Cost-Effectiveness Analysis of Nivolumab versus Docetaxel for the Treatment of Advanced Non-squamous NSCLC Including PD-L1 Testing in the United States

Poster#: PT35

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BACKGROUND

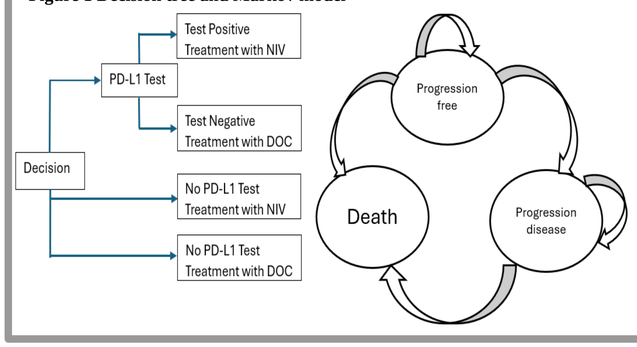
- Nivolumab (NIV) is an FDA-approved immunotherapy for the treatment of advanced non-squamous non-small cell lung cancer (NSCLC), with results from the Checkmate-057 trial showing NIV to have a superior efficacy and safety profile compared to docetaxel (DOC).
- A companion diagnostic test (Programmed death ligand 1 (PD-L1) IHC 28-8 pharmDx) is also approved by the FDA to identify patients who might benefit most from NIV.
- Limited study evaluated the cost-effectiveness of PD-L1 diagnostic-informed treatment decisions using NIV or DOC compared to standard treatment without testing , and results varied across perspectives, models and data sources.
- This study aimed to examine the cost-effectiveness of NIV versus DOC for non-squamous NSCLC with and without the choice of treatment guided by PD-L1 testing in the US.

METHODS

Study design

- A Markov model with three health states (progression-free(PFS), progressive disease(PDF), death) from Checkmate-057 data compared NIV, DOC, and a PD-L1 test-guided strategy(**Figure 1**).
- The median starting age was 62 years;
- For the PD-L1 test-guided option, patients tested with PD-L1 positivity tumors (≥1% or 10%) received NIV, whereas those tested negative received DOC.
- A willingness-to-pay (WTP) threshold of $150,000/QALY was adopted from a US healthcare perspective.
- A lifetime horizon with a monthly cycle length was chosen; costs and outcomes were discounted at a 3% annual rate.

Figure 1 Decision tree and Markov model



Transition probability

- The transition probabilities from PFS to PDF and PDF to death were converted from the hazard rates, which were assumed constant over time and calculated by using the formula Hazard Rate = -ln (0.5) /Median Time in the state before conversion.
- PFS and overall survival(OS) outcomes were derived from the trial data.(**Table 1**)

Model inputs

- Costs were retrieved from published literature and the federal supply schedule from the Department of Veterans Affairs (VA). (**Table1**)
- Utility values were obtained from a study that calculated quality-of-life data collected using the EQ-5D instrument and applying a US-specific scoring algorithm. (**Table2**)

Sensitivity analysis

- A one-way sensitivity analysis (OWSA) was carried out by varying parameter inputs by ±50%.
- A probabilistic sensitivity analysis (PSA) was run with 1,000 iterations that incorporated beta distributions applied to all utility parameter inputs, gamma distributions applied to transition probability parameter inputs and triangular distribution applied to the input with the percentage of patients with positive test results to generate cost-effectiveness acceptability curves.

Software: TreeAge Pro 2023 R1.0

Table 1 Transition probability and cost inputs

	Input		Source
Transition probabitlity parameters			
	DOC	NIV	
PFS to PDF [Median time (95%CI)]	4.2(3.5-4.9)	2.3(2.2-3.3)	Checkmate-057 trial
PDF to death [Median time (95%CI)]	3(2.7 -3.3)	8(7.7-8.29)	
Cost inputs			
Unit costs	$3.151 (0.145-3.151)/mg	$67.78(28.25-67.78)/mg	FSS
Drug administration	$143.08		Chaudhary et al.
CT (every 6 weeks)	$287		Chaudhary et al.
Immunohistochemistry PD-L1 test	$108.38		CMS.gov, CPT 88342
Alopecia (transition reward)	$872.73 (783.19 - 972.48)		Mostaghimi et al.
Febrile neutropenia (transition reward)	$169190.83 (144564.64 -201598.03)		Kawatkar et al.
Anaemia (transition reward)	$9341.19 (2903.47 - 11913.97)		Liou et al.
Best supportive care in progressive phase (per cycle)	$1,832.24		Chaudhary et al.
Routine physician office visits	$80.01		Chaudhary et al.
Radiotherapy - per fraction	$1,319.39		Chaudhary et al.
X-ray	$26.91		Chaudhary et al.
Oncologist visit in the progressive phase	$80.01		Chaudhary et al.

RESULTS

- In the base model, NIV treatment was expected to generate 0.91 QALYs at a cost of $70,283, and DOC treatment was expected to generate 0.67 QALYs at a cost of $56,752, which resulted in an ICER of $55,322/QALY. (**Table 3**)
- The resulting ICER was $86,192/ QALY in the ≥ 1% PD-L1 test-based model and $95,426/QALY in the ≥ 10% PD-L1 test-based model, compared to DOC.(**Table 3**)
- All the OWSAs resulted in an ICER < $150,000/QALY, and the PSA revealed that NIV had an ICER < $150,000/QALY in 100% of iterations. (**Figure 3**)

Table 2 Utility inputs

	PFS		Utility PDF		Distribution type
Utility	0.772 (0.75-0.78)		0.716 (0.69-0.74)		Beta

Table 3 Probabilistic results: Costs, QALYs, and ICER

Output	DOC	NIV	PD-L1≥1%	PD-L1 ≥10%
Total QALYs	0.67	0.91	0.80	0.76
Total Cost ($)	56752	70283	67925	65431
ICER	55322		86192	95426

Figure 3 Cost-effectiveness Acceptability Curve

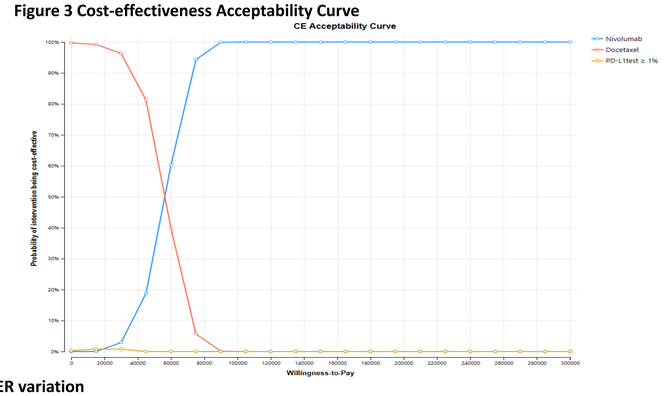
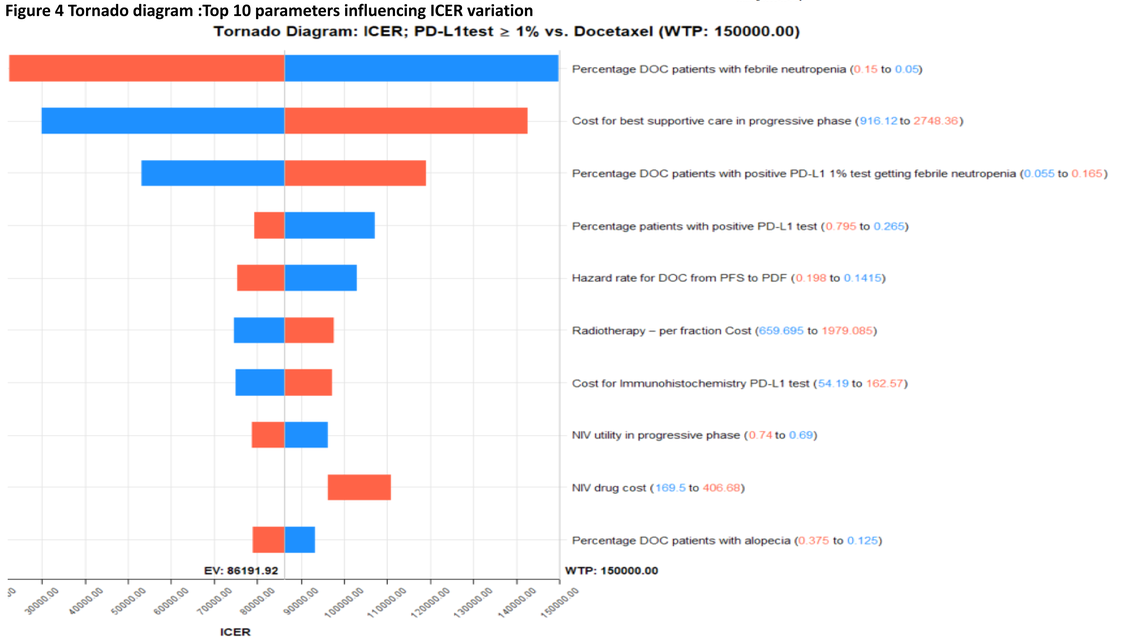


Figure 4 Tornado diagram :Top 10 parameters influencing ICER variation



CONCLUSIONS

- From a US healthcare perspective, NIV could be considered cost-effective for the treatment of non-squamous NSCLC compared with DOC at a WTP threshold of $150,000/ QALY.
- PD-L1 testing and selecting patients for NIV based on test positivity thresholds have also demonstrated cost-effectiveness compared to DOC.

References

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