Reforming the Delivery of Smoking Cessation: A Distributional Cost-Effectiveness Analysis of Providing Smoking Cessation as Part of Targeted Lung Cancer Screening

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INTRODUCTION

Lung cancer is the most common cause of cancer-related deaths worldwide [1]. Furthermore, smoking-related disease is the largest cause of health inequality in England, driven by increased prevalence of smoking in deprived areas compared to less deprived areas [2]. Smoking cessation is an effective public health intervention against lung cancer and other smoking-related diseases.

The English Lung Cancer Screening (LCS) programme invites people aged 55–74 who either smoke or used to smoke for a screening test. Integrating smoking cessation support into LCS may optimise cessation services compared with a central referral service. Recent evidence suggests this would be a cost-effective approach in England [3]. However, limited evidence is available on the equity impact.

Aggregate distributional cost-effectiveness analysis (DCEA) builds upon traditional cost-effectiveness analysis to provide information about the societal distribution of costs and health effects. The objective of this study was to:

- Conduct an aggregate DCEA of providing smoking cessation as part of LCS compared with usual care.
- Estimate the impact of providing smoking cessation as part of LCS on health inequalities and health-related social welfare in England.

METHODS

An aggregate DCEA was conducted to estimate the impact of providing smoking cessation as part of LCS compared with usual care on health inequalities in England, using Index of Multiple Deprivation (IMD) quintiles as the stratifying socioeconomic variable. The DCEA was developed in R [4] following the methods laid out in Asaria et al. 2016 [5].

The base population was current smokers in England aged 55–74 i.e. those who are eligible for smoking cessation support as part of LCS. The impact of providing smoking cessation as part of LCS was quantified by the estimated differences in the uptake of smoking cessation services, as well as different mixes of interventions (including no interventions), based on reported services offered and uptake.

Uncertainty was incorporated through probabilistic sensitivity analysis (PSA). Additionally, extensive sensitivity and scenario analysis was undertaken to explore how the health equity impact differed under alternative assumptions, including alternative uptakes and health opportunity costs (HOC). Key inputs for the DCEA are presented in Table 1.

Table 1: DCEA inputs

Input	Source
Discounted incremental costs and quality-adjusted life years	Markov model, adapted from previous National Institute for Health and Care Excellence guidelines [3].
Population of England by IMD quintile	Office for National Statistics [6].
Prevalence of smoking in England by IMD quintile	Health Survey for England [7].
Baseline quality adjusted life expectancy (QALE)	Love-Koh et al. 2023 [8].
Predicted uptake of semaglutide by IMD quintile	Murray et al. 2024 [9]. Assumed flat gradient in base case. Scenario analysis considered higher uptake in the least deprived.
HOC by IMD quintile	Assumed flat following Anaya-Montes et al. 2025 [10]. Scenario analyses considered alternative gradients weighted towards the most and least deprived, as well as estimates from Love-Koh et al. 2020 [11].
HOC threshold	£15,000/quality-adjusted life year (QALY). Scenario analysis used thresholds of £20,000/QALY and £30,000/QALY.
Atkinson inequality aversion parameter (IAP)	Assumed 6.5 in base case to align with Robson et al. 2024 [12]. Sensitivity analysis used 10.95 [13].

RESULTS

Figure 1 shows the health benefit, health opportunity cost, and net benefit by IMD quintile for providing smoking cessation as part of LCS compared with usual care. The results of the PSA iterations are plotted on the equity-efficiency impact plane in Figure 2.

Under all base case assumptions, smoking cessation provided as part of targeted LCS had a positive net health benefit and equity impact. The HOC was positive for all IMD quintiles because smoking cessation provided as part of LCS dominated usual care in the economic model. The total net health benefit was 142,035 QALYs, of which 34,863 QALYs went to IMD1 compared to 23,612 QALYs to IMD5. The reasons for differing outcomes across quintiles were driven by the prevalence of smoking and uptake of smoking cessation by IMD.

Figure 1: Health benefit, health opportunity cost and net health benefit

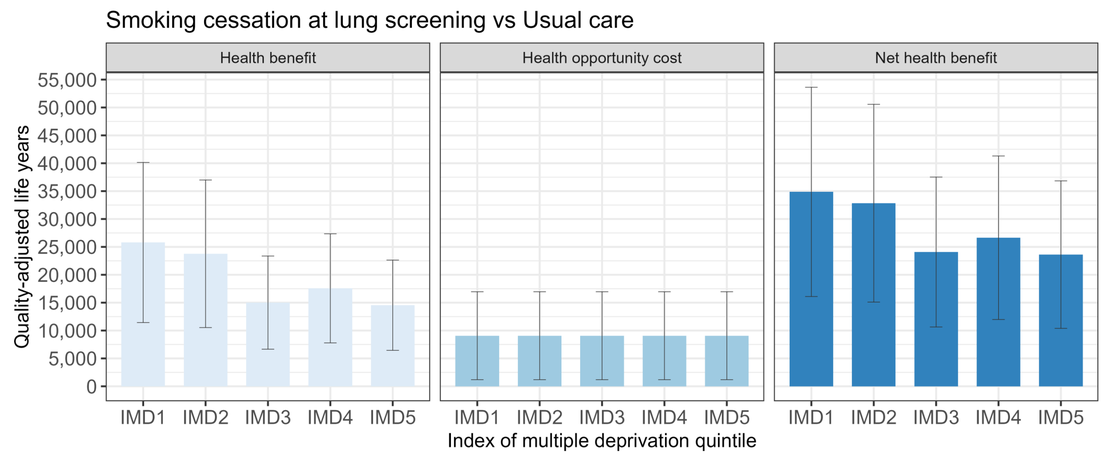
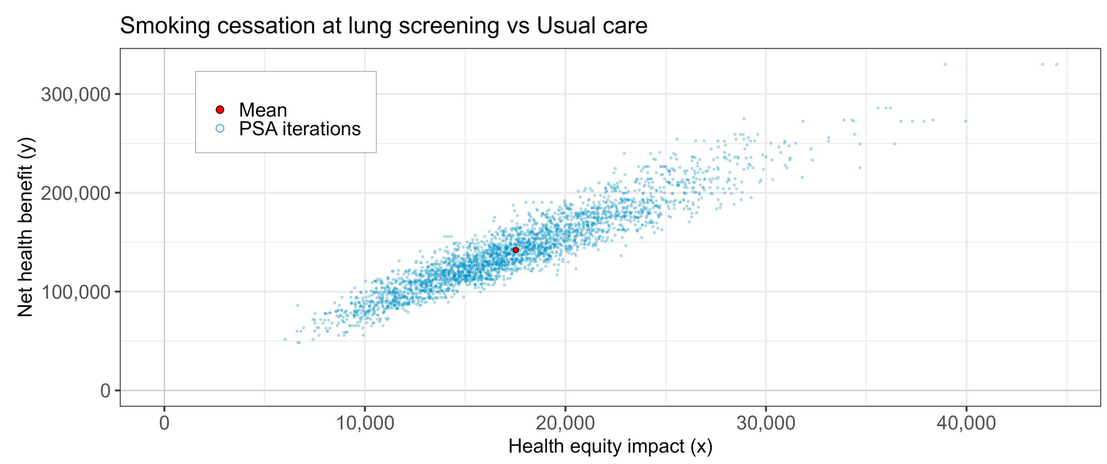


Figure 2: Equity-impact plane



SCENARIO ANALYSIS

Scenario analyses supported a likely positive equity impact. Providing smoking cessation as part of LCS remained health and equity-improving under all HOC and IAP assumptions and at all HOC thresholds considered.

The analysis was sensitive to uptake, with unequal uptake potentially worsening inequalities. Threshold analysis suggested that providing smoking cessation as part of LCS changed from equity-improving to equity-reducing between a ±45% and ±50% pro-affluent uptake gradient (where uptake is greater in the least deprived). Therefore, targeted implementation of smoking cessation will be important to improve health inequalities.

CONCLUSIONS

Reforming smoking cessation services as part of LCS would likely improve population health and equity.

Uptake is a key determinant of the impact on health inequalities.

The DCEA highlights the importance of implementation strategies in reducing health inequalities.

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