

# Pulmonary Nodules and Lung Cancer Screening





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# The Problem of Pulmonary Nodules

- Pulmonary nodules can be malignant
- Incidentally found pulmonary nodules can be lost to f/u and not be noticed again until they are symptomatic malignancies

# Lung Cancer Prevalence in the US

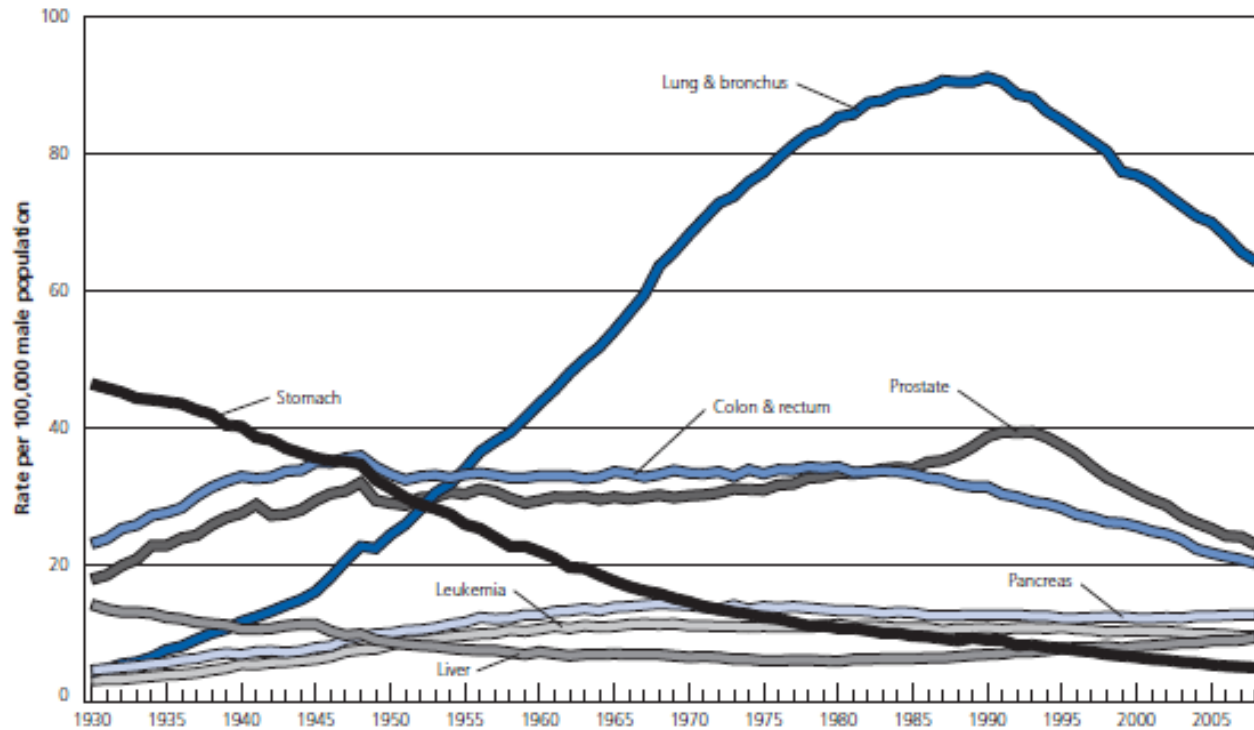
## Estimated New Cases\*

			Males	Females			
Prostate	233,000	27%			Breast	232,670	29%
Lung & bronchus	116,000	14%			Lung & bronchus	108,210	13%
Colorectum	71,830	8%			Colorectum	65,000	8%
Urinary bladder	56,390	7%			Uterine corpus	52,630	6%
Melanoma of the skin	43,890	5%			Thyroid	47,790	6%
Kidney & renal pelvis	39,140	5%			Non-Hodgkin lymphoma	32,530	4%
Non-Hodgkin lymphoma	38,270	4%			Melanoma of the skin	32,210	4%
Oral cavity & pharynx	30,220	4%			Kidney & renal pelvis	24,780	3%
Leukemia	30,100	4%			Pancreas	22,890	3%
Liver & intrahepatic bile duct	24,600	3%			Leukemia	22,280	3%
<b>All Sites</b>	<b>855,220</b>	<b>100%</b>	<b>All Sites</b>	<b>810,320</b>	<b>100%</b>		

CA Cancer J Clin. 2014;64:9-29

# How serious is it?

Age-adjusted Cancer Death Rates,\* Males by Site, US, 1930-2008



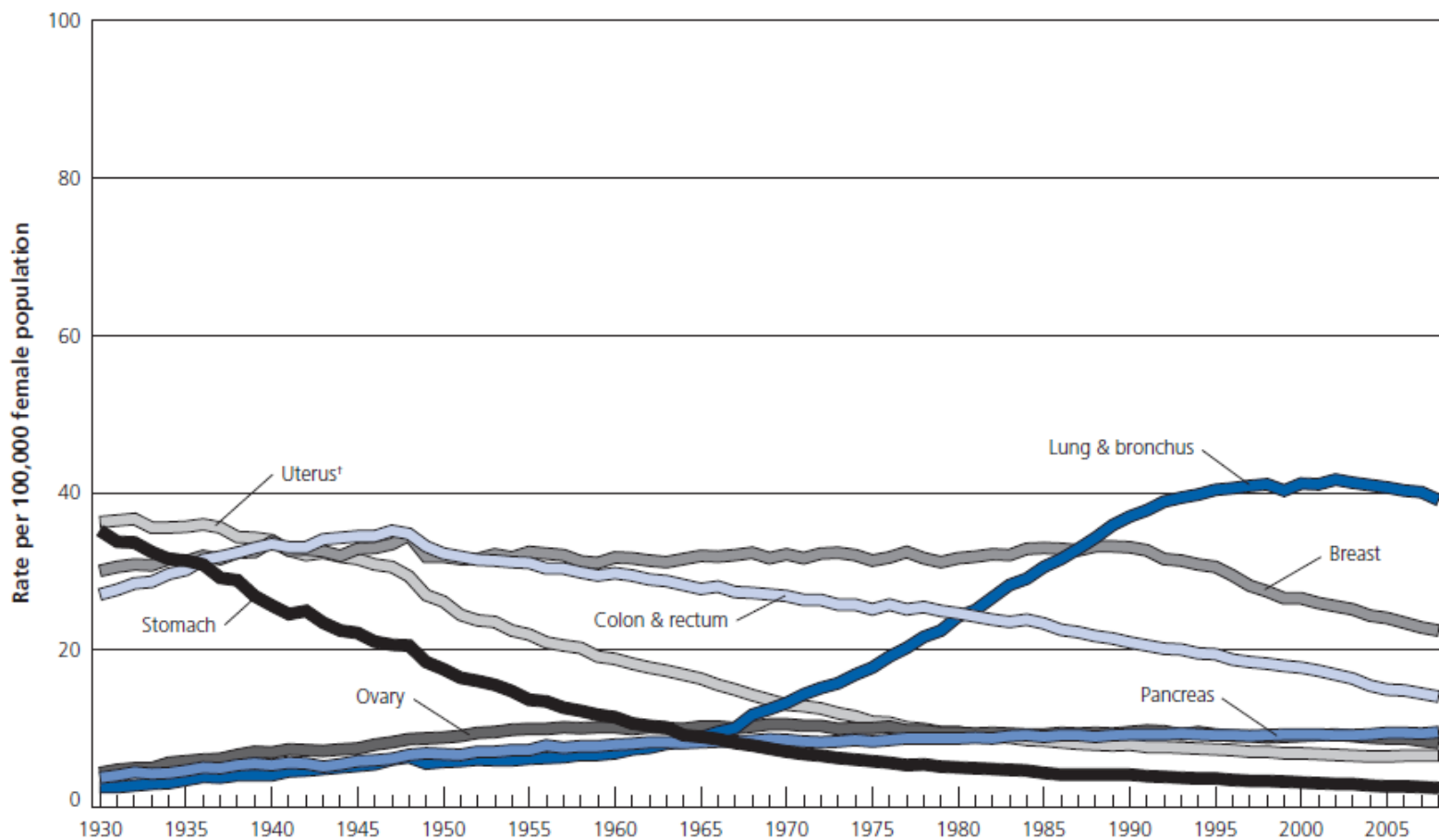
\*Per 100,000, age adjusted to the 2000 US standard population.

**Note:** Due to changes in ICD coding, numerator information has changed over time. Rates for cancer of the liver, lung and bronchus, and colon and rectum are affected by these coding changes.

**Source:** US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2008, National Center for Health Statistics, Centers for Disease Control and Prevention.

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### Age-adjusted Cancer Death Rates,\* Females by Site, US, 1930-2008



\*Per 100,000, age adjusted to the 2000 US standard population. †Uterus cancer death rates are for uterine cervix and uterine corpus combined.

**Note:** Due to changes in ICD coding, numerator information has changed over time. Rates for cancer of the lung and bronchus, colon and rectum, and ovary are affected by these coding changes.

**Source:** US Mortality Volumes 1930 to 1959, US Mortality Data 1960 to 2008, National Center for Health Statistics, Centers for Disease Control and Prevention.

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# What is a pulmonary nodule

*“A spot in your lung.”*

## **Most are benign:**

- Old granulomatous disease/scars
- Coccidioidomycosis
- Aspergillosis
- Cryptococcosis
- Histoplasmosis

## **Some are malignant:**

- Definitive diagnosis can only be made with tissue (biopsy or resection)
- Smaller nodules usually do not require immediate work up by Pulmonary Specialty, **but do require follow up** on chest CT to ensure stability.

# How are Nodules Found?

- Until recently there were no recommendations for screening:
- Malignant nodules were found incidentally on imaging done for another purpose
- **Patients presented with symptoms of lung cancer**

# Incidental nodules

Seen on:

- CXR
- CT
- Myocardial perfusion imaging
- Abdominal CT
- Other imaging that captures lung fields

**CT chest is the best tool for evaluation and follow-up of pulmonary nodules**



# Types of Pulmonary Nodules

- Solid
- Subsolid (Ground-Glass Nodule)
- Mixed Solid/Subsolid

# High Risk Pulmonary Nodules

Morphology concerning for malignancy

- Spiculation/irregular border
- Size >8mm to 10mm
- Mixed solid and “ground glass” component
- Cavitated with thick wall (thickness  $\geq 15$  mm)

And/Or growth on subsequent imaging

- Malignant growth rate ( 1 mo < doubling time < 16 mo)

\* Persistent groundglass nodule >5mm is concerning for malignancy but typically for more indolent malignancy (adenocarcinoma in situ) and is sometimes not treated as a “high-risk” nodule.

# High risk patient

- **Smoking history**
- **Asbestos exposure**
- Family history of lung cancer in 1<sup>st</sup> degree relative
- Other current malignancy
- Advanced age
- Previous radiation to the chest
- Other exposures: radon, uranium, agent orange, arsenic, diesel exhaust, some forms of silica and chromium

# Relationship of diameter to likelihood of malignancy in incidentally detected pulmonary nodules

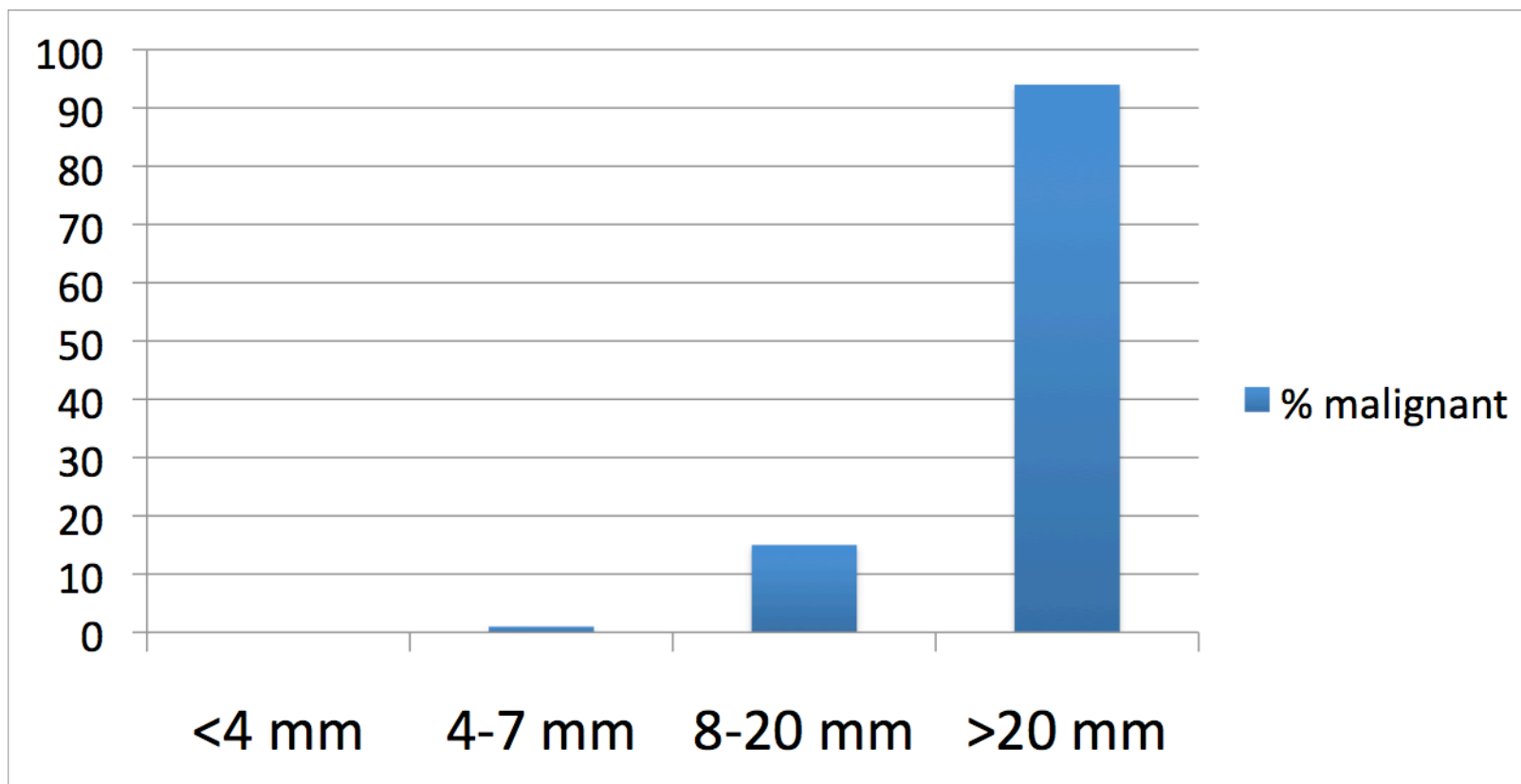
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<u>Initial nodule diameter</u>	<u>% malignant</u>
< 4 mm	0
4 – 7 mm	1-2
8 – 20 mm	15
> 20 mm	31

Study with 1520 patients, >20 pack years, > 50 years of age. Underwent 5 low-dose chest CT scans at annual intervals. 3356 non-calcified nodules detected in 1118 patients and out of those 68/3356 ultimately shown to be lung cancer.

[Swensen SJ et al. Radiology 2005;235:259-265.]

# Size and likelihood of cancer Which pulmonary nodules need f/u?



*Swensen. Radiology 2005; 235: 259*

# Nodule is identified, now what?

- Baseline CT chest (if seen on other imaging): to r/o other larger nodules and serve as good starting point for f/u

Then:

NO FOLLOW UP	FOLLOW UP WITH SERIAL CT CHEST	IMMEDIATE ACTION
<ul style="list-style-type: none"><li>• Definitively benign features</li><li>• Benign pattern of calcification</li><li>• Fat</li></ul>	<ul style="list-style-type: none"><li>• Size &lt;8-10mm</li><li>• No concerning features (ie not spiculated)</li><li>• Some kinds of ground-glass nodules</li></ul>	<ul style="list-style-type: none"><li>• Size &gt;8-10mm</li><li>• Malignant appearance/growth</li></ul>

# Fleischner Society Recommendations for Solid Nodules

Nodule size	Low-risk patient	High-risk patient
≤4 mm	No follow-up	12 months
>4-6 mm	12 months	6-12 months 18-24 months
6-8 mm	6-12 months 18-24 months	3-6 months 9-12 months 24 months
>8 mm	3 months 9 months 24 months	3 months 9 months 24 months

*Fleischner Guidelines. Radiology 2005; 237: 395.*

# Fleischner Society Recommendations for Subsolid Nodules

Solitary Pure Ground-glass Nodules	<5 mm: no follow-up > 5 mm <ul style="list-style-type: none"><li>- Initial follow-up at 3-6 months</li><li>- Subsequent yearly follow-up</li><li>- Development of solid components</li></ul>
Solitary Part-solid Nodules	<ul style="list-style-type: none"><li>• Initial f/u at 3mo to confirm persistence</li><li>• If persistent and <u>solid component</u>: <b>&lt;5mm – then yearly surveillance</b> <b>&gt;5mm – then biopsy or surgical resection</b></li></ul>
Multiple Subsolid Nodules	F/u recs depend on pure GGN vs Mixed and or presence of a dominant lesion



# \*important note

- Guidelines for subsolid nodules DO NOT rely on risk factors, including smoking history. Malignancy risk is determined by the appearance of the nodule
- Malignancy should be considered in anyone with a persistent GGN, especially a mixed GGN

**<http://fleischner.org>**

**<http://www.acr.org/Quality-Safety/Resources/LungRADS>**

# Important considerations

- **Pulmonary nodule follow up may not be clinically indicated in your patient if:**
- They would be unable to tolerate **any** treatment for lung cancer (including surgery, chemotherapy, cyber-knife) and/or are unable to tolerate diagnostic CT guided lung biopsy
- Does not fit in pt's goals of care (pt must understand nodule could be cancer)
- Even if the nodule is malignant it will not likely affect the pt in her/his lifetime [as in the case of some GGO/AIS (adenocarcinoma in situ) nodules]
- Nodule is <4mm and pt has NO risk factors

# When to place a pulmonary consult

- Any solid nodule >8mm-10mm
- Any nodule that has grown
- Any nodule with concerning morphology such as spiculation *even if* the nodule is small (<8mm)
- Patient has complicated history or other current malignancy
- Primary care provider does not feel comfortable following the nodule

# Lung Cancer Screening

## National Lung Cancer Screening Trial 2002-2004

Compared annual low-dose screening CT chest to CXR in 53,456 individuals 55-74yo current and former smokers with at least 30py with 15yr or less quit date

- 20% decrease in lung cancer mortality
- 7% decrease in all cause mortality
- Number needed to screen to extend one life: 300

# Lung Cancer Screening

## U.S. Preventative Services Task Force

2013, Grade B recommendation

**Annual** lung cancer screening with low-dose Chest CT for asymptomatic adults 55-80yo who have 30py smoking hx and currently smoke or whose quit date was 15yrs or less.

# Lung Cancer Screening

## MEDICARE

2/5/2015:

- Medicare will now cover lung cancer screening with LDCT once per year for Medicare beneficiaries who meet all of the following criteria:
- Age 55-77, and are either current smokers or have quit smoking within the last 15 years;
- At least 30 “pack years” (an average of one pack a day for 30 years); and
- Written order from a physician or qualified non-physician practitioner that meets certain requirements.

# Why Screen?

- Most lung cancers are undetected until they become symptomatic at which point resection is often not possible and mortality is very high
- **5 year survival of resected stage 1A lung cancer is ~ 70%**



# Screening Challenges

False positives: NLST had a 25% false positive rate. These need further w/u with the least invasive being serial CT scans and more invasive being lung biopsy or unnecessary surgery.

- Recommendations are to scan for life or until 15yrs post quit date (NLST only scanned for 2yrs)
- Facilities need a standardized process for screening
- Cost

# What about radiation?

- Background radiation dose: 3 mSv/yr
- Background radiation dose in Denver: 5 mSv/yr
- 25 cross-country airplane flights: 1 mSv
- Standard chest CT: 6 mSv
- **Low dose chest CT: 1.5 mSv**
- Tc-99m sestamibi 1 day stress/rest: 12 mSv

# Smoking Cessation

- Ask at every visit
- 1-800-QUIT NOW
- [smokefree.gov](http://smokefree.gov)

# How to help them quit

- Set a quit date, ideally within 2 weeks.
- Remove tobacco products from the environment
- Identify/adjust behaviors that involve smoking (i.e. driving)
- Get support
- **What worked in the past?** - what led to relapse
- Anticipate challenges - including nicotine withdrawal
- Identify reasons for quitting and benefits of quitting

## NRT patch:

- >10cigs daily (1/2ppd) start 21mg/day and taper
- <10cigs daily: start 14mg/day taper

## Varenicline: 12week course

- 0.5 mg daily x3days, then
  - 0.5 mg twice daily x4days, and then
  - 1 mg twice daily for the rest of the course
- \*Monitor for neuropsychiatric and cardiovascular SE

Questions?

Thank you!