EE318

Decision-Analytic Modeling on Imaging Modalities in Breast Cancer Staging: A Systematic Literature Review

Puntscher S[1], Steigenberger C[1], Rochau U[1], Papon V[1], Buchberger W[2], Jahn B[1], Grubbe Hildebrandt M[3, 4, 5], Rasmussen MK[4, 5], Siebert U[1, 6, 7]

(1) Institute of Public Health, Medical Decision Making and Health Technology Assessment, Department of Public Health, Health Services Research and Health Technology Assessment, UMIT TIROL - University for Health Sciences and Technology, Hall in Tirol, Austria; (2) Research Unit for Quality and Efficiency in Medicine, Institute of Public Health, Medical Decision Making and Health Technology Assessment, Department of Public Health, Health Services Research and Health Technology Assessment, UMIT TIROL - University for Health Sciences and Technology, Hall in Tirol, Austria; (3) Department of Nuclear Medicine, Odense University Hospital, Odense, Denmark; (4) Centre for Innovative Medical Technology, Odense University Hospital, Odense, Denmark; (5) Department of Clinical Research, University of Southern Denmark, Odense, Denmark; (6) Center for Health Decision Science, Departments of Epidemiology and Health Policy & Management, Harvard Chan School of Public Health, Boston, MA, USA; (7) Institute for Technology Assessment and Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Boston, MA, USA

BACKGROUND

- Breast cancer is the most common cancer in women and a leading cause of cancer-related death.[1]
- Accurate tumor staging and response monitoring in metastatic breast cancer remain challenging, impacting treatment decisions, survival, and quality of life.[2,3]
- An update of clinical guidelines regarding optimal imaging selection for staging is needed.[4]
- Aim of PREMIO COLLAB Project: to prolong overall survival and enhance quality of life in metastatic breast cancer patients by guiding improved treatment response monitoring (see Figure 1).

AIM

To synthesize and appraise existing decision-analytic models by evaluating their structure, assumptions, data sources, and clinical as well as health economic relevance.

Research aim: Compare strategies to assess the effect on quality of life, QALYs, survival

Purpose of decision-analytic model: Identify cost-effectiveness tradeoff of innovative imaging modalities

METHODS

Systematic search (PubMed, Embase, International HTA Database) up to March 2025, following PRISMA guideline.[5]

Inclusion and exclusion criteria:

- **P**opulation: Patients with advanced breast cancer
- **I**ntervention: FDG-PET/CT or PET/CT
- **C**omparator: All other imaging modalities used for breast cancer staging
- **O**utcome: E.g., QALYs, survival, biopsies avoided
- **S**tudy type: Decision-analytic modeling studies
- Languages: English, Danish, German, Italian

Screening and extraction by two reviewers; data extracted on populations, interventions, outcomes, model type, and others.

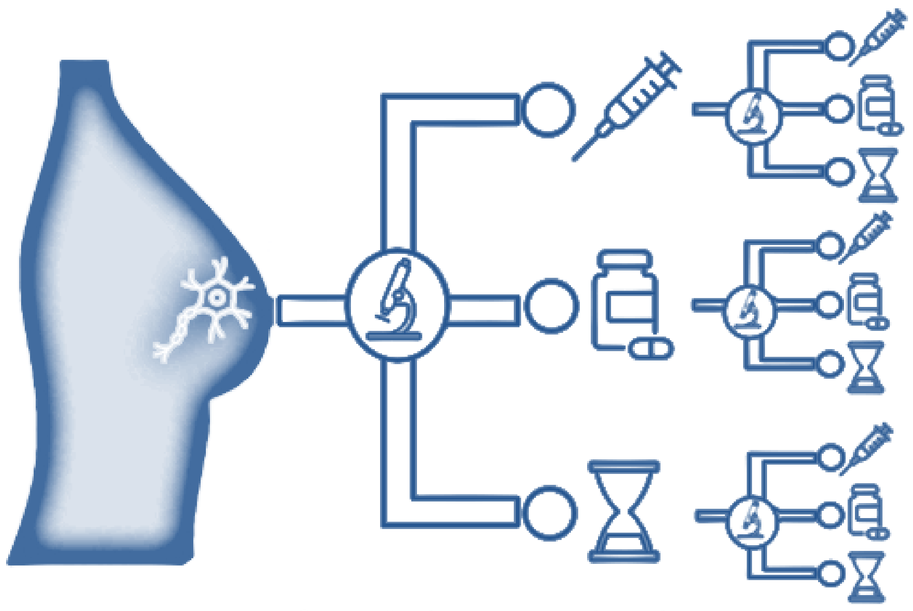

Figure 1: Process of study intervention in PREMIO COLLAB
(The figure is the authors' own illustration)

RESULTS

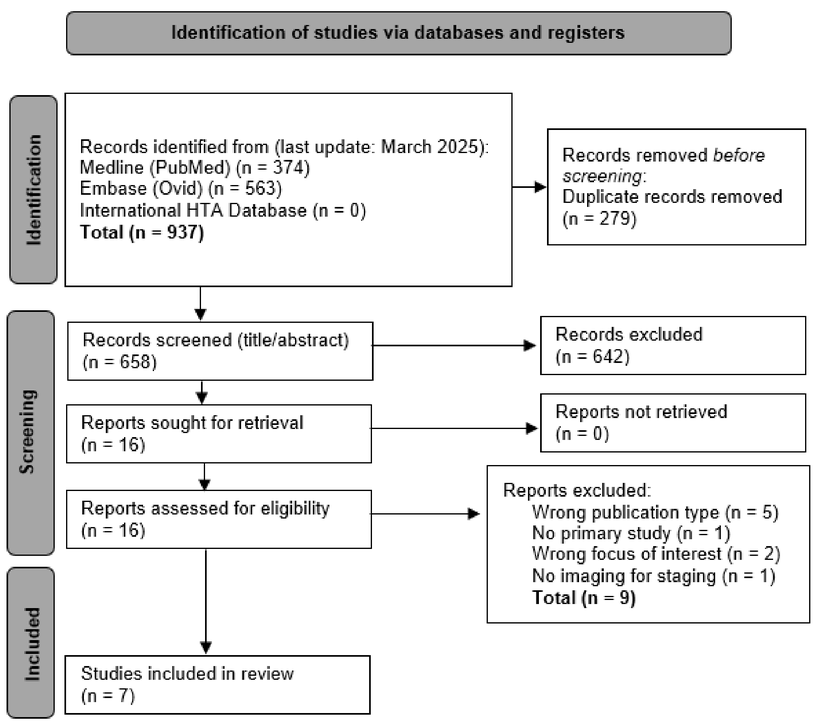

Figure 2: PRISMA 2020 flowchart [5]

Aspect	Findings
Countries	Australia, Canada, the Netherlands, United Kingdom, and United States
Model types	Decision trees (n=3), decision tree combined with a Markov state-transition model (n=1), discrete-event simulation (n=2), and a simulation model (not further defined) (n=1)
Evaluated strategies	2-8 strategies; e.g., PET/CT, PET, MRI, four-node sampling, biopsy, FDG-PET/CT, FES-PET/CT, and conventional work-up
Reported outcomes	Diagnostic accuracy (sensitivity/specificity), QALYs, number of re-biopsies, costs, and incremental cost-effectiveness ratios (ICERs)
Findings	Advanced imaging reduced biopsies (5/7) → less adverse events, potentially cost-effective in 2 studies, in 1 study not cost-effective
Limitations	Sparse accuracy data, insufficiently validated models

CONCLUSION

Advanced imaging modalities show potential clinical and cost-effectiveness benefits, especially in specific patient subgroups or diagnostic pathways. However, evidence is limited. High-quality research, including prospective trials and more precise economic evaluations, and robust decision-analytic models are needed to support evidence-based practice.

Abbreviations: CT: Computed Tomography; FDG-PET/CT: Fluorodeoxyglucose Positron Emission Tomography/Computed Tomography; FES-PET: 16α-[^{18}F]fluoroestradiol Positron Emission Tomography / Computed Tomography; MRI: Magnetic Resonance Imaging; PET: Positron Emission Tomography; QALYs: quality-adjusted life years

References: [1] Arnold M, Morgan E, Rumgay H, et al. Current and future burden of breast cancer: Global statistics for 2020 and 2040. The Breast 2022;66:15-23. [2] Humbert O, Cochet A, Coudert B, et al. Role of Positron Emission Tomography for the Monitoring of Response to Therapy in Breast Cancer. The Oncologist 2015;20(2):94-104. [3] Vogsen M, Jensen JD, Christensen IY, et al. FDG-PET/CT in high-risk primary breast cancer—a prospective study of stage migration and clinical impact. Breast Cancer Research and Treatment 2021;185(1):145-153. [4] Vogsen M, Harbo F, Jakobsen NM, et al. Response Monitoring in Metastatic Breast Cancer: A Prospective Study Comparing (18)F-FDG PET/CT with Conventional CT. Journal of Nuclear Medicine 2023;64(3):355-361. [5] Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71.

Funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement **No 101136812**

UMIT TIROL – DIE TIROLER PRIVATUNIVERSITÄT

PREMIO COLLAB – Personalised response monitoring in oncology: co-creating clinical trials in advanced breast cancer

Contact: caroline.steigenberger@umit-tirol.at