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Purpose

- To compare the accuracy and sensitivity of Dual-energy subtraction radiography (DESR) to conventional radiography (CR) in the detection of pulmonary nodules
- Showcase DESR as an imaging aid in the detection of pulmonary nodules

Background

- Dual-energy Subtraction Radiography (DESR) is a radiological technique pioneered in the 1980s that leverages the attenuation patterns of different tissues at different energies. Specifically, bone and other calcium-containing tissue are more attenuated when compared with soft-tissue structures at low energies. This can generate two chest radiographs: one that contains radio-opaque structures such as bone and one that has primarily radiolucent soft-tissue structures¹.
- While DESR may have an unclear role between CR and current recommended screening modalities for pulmonary nodule detection, such as low-dose computed tomography (LDCT), DESR has some key advantages to both techniques. DESR utilizes less radiation than LDCT and compared to CR, studies have shown that DESR has superior sensitivity and accuracy for identifying pulmonary nodules that are obscured by rib and clavicle interference².
- However, other studies have shown no difference in sensitivity and/or AUC between DESR and CR^{3,4}.
- This abstract is the first combined meta-analysis investigating DESR versus CR by comparing key data, including ROC AUC and sensitivity.

Methods

The authors searched Pubmed/MEDLINE using the terms "Dual energy subtraction radiography," and "Subtraction Radiography." Only studies involving the diagnosis of pulmonary nodules and those comparing DESR to conventional plain-film chest radiography were included. The following data was recorded: Reader Type (Resident or Attending Physician or Both), Number of radiographs, Number of nodules, diameter of nodules (in mm), and Energies used (Kvp) (Some data not shown).

The quantitative outcomes were the difference of Receiver Operating Characteristic Area under the curve (ROC AUC) and difference in sensitivity between DESR and CR.

ROC AUC & Sensitivity Data

Figure 1: Boxplots of ROC AUC values of DESR compared to CR nodule detection methods from 13 published studies

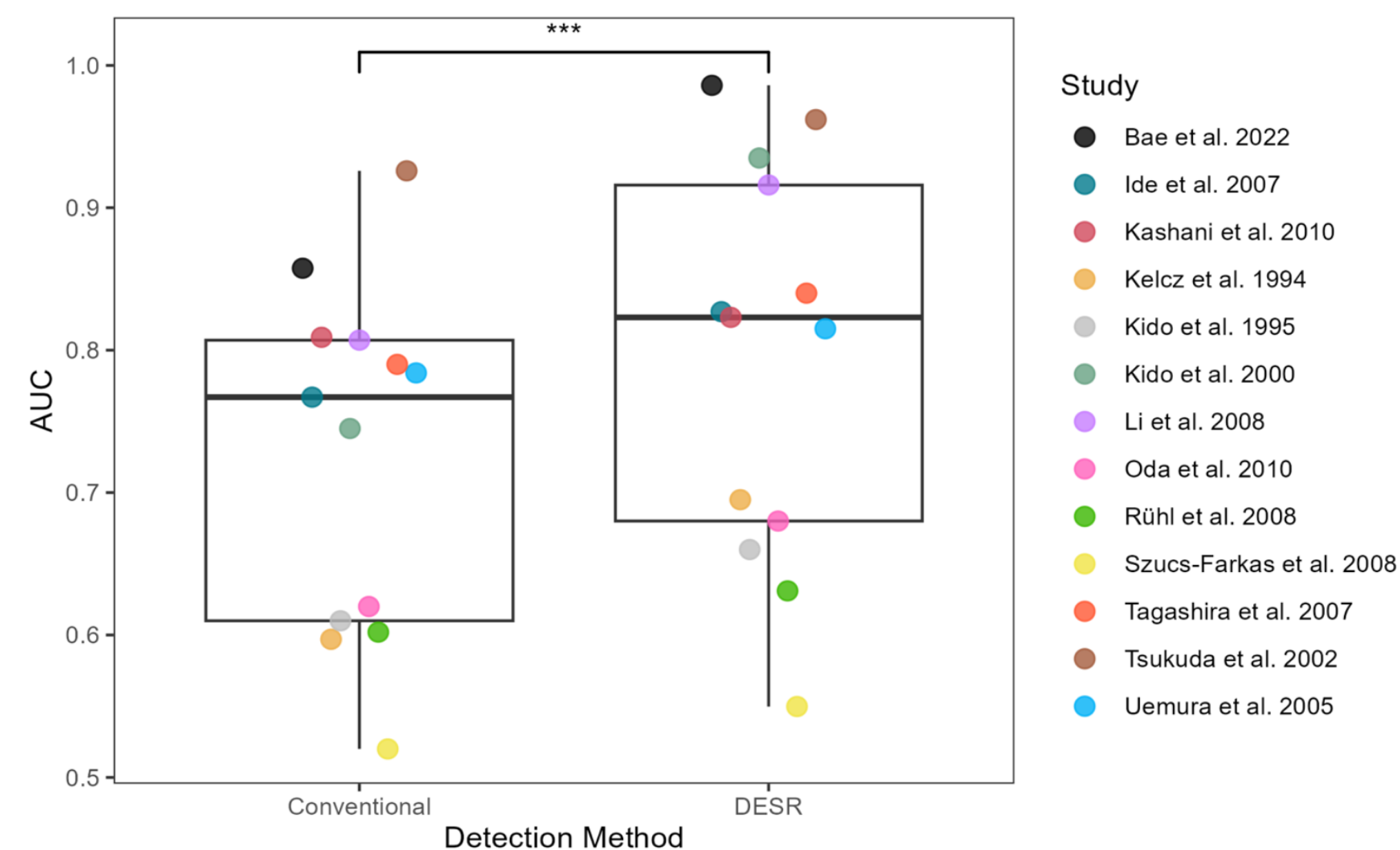
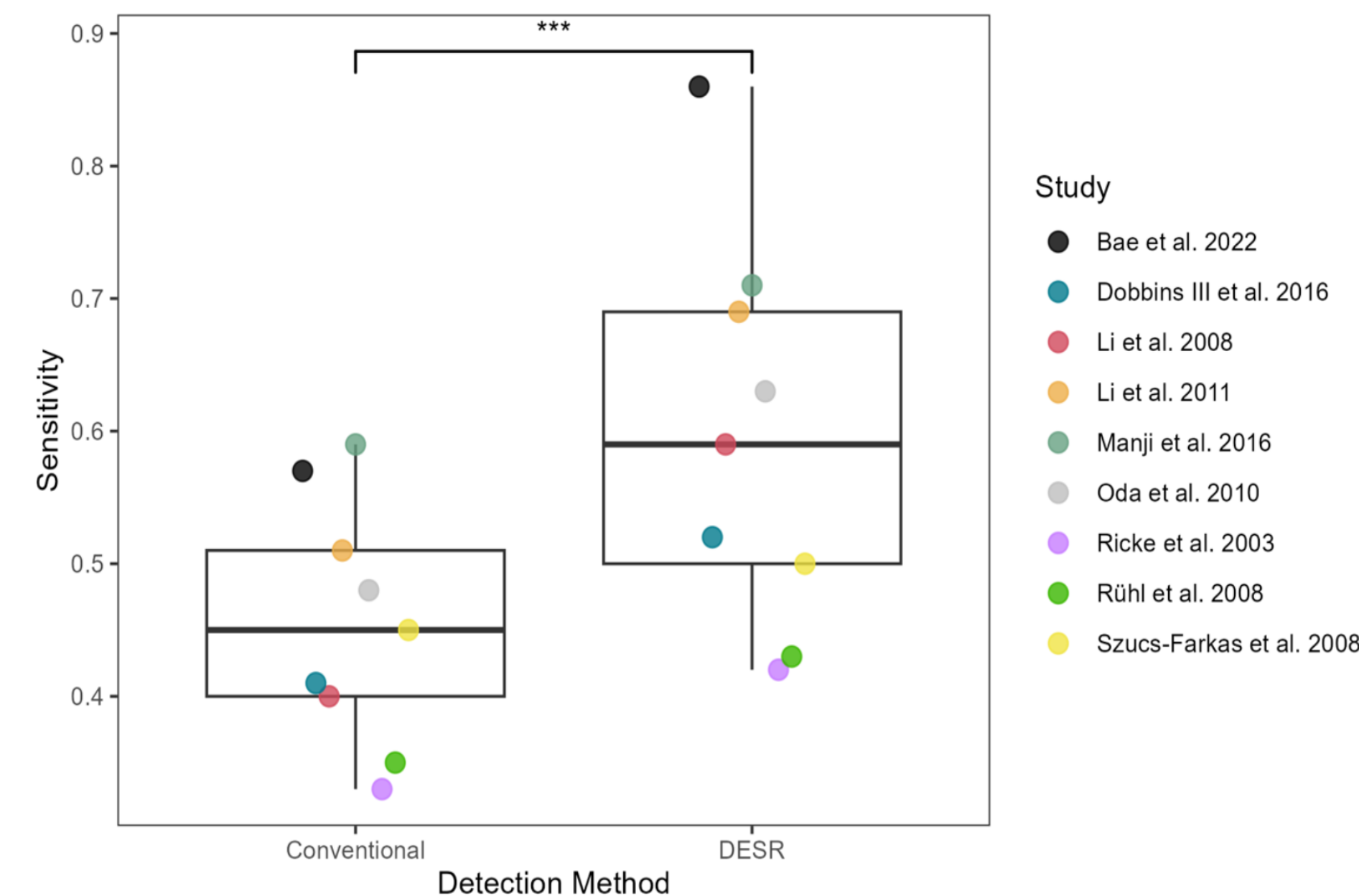


Figure 2: Boxplots of Sensitivity values of DESR compared to CR nodule detection methods from 9 published studies



Results

A total of 17 studies were analyzed. A total of 1365 patients were included in the review, 465 of whom were controls without any nodules present. A total of at least 1661 nodules were identified among the 900 patients with pulmonary nodules. The mean/median of nodule size ranged from 5 mm to 27 mm.

The average ROC AUC for pulmonary nodule detection in the DESR group was 0.794 (SD = 0.139) and the average ROC AUC in the CR group was 0.726 (SD = 0.122). The mean difference for DESR ROC AUC compared to conventional radiography ROC AUC was 0.07 (p < 0.001). This means that, on average, there is a 7% increase in the ability of physicians to identify if a lung nodule is present or not when DESR is used instead of CR.

The average sensitivity for pulmonary nodule detection in the DESR group was 0.594 (SD = 0.144) and the average sensitivity in the CR group was 0.454 (SD = 0.091). The mean difference for the sensitivity of DESR to CR was 0.14 (p < 0.001), and the effect size was large.

Conclusions

DESR showed superior sensitivity and ROC AUC values compared to CR in detecting pulmonary nodules. This shows how DESR is superior to CR in discriminating between classes (higher ROC AUC) and more effective in identifying true positives (higher sensitivity).

DESR may enhance radiologist capacity to detect pulmonary nodules and may be used to augment physician training and education.

References

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