



Research article

Effectiveness and cost-effectiveness of double reading in digital mammography screening: A systematic review and meta-analysis



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ABSTRACT

Purpose: Double reading is the strategy of choice for mammogram interpretation in screening programmes. It remains, however, unknown whether double reading is still the strategy of choice in the context of digital mammography. Our aim was to determine the effectiveness and cost-effectiveness of double reading versus single reading of digital mammograms in screening programmes.

Methods: We performed a systematic review by searching the PubMed, Embase, and Cochrane Library databases up to April 2017. We used the QUADAS-2 (Quality Assessment of Diagnostic Accuracy Studies) tool and CHEERS (Consolidated Health Economic Evaluation Reporting Standards) checklist to assess the methodological quality of the diagnostic studies and economic evaluations, respectively. A proportion's meta-analysis approach, 95% Confidence Intervals (95% CI) and test of heterogeneity (P values) were used for pooled results. Costs are expressed US\$ PPP (United States Dollar purchasing power parities). The PROSPERO ID of this Systematic Review's protocol is CRD42014013804.

Results: Of 1473 potentially relevant hits, four high-quality studies were included. The pooled cancer detection rate of double reading was 6.01 per 1000 screens (CI: 4.47%–7.77%), and it was 5.65 per 1000 screens (CI: 3.95%–7.65%) for single reading (P = 0.76). The pooled proportion of false-positives of double reading was 47.03 per 1000 screens (CI: 39.13%–55.62%) and it was 40.60 per 1000 screens (CI: 38.58%–42.67%) for single reading (P = 0.12). One study reported, for double reading, an ICER (Incremental Cost-Effectiveness Ratio) of 16,684 Euros (24,717 US\$ PPP; 2015 value) per detected cancer. Single reading + CAD (computer-aided-detection) was cost-effective in Japan.

Conclusion: The evidence of benefit for double reading compared to single reading for digital mammography interpretation is scarce. Double reading seems to increase operational costs, have a not significantly higher false-positive rate, and a similar cancer detection rate.

1. Introduction

Mammography screening programmes have been widely implemented in Europe [1]. In these programmes, trained physicians, radiologists or radiographers can read mammograms following

different strategies; i.e. single reading with or without CAD (computer-aided-detection), blinded or unblinded double reading, and followed or not by consensus and arbitration [2–4]. When double reading is performed, each reader determines whether the result of the mammogram is normal -in which case the woman is invited for a further screening

Abbreviations: CAD, computer-aided-detection; DCIS, ductal carcinoma in situ; FNAC, fine-needle aspiration cytology; ICER, incremental cost-effectiveness ratio; NHS-EED, Economic Evaluation Database produced by the NIHR Centre for Reviews and Dissemination (CRD) at the University of York; NPV, net present value; US\$ PPP, United States Dollar purchasing power parities

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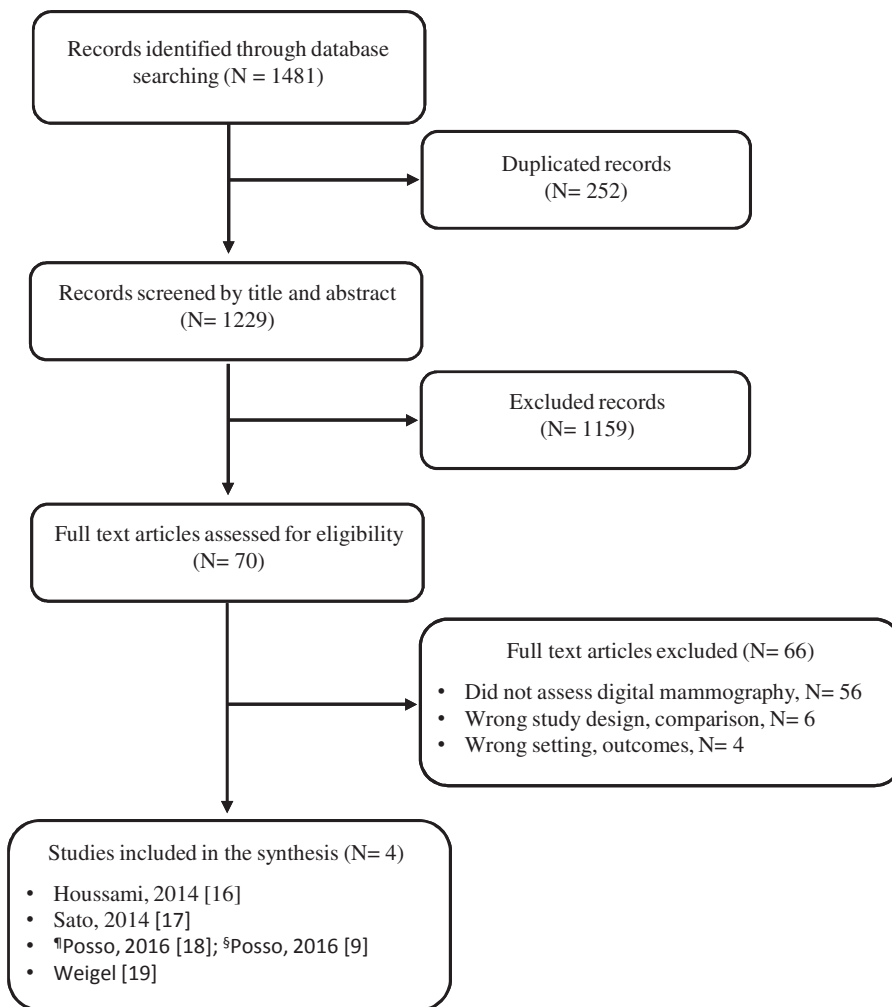


Fig. 1. PRISMA diagram of the study selection.

¶Main publication for the study. §Secondary publication not included in the meta-analyses.

round-, or abnormal -in which case additional tests are requested to confirm or rule out malignancy-. In case of disagreement between readers, the result of the mammogram can be determined by consensus and/or by arbitration [4].

The European screening guidelines published in 2006 [4], recommend double reading as the strategy of choice for mammogram interpretation. This recommendation, however, is based on studies performed in the context of screen-film mammography. These studies found that double reading was more effective than single reading increasing the sensitivity in 5–15% [4]. Regarding the cost-effectiveness, one systematic review published in 2001 suggested double reading as a cost-effective strategy [5]. More recently, in the same context of screen-film mammography, one study reported double reading with or without consensus/arbitration as a cost-effective strategy in the Netherlands [6].

Digital mammography is a relatively new technology that can be more sensitive for identifying small abnormalities [7,8]. The implementation of this technology, therefore, is rising very fast in European screening programmes [1]. Although there is little evidence on reading strategies for digital mammography, we have previously found that double reading can have more false-positives and similar detection rate than single reading [9]. Hence, we think that digital mammography may affect the accuracy for mammogram interpretation increasing the sensitivity of single reading.

As far as we know, there are no systematic reviews assessing double reading in the context of digital mammography. In order to support or eventually challenge the current recommendation of double reading in European screening programmes [4], a systematic review of the

effectiveness and cost-effectiveness of double reading of digital mammography has become relevant and is the aim of this systematic review.

2. Material and methods

2.1. Study design

We adhered to the guidance provided by the Cochrane Collaboration [10] and the PRISMA statement [11] for conducting and reporting this systematic review.

2.2. Search strategy and study selection

Databases were searched from 1st January 1990 to 20th February 2017, including Medline, EMBASE, and the Cochrane Library to obtain all relevant literature in the context of digital mammography. We searched for systematic reviews, experimental trials, and observational studies with a control group that compared double reading with single reading in the context of digital mammography. We also searched for cost-effectiveness, cost-utility and cost-benefit studies. We combined a series of terms for ‘Breast Neoplasms’, ‘Mass Screening’ and ‘double reading’. The search strategy is provided in Appendix A. We included studies we deemed as relevant based on our previous experience, and hand searched the bibliography of the included studies. Two reviewers independently screened the articles identified in the searches. Disagreements were resolved by consensus.

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