

Selected risk prediction models used in lung cancer screening

Risk prediction models are a statistical tool that combine different risk factors to estimate the probability of developing lung cancer over a set period of time.¹

Also known as 'risk calculators', they produce a personalised risk score which may be used to determine whether an individual is eligible for lung cancer screening. When selecting a model for a screening programme, it is important its performance is properly

validated to ensure only those who might benefit from screening are invited to participate.²

Below are some examples of risk prediction models that may be used to identify the target population for lung cancer screening. Please note this list is not exhaustive and other risk factors may be included in the models presented.

Risk factors	Examples of risk prediction models that may be used to calculate eligibility for screening										
	LLPv2 ³	LLPv3 ³	PLCOm2012 ^{4,5}	PLCOallm2014 ^{5,6}	LCRAT/ LCDRAT ^{7,8}	Bach ⁹	HUNT ¹⁰	TNSF-SQ ¹¹	Etzel ¹²	CanSPUC ^{13,14}	ALARM-NS ¹⁵
Target population	General population (UK)	General Population (UK)	People who have ever smoked (global)	People who have ever or never smoked (global)	People who have ever smoked (global)	People who have ever smoked	People who have ever smoked (Norway)	Taiwanese women who have never smoked	African Americans (US)	General population (China)	People who have never smoked (Asia)
Age and/or sex	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗	⊗
Smoking status	⊗	⊗	⊗	⊗	⊗	⊗	⊗		⊗		
Smoking history	⊗		⊗	⊗	⊗	⊗	⊗		⊗	⊗	
Race/ethnicity			⊗	⊗	⊗				⊗		
Education or household income ^a			⊗	⊗	⊗			⊗			⊗
Body mass index			⊗	⊗	⊗		⊗	⊗			⊗
Personal history of COPD, or potential markers of COPD ^b	⊗ ^b	⊗ ^b	⊗	⊗	⊗		⊗ ^b	⊗	⊗	⊗	⊗ ^b
Personal history of pneumonia	⊗	⊗									⊗
Personal history of cancer	⊗	⊗	⊗	⊗							⊗
Family history of lung cancer	⊗	⊗	⊗	⊗	⊗			⊗			
Occupational exposures, e.g. asbestos	⊗	⊗				⊗			⊗		
Second-hand smoke				⊗			⊗				
Other types of exposure, e.g. dust, hay fever, cooking fumes									⊗		

Adapted from *Lung cancer screening: learning from implementation* (Lung Cancer Policy Network, 2022).¹⁹

^a Education or household income are often used as indicators of socioeconomic position.¹⁶

^b Potential markers of COPD (e.g. daily cough during periods of the year/chronic bronchitis, emphysema, tuberculosis).^{17,18}

ALARM-NS: Asian lung cancer absolute risk model for never smokers; CanSPUC: Cancer Screening Program in Urban China model; COPD: chronic obstructive pulmonary disease; HUNT: HUNT lung cancer model; LLP: Liverpool Lung Project Risk models; LCRAT, lung cancer risk assessment tool; LCDRAT, lung cancer death risk assessment tool; PLCO: Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial models; TNSF-SQ: Taiwanese Never Smoker Female lung cancer risk model and Simplified Questionnaire.

REFERENCES

- Toumazis I, Bastani M, Han SS, et al. 2020. *Lung Cancer* 147: 154-86
- Robbins HA, Alcalá K, Swerdlow AJ, et al. 2021. *Br J Cancer* 124(12): 2026-34
- Field JK, Vulkan D, Davies MPA, et al. 2021. *Thorax* 76(2): 161-68
- Tammemägi MC, Ten Haaf K, Toumazis I, et al. 2019. *JAMA Netw Open* 2(3): e190204
- Brock University. <https://brocku.ca/lung-cancer-screening-and-risk-prediction/risk-calculators/>
- Tammemägi MC, Church TR, Hocking WG, et al. 2014. *PLOS Medicine* 11(12): e1001764
- Katki HA, Kovalchik SA, Petito LC, et al. 2018. *Ann Intern Med* 169(1): 10-19
- Katki HA, Kovalchik SA, Berg CD, et al. 2016. *JAMA* 315(21): 2300-11
- Bach PB, Kattan MW, Thornquist MD, et al. 2003. *J Natl Cancer Inst* 95(6): 470-8
- Markaki M, Tsamardinos I, Langhammer A, et al. 2018. *EBioMedicine* 31: 36-46
- Chien LH, Chen CH, Chen TY, et al. 2020. *Cancer Epidemiol Biomarkers Prev* 29(2): 452-59
- Etzel CJ, Kachroo S, Liu M, et al. 2008. *Cancer Prevention Research* 1(4): 255-65
- Guo LW, Lyu ZY, Meng QC, et al. 2022. *Lung Cancer* 163: 27-34
- Guo L-W, Lyu Z-Y, Meng Q-C, et al. 2022. *Front Oncol* 11: 766939
- Warkentin MT, Tammemägi MC, Espin-Garcia O, et al. 2022. *J Natl Cancer Inst* 114(12): 1665-73
- International Agency for Research on Cancer. 2019. *Reducing social inequalities in cancer: evidence and priorities for research.*
- Fan H, Wu F, Liu J, et al. 2021. *Ann Transl Med* 9(5): 390
- Jones PW, Agusti AGN. 2006. *Eur Respir J* 27(4): 822-32
- Lung Cancer Policy Network. 2022. *Lung cancer screening: learning from implementation.*

