An Overview of Lung Cancer
&
Advances in Treatment

Brian Nam

April 17, 2024

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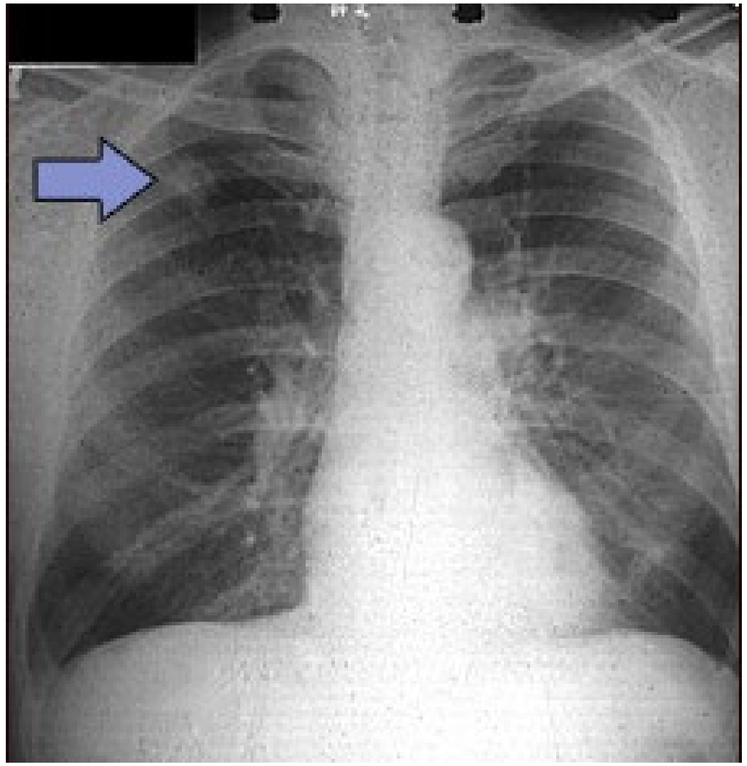
Today's talk:

Cancer statistics

Diagnosis/staging

New treatment options

Technological advances



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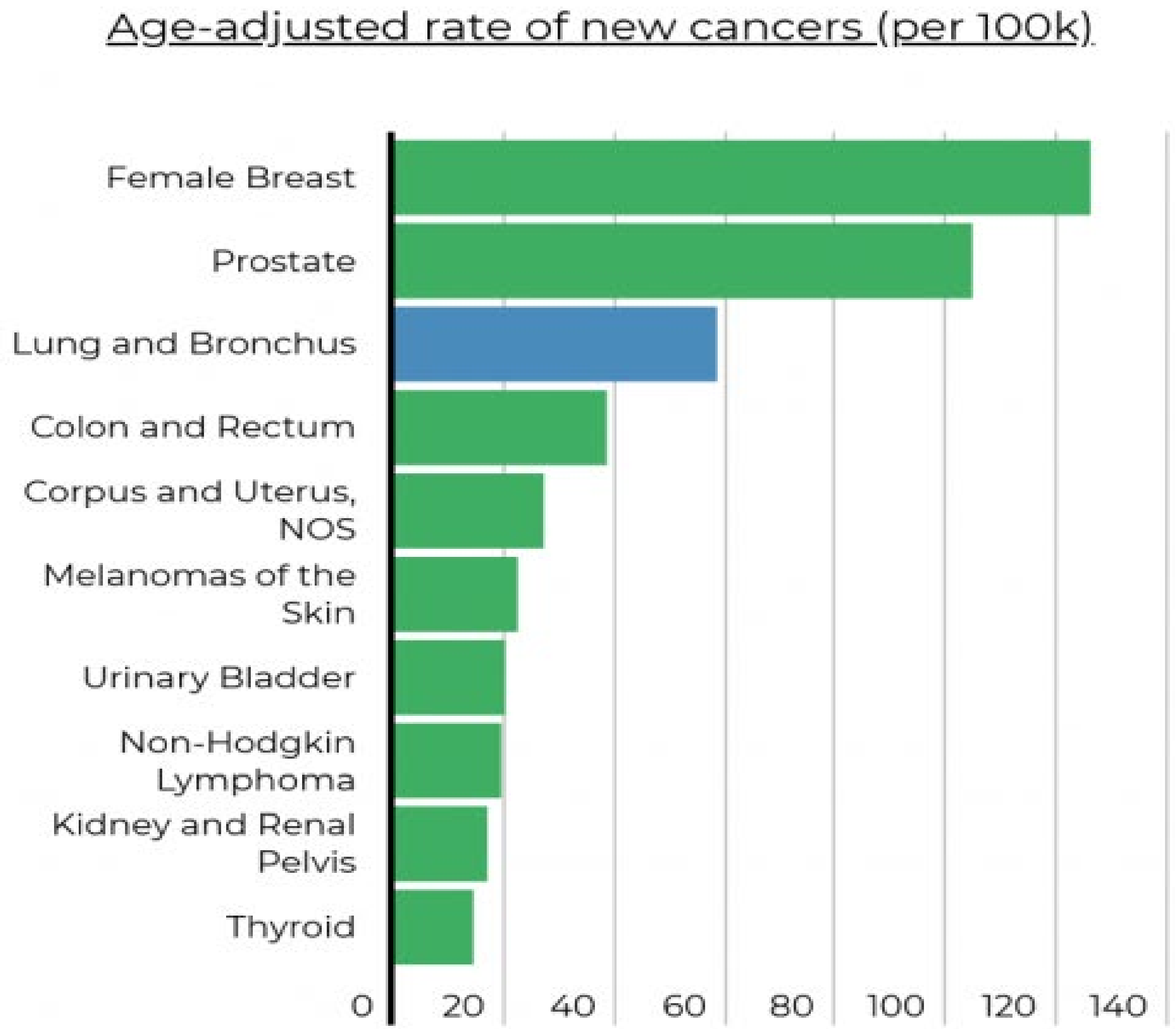
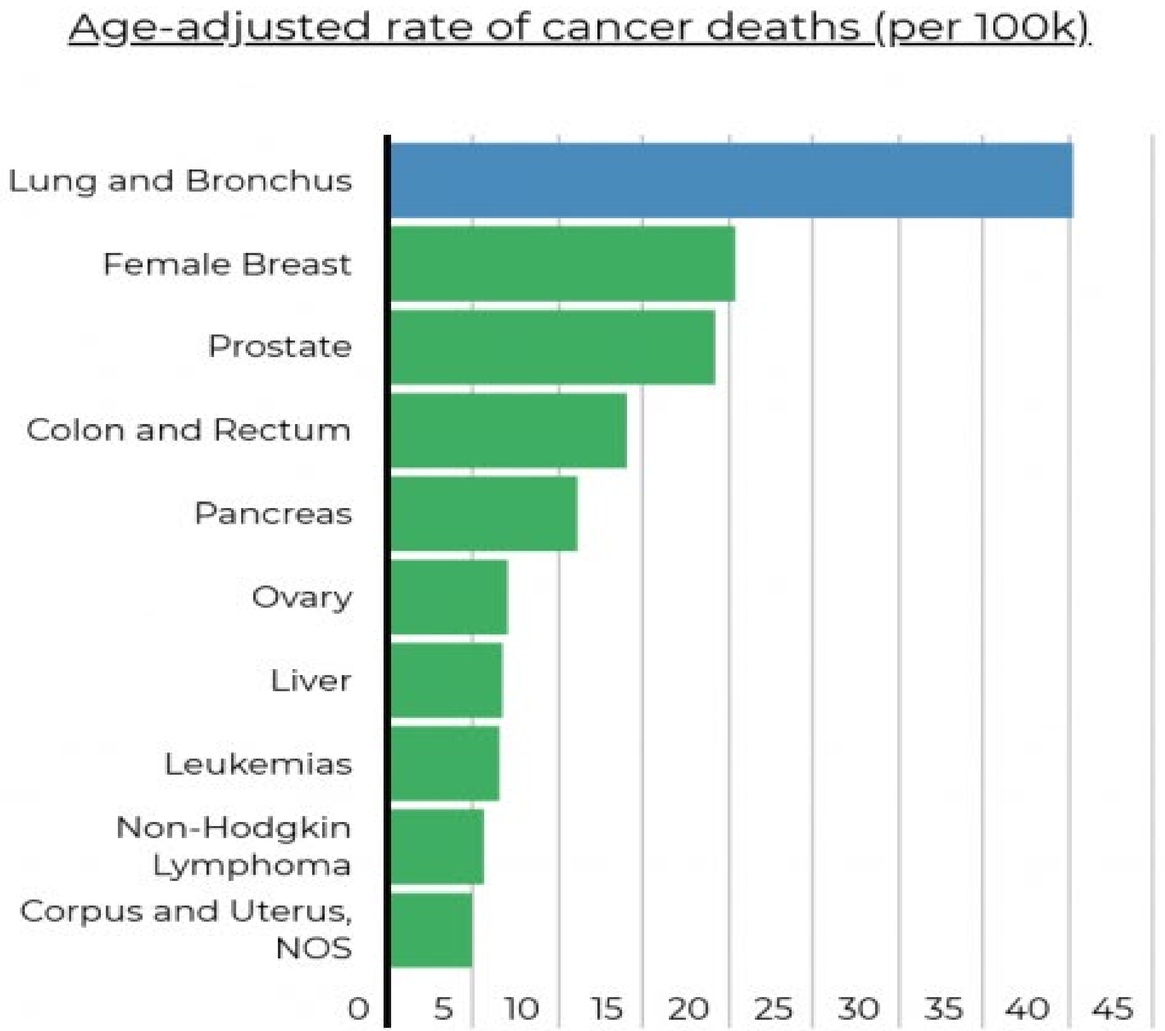
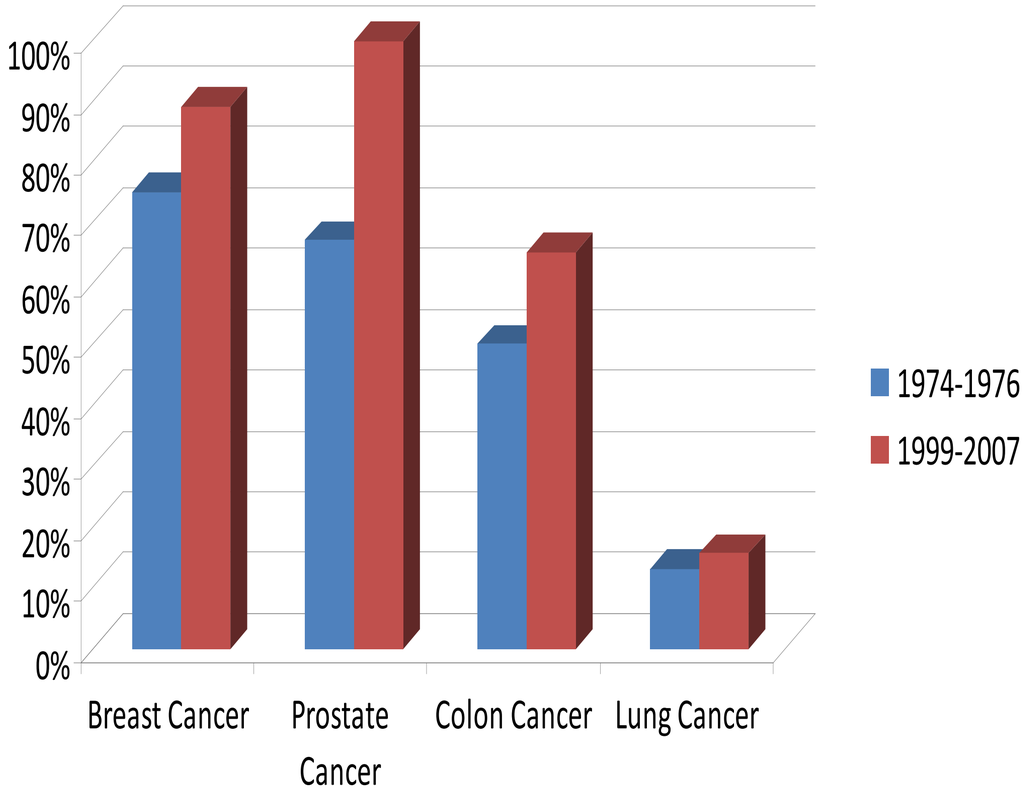
Lung cancer is the #1 cause of cancer death



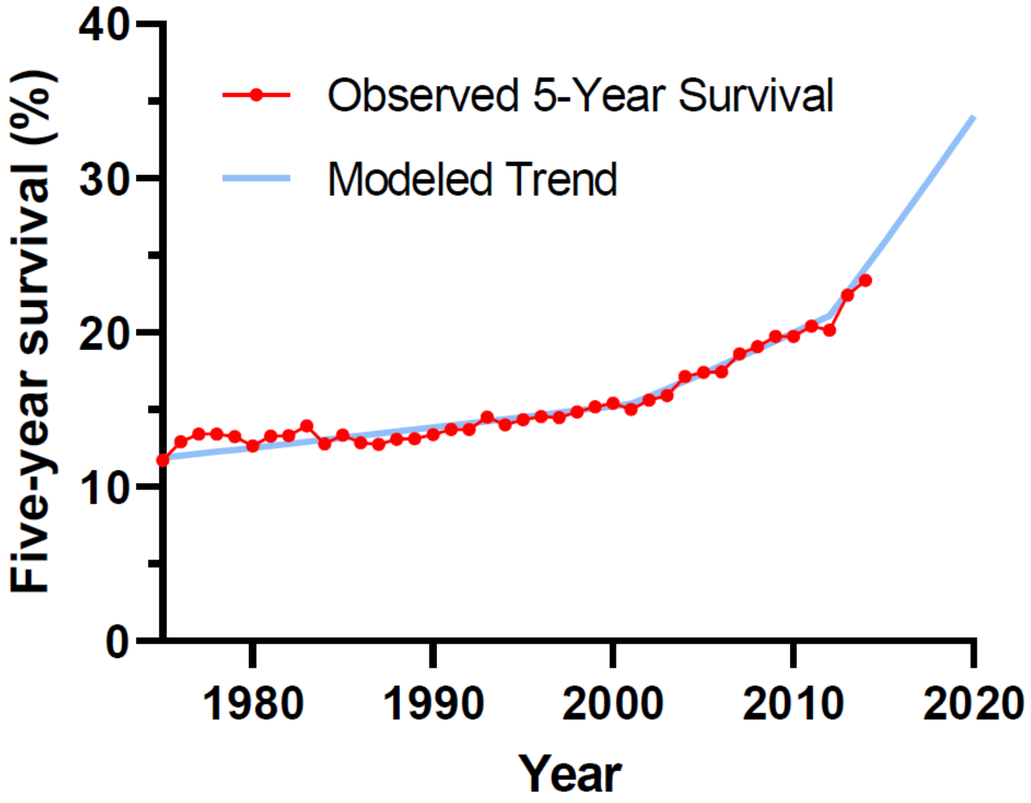


Survival rates for lung cancer have not changed from 1974-2007



5-Year Survival Rate

However, there has been significant improvement in the past 15 years



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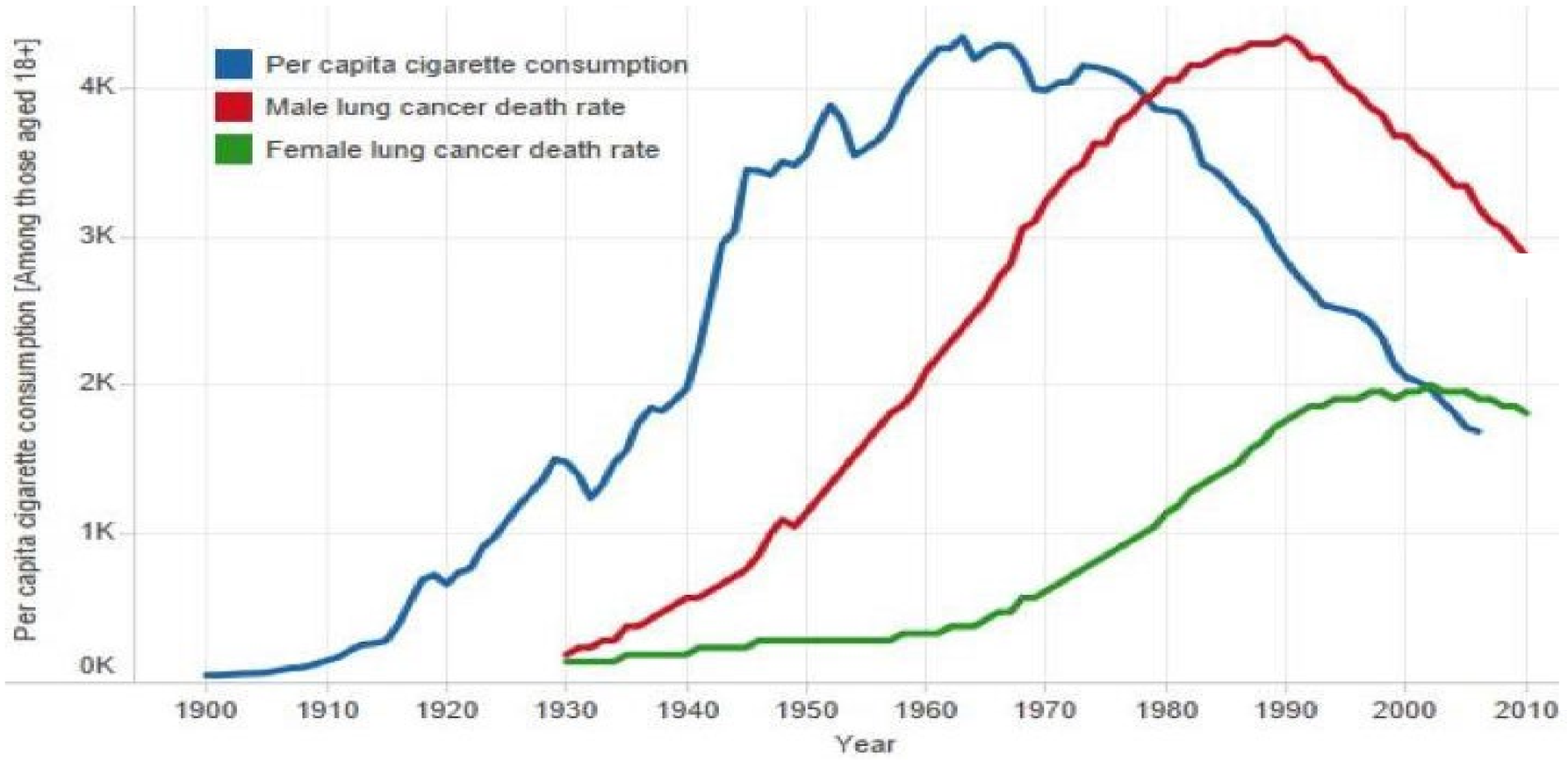
Smoking is responsible for 80-90% of lung cancer



Other causes include radon exposure, second-hand smoking and genetics

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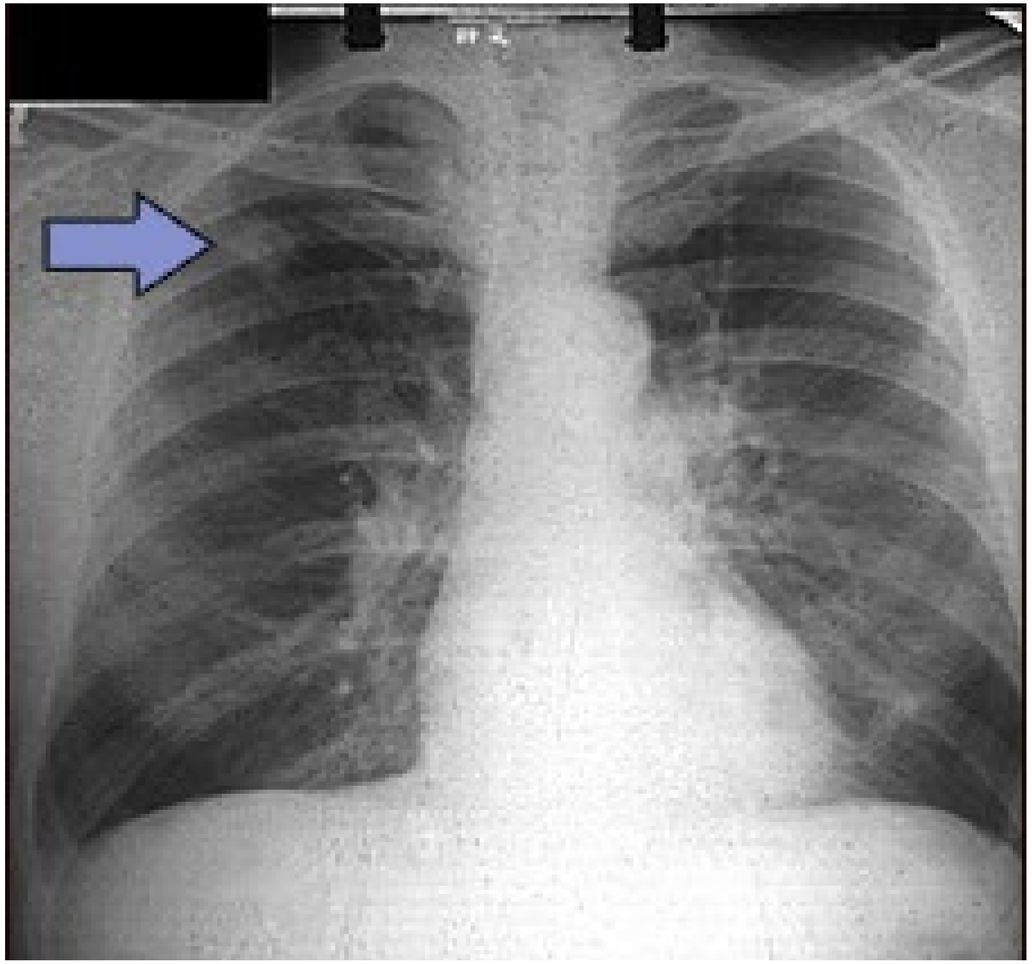
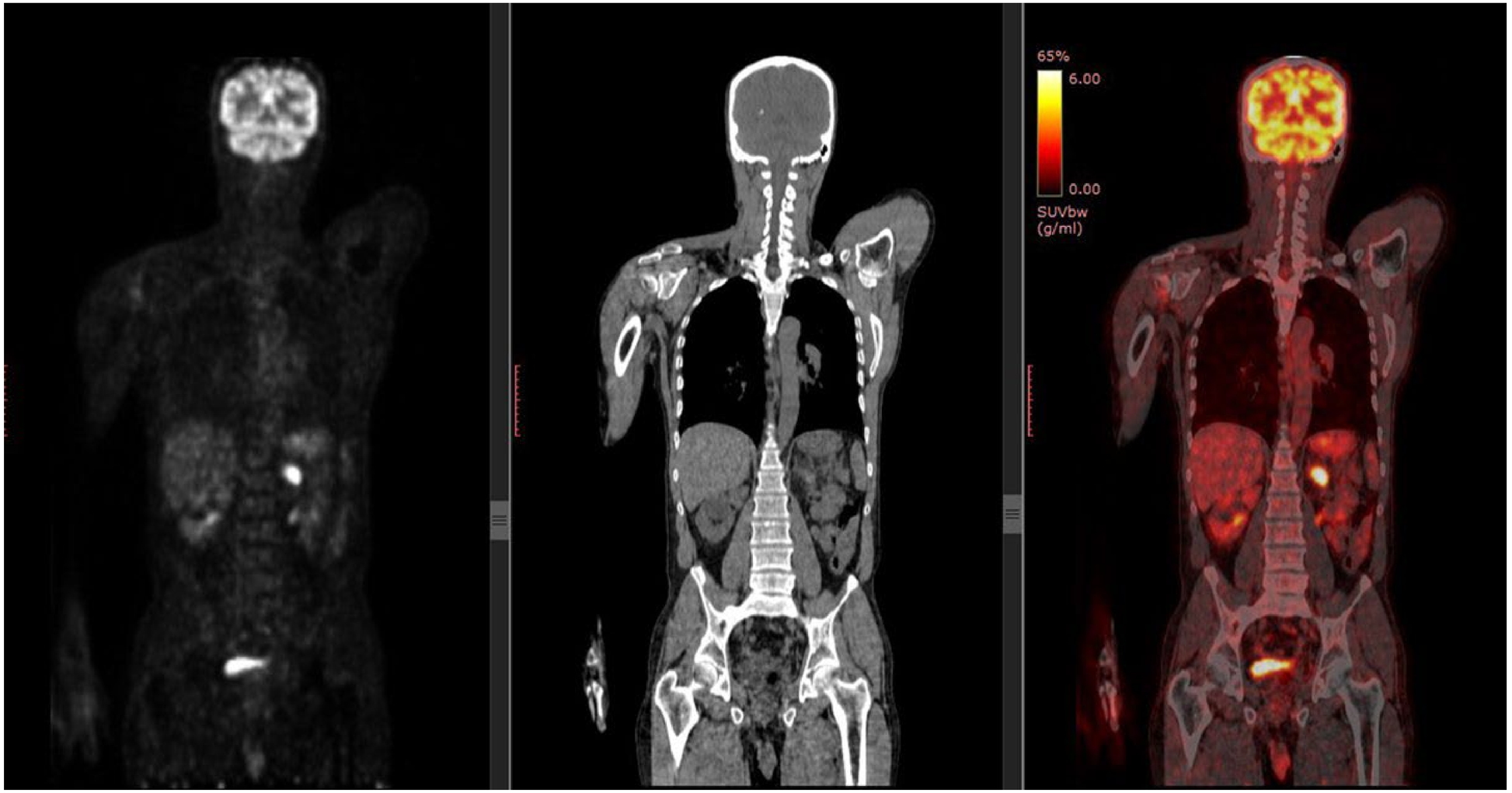
Diagnosis of lung cancer

Chest x-ray



CT scan

A PET scan is a full body cancer scan



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Robotic bronchoscopy

Can biopsy small spots in the lung accurately

In the future, we will be able to treat lung cancer via this platform

https://www.youtube.com/watch?v=Ofq1en7T_oo

Time stamps:
0:51- 1:00 : Robotic bronchoscope is deployed
2:10-2:17 : Robotic controller
2:20-2::30: Bronchoscope is maneuvered
4:24-4::35 : Target lesion biopsy

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Staging System

TNM system:

T: size of tumor

N: lymph node involvement

M: metastasis

Supraclavicular	Scalene	Mediastinal: Contra-	Mediastinal: Ipsi-	Subcarinal	Hilar: Contra-	Hilar: Ipsi-	Peribronchial (ipsilateral)	Lymph Node (N)
								Stage IV (Metastatic: M1a or M1b, any T, any N)
+	+	+			+			N3
–	–	–	+ &/ +		–			N2
–	–	–	–	–	–	+ &/ +		N1
–	–	–	–	–	–	–	–	N0

Metastatic (M):

M1a:
Local intrathoracic spread:
- Malignant pleural/pericardial effusion
- Separate tumor nodule(s) in the contralateral lung

M1b:
Disseminated (extrathoracic) disease:
Liver, bone, brain, adrenal gland, etc.

Stage IA		Stage IB	Stage IIA	Stage IIB		
T1a	T1b	T2a	T2b	T3	T4	Primary Tumor (T)
≤2cm	>2cm but ≤3cm	>3cm but ≤5cm	>5cm but ≤7cm	>7cm	Any	a. Size
No invasion proximal to lobar bronchus		Main bronchus (≥2cm distal to the carina)		Main bronchus (<2cm distal to the carina)	–	b. Endo-bronchial location
Surrounded by lung or visceral pleura		Visceral pleura		Chest wall/diaphragm/ mediastinal pleura/ parietal pericardium	Mediastinum/trachea/heart/ great vessels/esophagus/ vertebral body/carina	c. Local Invasion
		Atelectasis/obstructive pneumonitis that extends to the hilar region but does not involve the entire lung		Atelectasis/obstructive pneumonitis of entire lung; separate tumor nodule(s) in ipsilateral primary tumor lobe	Separate tumor nodule(s) within the ipsilateral lung but different lobe as the primary mass	d. Other

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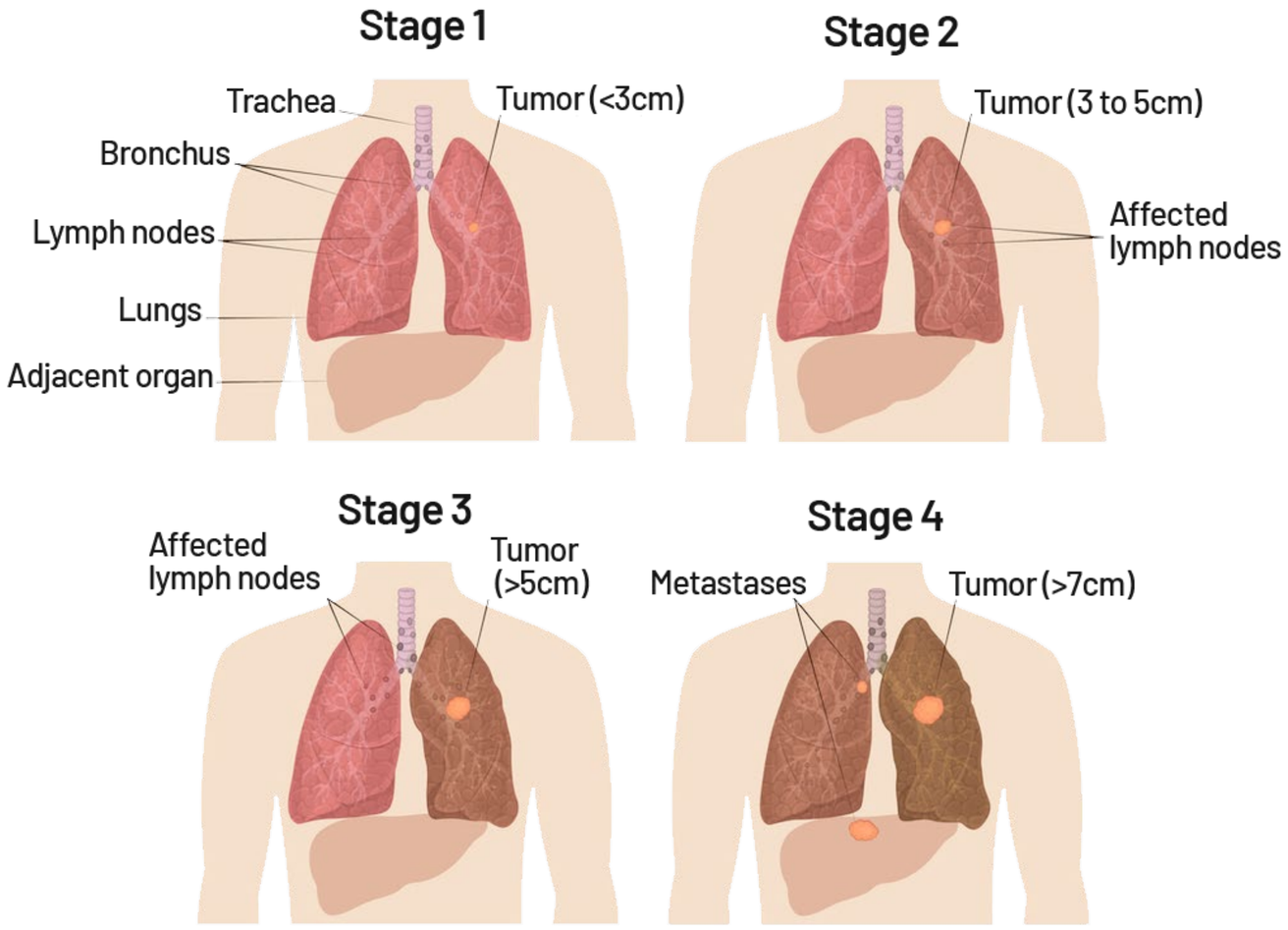
Stages of Lung Cancer



Stage I:	Small size
Stage II:	Local lymph node spread
Stage III:	Distant lymph node spread
Stage IV:	Cancer has spread outside of the lungs

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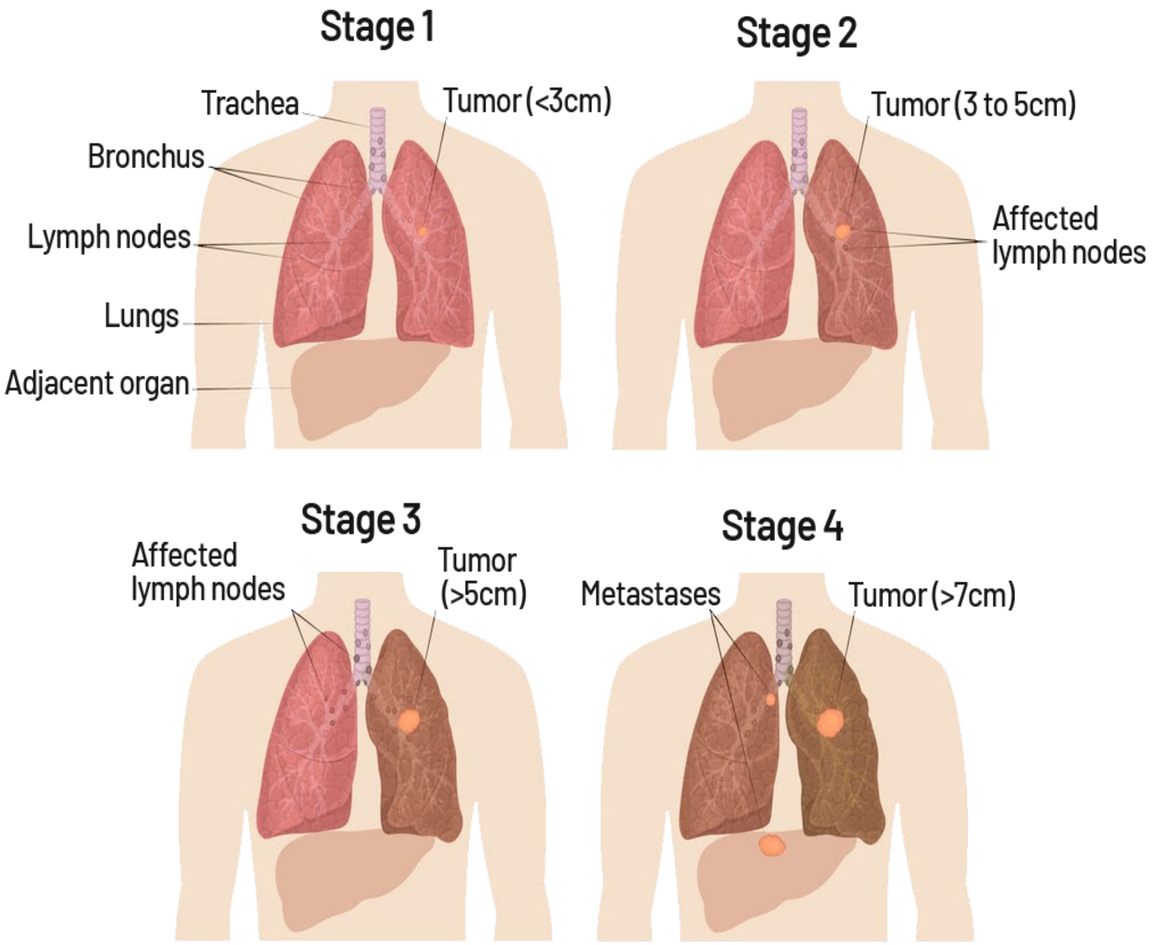
Treatment Options



- Surgery
- Radiation
- Chemotherapy
- Targeted drug therapy
- Immunotherapy

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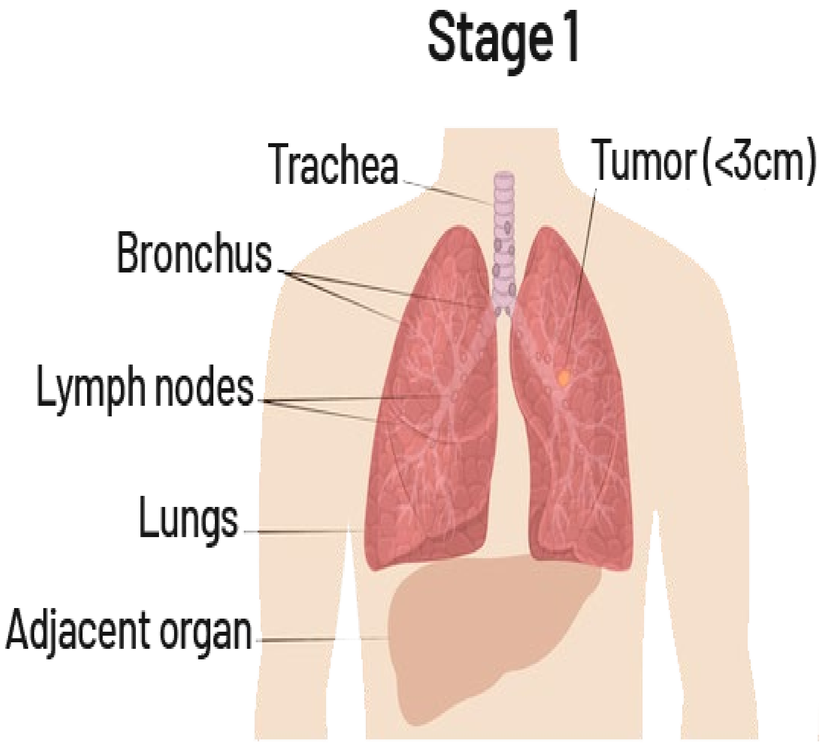
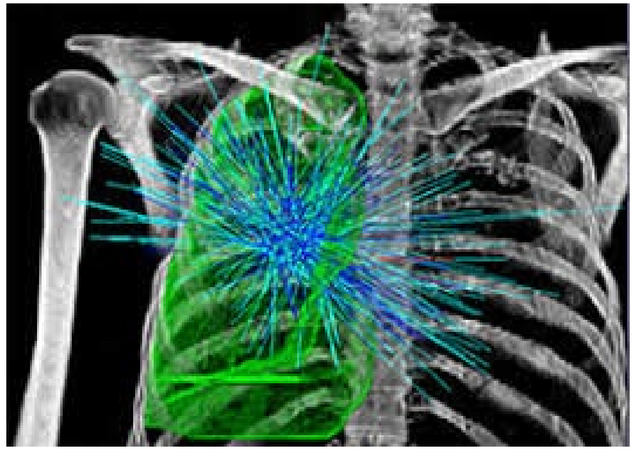
	Old approach	Modern approach
Stage I:	Surgery	**Robotics**, **stereotactic radiation**
Stage II:	Surgery, chemo	**Robotics**, chemo, **targeted therapy**
Stage III:	Chemo, radiation	Chemo, radiation, **robotics**, **immunotherapy**
Stage IV:	Chemo	Chemo, **targeted therapy**, **immunotherapy**

Stage I



Surgery: **Robotics**



Radiation: **Cyberknife**

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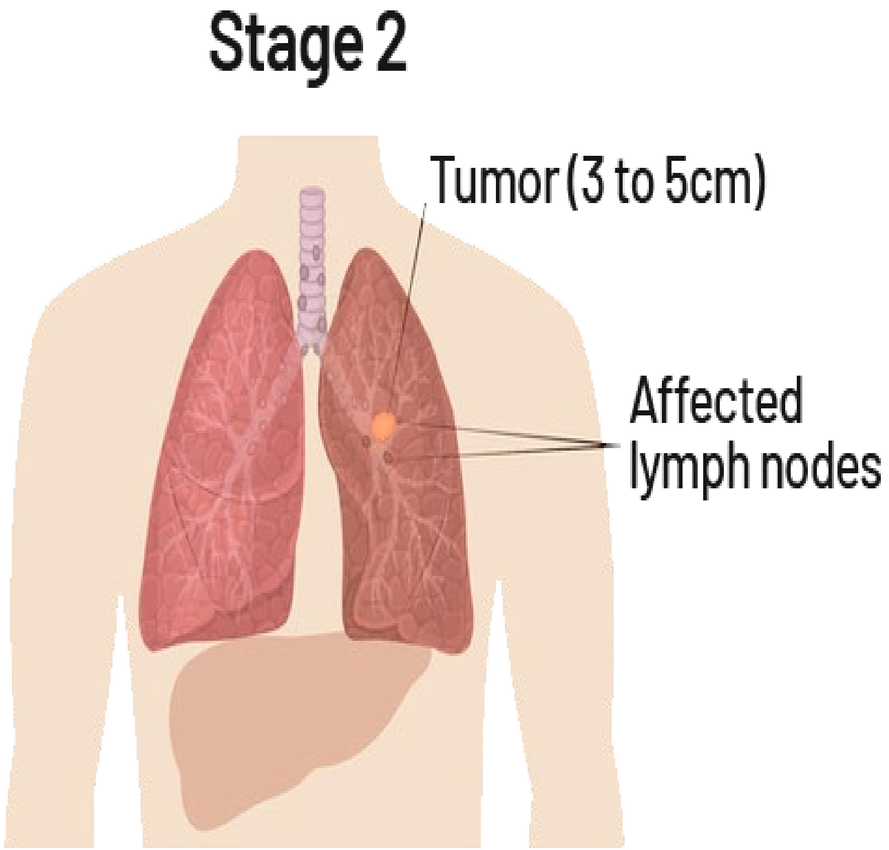
Stage II



Treatment:

Robotics and chemo, **targeted therapy**

Targeted therapy:

Medications that target genetic changes specific to a patient's tumor.

Highly effective. Oral medications. Less side effects

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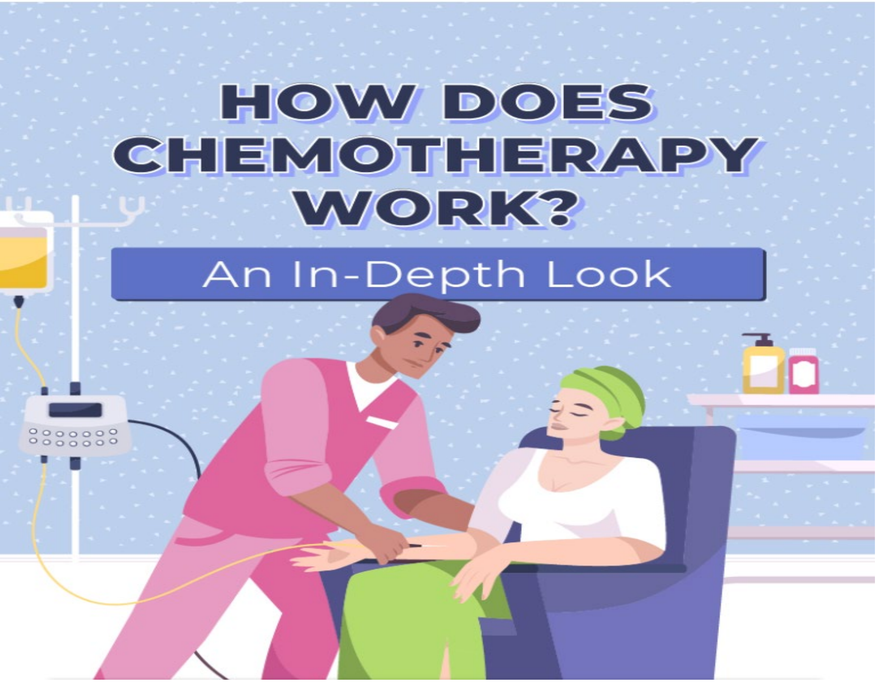
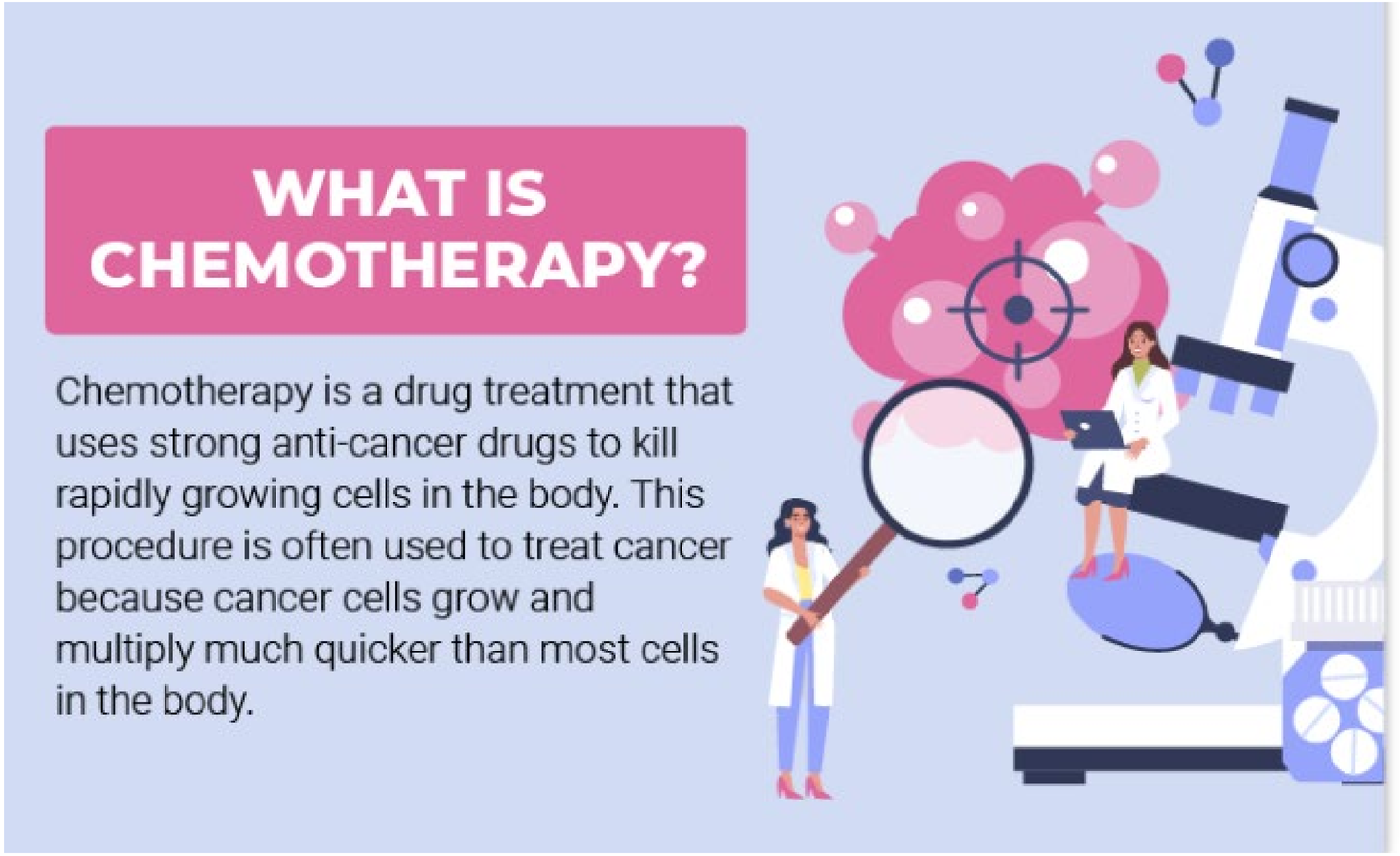


Chemotherapy

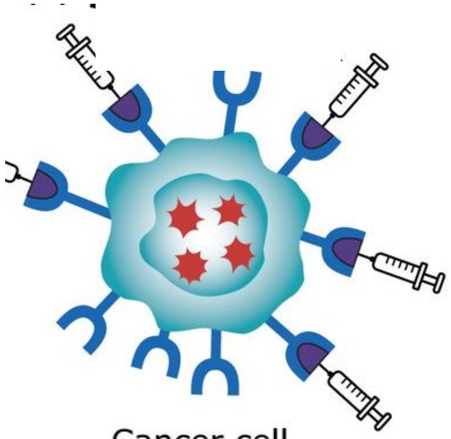
- IV medications
- Destroys rapidly growing cells
  -both normal and cancer
- Side effects



Targeted therapy

- Oral medications
- Specifically target cancer cells
- Less side effects
- Can be very effective

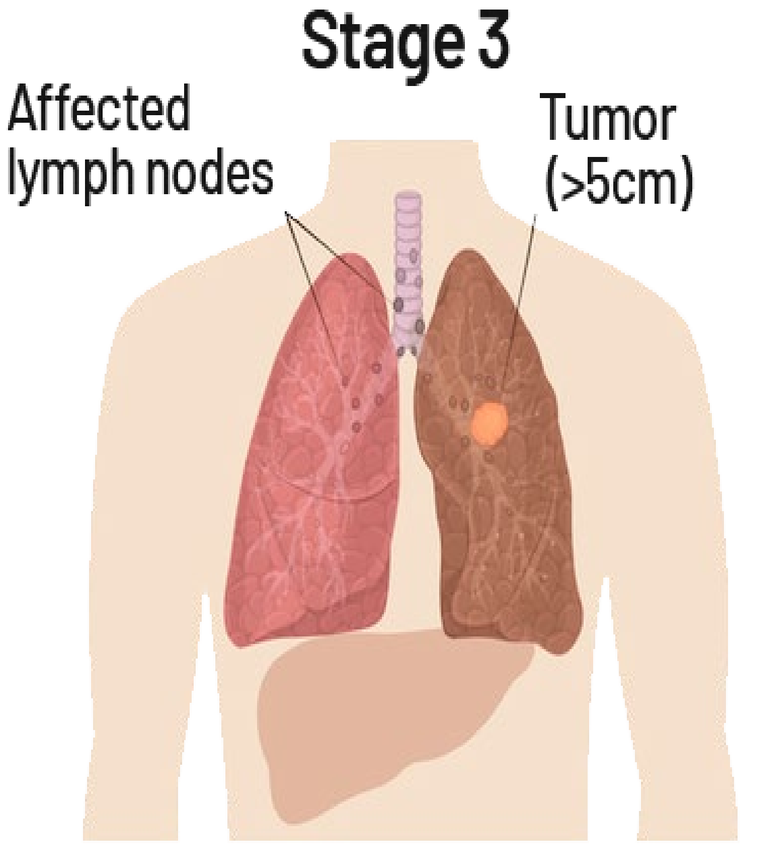
Drug designed to bind to targeted receptor will find and damage cells with largest number of receptors



Cancer cell

Inhibitors			
EGFR	**ALK**	**ROS**	**RET**
Erlotinib*	Crizotinib*	Crizotinib*	Alectinib
Gefitinib*	Ceritinib*	Ceritinib	Cabozantinib
Afatinib*	Alectinib*	Lorlatinib	Vandetanib
Osimertinib*	Lorlatinib	Cabozantinib	Lenvatinib
Rociletinib	Brigatinib	Foretinib	Apatinib
EGF816	Ensartinib	Entrectinib	Ponatinib
ASP8273	Entrectinib	DS-6051b	Sunitinib
HM61713			Dovitinib
MET	**TRK1**	**HER2**	**BRAF/MEK**
Crizotinib	Entrectinib	Afatinib	Vemurafenib
Tivantinib	LOXO-101	Dacomitinib	Dabrafenib
Cabozantinib	DS-6051b	Neratinib	Trametinib
Foretinib		Lapatinib	Selumetinib
Volitinib		Pyrotinib	
Capmatinib			
MSC2156119J			
AMG337			
AMG208			

Stage III



Treatment:

Chemo, **immunotherapy**, **robotics**

Immunotherapy:

Medications that boost your immune system to target cancer

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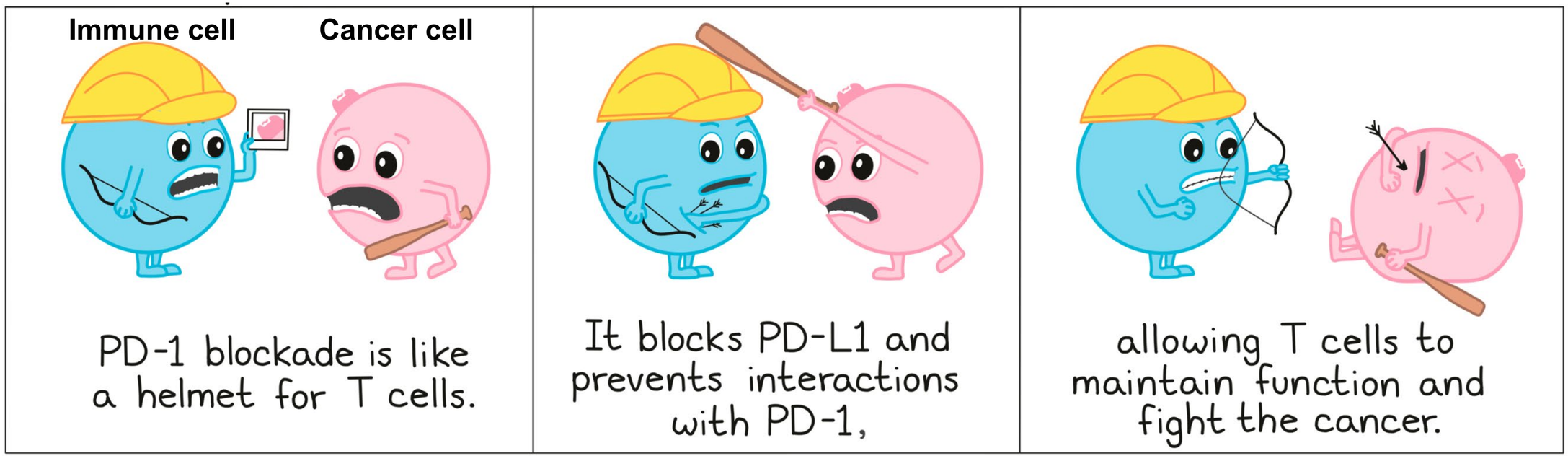
Immunotherapy

- IV medications
- Boosts the immune system to detect and kill cancer cells
- Less side effects
- Can be effective



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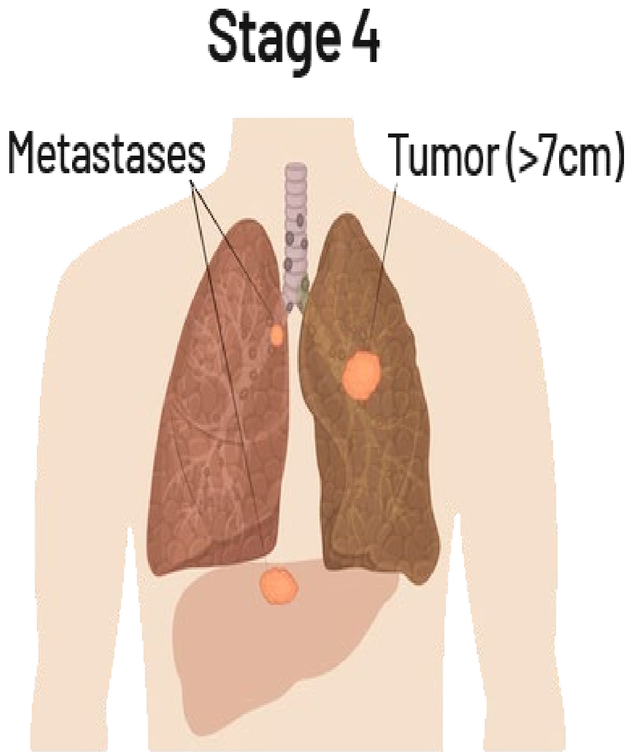
Stage IV



Treatment:

Chemo

Targeted therapy

Immunotherapy

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Multidisciplinary Approach

Lung cancer treatment is **complex**

A **multidisciplinary clinic** includes consultation with - a surgeon, medical oncologist and radiation oncologist

- also includes social workers, geneticists, nutritionists, psychologists, and palliative care specialists

An **optimal** treatment plan can be formulated efficiently.

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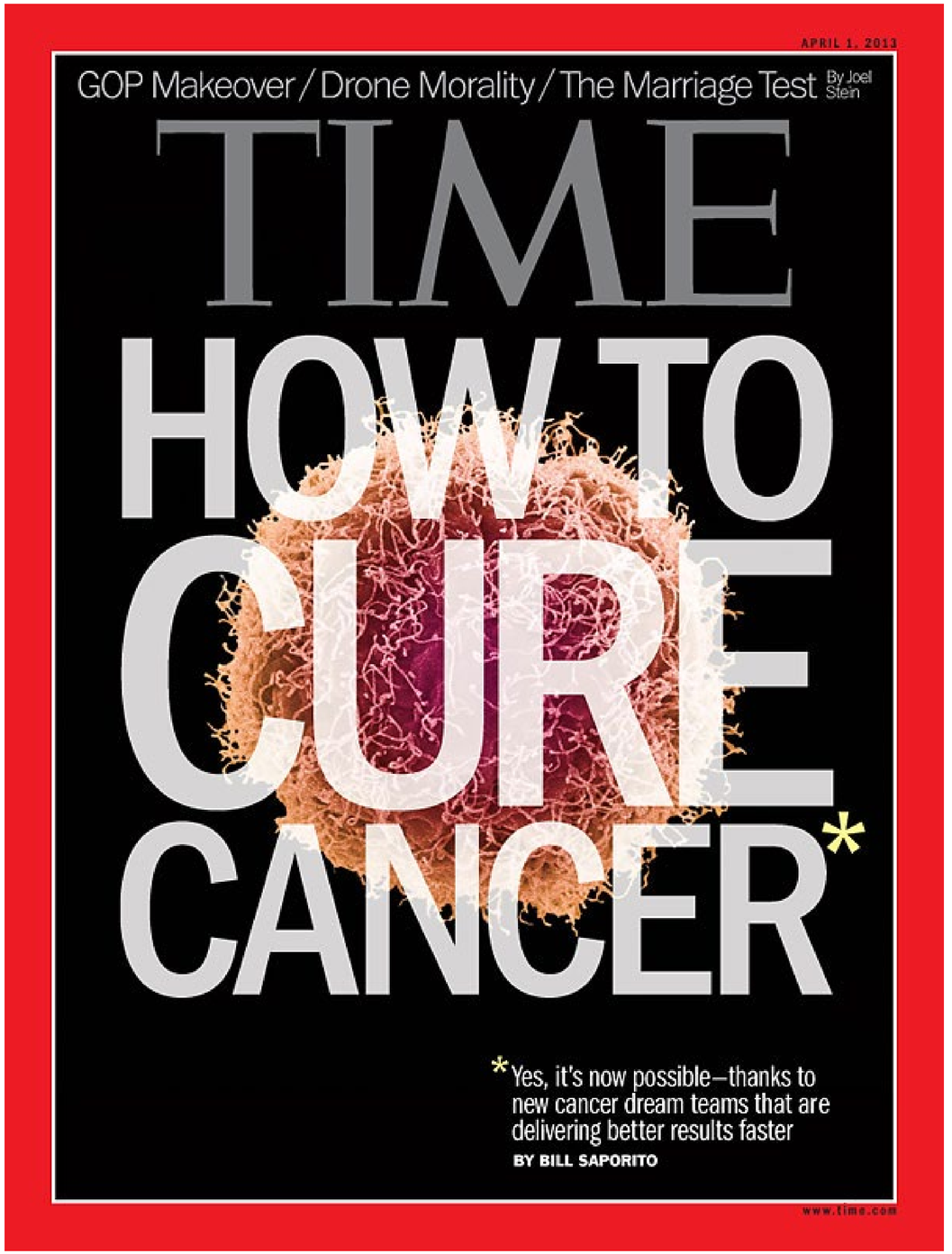

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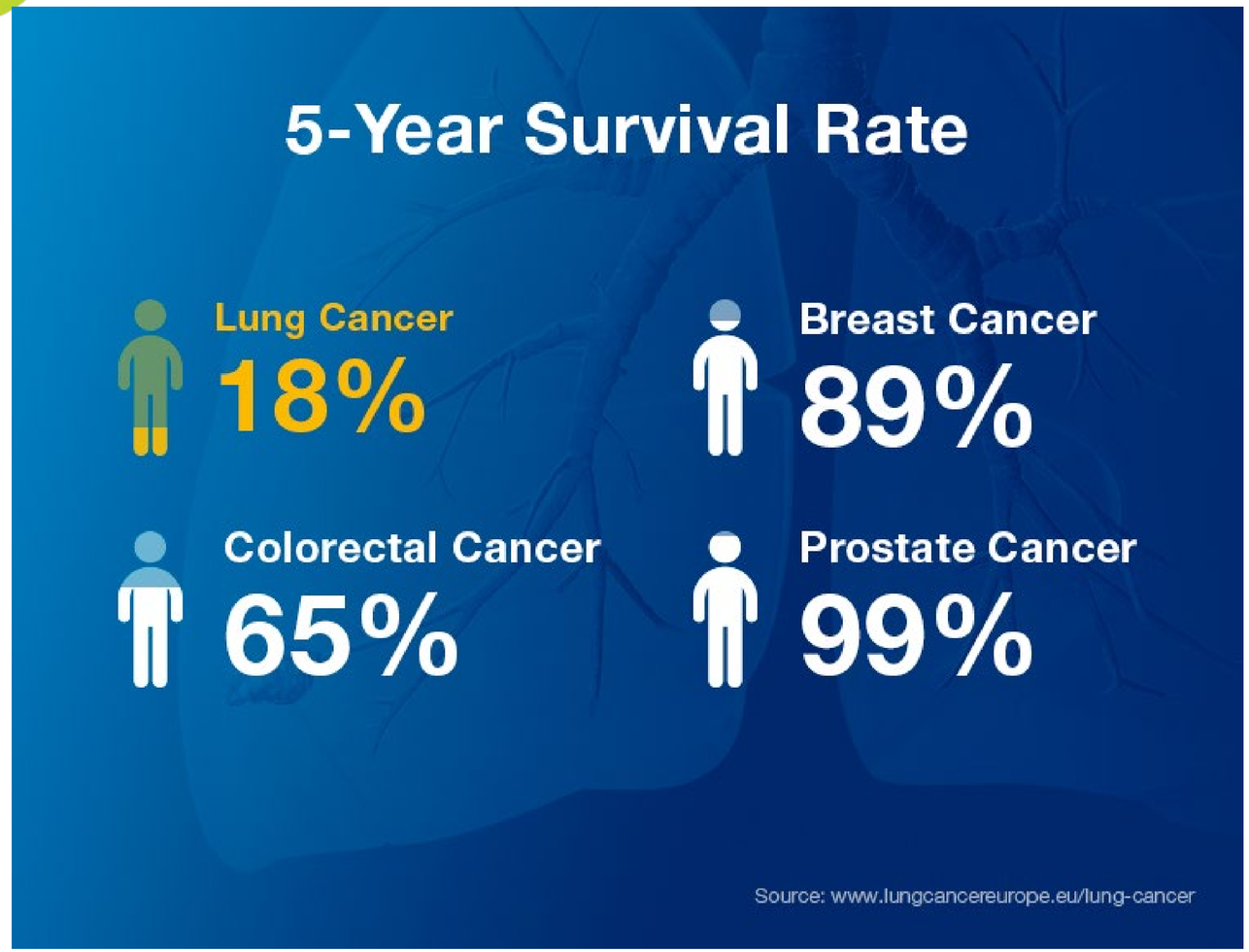
Survival rates remain poor



- Most patients are often found at stage IV

- Prognosis is much worse

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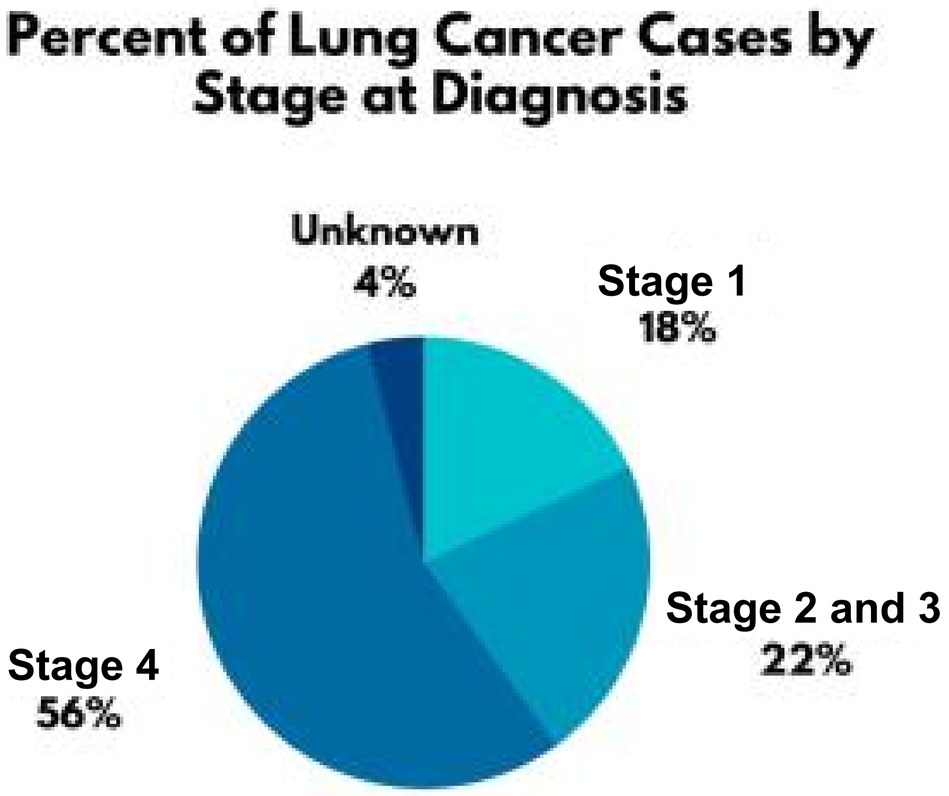
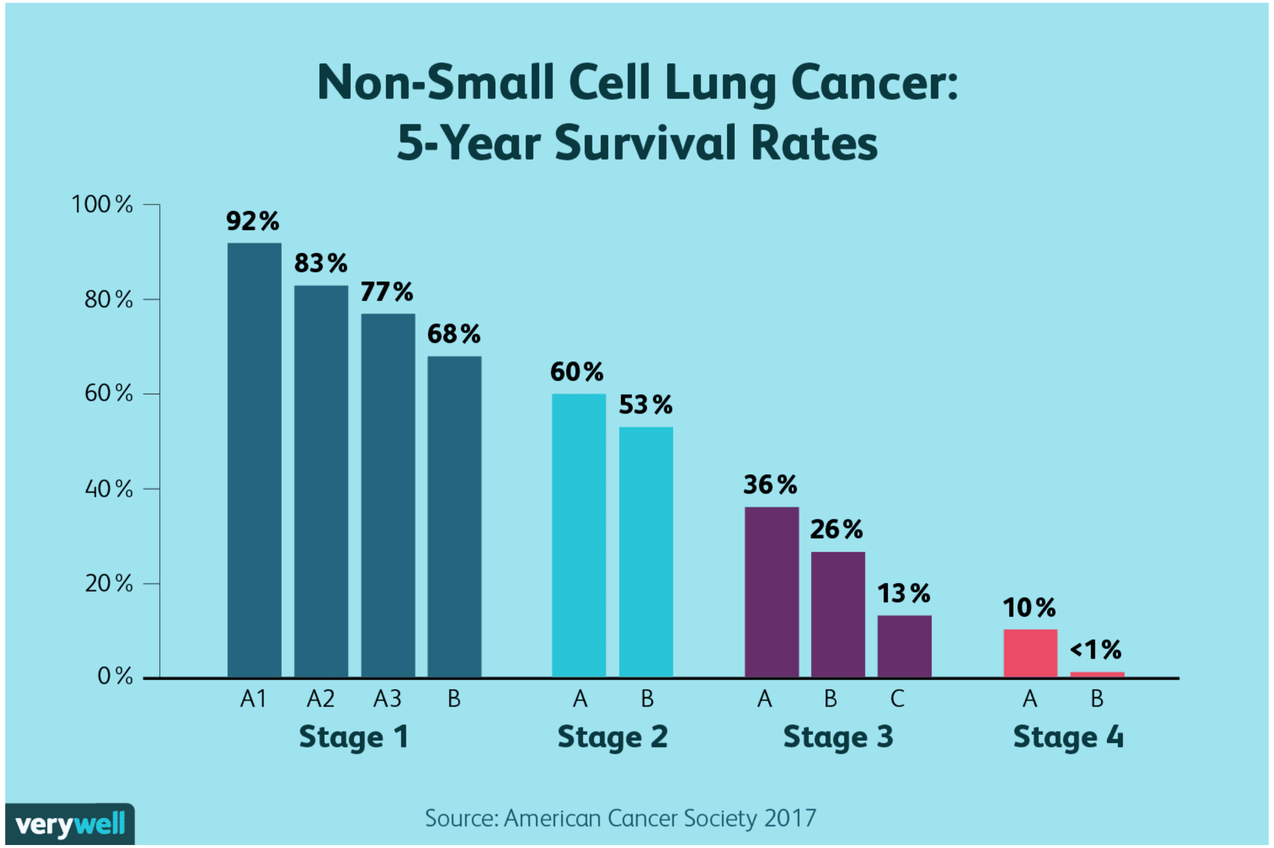
Early detection is key





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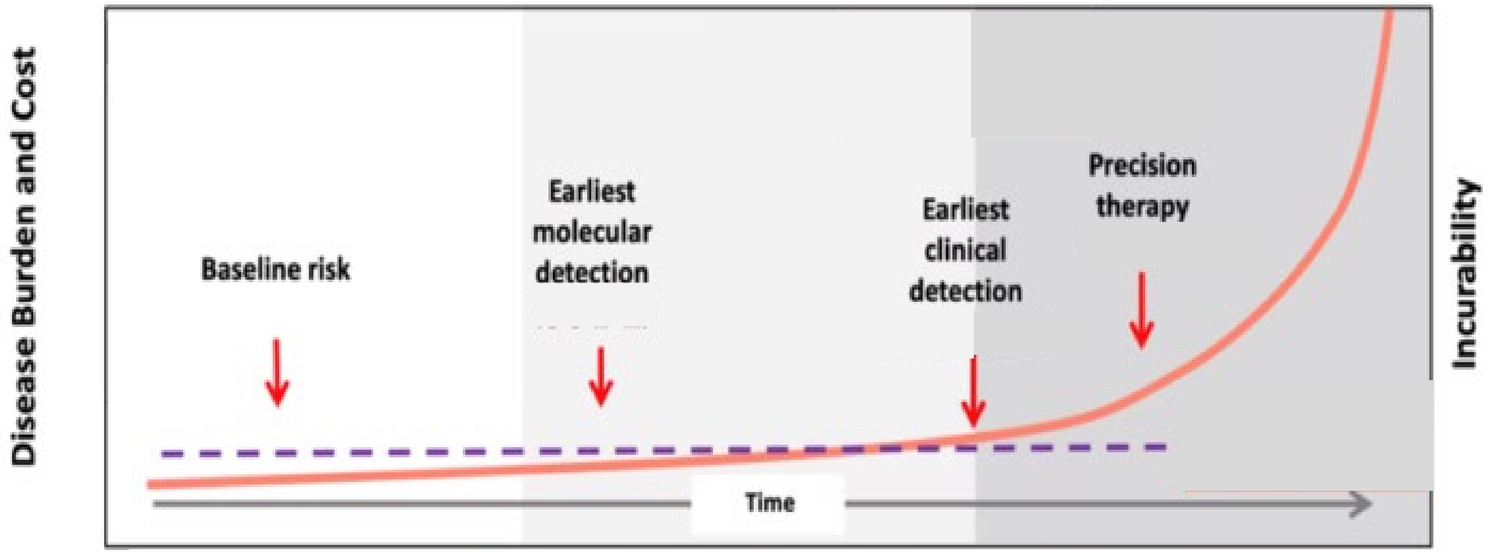
How to Eliminate Lung Cancer



Prevention	Early diagnosis	Precision Therapy
Smoking cessation	Lung cancer screening	Targeted therapy
	Biomarkers	Immunotherapy
	Radiomics	

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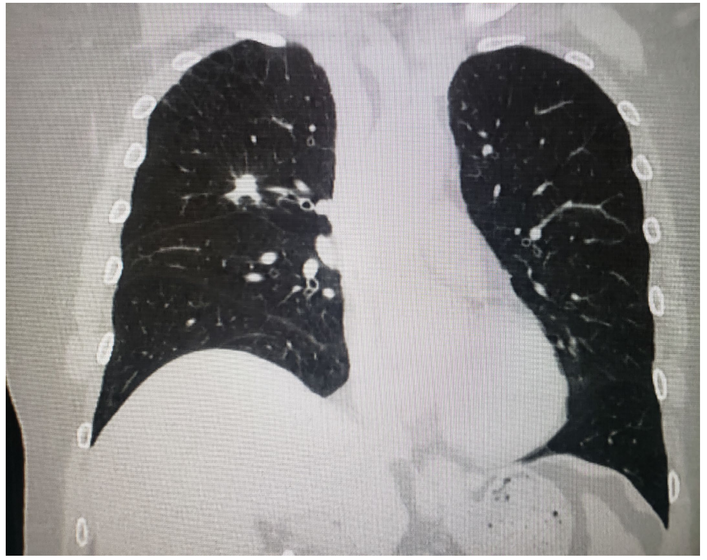
Lung cancer screening: Annual low-dose CT scan

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 AUGUST 4, 2011 VOL. 365 NO. 5

Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening

The National Lung Screening Trial Research Team*



Benefit: 20% reduction in lung cancer related deaths

Eligibility: Age 50-80. 20 pack-year smoking history

Christianacare Lung Health Program

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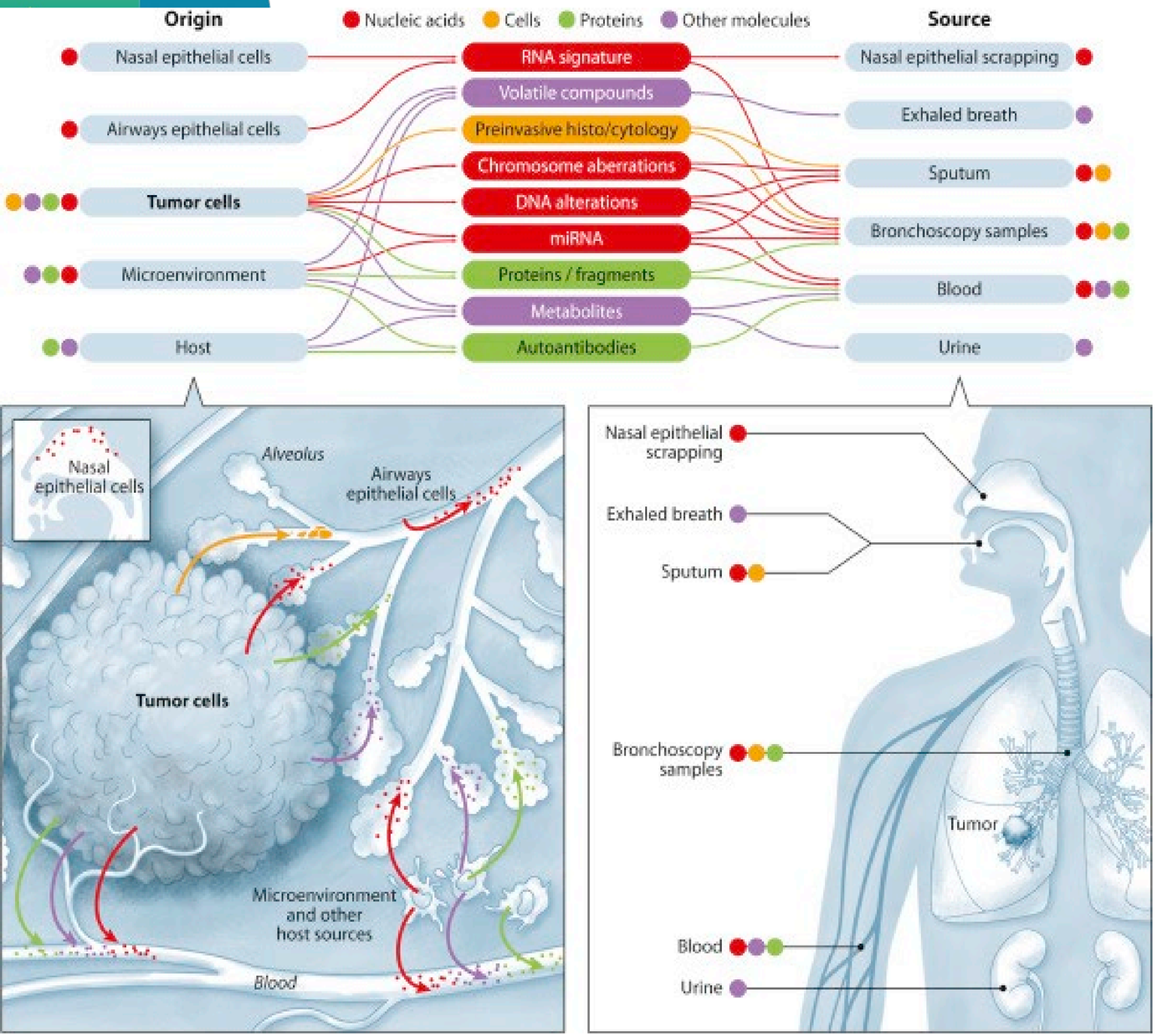

Biomarker

- a simple test that can identify patients with cancer

A Gene Expression Classifier from Whole Blood Distinguishes Benign from Malignant Lung Nodules Detected by Low-Dose CT

AndrewV. Kossenkov, Rehman Qureshi, NoorB. Dawany, Jayamanna Wickramasinghe, Q in Liu, R.Sonali Majumdar, Celia Chang, Sandy Widura, Trisha Kumar, WenHwai Horng, Eric Konnisto, Gerard Criner, JunhiehJ. Tsay, Harvey Pass, Sai Yendamuri, Anil Vachani, Thomas Bauer, **Brian Nam**, William N. Rom, Michael K. Showe and Louise C. Showe. Cancer Res. 2019 Jan 1; 79(1):263-273

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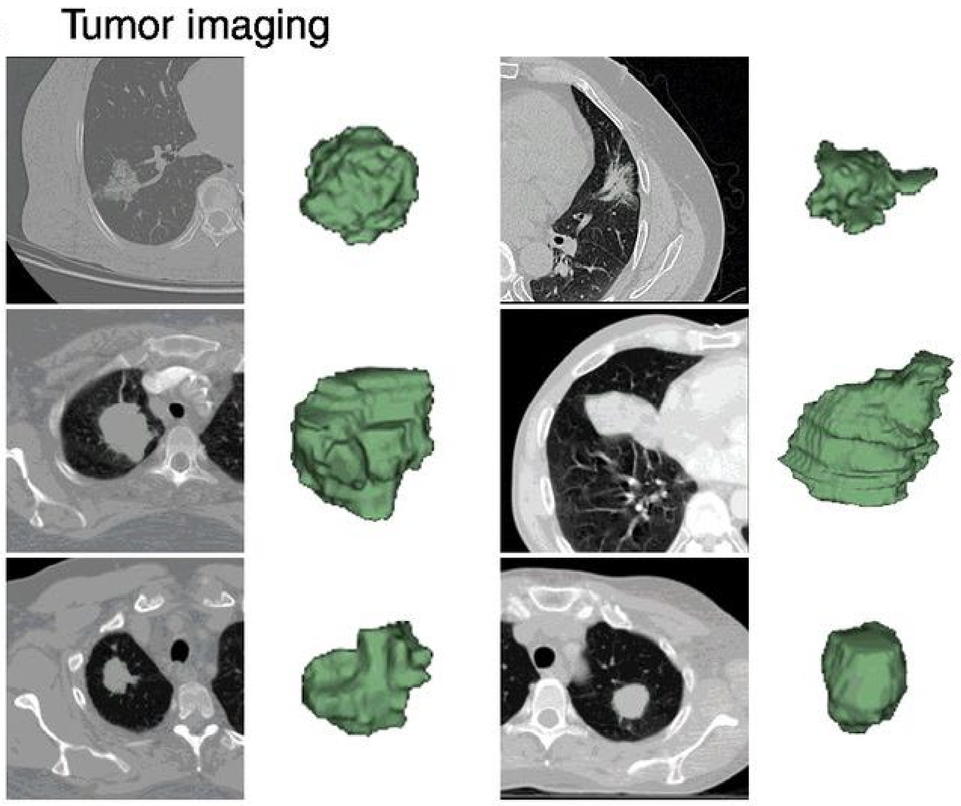
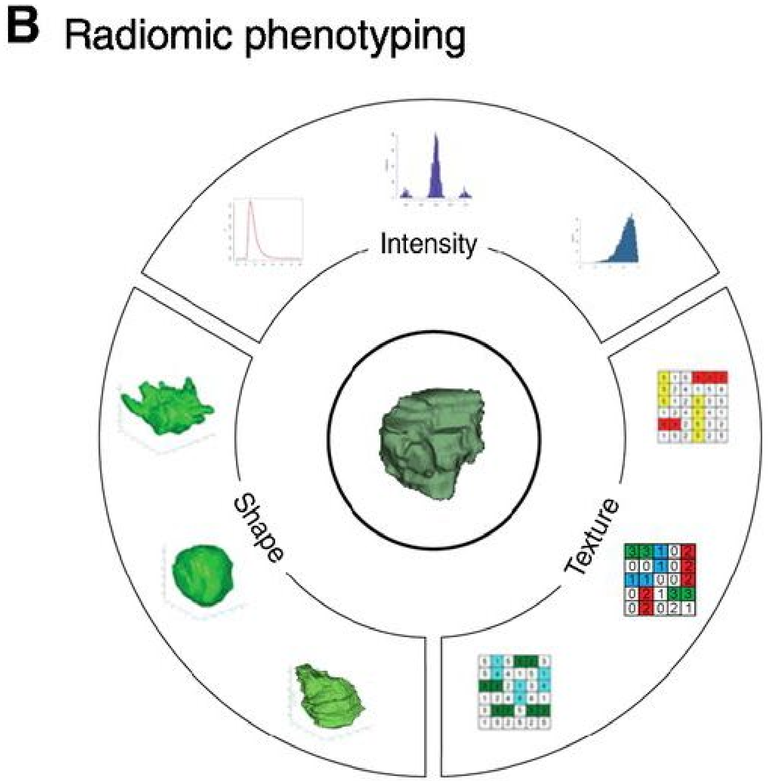
Radiomics

Use of machine learning to process CT scans

- Improves diagnosis

- Can predict prognosis and response to therapies





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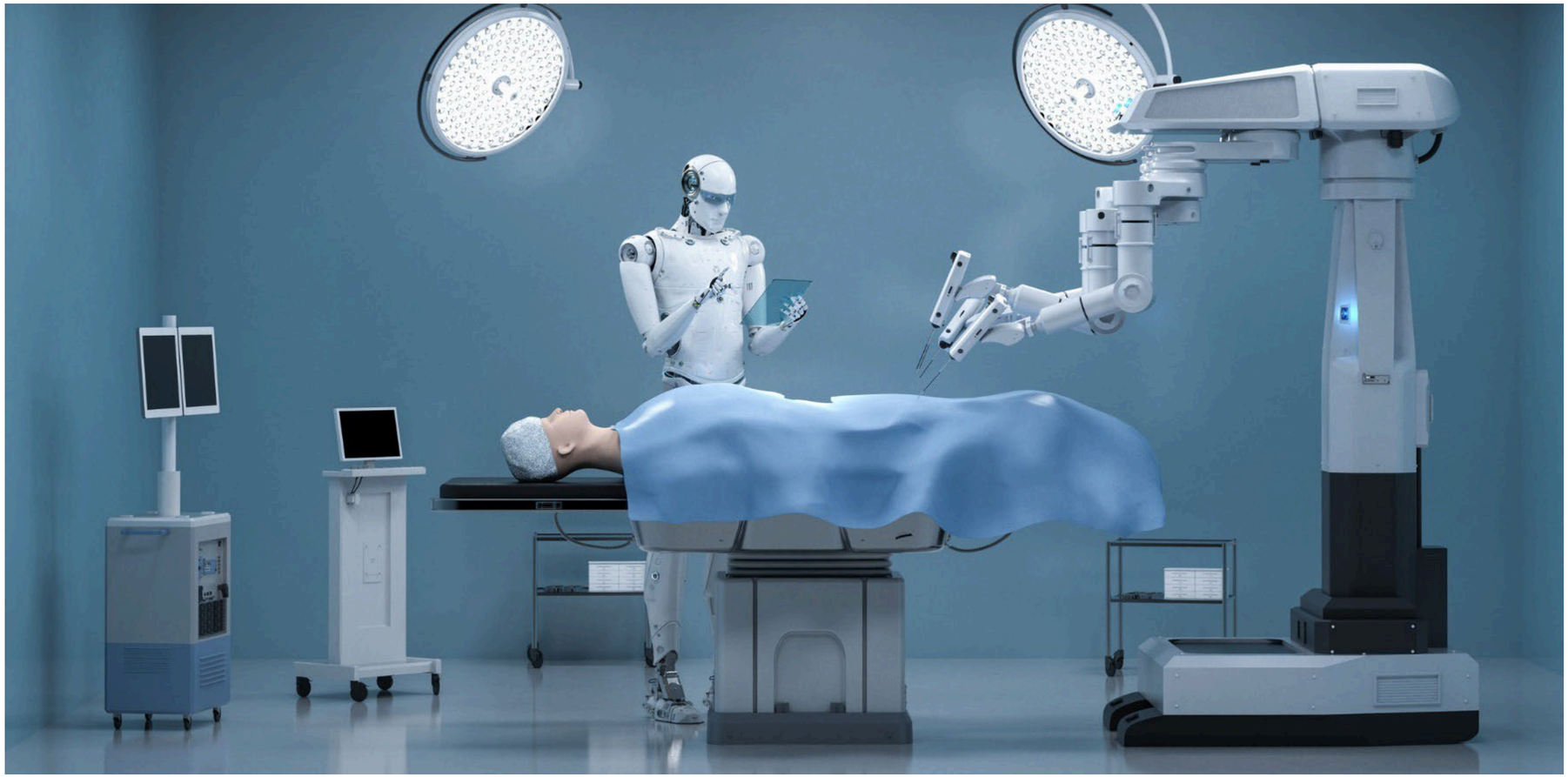
Technologic advances: Robotics



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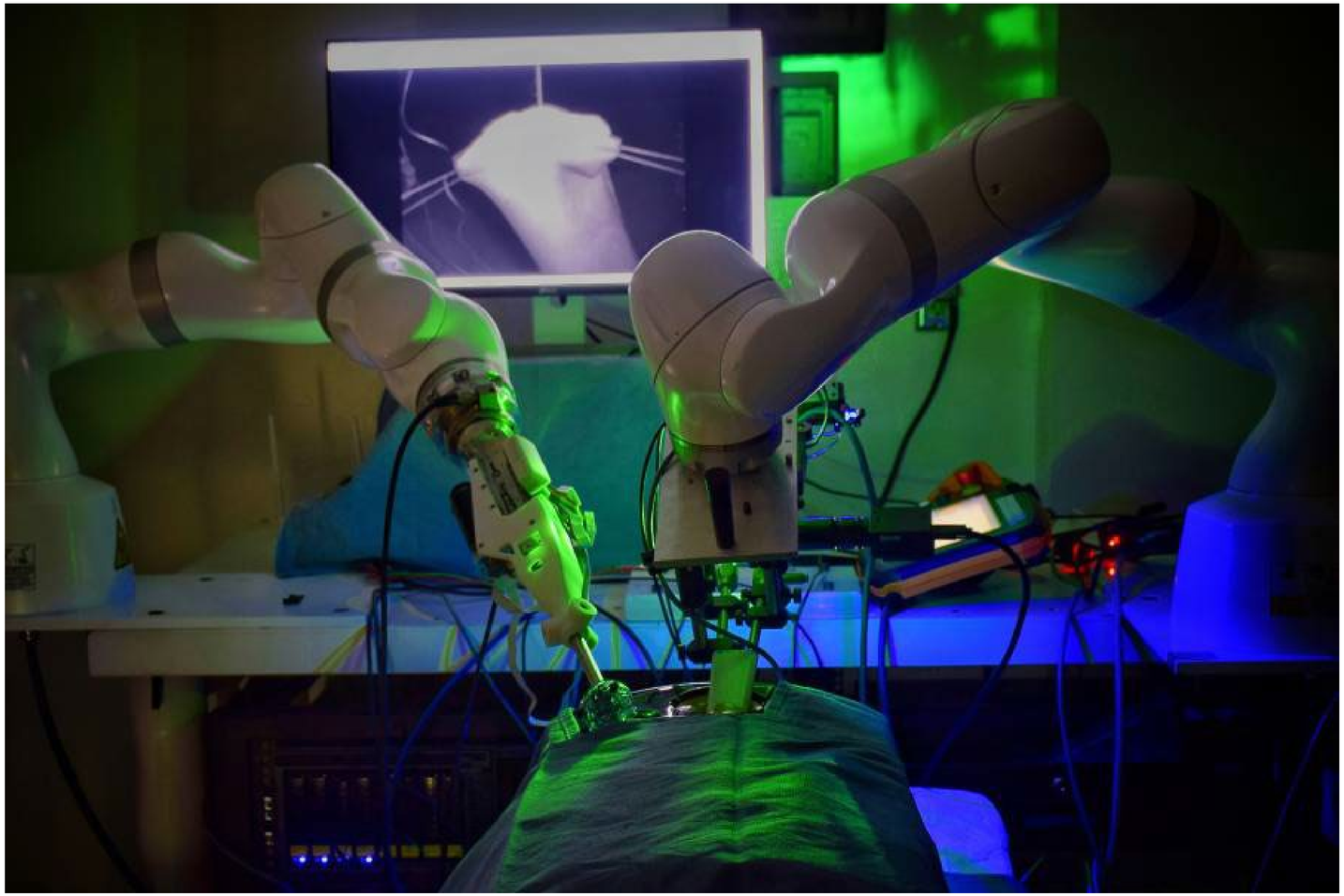
Autonomous robot?



Robot performs first laparoscopic intestinal connection without human help

- Johns Hopkins University 2022

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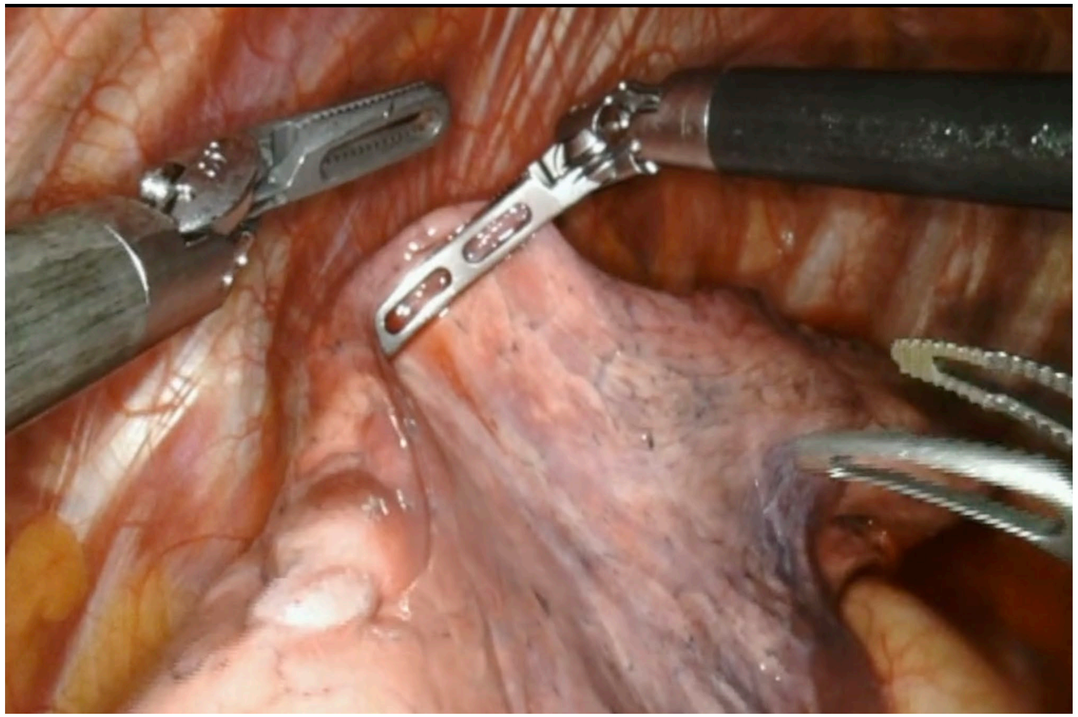
Robotic Surgery



https://vimeopro.com/roboticthoracicsurgery/robotic-thoracic-surgery/video/247511474
Timestamp: 15:30, 24:10

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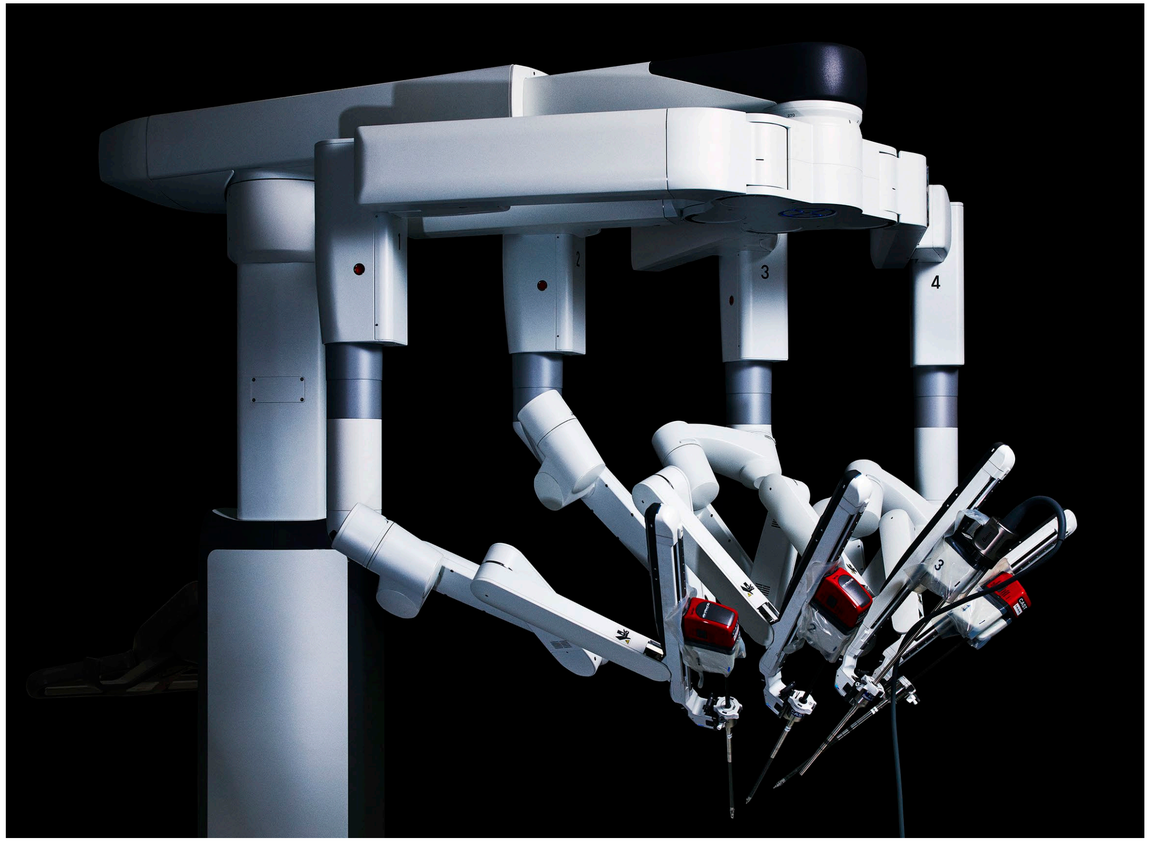
Robotic surgery



- Precision surgery
- Less post-operative pain
- Shorter hospital stays
    - Average of 2 days
- Less cost to our health system

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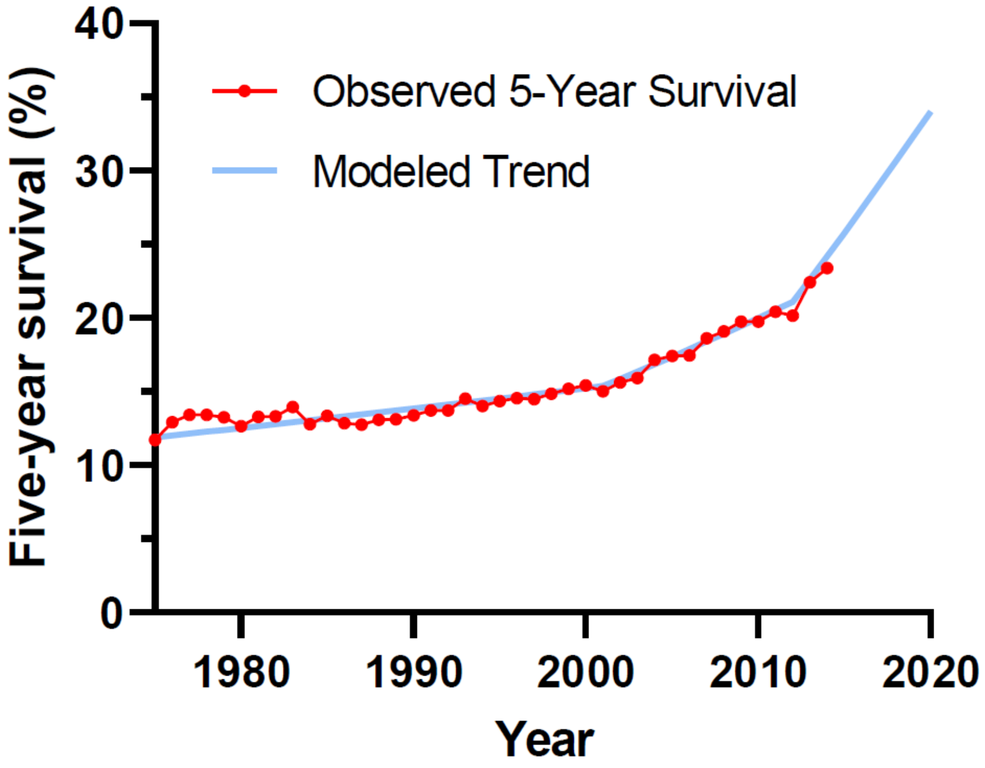
Conclusions



Treatment of lung cancer continues to improve

Targeted/Immunotherapy

Improved early detection

Technological/robotic advances

Thank you

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