Costs and cost-effectiveness of smoking cessation within an organized CT lung cancer screening program

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Background

Low-dose CT (LDCT) screening of smokers at high risk of developing lung cancer (LC) has been shown to reduce LC-specific and overall mortality. An analysis of former smokers in the National Lung Screening Trial (NLST) suggests that smoking abstinence coupled with LDCT screening realized more mortality benefits than abstinence alone or LDCT alone.

Objectives

The Canadian Partnership Against Cancer with Statistics Canada developed a microsimulation model (OncoSim-LC, version 2.5) to project the impact of cancer control measures on LC incidence, mortality and cost. Assuming that each visit for LDCT is a teachable moment to promote smoking cessation, we assessed the potential cost and cost-effectiveness of integrating cessation into an organized screening program.

Approach

OncoSim-LC incorporates Canadian demographics, risk factors, cancer management, outcomes and resource utilization. OncoSim-LC simulates the impact of smoking on incidence of lung cancer and on other smoking-related causes of death. We compared organized screening with and without smoking cessation. Modelling assumptions included: annual screening of people aged 55-74 with 30+ pack-year history, a target participation rate of 42% (60% recruitment, 70% adherence) reached over 10 years; an intensive cessation intervention (nicotine replacement therapy + varenicline + 12 weeks of counselling) at a cost of $490; up to 10 cessation attempts integrated with screening and a permanent quit rate of 5% per cessation attempt. Incidence, mortality and overall costs were projected for 2017-2036. Cost-effectiveness was estimated with a lifetime horizon, health system perspective and 1.5% discount rate. Costs are in 2016 CAD.

Results

Cessation within a screening program would cost approximately $76 million (undiscounted) per year for 2017-2036 or 8% of the total cost of screening, treatment and cessation. Compared to screening with no cessation, approximately 110 fewer LC cases and 50 fewer LC deaths would occur annually at a cost of $14,000/QALY. Increased participation 72% (80% recruitment and 90% adherence) would result in 260 fewer LC deaths at a cost of $24,000/QALY. A permanent quit rate of 10% improves cost-effectiveness to $6,000/QALY. A 50% increase in the cost of cessation would decrease the cost-effectiveness to $22,000/QALY.

Discussion

Smoking is a preventable cause of cancer and other chronic diseases. LC screening provides a teachable moment for smoking cessation. Therefore, integrating smoking cessation within an organized LC screening program is potentially a good use of limited healthcare resources that could result in long-term health benefits from a reduction in smoking-related diseases. Relative to many other funded interventions in cancer control, cessation within a LC screening program appears to be very cost-effective.

Conclusion

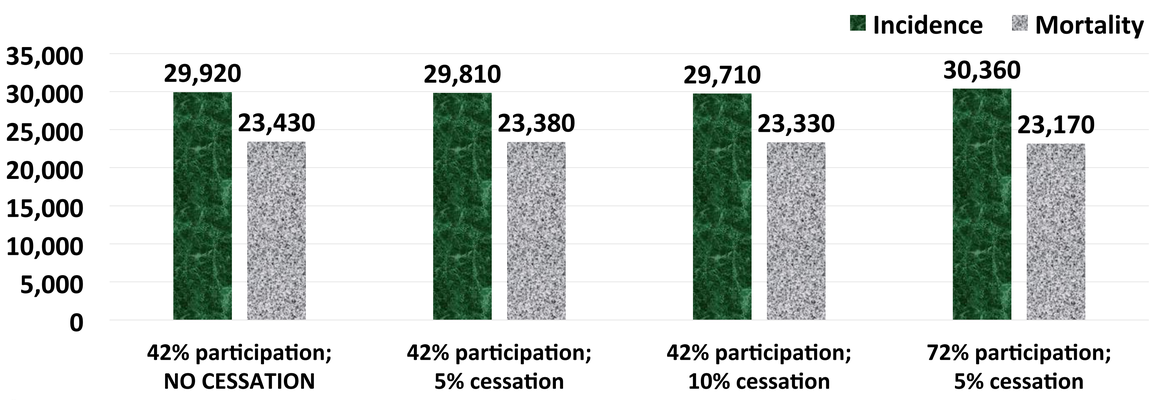
Based on the OncoSim-LC model, a cessation program within an organized LDCT screening program is projected to cost well under $50,000/QALY in Canada. Integrating robust smoking cessation initiatives within a LDCT screening program could save lives and be relatively cost-effective.

Table 1: Assumptions for comparative scenarios

Variable	Screening – No cessation (Reference/ Comparator scenario)	Screening with 5% cessation	Alternative intervention scenarios
Eligibility	55-74 year-olds with 30+ pack year smoking history		
Screening frequency	Annual screening		
Screening participation: recruitment and adherence rates	42% participation (60% recruitment; 70% adherence)	42% participation (60% recruitment; 70% adherence)	20%, 40%, 80% recruitment; 50%, 90% adherence
Cessation attempts	N/A	Up to 10 per individual	Up to 10 per individual
Cessation success rate (permanent)	N/A	5%	2.5%, 10%, 20%
Cessation cost (2016 CAD)	N/A	$490* (Base cost)	Base cost +25%, Base cost +50%, Base cost +100%

*Smoking intervention (nicotine replacement therapy + varenicline + 12 weeks counselling) cost $490

Figure 1: LDCT screening with and without cessation:Average annual lung cancer incidence and mortality with varying smoking cessation success rates & participation rates (2017-2036) §



§non-age standardized; rounded

Reduction in incidence with cessation (%)	0.4%	0.7%	1.1%
Reduction in deaths with cessation (%)	0.2%	0.4%	0.7%

Table 2: Cost-effectiveness of LDCT screening with compared to screening without cessation

Scenarios	Difference in lifetime total cost compared to screening	Difference in lifetime health-adjusted person-years (QALYs)	ICER= ΔCost/ΔQALY
Screening w/o cessation (42% participation)	N/A	N/A	N/A
Screening with cessation (42% participation; 5% cessation)	$1,866 M	133,000	$14,000
Screening with cessation (42% participation; 10% cessation)	$1,409 M	224,000	$6,000
Screening with cessation (72% participation; 5% cessation)	$4,663 M	195,000	$24,000
Screening with cessation (42% participation; 5% cessation; cessation cost increased by 50%)	$2,897 M	133,000	$22,000

* Costs: 2016 $CAD; 1.5% discount rate applied; numbers rounded; M=million

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