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# Pilot lung cancer screening program using low dose computed tomography: results in Serbia during 1-year period

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## EPIDEMIOLOGY

Early twentieth century rate the incidence doubled every decade, while the incidence rate increased in the 1990s XX century amounted to about 3% per year.

In our country, about 36,000 new cases of cancer are discovered annually, while more than 20,000 people die from cancer. In a year in Serbia, 7,000 patients get lung cancer every year, while about 5,000 die of this disease.

The average age of patients treated for lung cancer is 64 years, the youngest patient was 21 years old, and the oldest was 94, men are in the lead in the treatment of lung cancer, so 71% of men and 29% of women.

In the last 10 years, there were only nine percent of non-smokers among the sick, 27 percent of ex-smokers, and most were active smokers, as many as 66 percent.

The regions with the highest incidence and mortality were the city of Belgrade, Sumadija districts.

## LDCT

Low Dose CT (LDCT) is a type of CT scan that is technically similar to a standard CT scan of the chest without IV contrast.

The point is on achieving the lowest effective dose (ED) with customized CT imaging parameters (using minimum tube current (mA) and maximum tube rotation speed with minimum recording time and achieving adequate diagnostic image quality sufficient for reliable interpretation of findings. It is characterized by: the use of minimum strength X-ray tube currents (mA) and maximum rotation speeds X-ray of the tube. Use of time minimum duration recording. Technical requirements and study recommendations for creating conditions to achieve the minimum possible effective dose\* during Low-dose CT screening.

< 50kg	50-80kg	>80kg
0.4mGy	0.8mGy	1.6mGy

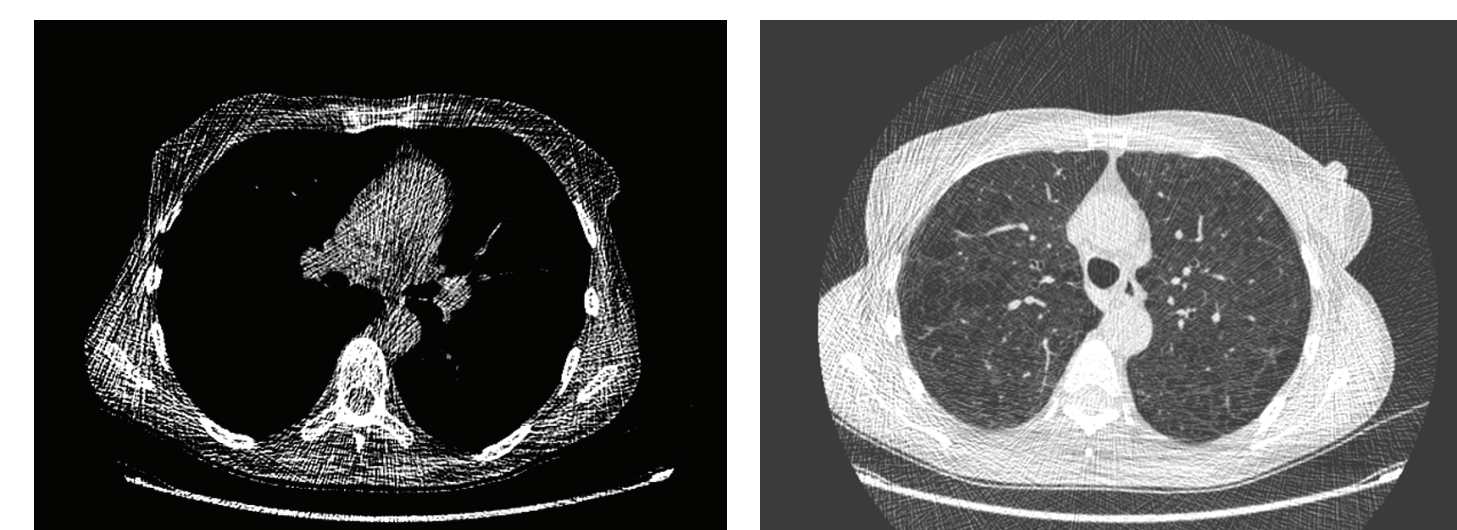
CT dose index (CTDI) (measured in mGy) is standardized a measure of the amount of radiation dose to a CT scanner given to the user allows you to compare the radiation doses of different CT scanners. For spiral scanners in current use, the CTDIvol parameter (volume) is the index most commonly used.

## SCREENING COVERS

The population between 50 and 74 years. People with a smoking path of 30 \*cigar box years, 20 \*cigar box years with another risk factor (COPD, previous smoking-related cancer, first-line relative diseased from lung cancer, exposure to carcinogens at work). Former smokers who quit smoking 10 or less years ago and smoked 20 to 30 \*cigar box a year.

\*cigar box = number of years of smoking x number of packs of cigars.

PROTOKOL	CTDI mGy	Total DLP mGy*em
IPBV – Skrining < 50kg	0.20 - 0.40	16
IPBV – Skrining 50-80kg	0.5 - 0.7	24
IPBV – Skrining >80kg	1.2 - 1.4	57
IPBV – Low dose fabricki	3.5	144
IPBV – HRTC	15	647
IPBV – CTPA	41	1034



Taken from the PACS system  
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## Lung-RADS® Version 1.1 Assessment Categories Release date: 2019

Category Description	Lung-RADS Score	Findings	Management	Risk of Malignancy	Est. Population Prevalence
<b>Incomplete</b>	0	Prior chest CT examination(s) being located for comparison Part or all of lungs cannot be evaluated	Additional lung cancer screening CT images and/or comparison to prior chest CT examinations is needed	n/a	1%
<b>Negative</b> No nodules and definitely benign nodules	1	No lung nodules Nodule(s) with specific calcifications: complete, central, popcorn, concentric rings and fat containing nodules			
<b>Benign Appearance or Behavior</b> Nodules with a very low likelihood of becoming a clinically active cancer due to size or lack of growth	2	<b>Perifissural nodule(s)</b> (See Footnote 11) < 10 mm (524 mm <sup>3</sup> ) <b>Solid nodule(s):</b> < 6 mm (< 113 <sup>3</sup> ) new < 4 mm (< 34 mm <sup>3</sup> ) <b>Part solid nodule(s):</b> < 6 mm total diameter (< 113 mm <sup>3</sup> ) on baseline screening <b>Non solid nodule(s) (GGN):</b> < 30 mm (< 14137 mm <sup>3</sup> ) OR ≥ 30 mm (≥ 14137 mm <sup>3</sup> ) and unchanged or slowly growing <b>Category 3 or 4 nodules unchanged for ≥ 3 months</b>	Continue annual screening with LDCT n 12 months	< 1%	90%
<b>Probably Benign</b> Probably benign finding(s) - short term follow up suggested; includes nodules with a low likelihood of becoming a clinically active cancer	3	<b>Solid nodule(s):</b> ≥ 6 to < 8 mm (≥ 113 to < 269 mm <sup>3</sup> ) at baseline OR new 4 mm to < 6 mm (34 to < 113 mm <sup>3</sup> ) <b>Part solid nodule(s)</b> ≥ 6 mm total diameter (≥ 113 mm <sup>3</sup> ) with solid component < 6 mm (< 113 mm <sup>3</sup> ) OR new < 6 mm total diameter (< 113 mm <sup>3</sup> ) <b>Non solid nodule(s)</b> (GGN) ≥ 30 mm (≥ 14137 mm <sup>3</sup> ) on baseline CT or new	6 month LDCT	1-2%	5%
<b>Suspicious</b> Findings for which additional diagnostic testing is recommended	4A	<b>Solid nodule(s):</b> ≥ 8 to < 15 mm (≥ 268 to < 1767 mm <sup>3</sup> ) at baseline OR growing < 8 mm (< 268 mm <sup>3</sup> ) OR new 6 to < 8 mm (113 to < 268 mm <sup>3</sup> ) <b>Part solid nodule(s):</b> ≥ 6 mm (≥ 113 mm <sup>3</sup> ) with solid component ≥ 6 mm to < 8 mm (≥ 113 to < 268 mm <sup>3</sup> ) OR with a new or growing < 4 mm (< 34 mm <sup>3</sup> ) solid component <b>Endobronchial nodule</b>	3 month LDCT; PET/CT may be used when there is a ≥ 8 mm (≥ 268 mm <sup>3</sup> ) solid component	5-15%	2%
<b>Very Suspicious</b> Findings for which additional diagnostic testing and/or tissue sampling is recommended	4B	<b>Solid nodule(s):</b> ≥ 15 mm (≥ 1767 mm <sup>3</sup> ) OR new or growing, and ≥ 8 (≥ 268 mm <sup>3</sup> ) <b>Part solid nodule(s) with:</b> a solid component ≥ 8 mm (≥ 268 mm <sup>3</sup> ) OR a new or growing ≥ 4 mm (≥ 34 mm <sup>3</sup> ) solid component	Chest CT with or without contrast, PET/CT and/or tissue sampling depending on the *probability of malignancy and comorbidities. PET/CT may be used when there is a ≥ 8 mm (≥ 268 mm <sup>3</sup> ) solid component. For new large nodules that develop on an annual repeat screening CT, a 1 month LDCT may be recommended to address potentially infectious or inflammatory conditions	> 15%	2%
<b>Other</b> Clinically Significant or Potentially Clinically Significant Findings (non lung cancer)	S	Category 3 or 4 nodules with additional features or imaging findings that increases the suspicion a malignancy <b>Modifier - may add on to category 0-4 coding</b>	As appropriate to the specific finding	n/a	10%

Taken from the <https://www.acr.org/>

## LUNG RADS

Lung-RADS (Lung Imaging Reporting and Data System), is a classification proposed to aid with findings in low-dose CT screening exams for lung cancer. The goal of the classification system is to standardize follow-up and management decisions. The system is similar to the Fleischner criteria but designed for the subset of patients intended for low-dose screening studies.

## RESULTS

Of the planned 2,000 participants, 50.7% (1015/2000) responded to the screening program in the first year. The majority of participants were females 59.5% (604/1015) and the average age 73.1% (742/1015) were females 55-69 years of age.

During the screening program, 1.3% (11/851) of active smokers accepted smoking cessation treatment, and 1.1% (9/851) stopped smoking. Invasive diagnosis was performed in 3.44% (35/1015) of persons, of which 57.1% (20/35) were malignant and 42.8% (15/35) benign. Of the findings of primary lung cancer, 81.3% (13/16) were NCSLC 50.0% (adenocarcinoma) 50.0% (8/16), squamous 25.0% (4/16), undifferentiated 6.3% (1/16), and 18.7% (3/16) were SCLC. 56.2% (9/16) of lung cancers were detected in the first or second stage of the disease. Malignant etiology of primary lung cancer was more common in men than in the female population (2.67% vs. 1.32%, p = 0.02).

## CONCLUSION

Decreased irradiation dose, together with higher accuracy (CAD software package) compared to chest X-rays, makes LDCT excellent screening tool, which allows early detection of lung cancer, and therefore improves survival rate.

Response rate for pilot LC screening in Serbia is still low and need to be increased, in particular among males, singles and unemployed. This pilot program shows the need for widening in all regions. Better health education, innovative approaches and more recognizable campaign needs to be established in order to decrease smoking prevalence.