Optimizing imaging-based lung cancer screening

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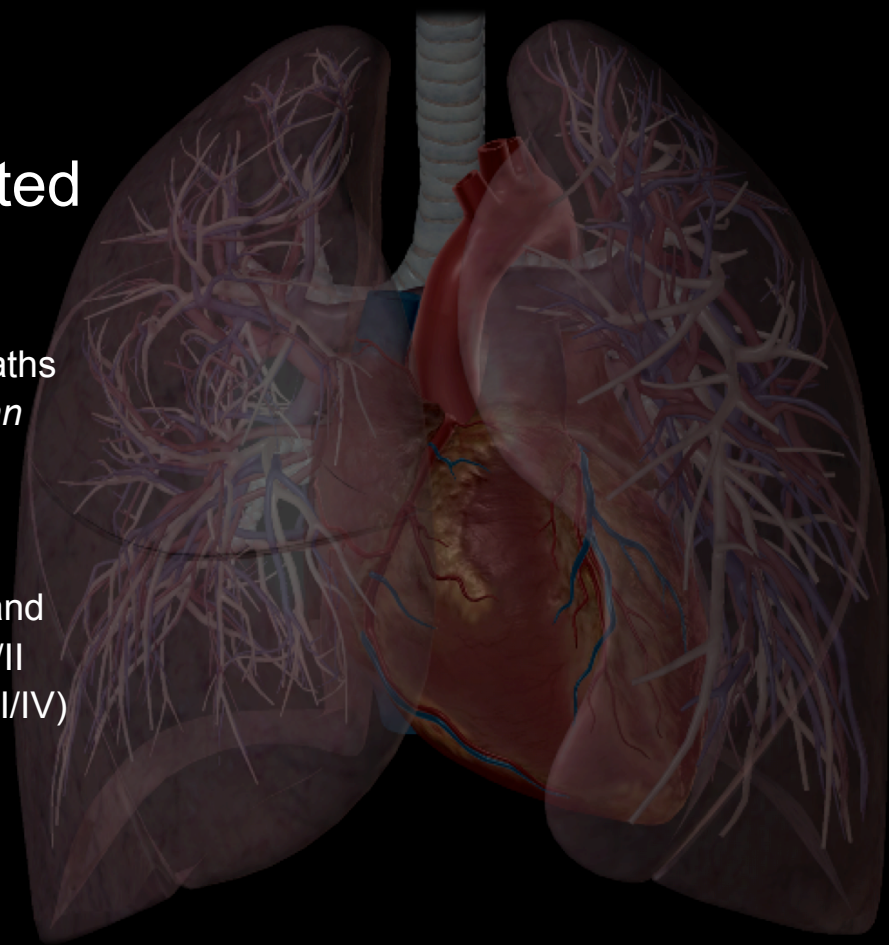
Center for SMART Health
UCLA CTSI | IPH | Institute for Risk Sciences

The impact of lung cancer

Lung cancer is the single largest cause of cancer-related mortality in the United States and worldwide

- In 2018, approximately 154,000 related deaths are estimated due to lung cancer (*more than colon, breast, and prostate cancer deaths, combined*)
- Earlier detection is key to survival, with significant improvement in 5-year survival and curative chances if detected during Stage I/II (most lung cancers are detected in Stage III/IV)



More comprehensive characterization of at-risk populations through electronic health records (EHRs) and omics

Machine learning/data science approaches for earlier detection of actionable lung cancer (vs. indolent disease)

Operationalizing precision medicine techniques in real-world populations to maximize individual health outcomes

Several opportunities exist to improve imaging-based lung cancer screening

Enabling precision medicine in LAC-DHS

Opinion

Are We Being Misled About Precision Medicine?

Doctors and hospitals love to talk about the cancer patients they've saved, and reporters love to write about them. But deaths still vastly outnumber the rare successes.

By Liz Szabo

Ms. Szabo is a health reporter for Kaiser Health News.

Sept. 11, 2018

Risk stratification is essential to implementing lung cancer screening and precision medicine in LAC-DHS

- Second largest public health system in the United States, with ~600,000 patients
  - Many individuals are underrepresented and/or from lower socioeconomic groups, with less access to healthcare (i.e., underserved)
  - No current lung cancer screening pr
  - ly resource constrai
  - ning decisions n
  - s to those who
  - screening cannot be
  - ation
  - nstream consequences o
  - onsider the cost of treatment (im
  - cancer treatments are cost prohibitive)

DHS

st

other lung

Integration

Combining what we have and what we know

Navigation

Building a process for tailored care & resources

Engagement

Working with patients, community, and stakeholders

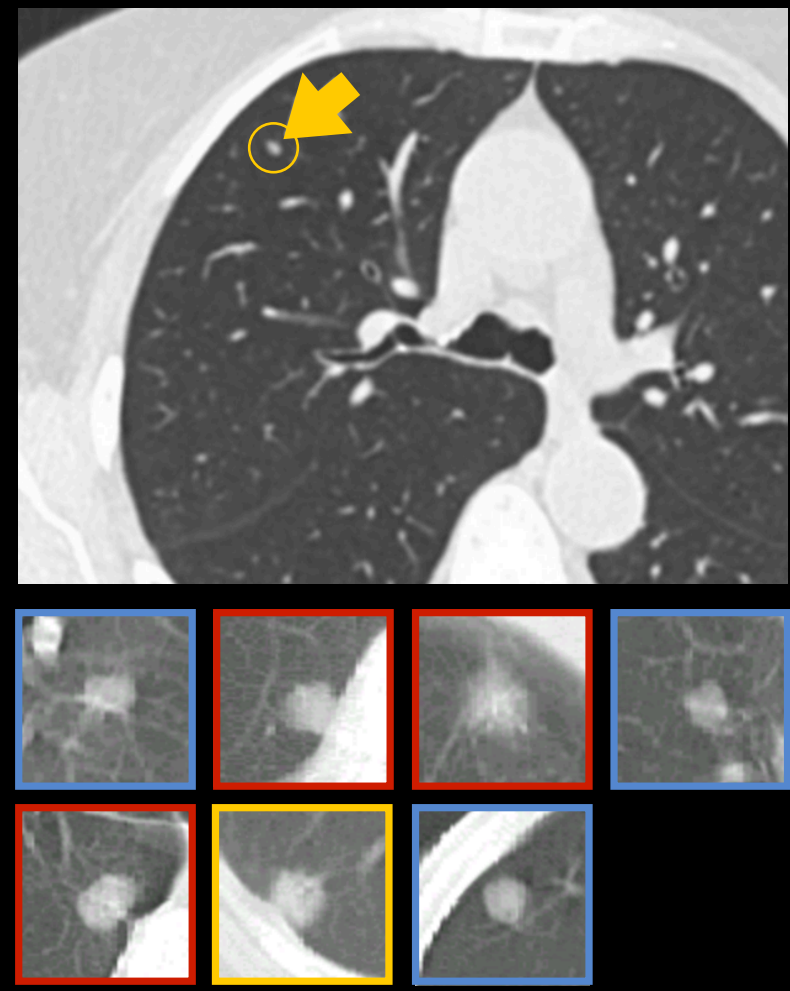
Enhancing image analysis

Interpretation is labor-intensive and challenging, even for experts

- Many indeterminate pulmonary nodules (IPNs) are found on LDCT
- Nodules vary in size, and it is difficult to know of a nodule is benign or malignant

Constructed a CNN for nodule detection and diagnosis

- Nodule detection is straightforward, with >95% accuracy
- Classification is much more challenging, given limited real-world data and changing imaging (e.g., Kaggle competition)
- Still an active area of research with clinical translation of deep learning still challenging

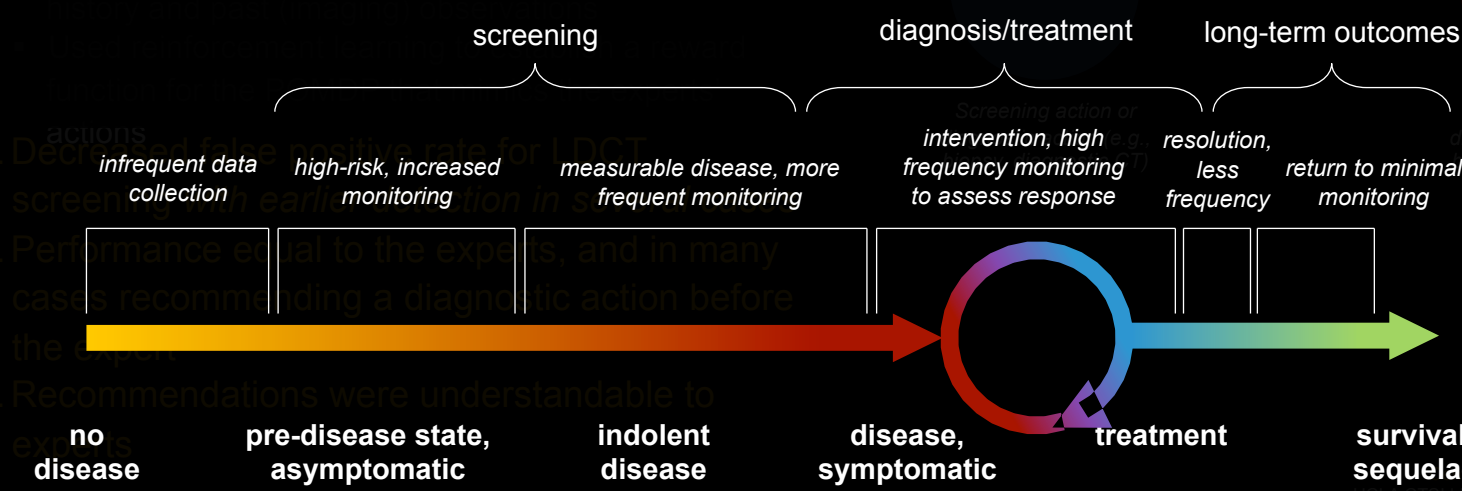


New continuous time models to handle real-world data, integrating new observations for risk assessment

Exploring approaches to optimize sequential decision making processes based on stratified risk

Methods are needed to understand when risk models need to be retrained over time

Cancer is a complex, evolving entity, and phenotypes change over time and across subgroups



Open questions for lung cancer risk models

Determining appropriate strategies to mitigate overdiagnosis and optimize resource allocation

- Not all lung nodules will become malignant; as we begin to better understand characterization of these nodules, can we do a better job of risk stratification over time?
- What combination of screening methods (imaging, genetics, genomics) will likely be appropriate for risk assessment?
- Not all patients are compliant with longitudinal screening and treatment over time, can we do a better job of identifying individuals who will therefore likely benefit from resource utilization?