Applying the NICE Disease Severity Modifier to the Context of Cancer Screening

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INTRODUCTION

- The National Institute for Health and Care Excellence (NICE) is responsible for technology appraisals and subsequent NHS reimbursement decisions in England
- Technologies with an incremental cost-effectiveness ratio (ICER) between £20,000 and £30,000 per quality-adjusted life-year (QALY) gained may be considered cost-effective and reimbursed
- In 2022, NICE introduced a severity of disease modifier[1]
  - A weighting of 1.2 to QALYs gained through the intervention may be applied when absolute QALYs lost with the disease are ≥12, or the proportional shortfall is ≥85% of expected remaining QALYs
  - A higher weighting of 1.7 may be applied when absolute QALYs lost are ≥18 or the proportional shortfall is ≥95%
  - The 1.2 and 1.7 weightings are equivalent to the £30,000 ICER threshold increasing to £36,000 and £51,000, respectively
- The severity of disease modifier has yet to be studied for use in cancer screening evaluations, which differs from typical technologies as both those with and without the disease of interest receive the intervention

OBJECTIVE

- This study aims to estimate the prevalence of undiagnosed lung cancer in an English population-based cohort of 100,000 persons, observed from 50 years of age over their lifetime
- Subsequently, we aim to identify the ages (from 50 to 79) and undiagnosed stages (I to IV) where the severity of disease modifier would potentially be applicable

METHODS

- A state-transition model[2] was used to simulate a cohort of 100,000 individuals aged 50 over a lifetime horizon
- The number and stage (I-IV) of clinically diagnosed lung cancers over the lifetime horizon were based on age- and stage-specific incidence rates from England
- Subsequently for each clinically diagnosed cancer, stage-specific dwell times were used to define the prior years in which the cancer was present but undiagnosed and the corresponding stages
- Expected discounted (3.5% rate) QALYs for an undiagnosed lung cancer at a given age and stage were calculated by applying age-specific utility to the estimated lead time to clinical diagnosis, and stage-specific cancer utility to the estimated mean survival for the stage and age at which the cancer would have been diagnosed
- Here, mean survival was estimated using Bayesian flexible parametric survival models fitted to English stage-specific net survival estimates and population life tables[3]
- We then calculated the absolute and proportional QALY shortfalls for each undiagnosed lung cancer stage and age combination using published quality-adjusted life expectancy estimates for the English population,[4] and evaluated them against the NICE severity of disease criteria

KEY RESULTS: THE NICE SEVERITY OF DISEASE CRITERIA WERE MET AT MOST AGES AMONGST PERSONS WITH UNDIAGNOSED STAGE III AND IV LUNG CANCER, SUGGESTING SCREENING FOR LUNG CANCER MAY BE UNDERVALUED

- Expected QALYs with undiagnosed lung cancer were significantly lower than the equivalent general population expectation (**Table 1**; individual years averaged into 5-year age bands)
- The age range over which the QALY shortfall met the severity of disease criteria widened by the stage of undiagnosed cancer (**Figure 1**; individual years averaged into 5-year age bands)
- The absolute QALY shortfall criterion was met at ages 50-60 for undiagnosed stage IV lung cancer, whereas the proportional shortfall was met at all studied ages (50-79)
- For undiagnosed stage III cancer, the absolute and proportional criteria were met at ages 50-57 and 50-70, respectively
- For undiagnosed stage II lung cancer, the absolute criteria was met at ages 50-51; neither criteria was met for undiagnosed stage I lung cancer at any age
- The number of undiagnosed lung cancers increased as the cohort aged. The yearly average number of undiagnosed lung cancers was 307 for ages 50 to 54, increasing to 2,650 for ages 75 to 79 (**Figure 2**; the number of undiagnosed lung cancers in individual years are averaged into 5-year age bands)
- Across the ages, on average, 46% of the undiagnosed lung cancers met either of the severity of disease criteria (**Figure 2**; stages and ages meeting the criteria colour highlighted, with individual years averaged into 5-year age bands)

Figure 1. Absolute and Proportional QALY Shortfall by Stage of Undiagnosed Lung Cancer and Age Group

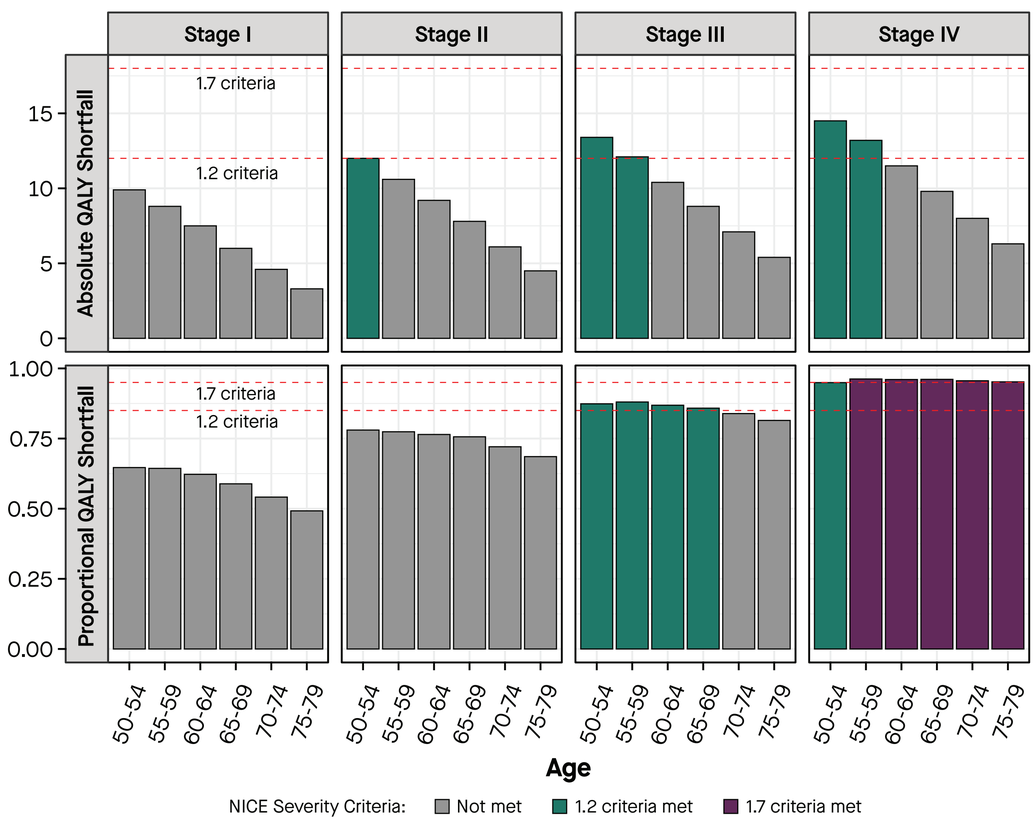

Figure 2. Number of Undiagnosed Lung Cancers and Those Meeting the Severity of Disease Criteria by Age Group and Cancer Stage Based on a Starting Cohort of 100,000 Individuals

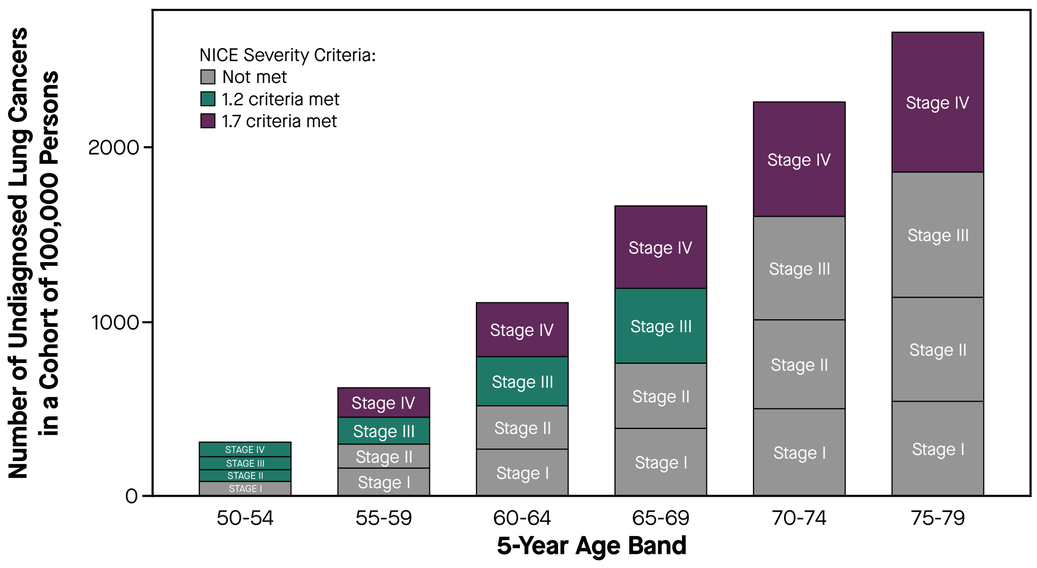

Table 1. Quality-Adjusted Life Expectancy by Attained Age (Individual Years Averaged Into 5-Year Age Bands) for the General English Population and for Those With Undiagnosed Lung Cancer

Age	Quality-Adjusted Life Expectancy				
	English Population[4]	Undiagnosed Lung Cancer Stage I	Undiagnosed Lung Cancer Stage II	Undiagnosed Lung Cancer Stage III	Undiagnosed Lung Cancer Stage IV
50-54	15.3	5.4	3.4	1.9	0.8
55-59	13.7	4.9	3.1	1.6	0.5
60-64	12.0	4.5	2.8	1.6	0.4
65-69	10.3	4.2	2.5	1.5	0.4
70-74	8.4	3.8	2.3	1.4	0.4
75-79	6.6	3.3	2.1	1.2	0.3

CONCLUSIONS

- The NICE severity of disease modifier holds significant potential for application in lung cancer screening by approaching the technology as an intervention for undiagnosed disease

References

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Disclosures

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