Value Assessment Under Uncertainty: Measuring Insurance Value and Risk Aversion for a Novel Neurological Treatment Using a Stated Preference Survey

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Objectives

To quantify the insurance value of a hypothetical novel neurological treatment that reduces the progression of mobility impairment and quantify risk aversion over mobility-based health states.

Conclusions

- Eighty percent (80%) of the value of a novel treatment improving mobility impairments for patients with neurological conditions was due to insurance value.
- Stated preference results imply a cost-effectiveness threshold of $502,192 per QALY for treating mobility impairments for patients with neurological conditions.
- Individuals were risk averse (mean relative risk aversion = 0.680) over mobility impairment health states caused by neurological conditions.

Background

Neurological conditions pose a significant burden to patients, accounting for 8.9 million disability-adjusted life years (DALYs), reduced quality of life (QoL), and $1.07 billion in annual treatment costs.[1–5]

The symptoms of many neurological conditions can broadly be described by progressively worsening ambulatory impairments.[5,6]

Traditional cost-effectiveness approaches may undervalue treatments for neurological conditions: quality-adjusted life years (QALYs) undervalue health gains of disabled patients; risk-averse patients place higher value on quality-of-life (QoL) gains for severe disease; and members of the general population value having treatments available to them should they get sick in the future.[7–10]

Methods

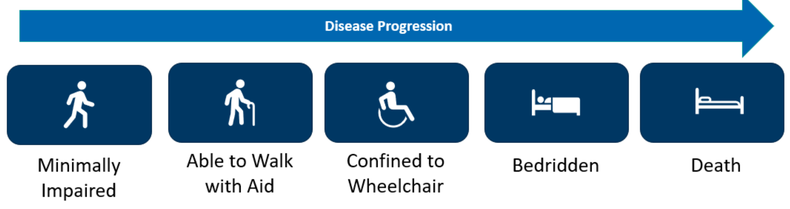
Survey Design

A survey was administered to US residents aged ≥ 21 years. Respondents considered five mobility health states anchored to multiple sclerosis (Figure 1).[6, 11]

The insurance value module used a multiple random staircase design to measure respondent willingness-to-pay (WTP) for generous coverage of a hypothetical, novel treatment that delayed the progression of mobility impairments by 25% (Figure 2).[9, 12]

The relative risk aversion (RRA) module evaluated risk preferences by respondents selecting one of two hypothetical treatments with varying probabilistic outcomes for their mobility impairment health in the following year (Figure 3).[13]

Figure 1: *Mobility Impairment Health States*



Survey Administration

The survey was pilot tested on n=4 respondents prior to administration to a sample of n=600 members of the U.S. general population.
Respondents were included in analyses if they were U.S. residents, fluent in English, and aged ≥21 years.
Respondents were excluded for exhibiting non-monotonic preferences over health or switching treatments >3 times.

Figure 2: *Initial Insurance Value Module Question*

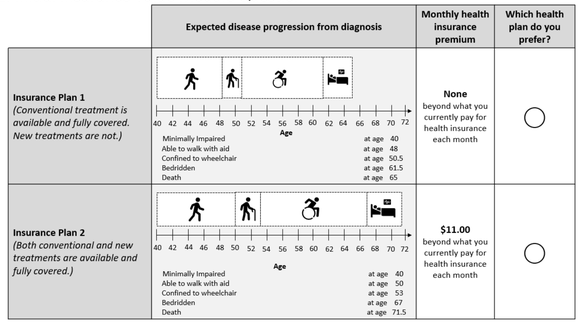


Figure 3: *RRA Module Question*

	Your health status rating (0-100)	Treatment A	Treatment B
Minimally impaired	[fill in with respondent's answer to Q2-4]		1 out of every 10 patients
Able to walk with aid	[fill in with respondent's answer to Q2-5]	1 out of every 10 patients	
Confined to wheelchair	[fill in with respondent's answer to Q2-6]	9 out of every 10 patients	
Bedridden	[fill in with respondent's answer to Q2-7]		9 out of every 10 patients
Which treatment do you prefer?	Please select one treatment by clicking on the circle.	○	○

Statistical Analyses

Insurance value was calculated as the difference in stated respondent willingness-to-pay and the expected value of treatment, defined as the product of weighted annual U.S. incidence of multiple sclerosis, myasthenia gravis, and Parkinson's disease (0.076%), discounted QALYs gained (1.759), and WTP per QALY of ($100,000).[14–16]

A constant relative risk aversion utility function was assumed; RRA was measured according to the Holt and Laury methodology.[13]

Results

259 respondents met the inclusion criteria. Respondents were representative of the U.S. general population (Table 1).

80.2% *of treatment value was due to the willingness to pay of healthy members of the general population (insurance value). Respondents were willing to pay **$538.12** more than the expected value of treatment (Table 2).*

35.5% *of respondents selected the **maximum monthly premium** ($100/month) suggesting WTP may be **higher** than reported in this study (Figure 4).*

*Results suggest a cost effectiveness threshold of **$502,192 per QALY** for neurology treatments delaying mobility impairments (Table 2).*

62.5% *of respondents were risk-averse (RRA > 0) over mobility impairment health states. Average RRA was **0.680 (SD = 1.843)** (Table 3, Figure 5).*

Insurance value results were robust. RRA estimates were sensitive to health state QoL.

Table 1: *Respondent Characteristics*

Characteristic	N/Mean	%/SD
Age	49.3	16.1
Female	132	51.0%
Married	133	51.4%
Income		
<$50,000	101	38.9%
$50,000–$99,999	97	37.5%
≥$100,000	56	21.6%
Not Reported	5	1.9%
Education		
College or more	94	36.3%

Table 2: *Respondent Willingness-to-Pay (WTP) and Insurance Value*

WTP Monthly	WTP Annual	Expected Value Annual	Difference	Insurance Value	Implied Cost Effectiveness Threshold
$55.95	$671.35	$133.23	$538.12	**80.2%**	$502,192

Table 3: *Relative Risk Aversion (RRA) Results*

Respondents with RRA > 0	Mean	Standard Deviation	Median	95% Confidence Interval
162	**0.680**	1.843	0.350	[0.506–0.855]

Figure 4: *Distribution of Respondent WTP, Monthly*

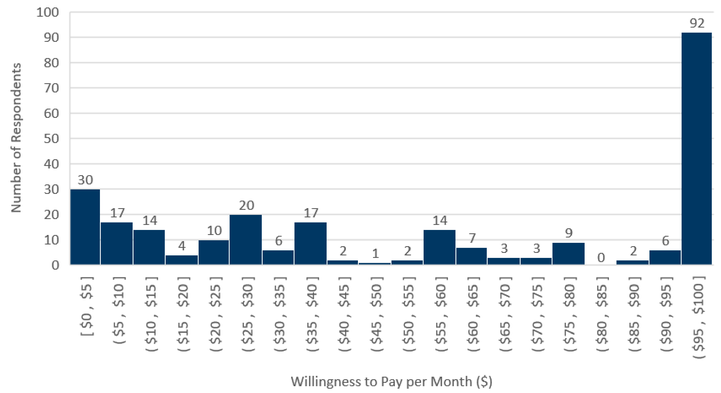
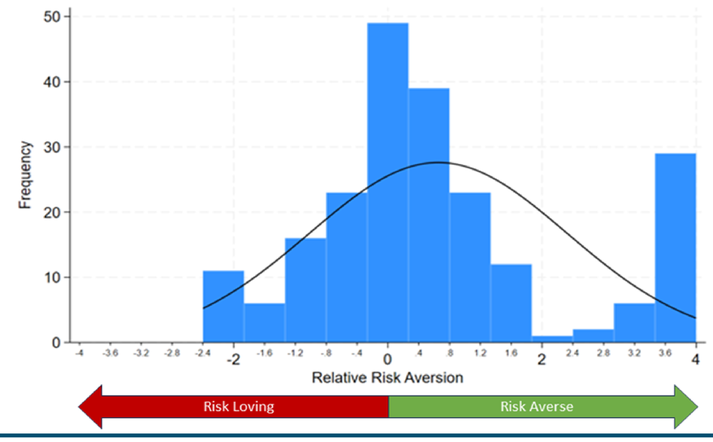


Figure 5: *Distribution of RRA*



Discussion

*Insurance value results imply a cost-effectiveness threshold **3x higher** than traditionally assumed in CEA models.*

*Members of the U.S. general population were **risk-averse** over neurological health, implying that the use of generalized risk-adjusted cost effectiveness models may better capture the value of treating severe neurological conditions.[10]*

Stakeholders can use insurance value results to capture the broader societal benefits of neurological innovation in value-based pricing and cost effectiveness thresholds.

Limitations include: RRA sensitivity to health state quality of life and neurological conditions affect patients and caregivers, yet this study surveys the general population of the U.S.

References

1. Feigin, VL., et al., (2021) JAMA Neurology 78(2): 165–176.
2. Stephen, C., et al. (2021) JAMA Neurology 78(1): 88–101.
3. Thakur, K., et al. (2016) Mental, Neurological, and Substance Abuse Disorders: Disease Control Priorities. 3rd ed. Vol 4.
4. Cella, D. et al., (2011) Archives of Phys. Med. and Rehab 92(10):S28–S36.
5. Walton, C., et al., (2020) Multiple Sclerosis Journal 26(14): 1816–1821.
6. Perez, L., et al., (2007) J Neurosci Nurs. 39(6):342-53.
7. Esposito, L. and Hassoun N., (2017) Journal of Public Health 39(3): 633–639.
8. Lakdawalla, D., et al., (2018) Value in Health 21(2): 131–139.
9. Shafrin, J., et al. (2021) Value in Health 24(6): 855–861.
10. Lakdwalla, D, and Phelps, C. (2022) EuroJHE 23: 433–451.
11. Kurtzke, J. (1983). Neurology 33(11):1444–1452.
12. Montalban, X., et al., (2017) NEJM 376(3): 209–220.
13. Holt, C. and Laury S., (2002) AEA 92(5): 1644–1655.
14. Dresser L., et al. (2021) Journal of Clinical Medicine 10(11): 2235.
15. Ou, Z., et al. (2021) Frontiers in Public Health 9: 776847.
16. Sharma K., et al. (2018) AAN Enterprises P1. 140.

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