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Impact on Health Outcomes and Productive Work of Anti-PD-(L)1 Inhibitors to Treat Early-Stage Cancers in England

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Background

- The NHS Long Term Plan states an ambition to improve cancer survival rates and increase the proportion of cases diagnosed at an early stage.[1]
- However, improving early diagnosis rates will only lead to improved outcomes if patients rapidly receive the appropriate treatment following their diagnosis.
- Anti-programmed cell death-(ligand) 1 (anti-PD-[L]1) inhibitors are mainstay treatments for many advanced/metastatic cancers and have also been shown to improve recurrence-/event-/disease-free survival when used in adjuvant/perioperative treatment of early-stage tumours.[2]
- This has prompted expansion into early-stage settings, which has changed the treatment paradigm for patients with these life-limiting diseases.[2,3]

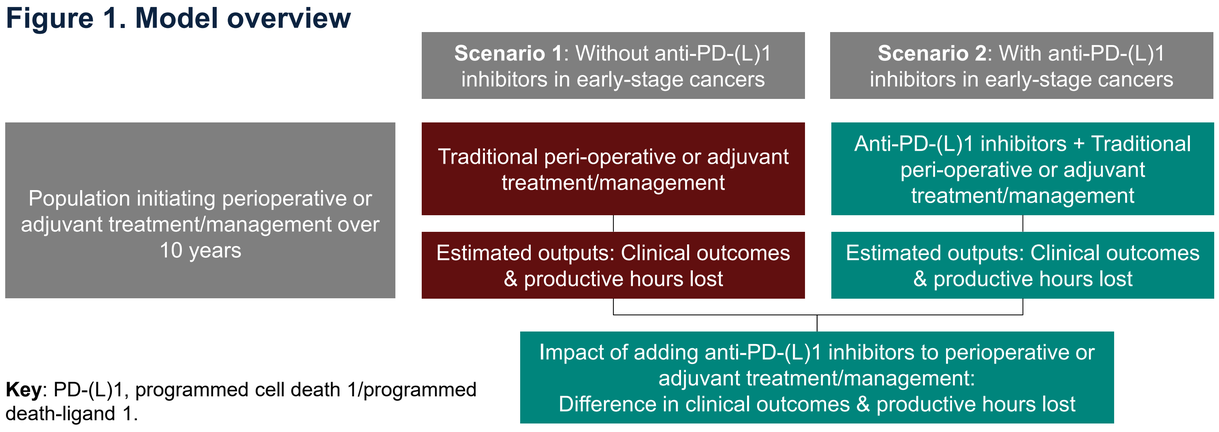
Aims

- To quantify the estimated impact on health and productivity outcomes of using anti-PD-(L)1 inhibitors approved as perioperative or adjuvant treatment of early-stage cancers in England.

Methods

- A model was developed to assess the health and productivity outcomes of adopting anti-PD-(L)1 inhibitors in several early-stage cancers over 10 years in England. The model compares the outcomes in two scenarios (**Figure 1**):
  - **Scenario 1**: without anti-PD-(L)1 inhibitors in early-stage cancers (i.e., these are reserved for advanced/metastatic cancers)
  - **Scenario 2**: with anti-PD-(L)1 inhibitors in early-stage cancers (i.e., available both in early-stage cancers with approved indications, as well as in advanced/metastatic cancers)

Figure 1. Model overview



Key: PD-(L)1, programmed cell death 1/programmed death-ligand 1.

- The model focuses on four early-stage indications for anti-PD-(L)1 inhibitors with a positive National Institute for Health and Care Excellence (NICE) recommendation and predicts outcomes using 4-state Markov models with a 1-week cycle length and weekly new cohort entry, over 2024-2033 (**Figure 2**).
- The model leverages cost-effectiveness and budget impact models developed for health technology assessment submissions to NICE, data from pivotal trials, and England-specific data on projected eligible patients and market shares. The model assumptions are found in **Table 1.**
- Outcomes include: life years (LYs), quality-adjusted life years (QALYs), events/recurrences, active treatments for metastatic disease, deaths after recurrence, and productive hours lost.

Figure 2. Model structure

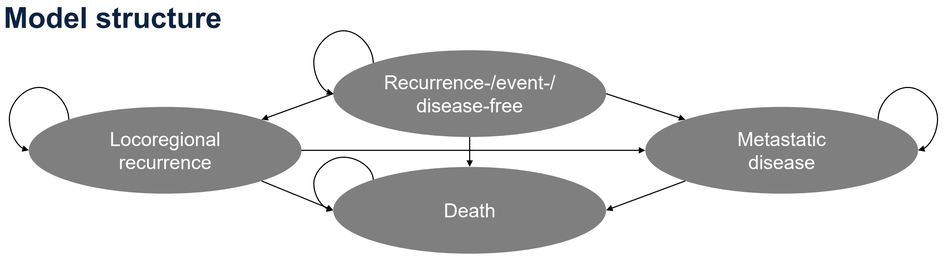


Table 1. General base-case setting and model assumptions

	Category	Input	
	Perspective	NHS and Personal Social Services	
	Time horizon	10 years (2024-2033)	
	Discounting	3.50% for clinical outcomes	
	Indications	• Melanoma Stage IIB/C • Melanoma Stage III	• Renal cell carcinoma • Triple negative breast cancer
	Population[4-5]	• 2024 population: 57,840,322; subsequent annual growth of 0.64% • Target population for each indication: based on publicly available epidemiology data, applied to the estimated population of England	
	Health state transitions[6-9]	Four 4-state Markov model (1 per indication); transition probabilities informed by clinical trials, NMA or published research	
	Treatment duration[10-13]	Specific to the treatment options received in perioperative or adjuvant setting, or in 1L and 2L metastatic setting for each indication	
	Market shares	Based on market research and expert opinion	
	Retreatment with anti-PD-(L)1 inhibitors	Retreatment with any or the same anti-PD-(L)1 inhibitor possible 6 months after perioperative or adjuvant treatment completion	
★★☆	Health state utilities[10-13]	• Informed by clinical trials and mapped to local values using UK-specific algorithms, adjusted for age and sex • Disutility of adverse events (Grade 3+ adverse events with ≥ 5% incidence in any treatment arm) assumed to be experienced at treatment initiation	
	Productivity[14-15]	Inputs taken from a patient and caregiver survey assessing productivity impact of early-stage cancer, and UK labour statistics	

Key: 1L, first-line; 2L, second-line; NMA; network meta-analysis, PD-(L)1, programmed cell death 1/programmed death-ligand 1.

Results

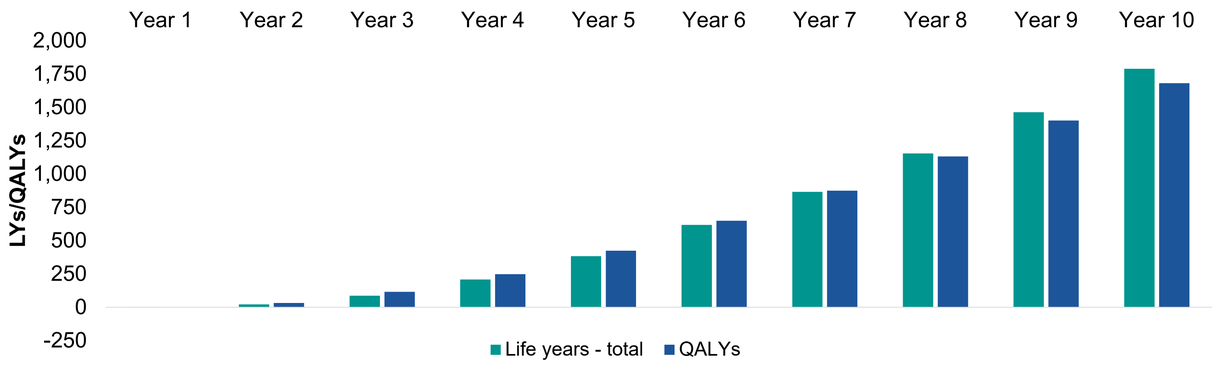
- Over 2024–2033, 36,815 (58%) of the 62,942 eligible patients with early-stage cancers are estimated to initiate perioperative or adjuvant therapy with anti-PD-(L)1 inhibitors for treatment of melanoma Stage IIB/C, melanoma Stage III, renal cell carcinoma and triple-negative breast cancer, resulting in overall health gains (increase in LYs and QALYs; decrease in recurrences, active metastatic treatments and deaths after recurrence), ranging from 3% to 20% (**Table 2**).
- The benefits accumulate steadily over the 10-year horizon and are anticipated to extend beyond this time frame (**Figure 3-4**).
- The anticipated increased survival for patients, and lower absenteeism and presenteeism for both patients and carers, also results in overall productivity gains (**Figure 5**).

Table 2. Total 10-year impact on health and productivity outcomes of using anti-PD-(L)1 inhibitors approved as perioperative or adjuvant treatment of early-stage cancers vs reserving them for advanced/metastatic cancers

Recurrences avoided	Active metastatic treatments prevented	Deaths after first event/ recurrence prevented	Recurrence-free LYs gained	LYs gained	QALYs gained	Productive years gained[a]
4,434	3,233	2,349	16,945	6,590	6,556	13,837
16%	13%	20%	9%	3%	3%	17%

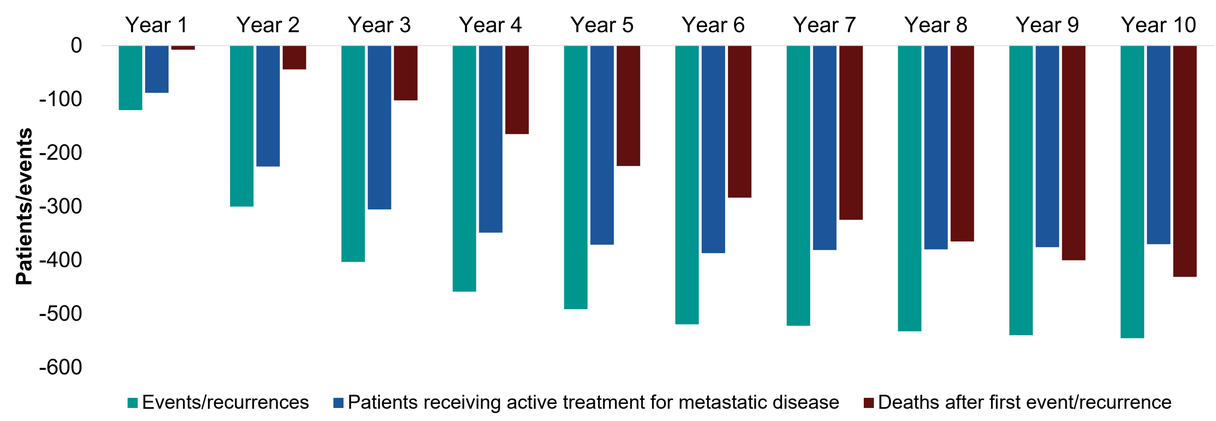
Key: LY, life years; PD-(L)1, programmed cell death 1/programmed death-ligand 1; QALY, quality-adjusted life years.
[a] Resulting from lower absenteeism and presenteeism for both patients and carers, and improved survival for patients.

Figure 3. Annual impact on LYs and QALYs when anti-PD-(L)1 inhibitors are used in early-stage cancer vs reserving them for advanced/metastatic cancers



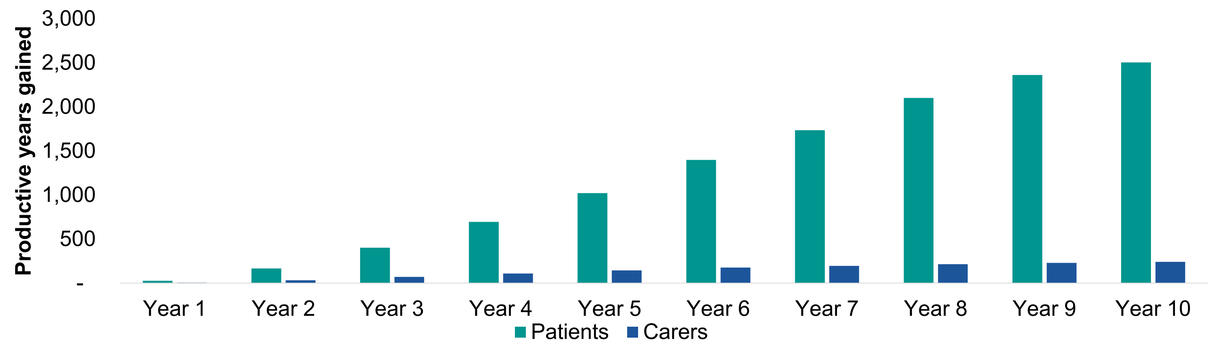
Key: LY, life years; PD-(L)1, programmed cell death 1/programmed death-ligand 1; QALY, quality-adjusted life years.

Figure 4. Annual impact on event-based outcomes when anti-PD-(L)1 inhibitors are used in early-stage cancer vs reserving them for advanced/metastatic cancers



Key: PD-(L)1, programmed cell death 1/programmed death-ligand 1.

Figure 5. Annual impact on productivity when anti-PD-(L)1 inhibitors are used in early-stage cancer vs reserving them for advanced/metastatic cancers



Key: PD-(L)1, programmed cell death 1/programmed death-ligand 1.

Conclusions

- Using anti-PD-(L)1 inhibitors in early-stage cancer, as opposed to reserving them solely for advanced/metastatic disease, can reduce the number of recurrences, extend the time spent by patients free of cancer, reduce the number of patients requiring metastatic treatment, and increase productivity of both patients and carers.
- Planning for and enhancing access to anti-PD-(L)1 inhibitors beyond what is modelled in this study is anticipated to further increase the health and productivity gains that can be achieved.

References

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Disclosures

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