Integrating Dynamic Pricing into Cost-Effectiveness Models: Implications for US-Based Drug Evaluations

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BACKGROUND

- Major Depressive Disorder (MDD) is one of the most prevalent and debilitating mental health conditions worldwide, affecting approximately 280 million people globally[1]
- In 2021 it was estimated that the prevalence of MDD had increased from 7% in 2018 to 27%, and MDD with anxiety had increased from 11 to 38%[2]
- MDD is often managed with a variety of treatments, including pharmacologic, psychotherapy, interventional, and lifestyle modification. Initial MDD treatment typically includes medications, with or without psychotherapy, which has been found to be more effective than medications alone[3]
- Traditional cost-effectiveness models usually assume static pricing, meaning that drug costs are treated as constant over time
- This approach fails to account for real-world price reductions that occur due to market competition, introduction of generic alternatives, and patent expirations
- Static pricing models may overestimate long-term treatment costs and underestimate cost-effectiveness, particularly over extended timeframes

OBJECTIVE

- The objective of this analysis is to explore impacts on estimated cost effectiveness by incorporating dynamic pricing capabilities using an existing open-source value model[4] for MDD
- This enhancement addresses a critical gap in current CEAs, which typically rely on static pricing assumptions that may misrepresent the long-term value of treatments. By introducing dynamic pricing, we aim to provide a more accurate framework for evaluating the cost-effectiveness of a novel MDD treatment throughout its lifecycle

METHODS

Model Background

- We extended an existing MDD open-source value model[4] to incorporate dynamic pricing mechanisms for a hypothetical new MDD therapy
- We utilized a continuous-time individual-patient simulation (CT-IPS) model with three health states: no response, partial response, and complete response
- The analysis incorporated direct healthcare costs, health state utilities, and indirect costs (transportation and productivity loss)

Treatment Pathways Evaluated

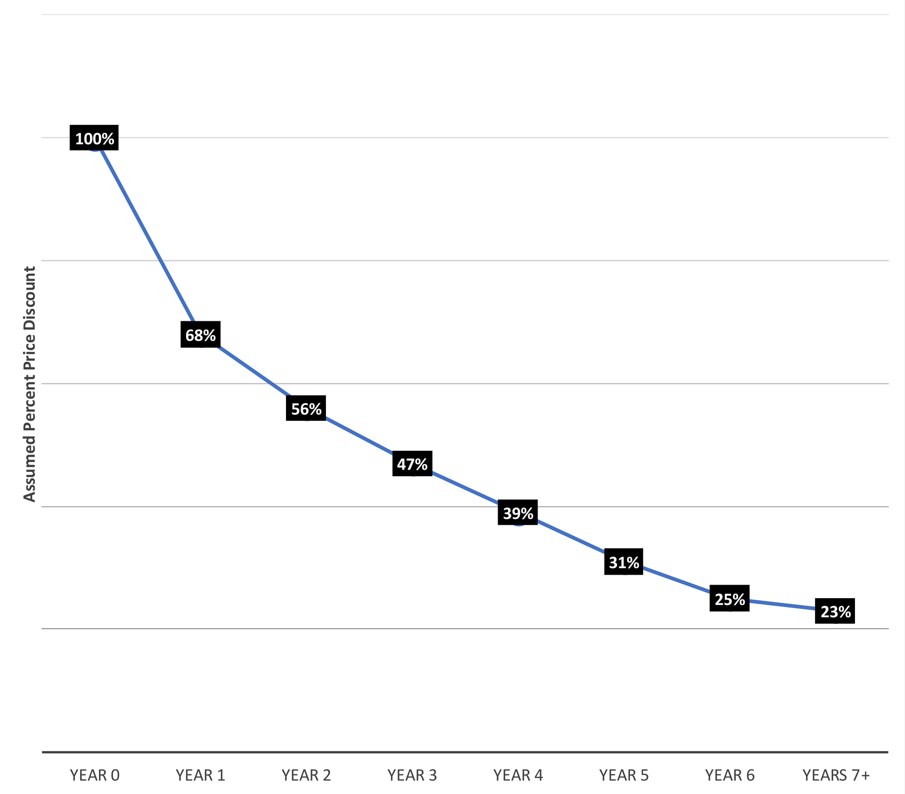
- This scenario compared two distinct treatment (tx) pathways (Table1): 1) A standard progression through tx (Standard tx) and 2) A hypothetical new tx used for all 4 lines of therapy (New tx)
- The analysis compared incremental costs and cost-effectiveness under two different assumptions for the New tx: static pricing of new treatment and dynamic pricing of new treatment
- We maintained static pricing for the standard treatment path

Table 1. Treatment Pathways

Treatment Line	Standard Treatment	New Treatment
Line 1	SSRI	Placeholder therapy
Line 2	SNRI	Placeholder therapy
Line 3	SNRI + atypical antidepressant	Placeholder therapy
Line 4	SNRI + antipsychotic	Placeholder therapy

SSRI: Selective Serotonin Reuptake Inhibitor, SNRI: Serotonin-Norepinephrine Reuptake Inhibitor

Figure 1. Inputs for testing dynamic pricing



Dynamic Pricing Implementation

- We modeled price trajectory over 10 years based on estimates from Serra-Burriel et al. (2024)[6]
- Annual price reductions following loss of exclusivity were assumed to occur in year 1 of the scenario (figure 1)
- Initial annual treatment cost of placeholder therapy was set at $14,000
- Evaluations were conducted over both 5-year and 10-year time horizons
- Static versus dynamic pricing scenarios were compared, using a $150,000/QALY WTP threshold
- ICERs were calculated comparing Standard tx with static pricing to the New tx assuming both static and dynamic pricing

RESULTS

Dynamic pricing significantly improves cost-effectiveness of the new therapy (New tx) compared to standard treatment (Standard tx)

5-year Horizon Outcomes:

- The hypothetical new therapy was estimated to yield 0.13 additional QALYs compared to standard treatment over a 5-year time horizon (Table 2)
- Dynamic pricing reduces total costs from $133,069 to $120,699 for New tx
- Direct treatment costs for New tx decrease by 30.5% ($40,549 to $28,179) with dynamic pricing
- ICER improves from **$221,314/QALY** (static pricing) to **$123,593/QALY** (dynamic pricing)

RESULTS Cont.

10-year Horizon Outcomes:

- The hypothetical new therapy provides 0.16 additional QALYs compared to standard treatment over a 10-year time horizon (Table 2)
- Dynamic pricing lowers total costs from $247,230 to $228,353 for New tx
- Direct treatment costs for New tx decreases by 38.2% ($49,386 to $30,509) with dynamic pricing
- ICER improves from **$199,342/QALY** (static pricing) to **$82,385/QALY** (dynamic pricing), a **58.7%** reduction

Table 2. Summary of results of comparison between Standard Treatments and a New Treatment

	5-year horizon		10-year horizon	
	Static Pricing	Dynamic Pricing	Static Pricing	Dynamic Pricing
Measure	**Standard tx**	**New tx**	**Standard tx**	**New tx**
Total QALYs	2.91	3.03	2.91	3.03
Total costs incurred	$105,053	$133,069	$105,053	$120,699
Difference vs Standard Treatment				
QALY difference	0.13	0.13	0.16	0.16
Cost difference	$28,016	$15,646	$32,174	$13,297
ICER ($/QALY)	221,314	123,593	199,342	82,385

CONCLUSION

Dynamic pricing can significantly influence estimates of the cost-effectiveness of new therapies by reducing treatment costs over time, reflecting genericization of drugs.

This shift highlights the importance of incorporating dynamic pricing into cost-effectiveness analyses to better reflect real-world conditions.

While pricing is straightforward to model dynamically, including price trajectory functions over time adds another layer of uncertainty. Researchers may also consider extending dynamic modeling to other inputs, such as effectiveness measures, that are usually considered to be static but could also change over time.

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References:

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