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Low-Dose Lung Cancer Screening Computed Tomography

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What is Computed Tomography (CT)?

- ❖ Computed Tomography (CT) is the process of creating a cross-sectional tomographic plane on any part of the body.
- ❖ A detector assembly measures the amount of radiation exiting the patient and feeds back the information, referred to as primary data.
- ❖ Three dimensional reconstructions of images are used for surgical planning, CT angiography (CTA), radiation therapy planning, and virtual reality imaging

(Long, Rollins, & Smith. 2019).

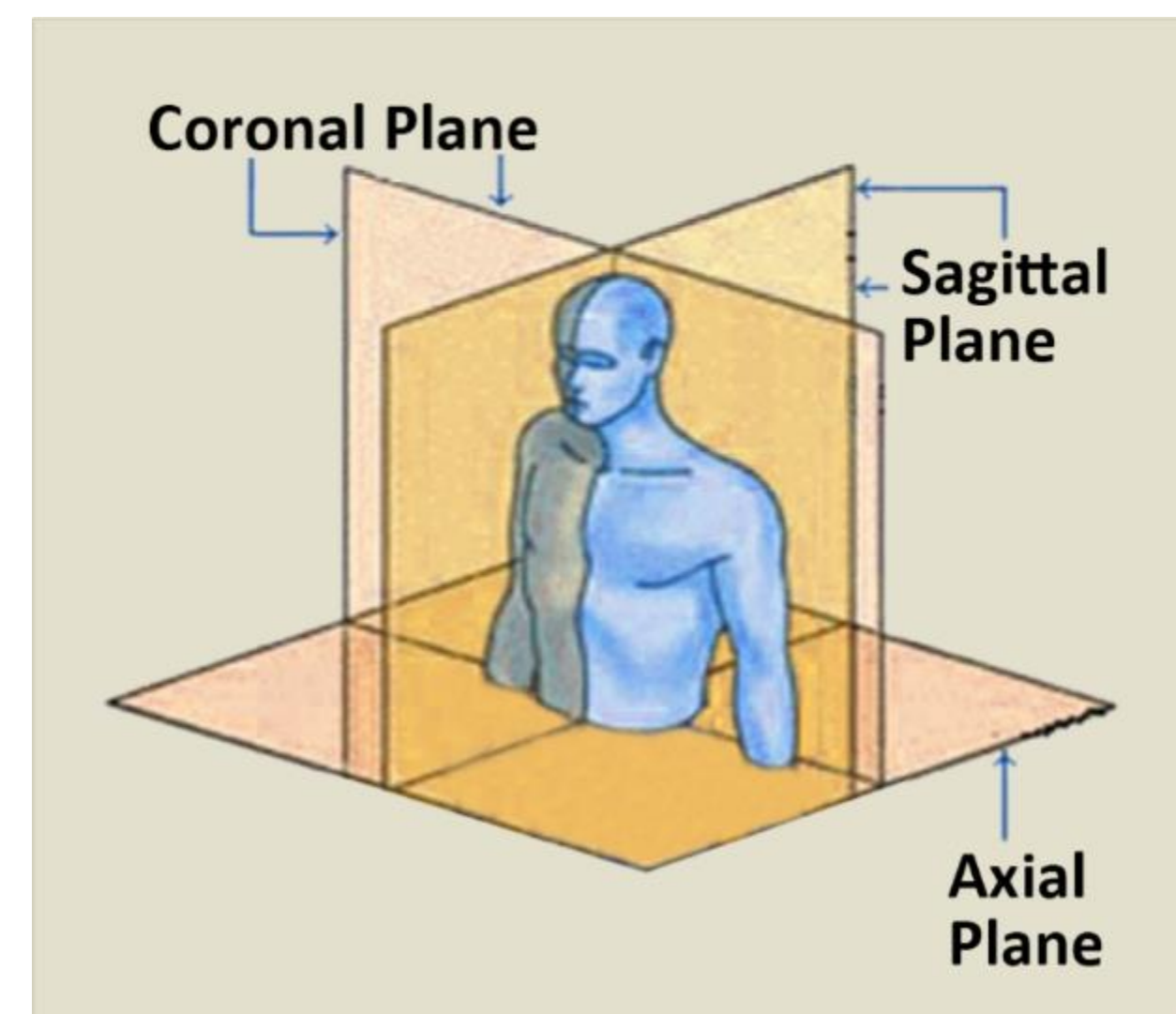


Image 1. Demonstrates the three-dimensional planes created from a CT scanner. (Image reconstruction planes, 2019).

Low Dose Chest CT Methods

- ❖ During a low dose CT (LDCT) scan, the patient is lying supine and given a pillow for comfort.
- ❖ A technologist runs the scan in a separate room and the table passes through the machine that creates cross-sectional images of the lungs.
- ❖ When the machine is ready to scan, the patient suspends on inspiration to create a clear picture of the lungs.
- ❖ After the low dose CT (LDCT) scan is complete, the patient can go about the day normally.

(Lung cancer screening, 2021).



Image 2. (New x-ray measurement approach could improve CT scanners, 2019)

Low Dose Lung Cancer Screening

- ❖ Lung cancer screening is a process that's used to detect the presence of lung cancer (Lung cancer screening, 2021).
- ❖ Lung cancer screening is usually reserved for people with the greatest risks of lung cancer, including older adults who are current or former smokers (Lung cancer screening, 2021).
- ❖ Pack years are calculated by multiplying the number of packs of cigarettes smoked per day and the number of years someone has been smoking (Lung cancer screening, 2021).
- ❖ Researchers also have discovered that environmental causes such as exposure to radon and diesel exhaust can increase the risk of lung cancer (What's new in lung cancer research?, 2019).

Statistics of Lung Cancer

- ❖ Lung cancer is the second most common cancer in both men and women.
- ❖ Average age of people when diagnosed is about 70.
- ❖ Most lung cancer statistics include both small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC).
- ❖ 13% of all lung cancers are SCLC.
- ❖ 84% of all lung cancers are NSCLC.
- ❖ About 235,760 new cases of lung (119,100 in men and 116,660 in women).
- ❖ About 131,880 deaths from lung cancer.

(Key statistics for lung cancer, 2021)

Standard vs. Low Dose CT Protocols

- ❖ A study was conducted to determine whether low-dose chest CT with 50 milliamperes-second (mAs) can substitute standard-dose chest CT with 150 mAs to evaluate lung lesions.
- ❖ The results show that detection of pulmonary nodules is possible with low dose CT images obtained with 20-50 mAs.
- ❖ Comparison of overall impression scores revealed no significant scoring difference between low dose CT and standard dose CT images.

- ❖ Low dose CT images using 50 mAs offers diagnostic performance and characterization capabilities compared to standard dose CT images.
- ❖ Low dose CT protocols can substitute the standard dose CT with 150 mAs to reduce patient dose.

(Kubo et al., 2016)

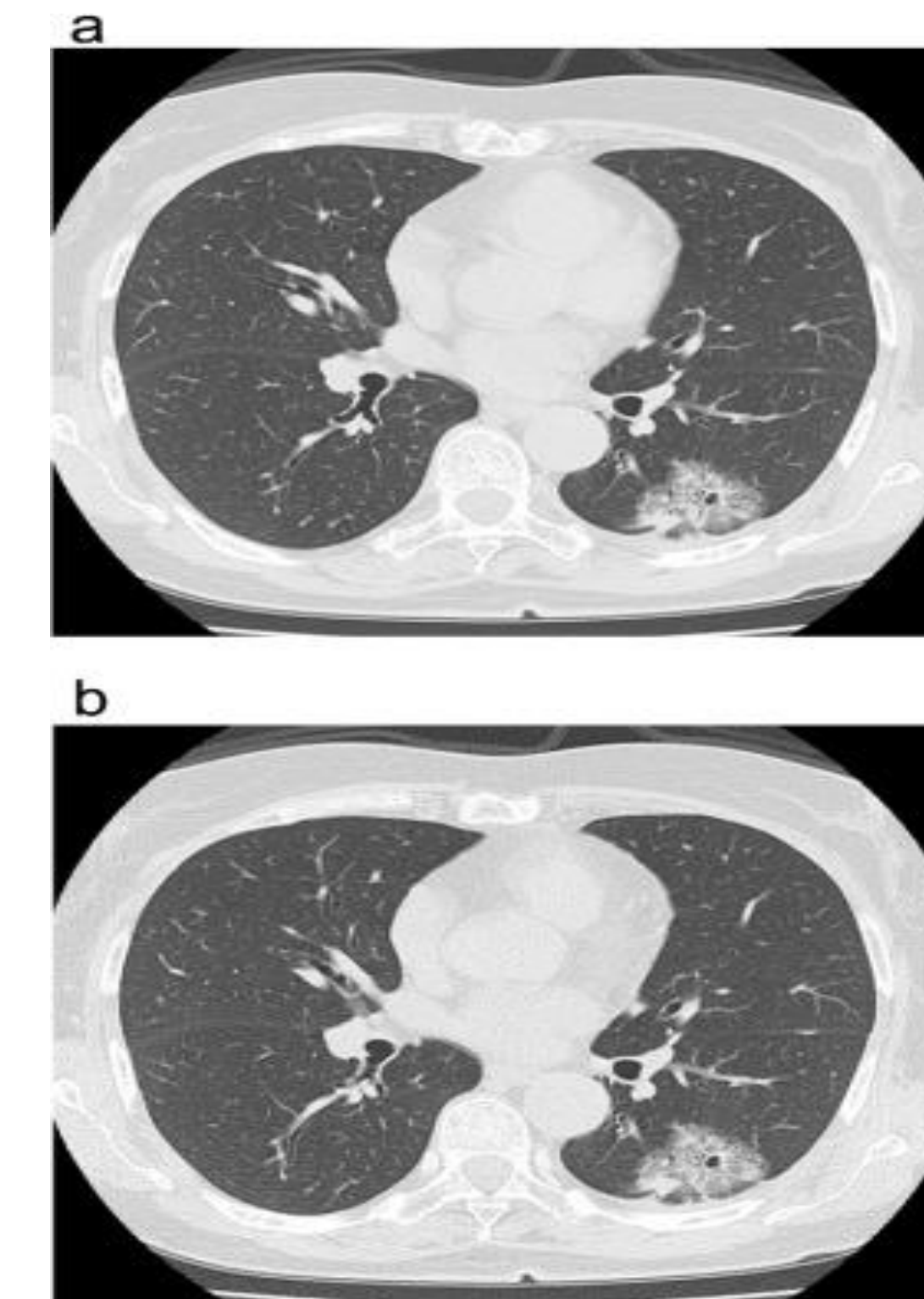


Image 3. (a. Standard dose image; b. Low dose image) 67-year-old female who had a chest CT examination for evaluation of a suspected mass in the left lower lobe. (Kubo et al., 2016).

Underutilization of Low Dose CT Screening

- ❖ This study used an established registry data to assess the lung cancer screening rate across the U.S.
- ❖ The 2015 National Health Interview Survey was used to estimate the screening eligibility for smokers in the United States Preventive Service Task Force criteria.

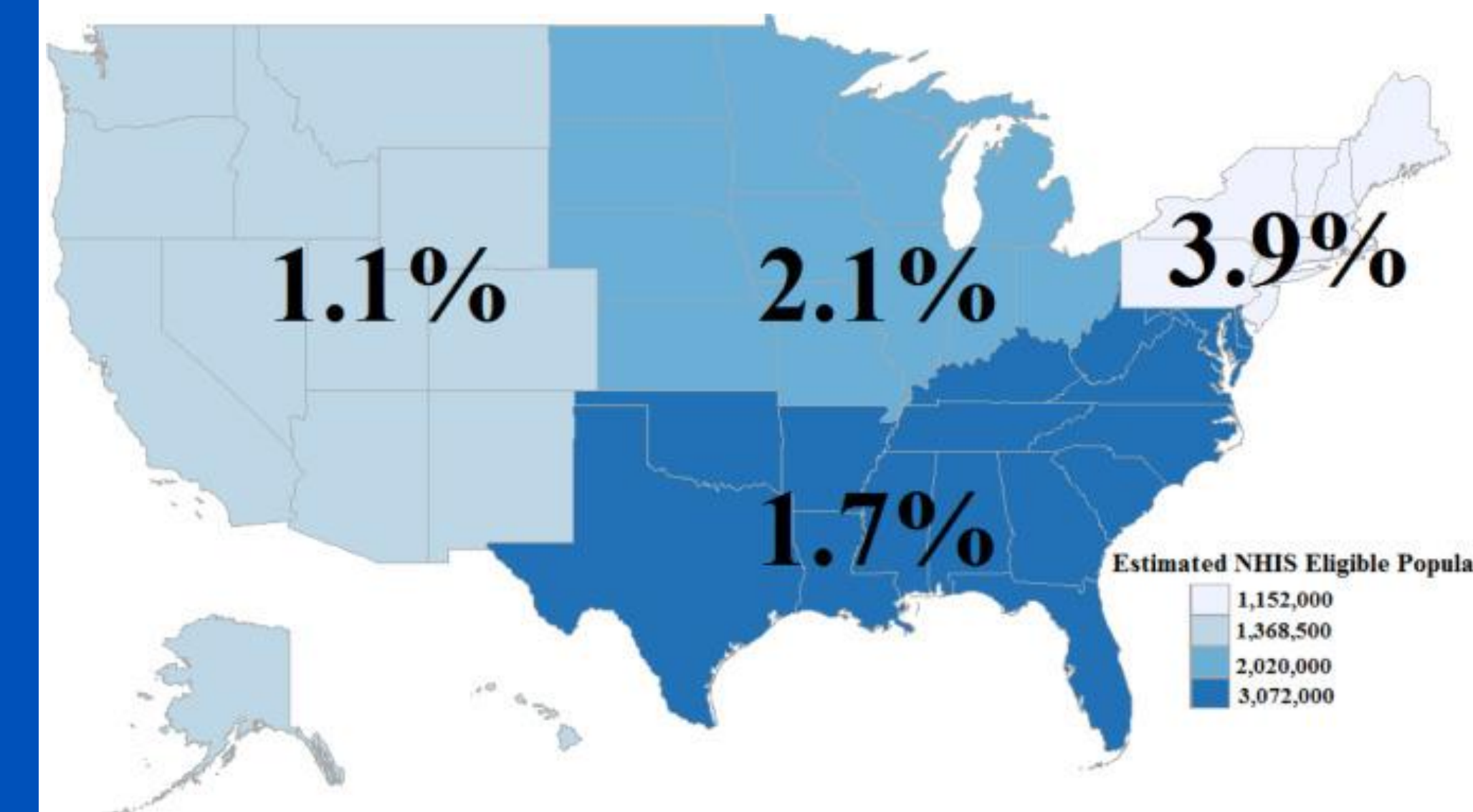


Image 4. The calculated screening rates from lowest to highest were the West at 1.1%, South at 1.7%, Midwest at 2.1%, and Northeast at 3.9%. Nationwide, the screening rate was 2.0% of an eligible 7,613,000 smokers. (Pham et al., 2020)

- ❖ Lung cancer screening remains heavily underutilized despite the guidelines recommended since 2013, insurance coverage, and the potential to prevent thousands of lung cancer deaths annually.
- ❖ Lung cancer screening may prevent over 12,000 premature lung cancer deaths annually.
- ❖ Results show that lung cancer screening with LDCT is heavily underutilized at a rate of only 2% in the United States.

(Pham et al., 2020).

Risks vs Benefits of Low Dose Lung Cancer Screening

Risks:

- ❖ The patient may undergo follow-up tests, additional scans, or invasive procedures if the scan shows a suspicious spot in the lungs
- ❖ Finding lung cancer that is too advanced to be cured
- ❖ Possibility of mistaking or missing a lung nodule on a low dose CT screening

Benefits:

- ❖ Detect lung cancer at an early stage
- ❖ Can start treatment and be cured at an early stage
- ❖ Uses low dose radiation instead of a standard dose CT screening

(Lung cancer screening, 2021).

Conclusion

Low dose CT screening is essential in the management of suspicious lung nodules. CT creates three-dimensional images and is the modality of choice when looking for lung cancer. Low dose CT screenings are usually for older people at higher risks of lung cancer who are current or former smokers. Using low dose CT protocol of 50 mAs compared to a standard low dose CT protocol scored no significant difference between the images, and the images showed plenty of information. This can substitute the standard CT protocol that uses 150 mAs and use the low dose protocol at 50 mAs to reduce patient dose.

Unfortunately, low dose CT screenings are heavily underutilized by a rate of 2% in the U.S. However, the risks and benefits of receiving radiation, detection of lung cancer at an early stage, and can be treated early should be considered.