

Appendices to EEPRU report: Estimating the overall population health effects of uniform pricing, indication-based pricing, and alternative commercial arrangements for new pharmaceuticals in the UK NHS.

Appendix 1: Revenue maximisation under uniform pricing

Under uniform pricing, the manufacturer will select the combination of indication launches that maximise revenue, where the selected set of indication launches at time t is denoted I_t^{UNI} . The total number of individuals who receive the product corresponding to this set of indication launches is denoted $N_{I_t^{UNI}}$. The manufacturer selects indication launches to maximise revenue:

$$\max R_t = \Delta p_{UNI,t} (N_{I_t^{UNI}}) \cdot N_{I_t^{UNI}} \quad [1]$$

The manufacturer faces a demand curve whereby price is a function of the indications launched and therefore of the total number of individuals who receive the product:

$$\Delta p_{UNI,t} (N_{I_t^{UNI}}) = \begin{cases} \Delta h_1 \cdot \lambda - \Delta n p c_1 & \text{if } N_{I_t^{UNI}} \leq n_1 \\ \Delta h_2 \cdot \lambda - \Delta n p c_2 & \text{if } n_1 < N_{I_t^{UNI}} \leq n_1 + n_2 \\ \Delta h_3 \cdot \lambda - \Delta n p c_3 & \text{if } n_1 + n_2 < N_{I_t^{UNI}} \leq n_1 + n_2 + n_3 \\ \vdots & \vdots \\ \Delta h_l \cdot \lambda - \Delta n p c_l & \text{if } n_1 + n_2 + n_3 + \dots + n_{l-1} < N_{I_t^{UNI}} \leq N \end{cases} \quad [2]$$

Within expression [2], the indications developed at time t are ordered from 1,2,3,...,l, according to the maximum achievable price for that indication ($\Delta h_i \cdot \lambda - \Delta n p c_i$); N reflects the total number of individuals who could receive the product if all indications that have been developed to date are launched. The uniform price may vary over time as additional indications become available, the demand curve changes, and the revenue maximising combination of indication launches, and pricing may change. Indications may be launched and then withdrawn if this is the revenue maximising strategy for the manufacturer.

Appendix 2: Effects of high approval norm for indication 1 on revenue

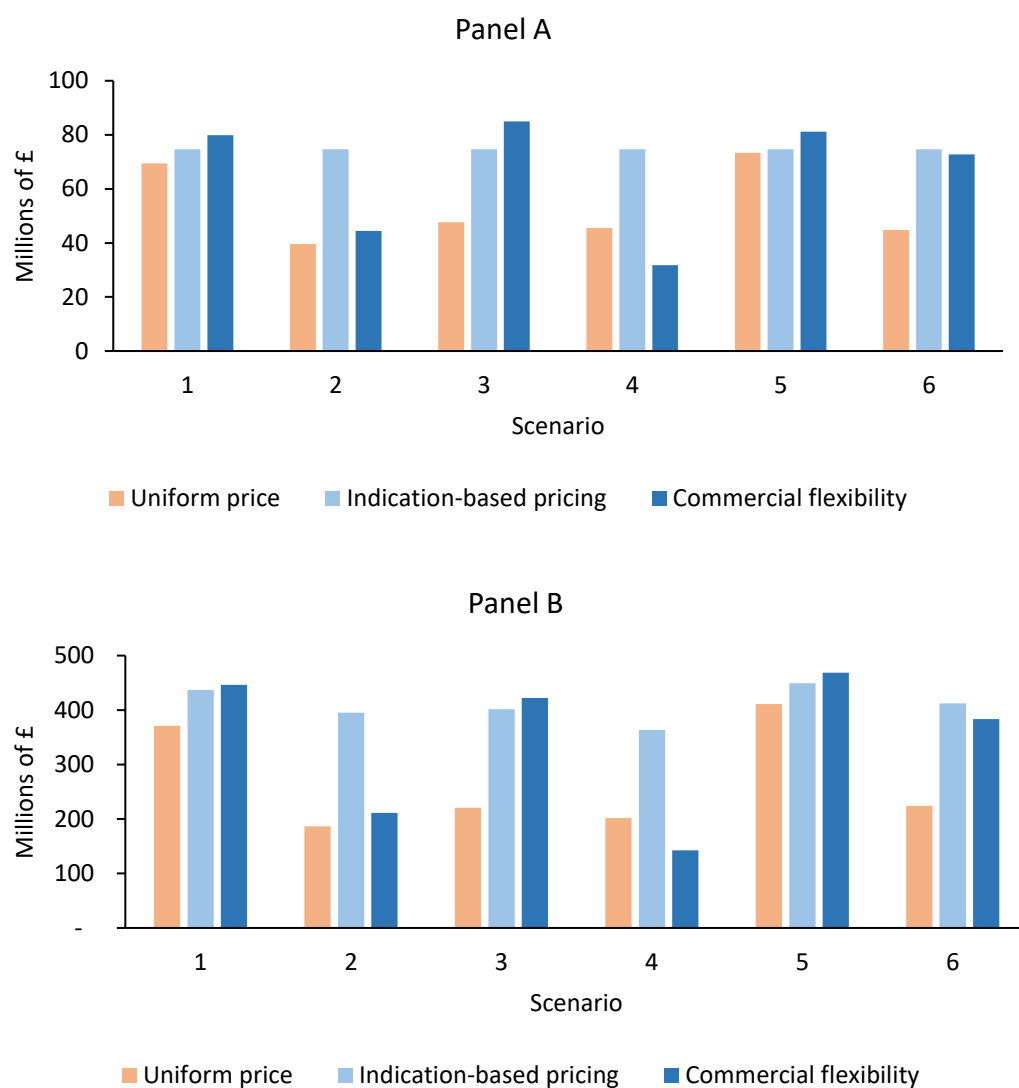


Figure 1. Increase in manufacturer revenue associated with a £100,000 per quality adjusted life year (QALY) approval norm for indication 1. Values are reported in millions of sterling British pounds (£), considering static effects (Panel A) and dynamic effects (Panel B).

Appendix 3: Additional information relating to evidence and methods used within case studies

For those appraisals where cost-effectiveness results were presented for subgroups within an indication, we estimated the weighted incremental quality-adjusted life years (QALYs) and the weighted incremental costs. The weighting was based on the subgroup prevalence retrieved from the literature. When no information was found, groups of equal size were used.

For the combination therapy (nivolumab + ipilimumab), we assumed the same percentage of discount for both drugs, achieved by splitting incremental cost according to expected total drug cost split based on list price. Revenue maximisation includes both components of combination therapy as both drugs are sold by the same company.

When the exact ICER was commercial confidence, we used the approval norm usually applied by the National Institute for Health and Care Excellence (NICE). The approval norm was assumed to be £30,000 per QALY gained with the exception of treatments considered to meet the “end of life” criteria where the approval norm is assumed to be £50,000 per QALY gained.

For those indications in which the breakdown of the incremental non-product cost is not reported, we used the budget impact analysis findings. If the budget impact analysis is not reported, then we set a zero value for the incremental non-product cost.

When the mean time-on-treatment (TOT) was not reported in the appraisal documentation, we retrieved the TOT curve and afterwards we extracted the points by using the online tool called WebPlotDigitizer (<https://automeris.io/WebPlotDigitizer/>). Lastly, the mean TOT was calculated using the area under the curve methodology.

Appendix 4: Results of dynamics analysis of case studies

Table A2. Summary of results for nivolumab and pembrolizumab case studies including dynamic effects.

	Nivolumab		Pembrolizumab	
	Uniform price	Pure IBP	Uniform price	Pure IBP
Proportion of patients with access during IPP	100%	100%	97%	100%
Total potential net health effects gained through use of new drugs*	32,551	32,551	57,204	57,751
Total potential net health effects gained through dynamic effects*	123,931	171,214	206,567	287,188
NHS expenditure on branded medicines	£3,597,120,343	£9,605,594,834	£5,442,017,700	£14,354,432,337
Health foregone due to payment manufacturers*	306,228	640,373	362,801	956,962
Realised population net health effects*	-83,326	-436,608	-90,390	-612,023
Share of value to the NHS	-53%	-214%	-34%	-177%
Share of value to manufacturer	153%	314%	138%	277%

Note. Values with an asterisk (*) are net health effects in quality-adjusted life years

Abbreviations. *IPP*, intellectual property patent; *NHS*, National Health Service.