Impact of Mucus Plugs on the Health Economic Burden in Chronic Obstructive Pulmonary Disease Patients

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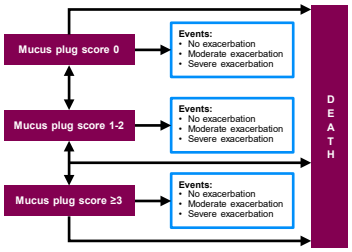
Why did we perform this research?

- Between 41–67% of patients with chronic obstructive pulmonary disease (COPD) have airway mucus plugs.[1,2]
- The presence of mucus plugs is associated with increased mortality, frequent exacerbations, and poor quality of life (QoL).[1-3]
- The objective of this study was to estimate the potential cost-effectiveness of an intervention aimed solely at reducing mucus plugs among adult patients with COPD receiving triple inhaled therapy.

How did we perform this research?

- A Markov cohort model was developed featuring 1-month cycles and 4 health states: 3 representing lung segment mucus plug scores (0, 1-2, and ≥3)[1] and the fourth representing death.
- Baseline characteristics for the simulated cohort were derived from the COPDGene® study[4]; standard of care (SoC) transition probabilities were based on published data.[5]
- The model used a lifetime horizon from a UK national healthcare perspective and compared SoC (ie, triple inhaled therapy) with a hypothetical intervention (ie, a biologic treatment for COPD).
- Disease state utilities[6] and healthcare resource utilization and related costs[7] were based on published data; the hypothetical intervention was priced based on drug acquisition costs for a biologic for COPD in the UK.[8,9]
- The base case scenario assumed a 50% reduction in mucus plugs; a 2-way sensitivity analysis assuming 75% reductions in drug acquisition costs and mucus plugs was also conducted.

Figure 1. Markov model structure



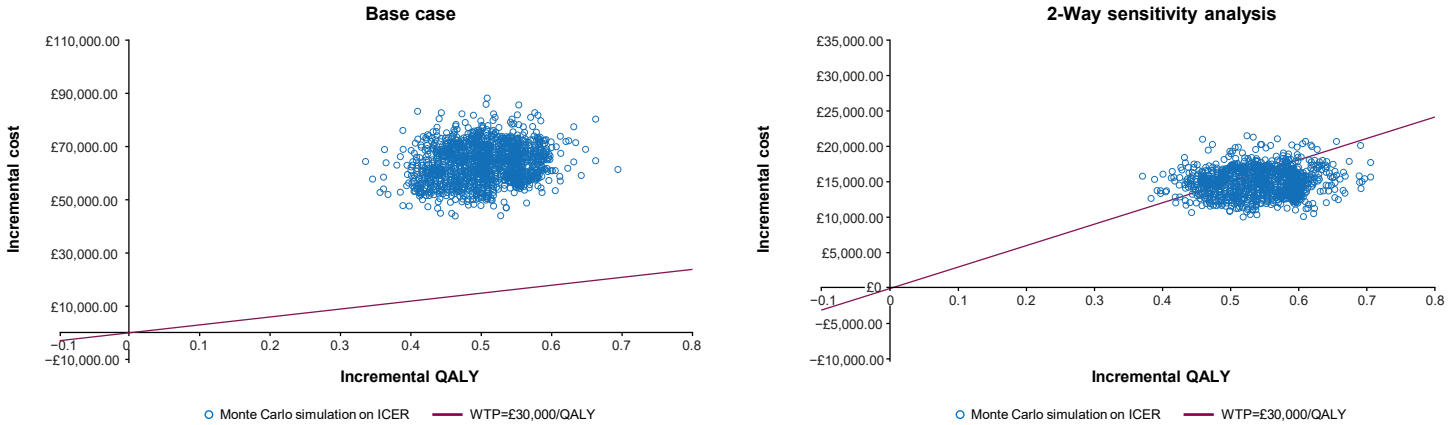
Notes: Purple boxes represent the 4 health states: mucus plug scores 0,1-2, or ≥3, and death. Blue boxes represent the events a patient can have in each mucus plug–related health state: no exacerbation, moderate exacerbation, or severe exacerbation.

What did we find?

Table 1. Cost-effectiveness comparison of SoC vs a biologic treatment for COPD: base case (50% reduction in mucus plug scores) and 2-way sensitivity analysis (75% reduction in drug acquisition costs and mucus plug scores)

Measure	Base case			2-Way sensitivity analysis		
	Biologic treatment	SoC	Difference	Biologic treatment	SoC	Difference
QALY gains	7.06	6.56	+0.50	7.10	6.56	+0.54
Cost, £	87,532	24,319	−63,213	39,057	24,319	−14,767
Exacerbation and disease management cost, £	24,017	25,631	+1,613	23,922	25,631	+1,708
ICER, £/QALY	—	—	126,249	—	—	27,338

Figure 2. Cost-effectiveness planes: base case (50% reduction in mucus plug scores) and sensitivity analysis (75% reduction in drug acquisition costs and mucus plug scores)



Notes: Cost-effectiveness plane for SoC vs a biologic treatment for COPD (base case and 2-way sensitivity analysis). Monte Carlo simulation results with 1000 repetitions are shown as blue circles. The WTP of £30,000/QALY is represented as a purple line; values located to the northwest of the line indicate non–cost-effectiveness under the stated WTP, and values located to the southeast of the line are cost-effective.

- In the base case, compared with SoC, an intervention to reduce mucus plugs by 50% generated quality-adjusted life-year (QALY) gains of 0.50, an incremental cost of £63,213, and saved £1,613 in exacerbation-related and disease management–related healthcare costs; however, the incremental cost-effectiveness ratio (ICER) was £126,249/QALY, which was above the UK willingness-to-pay (WTP) threshold of £30,000/QALY.
- In the 2-way sensitivity analysis, compared with SoC, an intervention to reduce mucus plugs by 75% generated QALY gains of 0.54, an incremental cost of £14,767, and saved £1,708 in exacerbation-related and disease management–related healthcare costs; the ICER was £27,338/QALY, which was below the UK WTP threshold of £30,000/QALY.

How might this impact current clinical practice?

- **This model indicates that a hypothetical intervention targeting mucus plug reduction may reduce associated outcomes (ie, exacerbations and mortality) and improve QoL, which could result in significant healthcare cost savings and QALY gains.**
- **These results address a gap in current health economic models and suggest that mucus plug reduction should be incorporated into models assessing the cost-effectiveness of biologics for COPD.**

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Abbreviations

COPD, chronic obstructive pulmonary disease; ICER, incremental cost-effectiveness ratio; QALY, quality-adjusted life-year; QoL, quality of life; SoC, standard of care; WTP, willingness to pay.

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Disclosures

JPCS was an employee of AstraZeneca during the time of study. JP, LR, and SS are employees of AstraZeneca and may hold stocks/shares. MS has nothing to disclose.