Informing Value-Based Pricing: Cost-Effectiveness Analysis of a Hypothetical First-Line Therapy for Metastatic Pancreatic Cancer

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Background

- Pancreatic cancer is an aggressive malignancy with limited treatment options and high mortality rates.[1]
- It is the 10th most common malignancy in the United Kingdom (UK), comprising 3% of all new cancer diagnoses and 6% of all cancer fatalities (2017-2019).[2]
- The economic burden of pancreatic cancer is substantial: 80% of patients experience financial difficulties, incurring average costs of £570 per month.[3]
- Currently, there are no approved treatment options for patients who are unsuitable for intensive combination chemotherapy, leading to a high disease burden.

Objective

- To evaluate the cost-effectiveness of a hypothetical first-line therapy compared with gemcitabine monotherapy for treatment-naive patients with metastatic adenocarcinoma of the pancreas who are unsuitable for intensive combination chemotherapy from the perspective of the UK National Health Service (NHS) and Personal Social Services (PSS).
- To explore how different combinations of PFS and OS hazard ratios (HRS) may impact the economically justifiable price (EJP) of the drug, thereby aiding an assessment of the economic viability of its clinical development.

Methods

- A partitioned survival model was developed incorporating three health states: pre-progression, post-progression, and death (Figure 1), for illustrating cost-effectiveness based on the decision problem (Table 1). The model time horizon was 10 years, and the cycle length was 1 week. Key model inputs and data sources are given in Table 2.
- The efficacy of the hypothetical therapy in the base case was modelled by applying hazard ratios of 0.45 and 0.5 to the gemcitabine PFS and OS curves, respectively. These values reflect an optimistic assumption of clinical benefit consistent with the therapy's hypothetical nature. Scenario analyses were conducted to examine the impact of variations in treatment efficacy on cost-effectiveness outcomes.

Figure 1: Model Structure

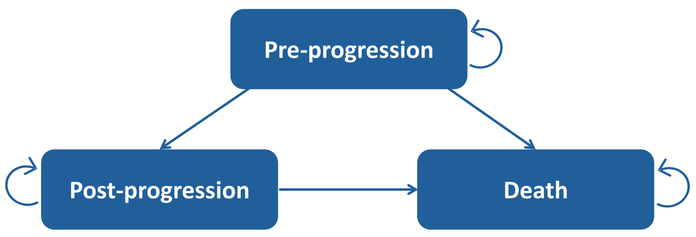


Table 1: Decision Problem

Population	Previously untreated adult patients with metastatic adenocarcinoma of pancreas who are unsuitable for intensive combination chemotherapy (e.g., FOLFIRINOX) but eligible for systemic treatment
Intervention	Hypothetical first-line therapy
Comparator	Gemcitabine monotherapy
Outcomes	Incremental costs, incremental QALYs, incremental LYs, ICER (incremental cost per QALY gained), Net monetary benefit (NMB)

Keys: ICER, incremental cost-effectiveness ratio; LY, life year; QALY, quality-adjusted life year

Table 2: Key Model Inputs and Data Sources

Input Category	Source / Assumption	Notes
Clinical efficacy (gemcitabine)	Kaplan–Meier curves from the MPACT trial. Median PFS: 3.7 months, median OS: 6.7 months.[5]	Used to model baseline progression-free survival (PFS) and overall survival (OS)
Efficacy of hypothetical therapy	Assumed hazard ratios: 0.45 (PFS), 0.5 (OS)	Applied to extrapolated gemcitabine survival curves
Adverse events	MPACT trial for gemcitabine and assumed same rates for hypothetical therapy	Frequency and severity data for gemcitabine-related adverse events
Direct medical costs and HCRU assumptions	Costs - NHS reference costs, PSSRU, and other UK-specific sources (2024 prices) HCRU – NICE TA476[6]	Used for drug acquisition, administration, and management costs
Health state utilities	Published literature[7]	Applied to Pre-progression and post-progression states
Discount rate	3.5% per annum	Applied to both costs and QALYs
Scenario analyses	Deterministic and scenario analyses with different HR assumptions	Explored robustness and uncertainty in key parameters

Keys: HCRU, Healthcare resource utilization; HR, hazard ratio; NHS, National Health Service; NICE, National Institute for Health and Care Excellence; OS, overall survival; PFS, progression-free survival; PSSRU, Personal Social Services Research Unit; QALY, quality-adjusted life year; TA, technology appraisal

Results

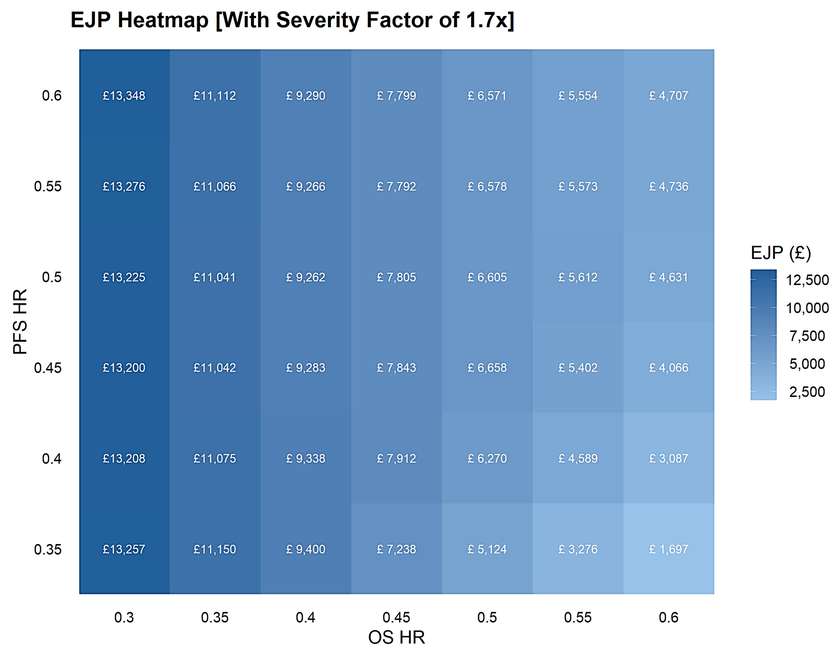
- Base-case outcomes were estimated using the assumed hazard ratios for OS and PFS, as presented in Table 3.
- A severity modifier was applied to account for the high disease burden and poor prognosis associated with metastatic pancreatic cancer in line with the NICE Health Technology Evaluation Framework.[8]
- The QALY shortfall calculation yielded a severity weight of 1.7, which was applied to all results.
- A scenario analysis was then performed to assess cost-effectiveness across varying efficacy assumptions.
- PFS and OS hazard ratios were adjusted in increments of 0.05 at a willingness-to-pay threshold of £20,000 per QALY.
- Incremental costs, incremental QALYs, and the EJP were calculated for each HR pair. The resulting EJP values for each HR combination are shown in Figure 2.

Table 3: Base Case Results (With a Severity Factor of 1.7)

Incremental			ICER (Cost per QALY gained)	NMB at £20,000 WTP	EJP
Costs	QALYs	LYs			
£8,319	0.791	1.076	£6,189	£18,564	£6,658

Keys: EJP, economically justifiable price; ICER, incremental cost-effectiveness ratio; LY, life year; NMB, net monetary benefit; QALY, quality-adjusted life year; WTP, willingness-to-pay threshold

Figure 2: EJP Heatmap (With a Severity Factor of 1.7x]



Keys: EJP, economically justifiable price; HR, hazard ratio; OS, overall survival; PFS, progression-free survival

Conclusion

- The base-case analysis indicates that this hypothetical first-line therapy for metastatic pancreatic cancer is cost-effective at a willingness-to-pay threshold of £20,000 per QALY. A severity weight of 1.7 appropriately reflects the high associated disease burden and supports a higher valuation of health gains.
- Scenario analyses further demonstrated the robustness of these findings. By varying the PFS and OS hazard ratios in increments of 0.05, the analysis explored a range of plausible efficacy outcomes. This showed that the therapy remained economically attractive across most scenarios. This approach also enabled estimation of the maximum price at which the therapy would remain cost-effective, providing useful insights for pricing and reimbursement considerations.

Limitations

- The efficacy of the hypothetical drug was modeled by applying assumed hazard ratios to survival curves extrapolated from gemcitabine survival curves. However, this approach lacks trial-based evidence and may not accurately represent real-world outcomes. Results should be interpreted with caution considering this substantial uncertainty.

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