyzed (February 2017) using Embase, Medline, PubMed, and Cochrane databases. Quality of evidence evaluated using the Grading of Recommendations Assessment, Development, and Evaluation framework. | Four articles examined of two randomize controlled trials | IV: Age  DV: Breast cancer mortality, all-cause mortality, false-positives, overdiagnosis | Qualitative synthesis | Breast cancer reduction and all-cause mortality not found generalizable and graded as “moderate” quality of evidence. False positive recall observed and considered “high” quality of evidence for women ages 40-49. Overdiagnosis based on estimates. | Implications: More rigorous randomized controlled trails needed  Limitations:  Randomization contamination, pre-screened participants, study generalizability, all studies conducted outside the United States (differing screening practices of invitation to screen versus opportunity to screen)  LOE: III C |

Key: LOE: level of evidence (Johns Hopkins Hospital/The Johns Hopkins University, 2012a, 2012b), IV: Independent variable, DV: Dependent variable, BC: Breast cancer, BCS: Breast cancer screening