EE336

Health economic evaluation of biologic treatment sequences for patients with moderate-to-severe active Crohn's Disease

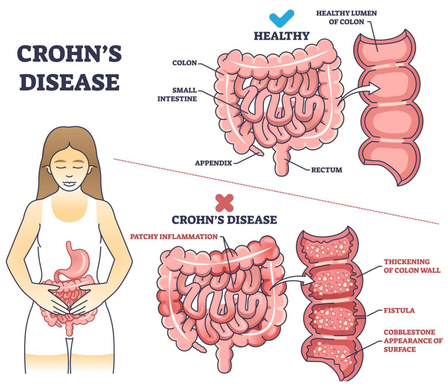
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Background

- Crohn's disease (CD) is a chronic and recurrent inflammatory bowel disease (IBD) characterised by transmural inflammation of the gastrointestinal (GI) tract[1]. CD may involve many parts of the entire GI tract especially small intestine and colon[1].





- Biologics for CD are antibody-based proteins that bind specific targets in the body to modulate immune activity[2]. Infliximab and adalimumab (**anti-TNFs**) are the mainstay of biologic treatment.

Risankizumab	Vedolizumab	Guselkumab
interleukin-23 (IL-23) inhibitor	α4β7 integrin antagonist	interleukin-23 (IL-23) inhibitor

All are indicated and recommended for the treatment of adult patients with **moderate to severe active CD** after failure of anti-TNFs in US.

Methods

- **Perspective**: US payer's perspective
- **Model**: A Markov model (Figure 1)
- **Time horizon**: 10 years
- **Cycle**: 8 weeks
- **Patient Population**: Adult patients with moderate-to-severe CD who had experienced treatment intolerance or inadequate response to infliximab and/or adalimumab.
- **Intervention and comparator**: Six strategies were evaluated

Sequence 1	GUS	VEDO	RISA		Sequence 4	RISA	VEDO	GUS
Sequence 2	GUS	RISA	VEDO		Sequence 5	VEDO	RISA	GUS
Sequence 3	RISA	GUS	VEDO		Sequence 6	VEDO	GUS	RISA

- **Primary outcomes**: Direct medical costs and quality-adjusted life-years (QALYs) gained.
- **Sensitivity analyses**: One-way sensitivity analysis (OSA) and probabilistic sensitivity analysis (PSA) were conducted.

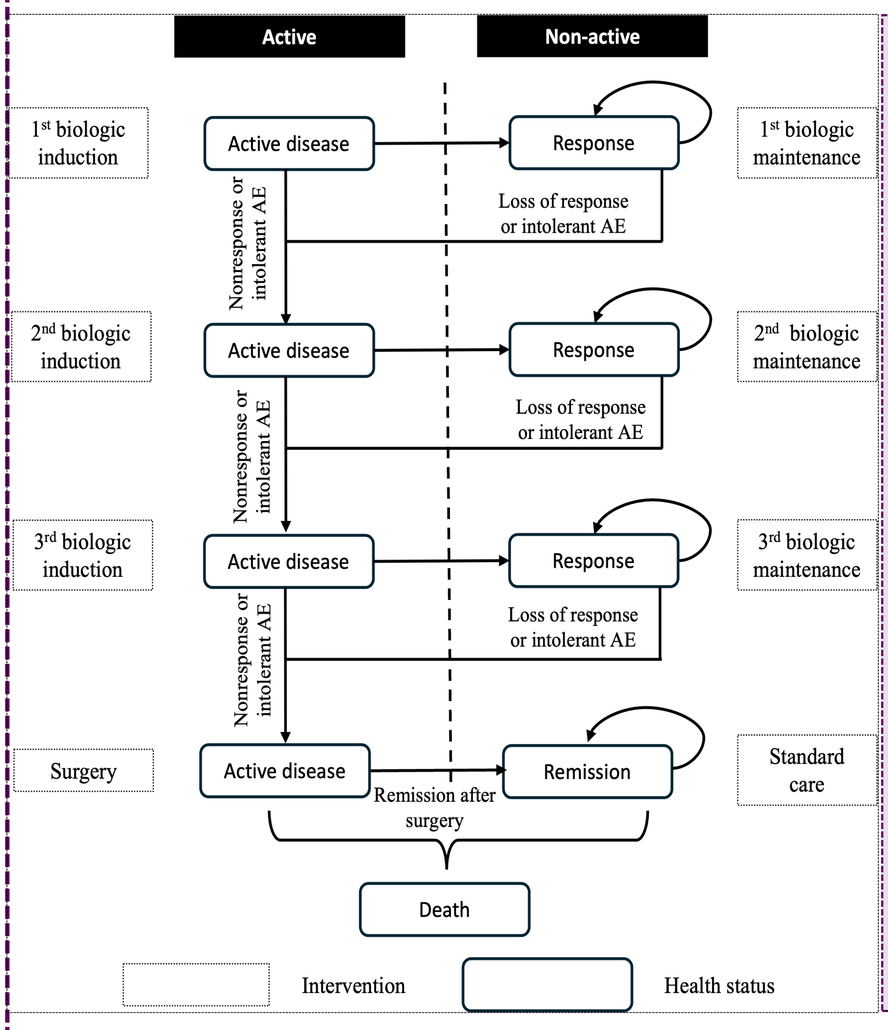


Figure 1 Simplified Markov model

Treatment pathway

- Sequential treatment of three biologics



- After treatment failure: CD-related surgery (intestinal resection)



- After surgery: Standard care (metronidazole plus azathioprine

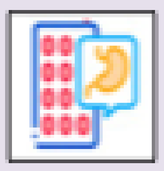


Table 1 Clinical model inputs

Parameters	Value	Range
Clinical inputs (per cycle)		
Induction response probabilities		
Guselkumab	0.3679	0.2943 to 0.4414
Risankizumab	0.3220	0.2576 to 0.3864
Vedolizumab	0.2719	0.2175 to 0.3263
Loss of response probabilities		
Guselkumab	0.0405	0.0324 to 0.0486
Risankizumab	0.0497	0.0392 to 0.0597
Vedolizumab	0.1157	0.0926 to 0.1388
Intolerant AE probabilities in induction phase		
Guselkumab	0.0091	0.0073 to 0.0109
Risankizumab	0.0160	0.0128 to 0.0191
Vedolizumab	0.0445	0.0356 to 0.0533
Intolerant AE probabilities in maintenance phase		
Guselkumab	0.0114	0.0091 to 0.0136
Risankizumab	0.0047	0.0038 to 0.0056
Vedolizumab	0.0184	0.0147 to 0.0221
Serious infection probabilities in induction phase		
Guselkumab	0.0091	0.0073 to 0.0109
Risankizumab	0.0053	0.0043 to 0.0064
Vedolizumab	0.0180	0.0144 to 0.0216
Serious infection probabilities in maintenance phase		
Guselkumab	0.0081	0.0065 to 0.0097
Risankizumab	0.0059	0.0047 to 0.0071
Vedolizumab	0.0091	0.0072 to 0.0109
Mortality		
Natural mortality	Age-specific	
Perioperative mortality	0.2442	0.2134 to 0.2739

- Model parameters were derived from published literatures and public data (Table 1 and Table2).

Table 2 Cost and utility inputs

Parameters	Value	Range
Utility inputs		
Utility		
Response	0.79	0.77 to 0.80
Active disease	0.65	0.64 to 0.66
Remission	0.69	0.63 to 0.74
Disutility		
Serious infection	-0.07	-0.38 to 0
Cost inputs (USD)		
Guselkumab (1 mg)	67.81	54.25 to 81.38
Risankizumab (1 mg)	14.60	11.68 to 17.52
Vedolizumab (1 mg)	20.98	16.78 to 25.18
Metronidazole (250 mg)	0.26	0.21 to 0.31
Azathioprine (50 mg)	0.18	0.14 to 0.22
Intravenous infusion	135.43	114.99 to 186.95
Outpatient care	241.24	215.77 to 296.88
Hospitalization		
Active disease	20,604	8,811 to 25,015
Surgery	49,972	17,364 to 64,476
Serious infection	22,567	20,321 to 25,038

Result

Base case results

- Sequence guselkumab - vedolizumab - risankizumab had the lowest cost (USD 245,752) and yield 5.016 QALYs (Table 3).
- Sequence risankizumab–guselkumab–vedolizumab generated additional QALYs at an ICER of USD 106,789/QALY and was not cost-effective at a WTP of USD 100,000/QALY.
- The remaining four sequences were dominated in the base-case analysis. .

Table 3 Base case results

Strategy	Cost (USD)	Incremental cost (USD)	QALYs	Incremental QALY	ICER
guselkumab - vedolizumab - risankizumab	245,752	-	5.016	-	-
risankizumab - guselkumab - vedolizumab	254,694	8,942	5.100	0.084	106,789

Sensitivity analyse results

- Eight influential factors with threshold values were identified to change the preferred cost-effective strategy to risankizumab – guselkumab – vedolizumab (Table 4).
- Sequence guselkumab – vedolizumab – risankizumab had a 98.91% probability of being preferred at USD 50,000/QALY, whereas risankizumab –guselkumab – vedolizumab had a 97.78% probability at USD 150,000/QALY (Figure 2) .

Table 4 Influential parameters and threshold values identified in OSA

Influential parameters	Threshold value
Guselkumab (1mg) cost	>USD76.54
Risankizumab (1mg) cost	<USD11.77
Vedolizumab (1mg) cost	<USD19.94
Loss of response probability (risankizumab)	<0.042
Loss of response probability (vedolizumab)	<0.098
Induction response probability (vedolizumab)	>0.311
Perioperative mortality	>0.272
Utility of remission	<0.666

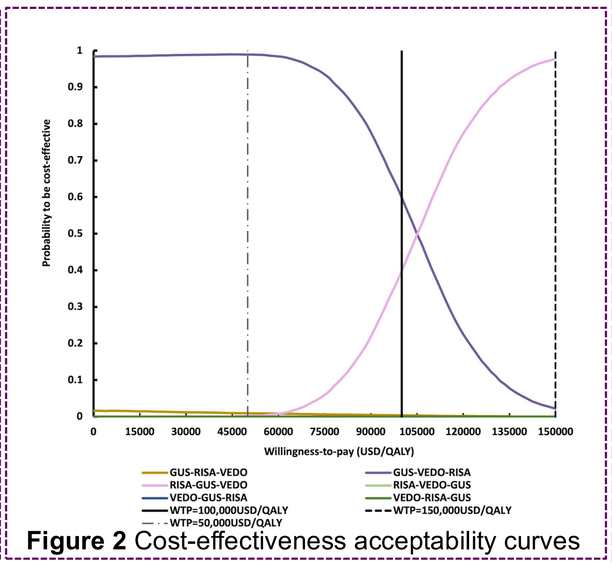


Figure 2 Cost-effectiveness acceptability curves

Conclusion

- Sequence guselkumab – vedolizumab – risankizumab was preferred sequence in base-case analysis and was highly sensitive to a number of influential factors and level of WTP.

References

1 Dolinger M, Torres J, Vermeire S. Crohn's disease. Lancet. 2024;403(10432):1177-1191
2 Rosman Z, Shoenfeld Y, Zandman-Goddard G. Biologic therapy for autoimmune diseases: an update. BMC Med. 2013;11:88. doi:10.1186/1741-7015-11-88.

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