Cost-Effectiveness of Gabapentin and Pregabalin in the Treatment of Painful Diabetic Neuropathy: A Real-World Data-Based Net Benefit Regression Analysis

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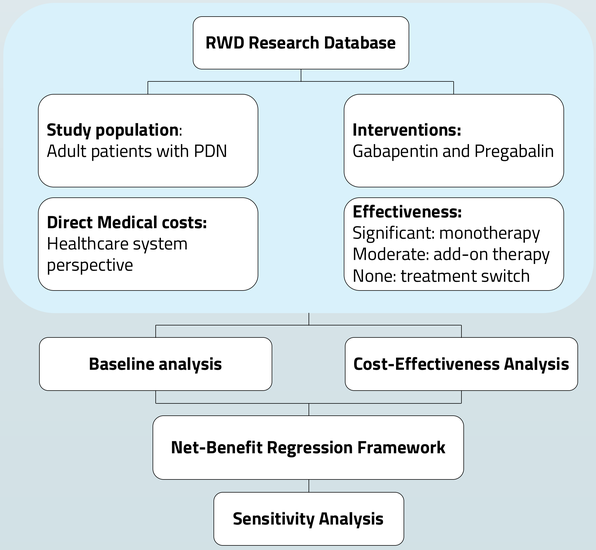
Introduction

Painful diabetic neuropathy (PDN) is a common and disabling complication of diabetes, affecting up to 50% of patients and significantly impairing quality of life. In China, the economic burden of PDN is rising, with real-world data showing underutilization of guideline-recommended first-line therapies such as duloxetine and pregabalin, and frequent use of opioids as initial treatment. Despite multiple available options, treatment decisions often lack pharmacoeconomic justification, and evidence from randomized controlled trials (RCTs) is limited in duration and generalizability.

To address these gaps, this study leverages real-world data (RWD) and introduces a net-benefit regression framework to evaluate the cost-effectiveness of PDN therapies under uncertainty. We hypothesize that this approach can better capture the economic value of treatments, particularly in the absence of a unified willingness-to-pay (WTP) threshold in China. The objective is to identify cost-effective first-line treatment strategies suited to the Chinese healthcare setting and support evidence-based clinical and policy decisions.

Method

The study evaluated the cost-effectiveness of pregabalin and gabapentin from a healthcare system perspective. Treatment response was classified into three levels with mapped utility values of 1.0 (significant), 0.7 (moderate), and 0 (none). Analyses included baseline comparison, ICER, net-benefit regression modeling, and sensitivity analysis, all performed using R 4.5.0.



Results

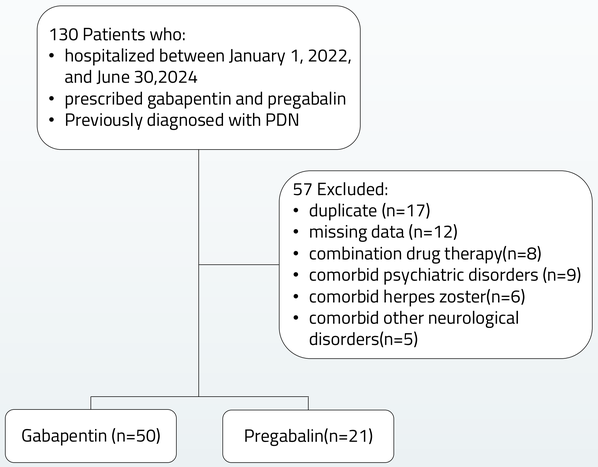


Figure 1. Study population flow diagram of included participants

Table 1. Baseline characteristics of the study groups

Characteristic	Gabapentin (n = 50)	Pregabalin (n = 21)	*p*-value
Age, yr	65.5 [53.0, 75.0]	70.0 [65.0, 77.0]	0.144
Sex			0.304
Female	25 (50.0%)	7 (33.3%)	
Male	25 (50.0%)	14 (66.7%)	
Diabetes type			0.312
T1DM	4 (8.0%)	0 (0.0%)	
T2DM	46 (92.0%)	21 (100.0%)	
Diabetes duration, yr	10.0 [5.0, 20.0]	10.0 [10.0, 20.0]	0.615
HbA1c, %	8.4 [6.9, 10.5]	7.0 [6.6, 8.2]	0.14
BMI, kg/m²	21.8 [20.5, 25.1]	22.3 [21.0, 25.0]	0.748
Scr, μmol/L	72.5 [65.0, 89.0]	76.0 [69.0, 92.0]	0.371
Diabetes Comorbidities			
DR	9 (18.0%)	6 (28.6%)	0.351
PVD	25 (50.0%)	9 (42.9%)	0.772
DFU	8 (16.0%)	2 (9.5%)	0.712
DN	18 (36.0%)	9 (42.9%)	0.783
Other Comorbidities			
Hypertension	27 (54.0%)	12 (57.1%)	>0.999
Dyslipidemia	7 (14.0%)	5 (23.8%)	0.32
Gout	2 (4.0%)	3 (14.3%)	0.15
Hyperuricemia	5 (10.0%)	0 (0.0%)	0.312
Medical insurance			0.650
Urban Employees	32 (64.0%)	11 (52.4%)	
Urban Residents	16 (32.0%)	10 (47.6%)	
Self-funded	1 (2.0%)	0 (0.0%)	
Other	1 (2.0%)	0 (0.0%)	
Hospital stay, d	10.0 [8.0, 13.0]	10.0 [8.0, 16.0]	0.667

Table 2. Hospitalization cost analysis of gabapentin and pregabalin for the treatment of PDN

Costs (USD)	Gabapentin (n = 50)	Pregabalin (n = 21)	*p*-value
Total	1,504.1 [1,245.2, 1,864.0]	1,528.0 [1,029.3, 1,963.3]	0.758
Medicine	471.2 [346.0, 635.6]	454.3 [347.6, 738.7]	0.637
Pain	0.7 [0.3, 3.1]	25.4 [12.9, 34.6]	<0.001
DSPN	185.3 [100.4, 292.4]	216.0 [118.7, 328.9]	0.720
AHA	28.0 [14.2, 37.7]	20.0 [11.4, 30.7]	0.182
Laboratory test	365.5 [295.4, 446.0]	334.6 [269.4, 389.1]	0.299
Examination	283.0 ± 136.6	266.5 ± 125.3	0.624
Treatment	164.9 [135.8, 232.2]	133.3 [85.6, 174.4]	0.067
Nursing care	70.4 [48.0, 82.9]	64.2 [46.3, 95.4]	0.985

Table 3. Effectiveness of gabapentin and pregabalin in the treatment of PDN

Effectiveness	Gabapentin (n = 50)	Pregabalin (n = 21)	*p*-value
Significant	41 (82.0%)	15 (71.4%)	0.032
Moderate	4 (8.0%)	6 (28.6%)	
None	5 (10.0%)	0 (0.0%)	

Table 4. Incremental cost-effectiveness analysis

Group	Mean cost (USD)	Effectiveness probability	ΔC	ΔE	ICER
Gabapentin	4.68	0.876	21.7	0.0383	571.58
Pregabalin	26.4	0.914			

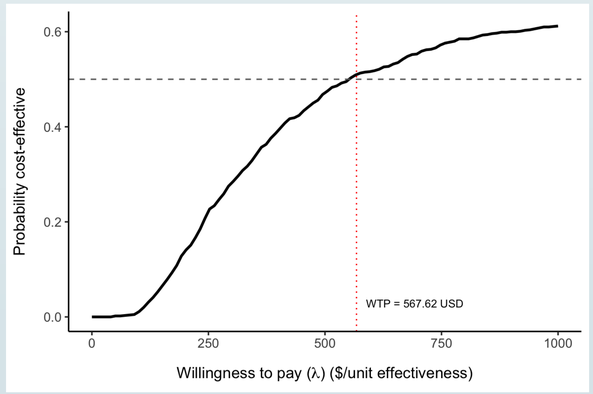


Figure 2. Cost-effectiveness acceptability curve (CEAC) comparing pregabalin with gabapentin. Treatment effectiveness was measured using a mapped score based on clinical response (1.0 = complete, 0.7 = partial, 0 = none). The curve shows the probability that pregabalin is cost-effective at different willingness-to-pay thresholds, expressed in USD per unit of effectiveness. The red dashed vertical line represents a WTP of USD 567.62 per unit, at which the probability of cost-effectiveness is approximately 50%.

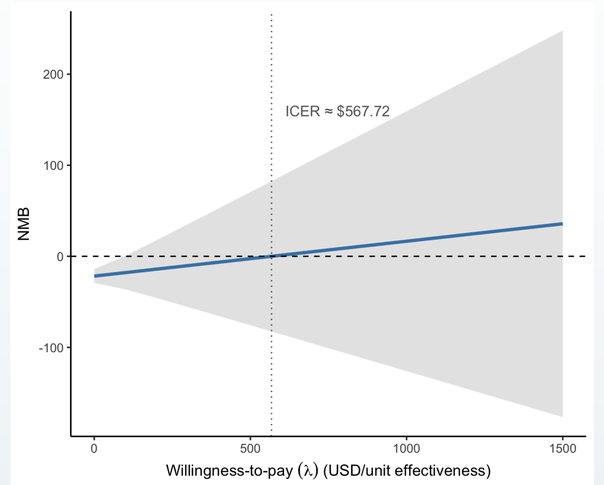


Figure 3. Net monetary benefit (NMB) analysis of pregabalin versus gabapentin. The solid blue line represents the incremental NMB across willingness-to-pay thresholds (0–1500 USD per unit of effectiveness), and the shaded region indicates the 95% confidence interval. The vertical dotted line marks the ICER (567.7 USD per unit of effectiveness).

Conclusion

In this real-world cost-effectiveness analysis comparing pregabalin and gabapentin for painful diabetic neuropathy (PDN), pregabalin incurred higher drug costs (26.41 USD vs. 4.68 USD) and marginally improved effectiveness (0.914 vs. 0.876), yielding an ICER of 567.6 USD per unit of effectiveness. Net monetary benefit (NMB) regression showed no statistically significant difference between treatments at any willingness-to-pay (WTP) level from 0 to 1500 USD. For instance, at WTP = 500 USD, the incremental NMB was −2.59 USD (95% CI: −75.7 to 70.5), and at WTP = 1500 USD it was 35.7 USD (95% CI: −177.0 to 248.0). The cost-effectiveness acceptability curve indicated that pregabalin's probability of being cost-effective did not exceed 62% even at the highest WTP level.

These findings suggest that gabapentin may be a more economically efficient first-line therapy in cost-sensitive settings. Further studies are warranted to evaluate long-term cost-effectiveness.

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