

# Breast cancer screening performance assessment by linkage with the SNDS : a generalizable method in a context of registries scarcity

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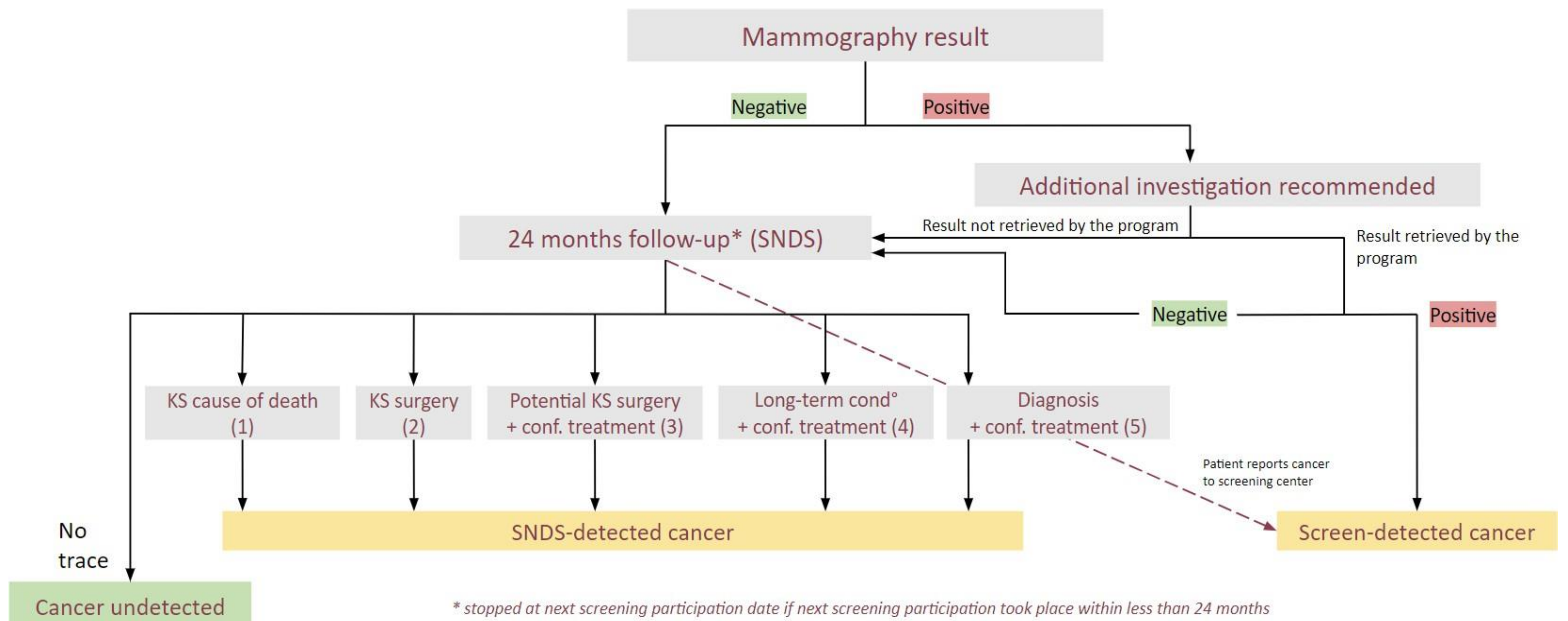


Fig 1. Patients follow-up in the SNDS to substitute for BC registries and identify cases

## Context

- Breast cancer (BC) was the leading cause of cancer death among women in Europe in 2022 (144,500 deaths) and in France in 2023 (12,100) [1, 2]
- The french national screening program for BC (DOCS) was designed to detect early forms of BC with mammography
- Public health institutions have underlined the need for specific metrics to assess performance of mammography [3–5] : sensitivity (SE), specificity (SP), positive predictive value (PPV), cancer detection rate (CDR) and interval cancer rates (ICR and RICR)
- Computing these metrics requires a linkage of screening data and BC registries to identify cases
- In France, BC registries are scarce and not always available for research [6]

## Aim of the study

Linking regional screening data to National Health Data System (SNDS) data (instead of registries) to identify cases, compute performance metrics, and compare the results with registry-based studies

## Metrics definitions

SE  $\mathbb{P}(\text{positive mammography} / \text{cancer})$   
 SP  $\mathbb{P}(\text{negative mammography} / \text{no cancer})$   
 PPV  $\mathbb{P}(\text{cancer} / \text{positive mammography})$   
 CDR  $\mathbb{P}(\text{cancer} / \text{screening participation})$   
 ICR  $\mathbb{P}(\text{interval cancer} / \text{screening participation})$   
 RICR  $\mathbb{P}(\text{interval cancer} / \text{cancer})$

## Data and method to identify BC

- Data linkage** : 265,217 digital mammographies from Gard and Lozère French departments between 2011-2018 (see Fig 2) from patients aged 50-74 years (mean = 61) without known risk factor were linked to the SNDS medico-administrative database

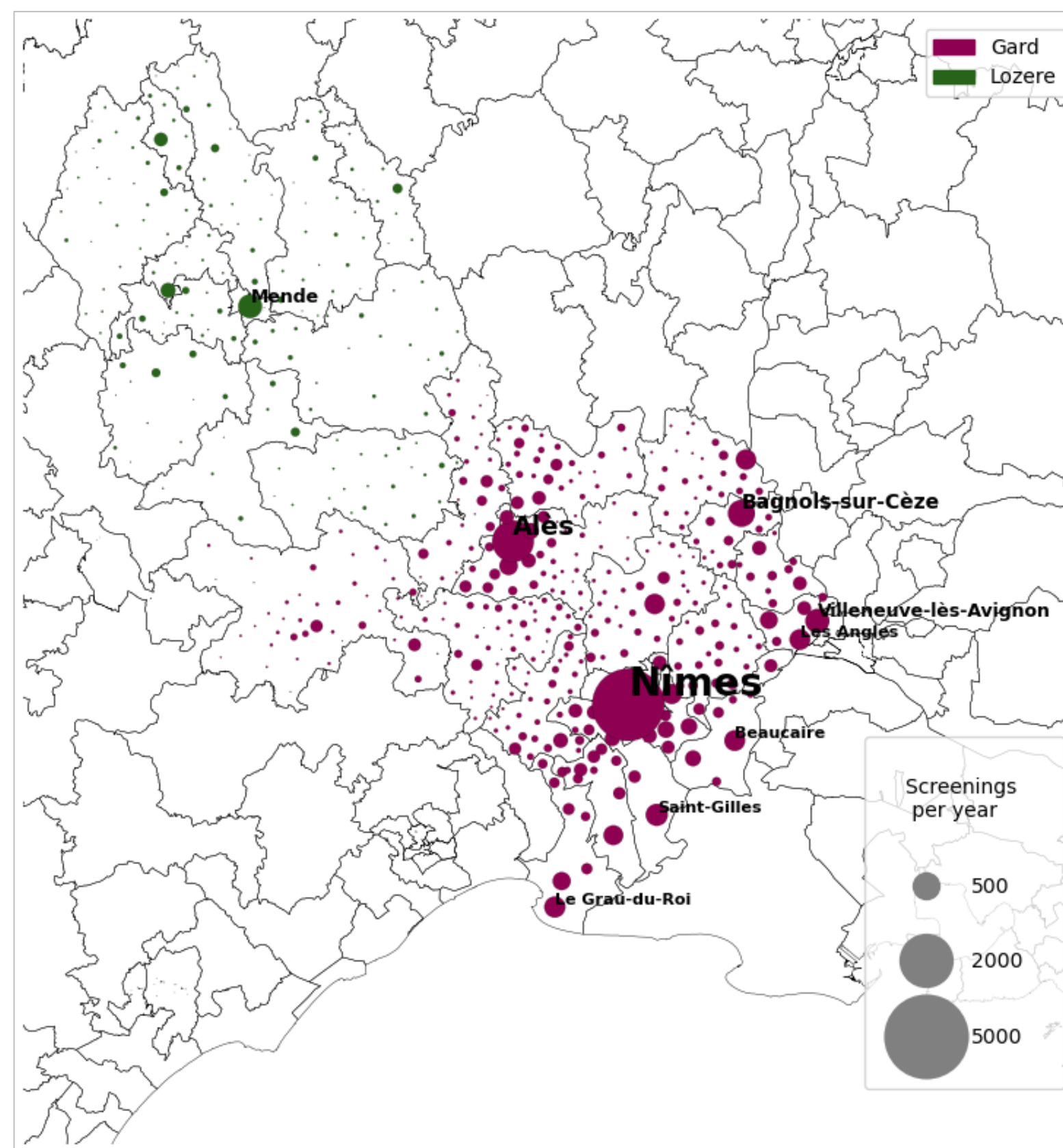


Fig 2. Yearly screenings number in Gard and Lozère departments (2011-2018)

- BC identification** (see Fig 1): by the screening program or in the SNDS within the minimum between 24 months and the time to next screening. In the SNDS, we used five criteria to identify cancer cases :

- Cancer death
- Unmistakable BC surgery
- Potential BC surgery confirmed with cancer treatments
- BC long-term condition (LTC) registration confirmed with cancer treatments
- BC diagnosis confirmed with cancer treatments

## Conclusion & discussions

- Results in line with the literature (see Fig 3) : linking the screening data with BC registries would allow us to further validate our SNDS-based methodology
- The database built to compute the metrics would be the largest BC organised screening database with medico-administrative follow-up available for research in France
- A systematic follow-up through the SNDS could allow for a routine monitoring of the DOCS, and detect abnormal evolutions such as in Fig 4.
- Interval cancer labels with the systematic SNDS follow-up of patients could prove useful to train machine learning models to detect mammograms abnormalities « missed » by radiologists and help personalize screening

## Main results

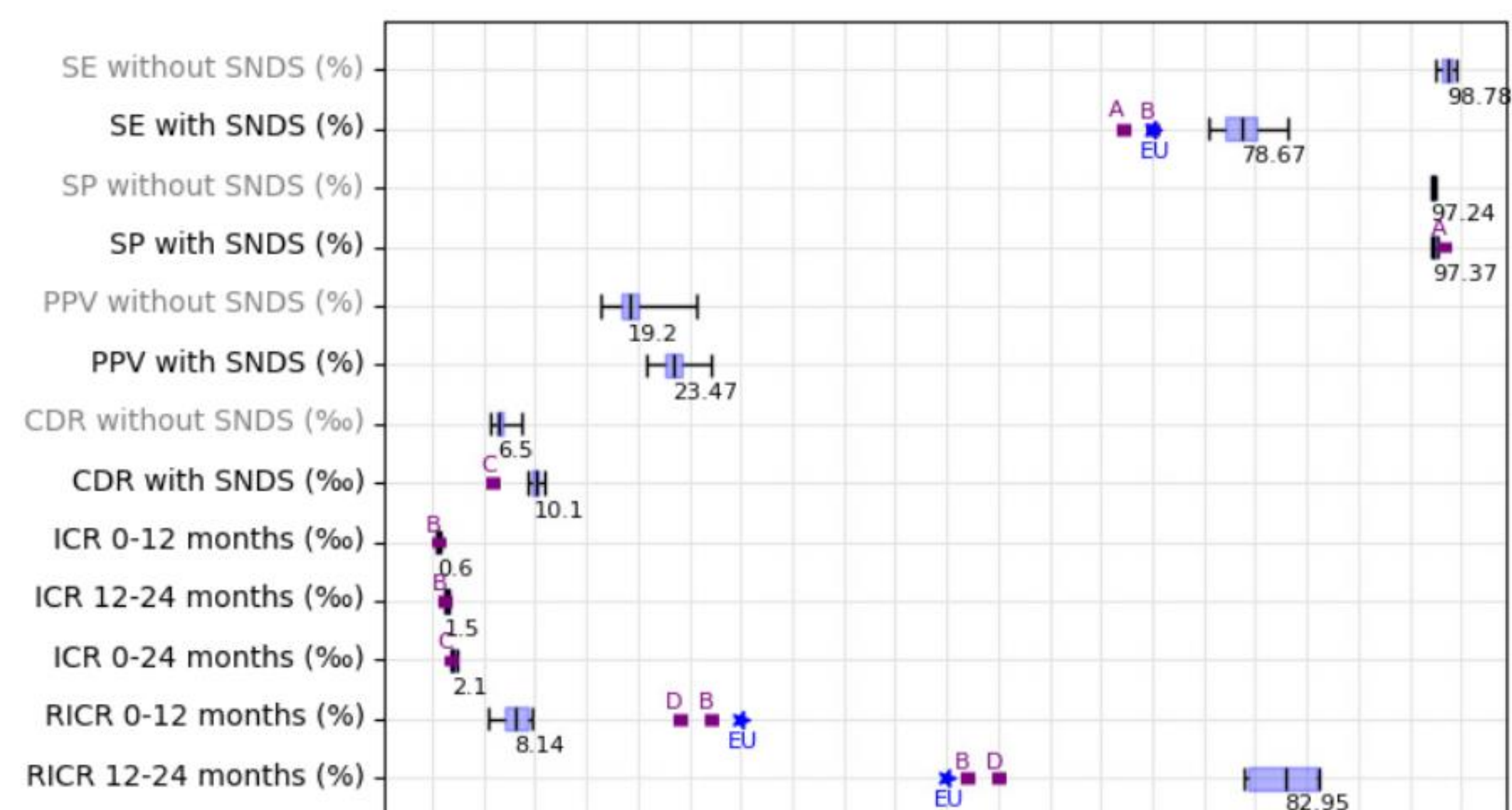


Fig 3. Performance metrics with 95% confidence and yearly min/max, with and without SNDS-detected cases, compared to other studies (A-B-C-D: see [5]-[7]-[8]-[9]) and European guidelines (EU) [10, 11] (2011-2018)

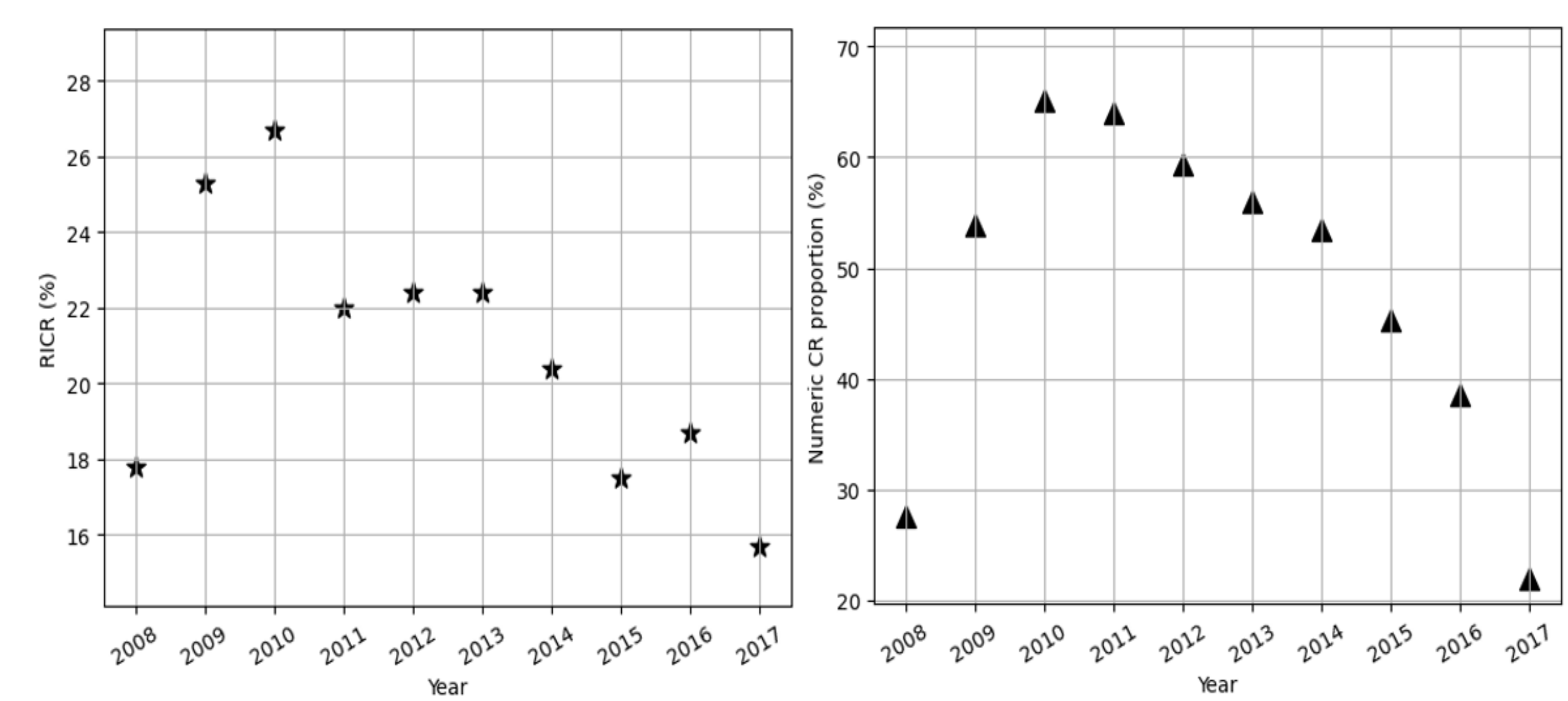


Fig 4. On the left: evolution of RICR 2008-2017. On the right: evolution of the proportion of numeric CR devices in use in DOCS-Occitanie. Pearson correlation is 0.84 (p-value = 0.002). CR stands for Computed Radiography, a mammography device technology used during the transition from analogic to digital radiography (DR). DR is currently the main technology used (by far) in DOCS-Occitanie centers.

Age	PPV (%)	CDR (‰)
50-59	17 (15.9-18.2)	8.4 (7.8-8.9)
60-69	27.7 (26.2-29.2)	10.7 (10.1-11.3)
70-74	33.5 (30.8-36.3)	13.3 (12.1-14.4)

Table 1. Evolution of PPV and CDR along with age

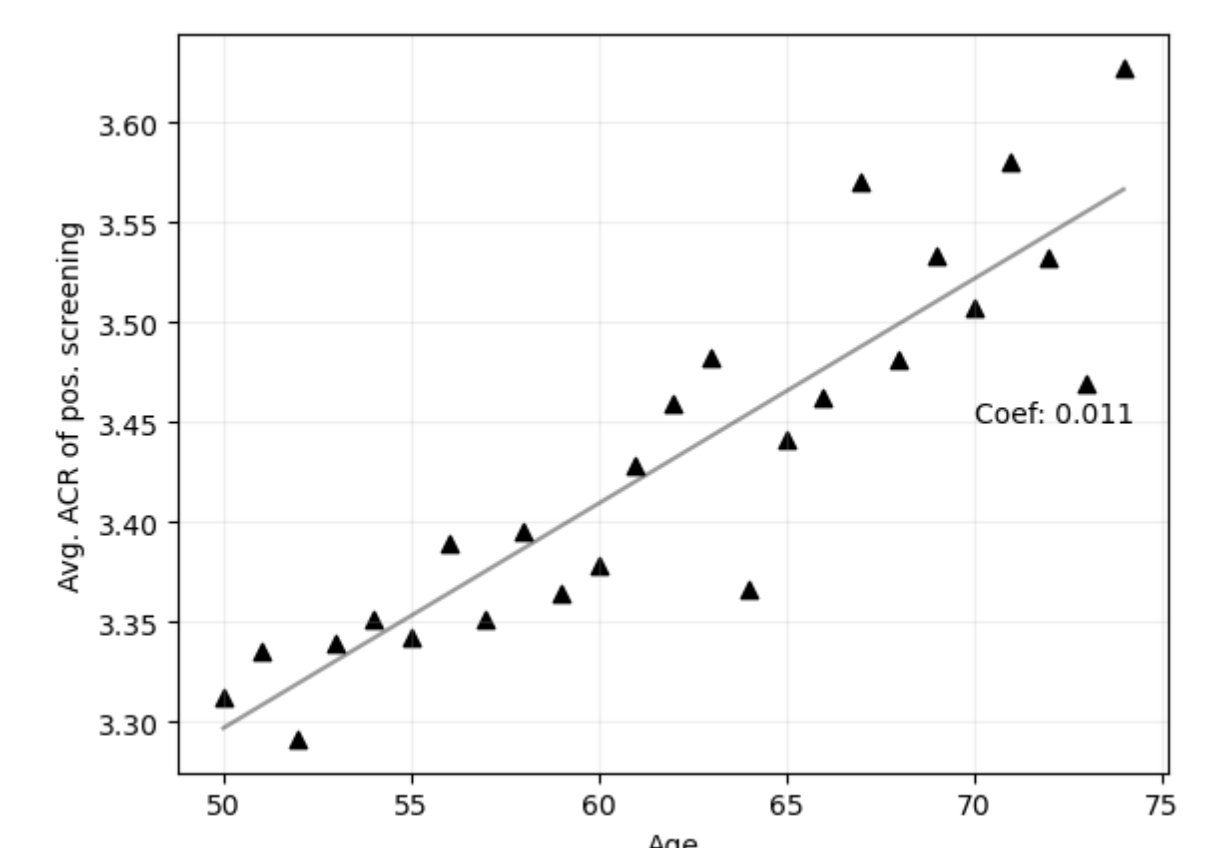


Fig 5. Evolution of average ACR level of positive screening with age

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