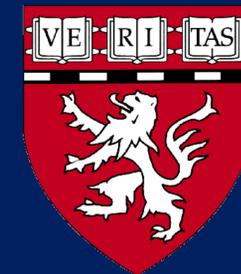




Validation of a deep learning-based model to estimate lung cancer risk from chest radiographs



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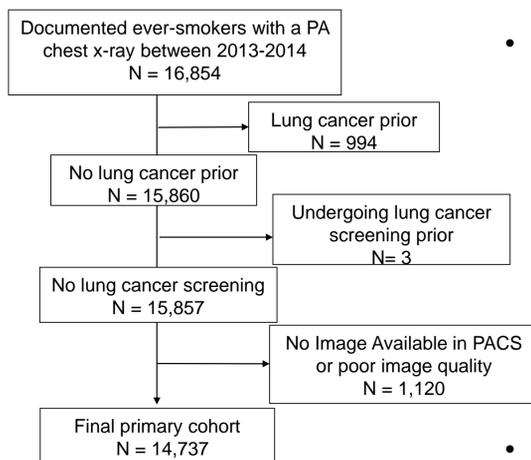
Background

- Lung cancer screening (LCS) with chest CT reduces lung cancer death by 20-25%
- Eligibility for LCS was determined by Centers for Medicare and Medicaid Services (CMS) criteria in 2015:
 - 55-77 years of age
 - ≥30 pack-year smoking history (packs per day x years of smoking)
 - Currently smoking or quit within 15 years
- In 2022, CMS expanded eligibility to those with ≥20 pack-years, 50-77 years of age
- <5% of eligible Americans are screened, underscoring the need for approaches to improve uptake
- Automated electronic medical record (EMR) approaches may help but CMS criteria is often not available in the EMR
- A deep learning-based model (CXR-LC) accurately estimated lung cancer risk using a CXR image, age, sex, and whether currently smoking in a retrospective analysis of two large multi-center clinical trial datasets

Purpose

To test whether CXR-LC can estimate lung cancer risk using CXR images and smoking history extracted from the medical record

Methods

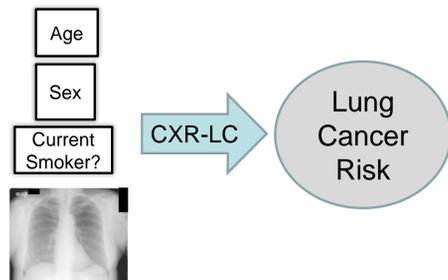


- We identified patients at the Mass General Brigham system who were:

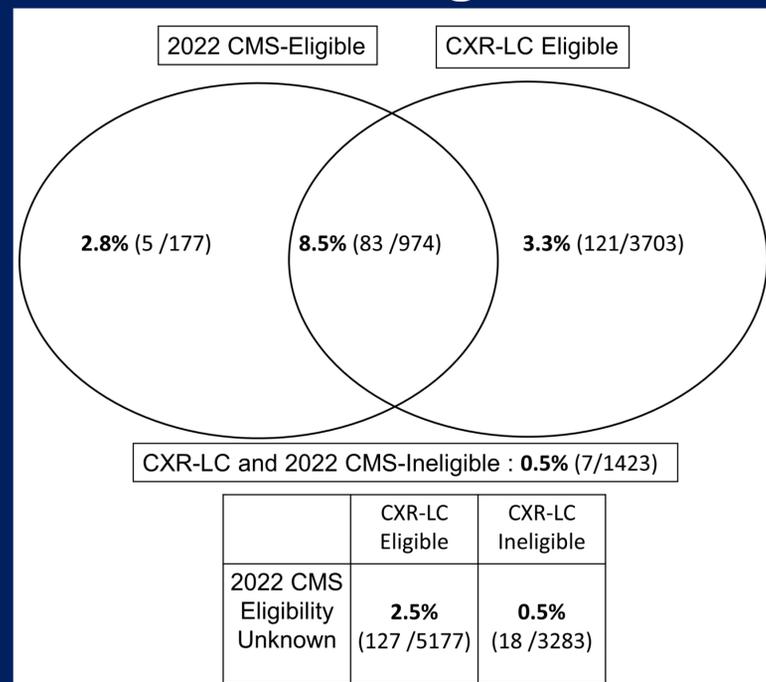
- Documented ever-smokers,
- Had a posterior-anterior CXR between 2013-2014
- No prior lung cancer and not undergoing LCS

- We used ICD-9/10 codes to identify patients with primary lung malignancy, and adjudicated incident events using manual chart review

- Smoking information to calculate CXR-LC and CMS eligibility were curated from the medical record



Patients eligible for screening by CMS and CXR-LC had an 8.5% rate of 6-year lung cancer vs. 0.5% for those CMS and CXR-LC ineligible



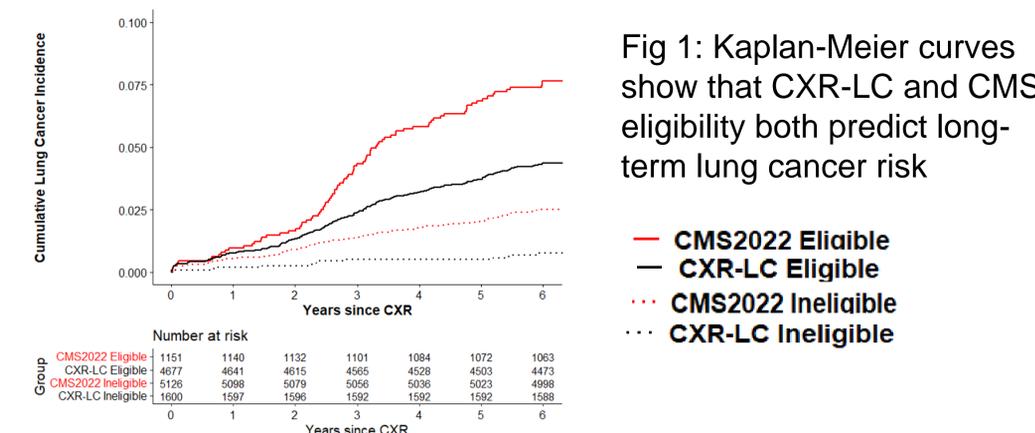
In 8,460 patients where CMS-eligibility could not be determined, CXR-LC eligible patients had a 5-fold higher rate of 6-year lung cancer than ineligible patients (2.5% vs. 0.5%; $p < 0.001$)



Results

Table 1: Cohort Characteristics

	N = 14,737
Mean age (sd), y	62.6 (6.8)
Male sex (%)	7154 / 14737 (48.5%)
Race	
White	12330 / 14473 (85.2%)
Black	1051 / 14473 (7.3%)
Asian	204 / 14473 (1.4%)
Other	456 / 14473 (3.2%)
Hispanic Ethnicity (%)	432 / 14737 (2.9%)
Current Smoking (%)	3433 / 12807 (26.8%)
Mean years since quit smoking (sd)	19.5 (13.2)
Mean pack-years (sd)	18.6 (23.5)
2022 CMS screening eligible	1151 / 6277 (18.3%)
2015 CMS screening eligible	714 / 7755 (9.2%)
6-year lung cancer incidence (%)	361 / 14737 (2.4%)



Conclusion

A deep learning model, CXR-LC, can accurately estimate lung cancer risk using data available in the EMR

Similar results were found in an extended analysis of black patients

Next Steps

- Pilot study to test whether CXR-LC can improve rates of LCS and reduce lung cancer death

References

- United States Preventive Services Task Force Recommendation Statement: <https://www.uspreventiveservicestaskforce.org/uspstf/recommendation/lung-cancer-screening>
- The National Lung Screening Trial Research Team. Reduced Lung-Cancer Mortality with Low-Dose Computed Tomography Screening. *NEJM*. 2011;365:395-409.
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