Effect of screening CT results on lung cancer risk prediction within the National Lung Screening Trial

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BACKGROUND:
In the course of screening, individual disease risk evolves based on screening results. We calculated how individual lung cancer risk changes based on screening CT findings using data from the National Lung Screening Trial (NLST), which conducted annual screening for 3 years.

METHODS:
We calculated the risk of lung cancer diagnosis following a CT screen as a function of individual 1-year lung cancer risk predicted in the absence of screening ("pre-screening risk"). Each participant's pre-screening risk, r, was calculated using a validated risk model (Katki et al., *JAMA* 2016) including covariates: age, education, sex, race, smoking intensity/duration/quit-years, body mass index, family history of lung cancer, and self-reported emphysema. We used log-binomial regression to calculate lung cancer risk during the 1-year interval following a negative screen ("interval cancer") and at the next annual screen as a function of pre-screening risk and prior screen result.

RESULTS:
Interval cancer risk among CT-negatives was calculated as $r^{1.32}$. At the next screen, risk was $r^{1.01}$ for prior CT-negatives and $r^{0.74}$ for prior CT-false-positives (all p<0.0001). Among participants at the first screen, median pre-screening risk was 0.32% with an interquartile range (IQR) of 0.19-0.53%. Among CT-negatives, median risk decreased from 0.32% to 0.05% (IQR 0.02-0.09%) during the subsequent interval, but reverted approximately to pre-screening risk at the next screen (median 0.29%, IQR 0.17-0.47%). For CT-false-positives, median risk at the next screen increased from 0.32% to 1.5% (IQR 1.1-2.3%). Only the immediately prior screen result, not earlier screens, predicted lung cancer risk (all p>0.2). Exponents were similar for each interval and at each screen (all p>0.07).

CONCLUSIONS:
CT-negatives experienced substantially reduced lung cancer risk over the next year, but risk reverted to pre-screening risk at the next screen. CT false-positives experienced substantially increased lung cancer detection at the next screen, with most risks exceeding 1%.