

Cost-effectiveness model of an anti-PD-1 antibody drug intervention for patients with extensive-stage small cell lung cancer (ES-SCLC)

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Abstract

In the U.S., there are currently two immuno-oncology drugs approved for the treatment of patients with extensive-stage small cell lung cancer (ES-SCLC). Serplulimab is up-and-coming in Phase III (NCT05873790, NCT05882630, NCT05468489) and will introduce additional competition for market share while still under development for multiple other indications. Most oncology interventions have challenges demonstrating cost-effectiveness because of incremental clinical benefits and the complexity of costs associated with care. Comparative effectiveness was evaluated using outcomes from ASTRUM-005 (NCT04063163) and costs were estimated using 2020 fee schedules which best reflect the costs incurred by the patient population. Cost per QALY was estimated to be \$322,419.44 – \$1,054,696.92 for serplulimab and \$174,293.90 – \$1,170,171.50 for the control regimen. The perspective taken in this analysis was based on hospital-based cancer care and that the patient has major complications at each admission given the cancer is Stage IV. A bi-variate sensitivity analysis was performed based on health state utility and high and low hospitalization costs (proxy for regionality).

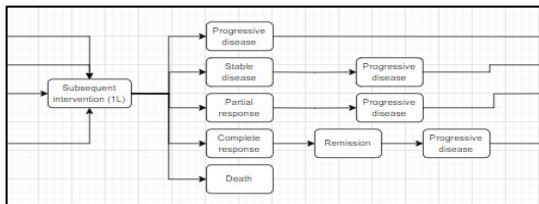
Key Research Question

What is the rebate needed for an immuno-oncology drug to be cost-effective as defined by willingness-to-pay thresholds?

Introduction

Disease state modeling has various levels of complexity from static, decision trees to dynamic transition and simulation models (most advanced). To maximize the variations of a realistic patient journey that are accounted for in health economic and epidemiological modeling, multi-variate analyses are needed to proceed. With an increase in the model complexity, the confidence of the outcomes modeled goes up. This kind of modeling requires more advanced computational power and mathematics than what is typically used for databases and statistics (will be revisited in a later presentation).

Figure 1. Markov model used to develop the CTSM



Results

Figure 2. Base case cost estimates for inpatient care in the U.S. using Medicare Fee Schedule for FY 2020

	Drug Costs	Direct Medical Cost	Cost Per QALY
ITT	\$408,010.05 – \$418,010.05	\$520,542.50 – \$546,618.57	\$540,823.38 – \$567,915.39
Control	\$307,625.85	\$388,006.17	\$403,123.30

Figure 4. In-patient cost variables with ranges determined by facility

Respiratory Neoplasms with MCC MS-DRG 180	
Average Hourly Wage	\$44.15 (SD: \$11.00, 95% CI: \$43.78 – \$44.52)
Wage Index Factor	0.989 (SD: 0.213, 95% CI: 0.982 – 0.996)
Non-labor Related Rate	\$353.21
DRG Weight	1.74
LOS	6.6

Figure 6. Drug cost reduction needed to meet WTP thresholds

	Serp	Atezo	Durva
\$30,000	83.2%	34.7%	100%
\$50,000	80.9%	27.1%	100%
\$100,000	74.2%	7.0%	83.3%
\$150,000	67.0%	0%	41.3%

Figure 3. Bi-variate sensitivity analysis in two scenarios of disease progression

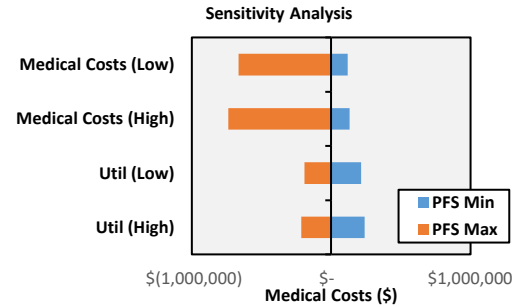
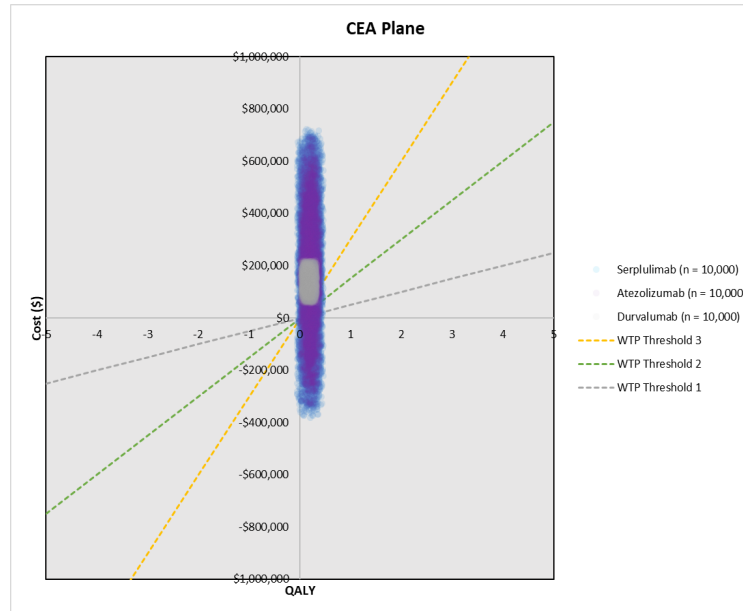


Figure 5. Cost-effectiveness analysis of serplulimab and chemotherapy compared to chemotherapy alone as a first-line option to treat ES-SCLC in a U.S. hospital setting (2020)



Discussion

After thorough analysis of the cohort simulation transition model, the key takeaways are as follows: (1) major variance in total direct costs are due to medical costs and cannot be ignored when modeling cost-effectiveness, (2) on the basis of willingness-to-pay thresholds, a majority of simulations indicate that a price reduction is needed to meet cost-effectiveness thresholds (either for the drug or the medical cost), and (3) the model used robust enough to simulate clinical outcomes in other disease states, but has limitations which will be discussed in the manuscript succeeding this paper. To answer the initial question as to what rebate is needed to make serplulimab cost-effective, we find that based on the WTP threshold and incremental cost-effectiveness ratio output by the model (Figure 6), the three drugs require significant price reductions to be cost-effective. Our pricing estimation for the indirect trial comparators will be discussed in the manuscript. Key effects in the price reduction estimate are from intra-trial outcomes and not the prices themselves. This methodology is a precursor for an advanced network meta-analysis approach that will be revisited at a later time.

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