



TITLE: Concurrent versus Sequential Digital Mammography and MRI for Breast Cancer Screening in High-Risk Patients: Comparative Clinical Effectiveness, Cost-Effectiveness, and Guidelines

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RESEARCH QUESTIONS

1. What is the comparative clinical effectiveness of concurrent versus sequential digital mammography and magnetic resonance imaging (MRI) for breast cancer screening in high-risk patients?
2. What is the comparative cost-effectiveness of concurrent versus sequential digital mammography and MRI for breast cancer screening in high-risk patients?
3. What are the evidence-based guidelines regarding the combined use of digital mammography and MRI for breast cancer screening in high-risk patients?

KEY FINDINGS

One economic evaluation was identified regarding the comparative cost-effectiveness of concurrent versus sequential digital mammography and MRI for breast cancer screening in high-risk patients. In addition, two evidence-based guidelines were identified regarding the combined use of digital mammography and MRI for breast cancer screening in high-risk patients.

METHODS

A limited literature search was conducted on key resources including PubMed, The Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. No filters were applied to limit the retrieval by study type. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between January 1, 2010 and April 23, 2015. Internet links were provided, where available.

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The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

SELECTION CRITERIA

One reviewer screened citations and selected studies based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria	
Population	Female patients at high risk for breast cancer
Intervention	Q1 & 2: Concurrent digital mammography and MRI Q3: Combined use (concurrent or sequential) of digital mammography and MRI for breast cancer screening
Comparator	Q1 & 2: Sequential digital mammography and MRI (six months apart) Q3: No comparator
Outcomes	Q1: Clinical benefits and harms (e.g., breast cancer detection, mortality, patient compliance) Q2: Cost-effectiveness Q3: Guidelines for combined use (e.g., perform concurrently or sequentially, recommended interval between modalities)
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines

MRI = magnetic resonance imaging.

RESULTS

Rapid Response reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, non-randomized studies, economic evaluations, and evidence-based guidelines.

One economic evaluation was identified regarding the comparative cost-effectiveness of concurrent versus sequential digital mammography and MRI for breast cancer screening in high-risk patients. In addition, two evidence-based guidelines were identified regarding the combined use of digital mammography and MRI for breast cancer screening in high-risk patients. No relevant health technology assessments, systematic reviews, meta-analyses, randomized controlled trials or non-randomized studies were identified. Furthermore, no relevant evidence regarding the clinical effectiveness of concurrent versus sequential digital mammography and MRI was identified.

Additional references of potential interest are provided in the appendix.

OVERALL SUMMARY OF FINDINGS

One economic evaluation¹ was identified regarding the comparative cost-effectiveness of concurrent versus sequential digital mammography and MRI for breast cancer screening in high-risk patients. In addition, two evidence-based guidelines^{2,3} were identified regarding the combined use of digital mammography and MRI for breast cancer screening in high-risk patients.

The economic evaluation¹ investigated the cost-effectiveness of various combined screening strategies. The most cost-effective strategies depending on lifetime disease risk are presented in Table 2.

Table 2. Cost-Effectiveness of Screening Strategies Based on Lifetime Disease Risk, Ahern et al. 2014¹

Lifetime Disease Risk	Most Cost-Effective Strategy	ICER
25%	Stagger MRI and mammography plus CBE annually from age 30 to 74	\$58 400/QALY
50%	Stagger MRI and mammography plus CBE bi-annually	\$84 400/QALY
75%	Biennial MRI plus mammography and CBE bi-annually	\$62 800/QALY

CBE = clinical breast examination; ICER = incremental cost effectiveness ratio; MRI = magnetic resonance imaging; QALY = quality adjusted life years.

The evidence based guidelines were produced by the Institute for Clinical Systems Improvement (ICSI)² and Alberta Health Services.³ The ICSI guideline states that annual MRI screening should be completed at a six-month offset interval from yearly mammogram in high-risk individuals. The Alberta Health Services guideline³ states that concurrent MRI and mammography should be performed annually for high-risk patients. In the case of both guidelines, 'high-risk' comprises individuals: with a personal history or family history of deleterious mutations (e.g., BRCA1/2), with a personal lifetime disease risk over 20% to 25% based on family history dependent models, who have received radiation treatment to the chest between the ages of 10 and 30, or who have genetic disorders that increase breast cancer risk.^{2,3}

No relevant evidence regarding the clinical effectiveness of concurrent versus sequential digital mammography and MRI was identified; therefore, no summary can be provided.

REFERENCES SUMMARIZED

Health Technology Assessments

No literature identified.

Systematic Reviews and Meta-analyses

No literature identified.

Randomized Controlled Trials

No literature identified.

Non-Randomized Studies

No literature identified.

Economic Evaluations

1. Ahern CH, Shih YC, Dong W, Parmigiani G, Shen Y. Cost-effectiveness of alternative strategies for integrating MRI into breast cancer screening for women at high risk. *Br J Cancer* [Internet]. 2014 Oct 14 [cited 2015 May 6];111(8):1542-51. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4200098>
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Guidelines and Recommendations

2. Institute for Clinical Systems Improvement (ICSI). Health Care Guideline: Diagnosis of Breast Disease 14th edition [Internet]. Bloomington (MN): ICSI; January 2012 [cited 2015 May 6]. Available from: https://www.icsi.org/_asset/v9I91q/DxBrdis.pdf
See: Appendix A – Breast MRI, page 38
3. Alberta Health Services (AHS). Magnetic Resonance Imaging for breast cancer screening, pre-operative assessment, and follow-up [Internet]. Edmonton (AB): AHS; January 2012 [cited 2015 May 6]. (Clinical Practice Guideline BR-007 Version 2). Available from: <http://www.albertahealthservices.ca/hp/if-hp-cancer-guide-br007-mri.pdf>
See: Recommendations: Screening, page 3

PREPARED BY:

Canadian Agency for Drugs and Technologies in Health

Tel: 1-866-898-8439

www.cadth.ca

APPENDIX – FURTHER INFORMATION:

Non-Randomized Studies – No Comparator

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[PubMed: PM21365619](#)

Economic Evaluations

Alternate or Unclear Intervention

7. Cott Chubiz JE, Lee JM, Gilmore ME, Kong CY, Lowry KP, Halpern EF, et al. Cost-effectiveness of alternating magnetic resonance imaging and digital mammography screening in BRCA1 and BRCA2 gene mutation carriers. Cancer [Internet]. 2013 Mar 15 [cited 2015 May 6];119(6):1266-76. Available from:
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3586945>
[PubMed: PM23184400](#)
8. de Bock GH, Vermeulen KM, Jansen L, Oosterwijk JC, Siesling S, Dorrius MD, et al. Which screening strategy should be offered to women with BRCA1 or BRCA2 mutations? A simulation of comparative cost-effectiveness. Br J Cancer [Internet]. 2013 Apr 30 [cited 2015 May 6];108(8):1579-86. Available from:
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3668482>
[PubMed: PM23579217](#)

Alternate Comparator

9. Pataky R, Armstrong L, Chia S, Coldman AJ, Kim-Sing C, McGillivray B, et al. Cost-effectiveness of MRI for breast cancer screening in BRCA1/2 mutation carriers. BMC Cancer [Internet]. 2013 [cited 2015 May 6];13:339. Available from:
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3711845>
[PubMed: PM23837641](#)
10. Saadatmand S, Tilanus-Linthorst MM, Rutgers EJ, Hoogerbrugge N, Oosterwijk JC, Tollenaar RA, et al. Cost-effectiveness of screening women with familial risk for breast cancer with magnetic resonance imaging. J Natl Cancer Inst. 2013 Sep 4;105(17):1314-

21.

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Guidelines and Recommendations - Unclear Methodology

11. Memorial Sloan Kettering Cancer Centre. Breast cancer screening guidelines [Internet]. New York (NY): Memorial Sloan Kettering Cancer Center; 2015 [cited 2015 May 6]. Available from: <http://www.mskcc.org/cancer-care/adult/breast/screening-guidelines-breast>
See: Our Breast Cancer Screening Guidelines
12. Toward Optimized Practice (TOP) Working Group for Breast Cancer Screening. Breast cancer screening: clinical practice guideline [Internet]. Edmonton (AB): Toward Optimized Practice; September 2013 [cited 2015 May 6]. Available from: http://www.topalbertadoctors.org/download/243/breast_cancer_guideline.pdf?_20150423125251
See: Women Requiring More Intensive Screening, page 3

Additional References

13. Lowry KP, Lee JM, Kong CY, McMahon PM, Gilmore ME, Cott Chubiz JE, et al. Annual screening strategies in BRCA1 and BRCA2 gene mutation carriers: a comparative effectiveness analysis. *Cancer* [Internet]. 2012 Apr 15 [cited 2015 May 6];118(8):2021-30. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3245774>
[PubMed: PM21935911](#)