

# Mammography Reading with Computer-Aided Detection (CAD): Single View vs Two Views

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**Abstract.** Two-view mammography is known to be more effective than one-view in increasing breast cancer detection and reducing recall rates. In addition, there is evidence that computer aided detection (CAD) systems are able to prompt malignant abnormalities that have been overlooked by a human reader. Using data from the UK NHS Breast Screening Programme (NHSBSP) we compared double reading with single reading using a CAD system, to assess the relationship between CAD and number of views in terms of the sensitivity of the screening regime to cancer detection and the recall rate of normal cases. CAD appeared to contribute to an increased cancer detection rate with single-view mammography without significantly increasing the recall rate. For two-view mammography, there was no significant change in sensitivity using CAD but a significantly higher recall rate. However, single-view mammography was used in incident rounds in which previous mammograms were available whereas two-view mammography was used in the prevalent round where no previous mammograms were available.

## 1 Introduction

It is known that two-view mammography has substantially superior sensitivity to single-view in screening and symptomatic examinations [1][2]. It is also known that computer aided detection (CAD) systems can prompt malignant abnormalities overlooked by a human reader [3][4]. In the UK National Breast Screening Programme, the policy of two-view mammography at first screen followed by single-view thereafter has recently been replaced by a policy of two-view mammography at every round. In this paper, we use data from a study comparing the original double reading with single reading using a CAD system, in which prevalent round mammograms were two-view and incident round mammograms were single-view, to

assess the relationship of the single reader using CAD and number of views in terms of the sensitivity of the screening regime to cancer detection rate and the recall rate of normal subjects.

2 Methods

In CADET [5], 10,096 mammograms, originally double read in 1996, and with the cancer casemix enriched by 50%, were reread by a single human reader assisted by the R2 ImageChecker CAD system with software version 5.0. Of the 10,096 mammograms 315 had cancers diagnosed at the original mammogram or up to six years later. We had data on number of views for all 315 of the cancers and for 9733 of the 9781 normal cases (99.5%). We retrieved prompt data on 309 cancers (98%). Reading conditions from 1996 were replicated in that incident round mammograms were hung with the previous examination undertaken three years earlier.

3 Statistical Analysis

We first compared two reading regimes for single-view with two-view mammograms separately, using the McNemar’s test. Further analysis was by logistic regression estimating the effects of number of views, tumour size, breast density, and node status on the odds of being recalled by the original double reading and by the single reader with CAD. This yielded odds ratio estimates of the relative risk of being recalled, and the deviance chi-squared tests for the significance of the association of the factors with the chance of being recalled. In addition, for the single reader with CAD, we also estimated the association with when the tumour was diagnosed.

4 Results

Table 1 shows the detection rates of all cancers diagnosed at or after the original 1996 screen by number of views for the original double reading and for the single reading with CAD.

**Table 1.** Detection rate of cancers and recall rate of normal subjects by use of CAD and number of views

| Outcome        | Single View  |              | Two view      |              |
|----------------|--------------|--------------|---------------|--------------|
|                | CAD          | No CAD       | CAD           | No CAD       |
| Detection rate | 95/241(39%)  | 73/241(30%)  | 31/74(42%)    | 30/74(41%)   |
| Recall rate    | 420/6879(6%) | 315/6879(5%) | 319/2854(11%) | 241/2854(8%) |

For single-view there is a very significant difference in sensitivity ( $p=0.0003$ ), with single reading using CAD being more sensitive than the previous double reading. However, it also confers a significant increase in recall of normal cases ( $p<0.0001$ ). For two-view there is no significant difference in sensitivity ( $p=0.9$ ), but again a significant increase in recall of normal cases with CAD ( $p<0.0001$ ). There were no significant differences between single-view sensitivity and two-view sensitivity either