



REVIEWS

Renal Denervation vs. Pharmacotherapy for Resistant and Uncontrolled Hypertension: A Systematic Review of Cost-effectiveness Analyses

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Keywords

Renal Denervation • Cost-effectiveness • Hypertension • Pharmacotherapy

Summary

Introduction. Cardiovascular morbidity and mortality are associated with hypertension. Catheter-based renal denervation has been successfully used to treat resistant hypertension. The present study aimed to evaluate the cost-effectiveness of RDN compared with standard medical therapy in patients with resistant (RH) and uncontrolled hypertension (UH).

Methods. Literature searches were performed in PubMed, EMBASE, Web of science, Scopus and google scholar for full economic evaluations on RDN in patients with resistant and uncontrolled hypertension published between 1990 and 2026. Articles were screened for relevance based on preset inclusion and exclusion criteria. Final Studies in the review graded using the Quality of Health Economic Studies (QHES) instrument.

Results. A total of 43 articles were identified using our defined

criteria. Two types of studies were identified: cost-effectiveness studies and cost-utility studies, the majority of which were cost-utility studies (69%). The average quality score was 89.6 (range 65-95). Treatment with RDN resulted in a 30% reduction in cardiovascular mortality. The lowest and highest incremental cost per quality adjusted life years for patients with UH were observed in Canada (\$10,055.5) and Taiwan (\$63,802.35), respectively. These values for patients with RH were reported in the Netherlands (\$2,187.5) and Australia (\$39,613).

Conclusion. The results of this systematic review indicate that RDN is a cost-effective intervention in most cost-effectiveness models. In order to more accurately estimate the economic value of RDN, future research based on long-term clinical data and in diverse health system settings is necessary.

Introduction

Hypertension is one of the most significant causes of death and disease worldwide. Resistant hypertension (RH) occurs when blood pressure persists uncontrolled despite taking three antihypertensive medications (including a diuretic) [1]. In order to regulate blood pressure, several body systems are involved, including renin-angiotensin-aldosterone system, sympathetic nervous system, endothelin, natriuretic peptides, arterial system, and immune system. Any disruption in the functioning of these systems can lead to increased blood pressure [2]. Approximately one billion adults worldwide are affected by the disease, which accounts for nearly 9% of disability-adjusted life years (DALYs) and accounts for more than 9 million deaths each year [3]. The burden of high blood pressure on societies is considerable, and it is linked to cardiovascular and renal disease, as well as increased healthcare costs. Its prevalence is increasing in low- and middle-income countries, while it has decreased in some high-income countries, but remains high [4].

As antihypertensive drugs aimed at modulating sympathetic nervous system activity are often not

able to inhibit sympathetic stimulation completely, renal denervation (RDN) has been proposed as a complementary or alternative treatment for controlling uncontrolled blood pressure (UH) [5].

The RDN procedure reduces nerve messages passing to and from the kidneys by inactivating sympathetic nerves surrounding the renal arteries, lowering blood pressure [6]. As a result of its therapeutic benefits for patients with hypertension and chronic kidney disease, which are common causes of sympathetic nervous system activity, RDN is of particular importance to nephrologists [7]. In a recent systematic review and meta-analysis, RDN was associated with an average 8.5 mmHg reduction in systolic blood pressure and demonstrated sustained therapeutic benefits [6]. A number of controlled studies utilizing different catheter-based systems have demonstrated consistent reductions in both office and ambulatory blood pressure measurements [8]. According to a recent network meta-analysis, treatment with RDN (either monotherapy or adjunctive therapy) improved control of diastolic blood pressure (DBP) during waking hours. Also, RDN alone was found to significantly reduce systolic blood pressure (SBP) during the day [9]. In recent years, several studies have been conducted on

the cost-effectiveness of RDN. In the present study, we systematically reviewed recent literature on the cost-effectiveness of RDN compared with standard medical therapy in patients with resistant and uncontrolled hypertension.

Methods

This systematic review was conducted using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [10]. The protocol was registered on the PROSPERO register of systematic reviews (CRD420261321853).

Sources of information included PubMed, Web of Science, Scopus, EMBASE and google scholar. Among the search terms used were terms related to RDNs and economic evaluations. A search strategy was formulated using medical subject headings and free-text terms. Search terms were restricted from 1990 to 2026. A list of search syntax can be found in the online supplementary material.

SELECTION

In addition to searching databases, titles and abstracts of citations identified were manually screened for relevance. Eligibility criteria included published studies in English evaluating the cost-effectiveness of RDN in the treatment of patients with RH and UH. There was a full economic evaluation included in primary studies, which compared interventions in terms of cost-effectiveness, cost-utility, and cost-benefit.

DATA EXTRACTION AND SYNTHESIS

Detailed information about relevant aspects (first author, year of publication), general information (country, population, interventions, comparators), and methodology (type of economic evaluation, type of analysis, perspective, time horizon, costs, reported outcomes, discount rate, costing year, Willingness to Pay (WTP) threshold, and sensitivity analysis) was collected through a customized data extraction form. We extracted data with the help of two reviewers (A. S. and M. T), then cross-checked, discussed, and finally finalized our findings with the assistance of a third reviewer (H. O). A narrative synthesis was used to summarize findings due to the heterogeneity among studies. Cost data were converted to 2024 US\$, using the CCEMG-EPPI-Centre cost converter, to allow for easier comparison between studies [11]. When the specific price base year was not explicitly reported in the source study (*e.g.*, in conference abstracts), the publication year was assumed as the costing base year for inflation and conversion purposes.

QUALITY ASSESSMENT

A validated questionnaire for the assessment of the quality of health economic studies is known as the Quality of Health Economic Studies (QHEs). It consists of 16 criteria framed as yes/no questions. Each question is weighted, with a point value between 1 and 9. A QHEs

score ranges from 0 to 100 [12]. Various cut-off scores were determined to distinguish between study quality levels: very low quality=0-24, low quality=25-50, medium quality=51-75, and high quality=76-100. The quality of the studies was evaluated separately by two investigators (A.S. and M.T.) and, when needed, by a third investigator (H.O).

Results

The flow chart in Figure 1 shows the process of identifying studies. A database search identified 485 articles, 244 of which were excluded as duplicates. We identified 53 economic studies based on their titles and abstracts. The selection criteria were met by 43 articles [13-54].

STUDY CHARACTERISTICS

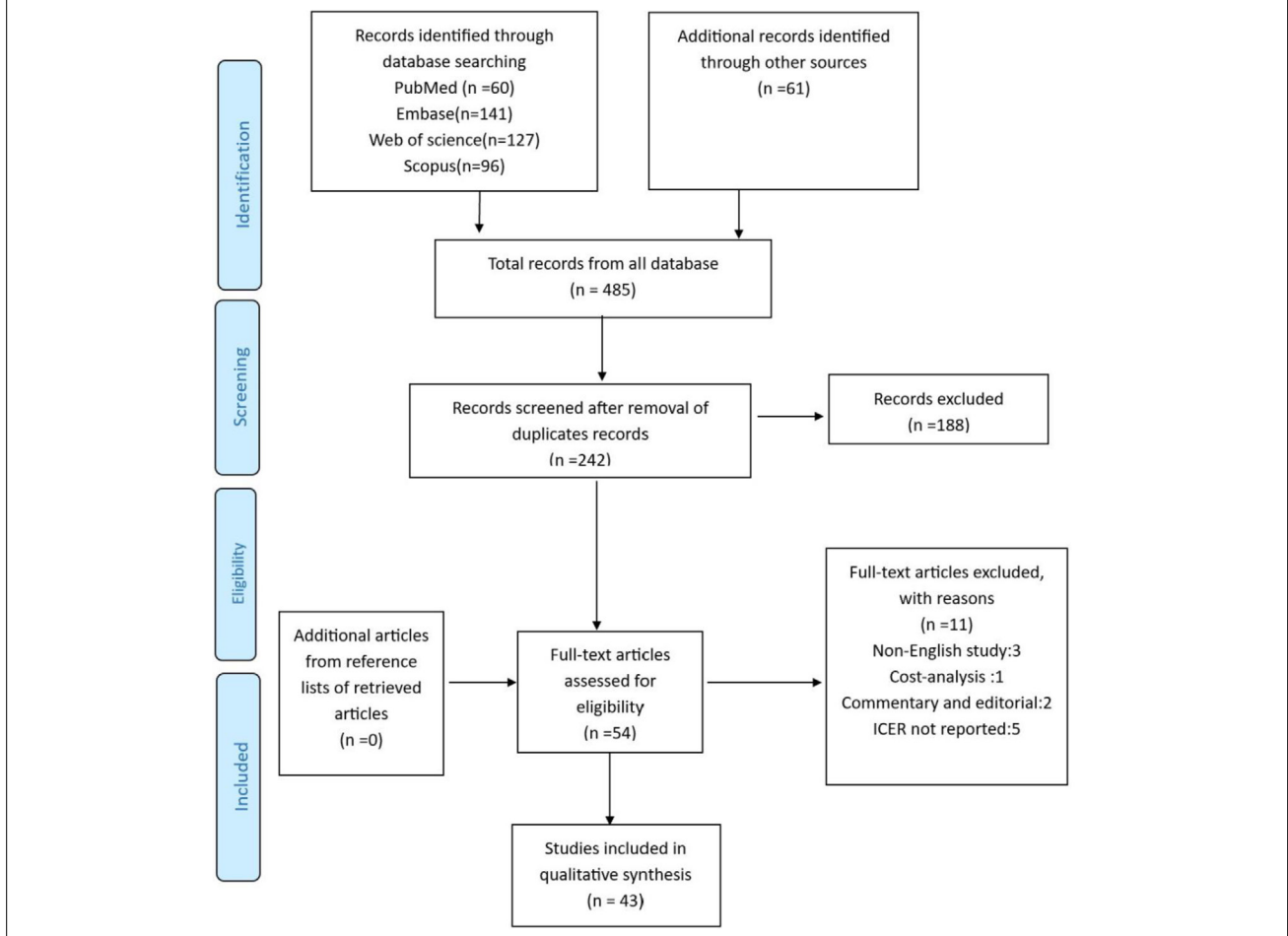
Most studies were conducted in the United Kingdom (n=8) [21, 22, 29, 32, 36, 39, 40, 53], the United States (n=6) [14, 25, 31, 43, 44, 54], and the Netherlands (n=6). This is followed by Canada [16, 38, 50], Sweden [18, 32, 37], and Germany [30, 42, 46], each with three studies; France [15, 27], Spain [23, 32], Colombia [33, 49], and Australia [26, 45], each with two studies; and finally, China [17], Japan [24], Thailand [17], Taiwan [19], Uzbekistan [13], South Korea [47], Italy [55] Mexico [52], the Czech Republic [32], and Israel [41], each with one study.

In total, 25 studies were conducted on patients with resistant hypertension [13-15, 21, 26-31, 33, 40, 41, 44-55] and 19 studies on patients with uncontrolled hypertension [16-20, 22-25, 32, 34-39, 42, 43, 55]. An empiric cost-effectiveness study was based on randomized controlled trials (RCTs). [27], while 42 studies used a modelling approach with multiple data sources [13-26, 28-55].

Also, cost-utility analysis was used in 30 studies [13-26, 28-43, 45-51, 53-55] and cost-effectiveness analysis in 11 studies [14, 15, 17, 21, 26-30, 44, 52]. Twenty-two studies used a payer perspective [16, 18, 21, 22, 24, 25, 27-30, 34, 36, 38, 39, 45, 47-49, 51-53, 55]; eight studies used a health system perspective [14, 15, 17, 23, 26, 33, 37, 50] and three studies used a societal perspective [19, 20, 31]. In eight studies, the perspective used was not specified [32, 35, 40, 42-44, 46, 54]. The study time horizon was reported to be at least 6 months and up to the end of the participants' lives. In two studies, the time horizon was not precisely specified [40, 48]. Other study characteristics (WTP threshold, discount rate) are reported in Tables I-II.

FINDINGS OF QUALITY ASSESSMENT

QHEs score was 89.6 points (SD=7.76 points). Table III describes the results of quality assessment in the literature based on the QHEs instrument. There were 17 studies with scores above 75, which are considered high-quality studies. The quality of two studies was rated as medium (51-74) [13, 27]. A majority of studies did not justify using the study perspective. There was no mention of the

Fig. 1. PRISMA flow chart for study selection.

funding source in one study [13]. In all the studies that were evaluated, full scores were achieved on each of the checklist items (Target, subgroup analysis, methods for extracting and valuing benefits, valid criteria and scales for outcomes, and conclusions (Fig. 2).

FINDINGS OF COST-EFFECTIVENESS OF RDN IN PATIENTS WITH UNCONTROLLED HYPERTENSION

Table IV presents the total costs, clinical outcomes, and ICERs for each comparator in the present study. According to Kandzari et al, catheter-based radiofrequency renal denervation (RF-RDN) was more cost-effective than standard care in the United States. SPYRALHTN-ON MED trial data were used to derive efficacy data. Applying the OSBP (office systolic blood pressure) reductions with RF-RDN observed in the SPYRAL HTN-ON MED trial, the relative risks of stroke, myocardial infarction, and cardiovascular death over a 10-year horizon were 0.80, 0.88, and 0.85, corresponding to a 20%, 12%, and 15% reduction in the probability of these events, respectively. At the incremental cost of \$11,275, RF-RDN increased quality-adjusted life years by 0.34 compared with standard care. In this study, the incremental cost-effectiveness ratio (ICER) was \$32,732 per QALY [25].

According to Lian et al., a study of netrodRDN's cost-effectiveness from a health system perspective in Japan showed a 30.61 reduction in cardiovascular, cerebrovascular, and renal events when compared with drug therapy. In this study, the ICER per QALY was \$3,451 [17]. According to another Japanese study, RF RDN is associated with a reduced risk of strokes, myocardial infarctions, and heart failures. In addition, RF RDN resulted in an increase of 0.36 QALYs at an incremental cost of ¥923,723 (\$10905.77), resulting in an ICER of ¥2,565,236 (\$30285.99) per QALY [24]. A Dutch study found that RF-RDN resulted in 0.8 risk reductions for stroke, 0.88 risk reduction for myocardial infarction, 0.89 risk reduction for angina pectoris and coronary artery disease, 0.72 risk reductions for heart failure, 0.96 risk reductions for end-stage renal disease, and 0.93 risk reductions for all-cause mortality. With RF-RDN, lifetime costs increased by €4.137 (\$5250) and QALYs increased by 0.61, resulting in ICER €6.784 (\$8609.14) per QALY [20].

A cost-effectiveness study of RFRDN in Canada by McFarlane et al. found that RFRDN increased QALYs by 0.51. Its ICER was \$11,809 per QALY, which is below the Canadian WTP threshold. In Canada, RFRDN was found to be a cost-effective strategy for managing blood pressure [16]. Study results from

Tab. I. Study design and setting overview.

Row	First author (Year of publication)	Country	Population	Population	Clinical Outcome	Comparators
1	Ribichini, Flavio L. (2026)	Italy	UH And RH	On average 55 years of age	Stroke, MI, AP/CHD, HF, ESRD CVD ACD, QALYs	RF RDN and standard of care (SOC)
2	Xursandov, I. (2025)	Uzbekistan	RH	Age group between 18 and 75 years	QALYs change in office blood pressure, non-fatal mi, non-fatal stroke, cv mortality	RDN Group Pharmacotherapy Group
3	Taylor, R. S. (2025)	United States	RH	136 patients aged 18 to 75 years	LYs, QALYs	Ultrasound RDN plus SoC versus SoC alone
4	S. Taylor (2025)	Belgium, France and the Netherlands	RH	Patients aged 18-75 years	LYs, QALYs	Ultrasound RDN plus SoC compared with SoC alone
5	McFarlane, P. A. (2025)	Canada	UH	On average, 55 years old with a baseline Office-based systolic blood pressure of 163 mmHg, and were on treatment with one to three anti-hypertensive medications	QALYs, stroke, MI, AP/CHD HF, ESRD, CVD, ACD	Radiofrequency renal denervation (RF RDN) vs. SoC
6	Lian, D. (2025)	China, Japan, and Thailand	UH	Initial age of 50 years	AMI, HF, sudden cardiac death, ischemic stroke, hemorrhagic stroke, transient ischemic attacks ESRD, Lys and QALY	Netrod RDN treatment plus antihypertensives compared with antihypertensives alone
7	Kahan, T. (2025)	Sweden	UH	Average 55 years of age, 19.9% female, with a baseline office SBP of 163 mmHg	Stroke, MI, AP/CHD HF, ESRD, CVD, ACD, QALY	RF RDN vs. SoC
8	Huang, H. C. (2025)	Taiwan	UH	Average age of participants was 55 years and the average baseline Office-based systolic blood pressure was 163 mmHg	Stroke, MI, AP/CHD, HF, ESRD, CVD, ACD, QALYs	RDN with standard-of-care (SoC) against SoC only
9	Daemen, J. (2025)	Netherlands	UH	Mean age 55 years, and prescribed one to three antihypertensive medications	QALYs	RF RDN vs. SoC
10	Taylor, R. S. (2024)	UK	RH	Patients aged -75 years with office BP ≥140/90 mmHg	Lys, QALYs, ESRD, CHD/ AP, MI, HF, stroke, recurrent stroke, mortality	Addition of the Paradise uRDN System compared with SoC alone
11	Sharp, A. S. P. (2024)	UK	UH	55 years of age with a baseline oSBP of 163 mmHg	Stroke, MI, AP/CHD, HF, ESRD CVD, ACD, QALYs	RF RDN vs. SoC
12	Rodríguez-Leor, Oriol (2024)	Spain	UH	, on average, aged 55 years, with a baseline office SBP of 163 mmHg	Stroke, MI AP/other CHD, HF ESRD, CVD, ACD Lys and QALYs	RF RDN in addition to SoC
13	Kario, K. (2024)	Japan	UH	Averaged 55 years of age, with a baseline SBP of 163 mmHg	QALYs, stroke, MI, and HF	RF RDN against SoC

Economic evaluation (model)	Perspective	Time horizon	Discount rate (%)	Sensitivity analysis	Willingness to pay
CUA (Markov model)	Payer perspective	Lifetime	3.0% per annum	Multi-way sensitivity and PSA	€25,000 per QALY
CUA (Markov model)	NR	10 years	0 and 6	DSA and PSA	\$5,000 per QALY
CEA and CUA (Markov model)	US health care system	Lifetime	3	One-way sensitivity analysis, scenario assessments and PSA	\$50,000 to \$100,00 and 0 per QALY
CEA and CUA (Markov model)	Health care system	Lifetime	For the French model, costs, QALYs and LYs were discounted at 2.5% annually up to 10 years, and 1.5% annually	One-way sensitivity analysis, PSA and scenario analyses	Belgium: WTP €40,000, France: WTP €50,000 and Netherlands: WTP €20,000
CUA (Markov model)	Publicly-funded Canadian healthcare payer's perspective	10-year and lifetime horizon	1.5	One-way sensitivity analyses, scenario analyses and PSA	\$50,000 per QALY
CEA and CUA (Markov model)	Healthcare system	30-year horizon(lifetime)	At 2% (Japan), 3% (Thailand), and 5% (China) per year	Univariate, PSA and scenario analyses	\$37,624 for Mainland China, \$101,849 for Japan, and \$21,894 for Thailand
CUA (Markov model)	Healthcare payer, with the societal perspective explored as a scenario	10-year and lifetime	3	One- and multi-way, and PSA	SEK 500,000 per QALY gained
CUA (Markov model)	Societal perspective	10-year and lifetime	3	One-way sensitivity analysis, scenario and PSA	Taiwan 1,000,000 TWD and 3,000,000 TWD per QALY
CUA (Markov model)	Societal perspective	10-year and lifetime	costs and effects were discounted 3.0% and 1.5%, respectively	DSA and PSA	€20,000 per QALY gained
CEA and CUA (Markov model)	Payer	Lifetime	3.5	One-way and PSA	£20,000-£30,000 (€23,214-€34,821) per QALY
CUA (Markov model)	UK healthcare payer perspective (National Health Service (NHS)	10-year and lifetime	3.5	Scenario analyses One-way and PSA	£20-30,000 per QALY gained
CUA (Markov model)	Spanish National Health System perspective	10-year and lifetime	3	DSA and PSA	€25,000 per QALY gained
CUA (Markov model)	public healthcare payer's perspective	Lifetime	2	DSA and PSA	¥5000,000 per QALY gained

Tab. I (follows). Study design and setting overview.

Row	First author (Year of publication)	Country	Population	Population	Clinical Outcome	Comparators
14	Kandzari, D. E. (2024)	United States	UH	On average 55 years old and had a baseline OSBP of 163 mm Hg	QALYs, stroke, MI, and cardiovascular death	RF RDN against SoC
15	Chowdhury, E. K. (2018)	Australia	RH	Aged 60 years at baseline, and without prior cardiovascular disease	Life year gained, QALY gained	RDN compared with (SoC)
16	Bulsei, J. (2018)	France	RH	Patients with resistant hypertension (DENERHTN) trial	mmHg reduction in daytime ambulatory SBP, risk of CV events or death	RDN with standardized stepped-care antihypertensive treatment (SSAHT) compared to SSAHT alone
17	Henry, T. L. (2015)	Netherlands	RH	Patients with resistant hypertension	LY, QALYs, AP, MI, HF, stroke, ESRD	RDN was compared with SoC
18	Gladwell, D. (2014)	UK	RH	Average age of 58 years, 43% were female, 16% were smokers, and 34% had an existing diagnosis of diabetes mellitus. Patients had a reported baseline SBP of 178 mmHg	LY, QALYs, stroke ESRD, HF, AP/CHD, MI	RDN vs. SoC
19	Dorenkamp, Marc (2013)	Germany	RH	With a baseline office SBP of 160 mmHg, 30-99 years of age free from prior CVD or renal disease.	Stroke, MI, ESRD, HF, Lys, HF, QALYs	RDN vs. best medical therapy (BMT)
20	Geisler, B. P. (2012)	United States	RH	The mean baseline SBP was 178 mm Hg mean age of 58 (55 to 61) years, were 43% female, had a diabetes mellitus prevalence of 34%, and a current smoker prevalence of 16%	Stroke, MI, all CHD, HF, ESRD, QALYs	RDN plus the existing SoC-3 or more antihypertensive medications
CEA: cost-effectiveness analysis; CUA: cost-utility analysis; QALYs: quality-adjusted life years; LYs: life years, RDN: renal denervation; MI: myocardial infraction, HF: Heart failure; ESRD: End-stage renal disease; AP: angina pectoris, CHD: coronary heart disease; PSA: probabilistic sensitivity analysis; DSA: deterministic sensitivity analysis, NR: not reported						

Taiwan also showed that RFRDN results in incremental costs of NT \$216,381 and QALY of 0.25 [19]. Sharp et al. reported, in a cost-effectiveness study conducted in the UK health system for patients with UH, that RFRDN led to a 10-year reduction in the relative risk of clinical events (strokes, MI, and heart failure) compared with the control group. This intervention resulted in an increase of 0.35 QALY at an incremental cost of £4,763 (\$7,515.98) and an ICER of £13,842 (\$21,274.49) per QALY [22]. Treatment costs for UH were highest in the United States

and Japan, and lowest in Thailand and China. In the United States, the difference between the two treatments was \$11,275; in Japan, it was \$10,905; and in Thailand and China, it was \$7,051 and \$7,250, respectively (Fig. 3). QALY estimates were highest in Japan and Canada, with a difference of 0.36 and 0.51, respectively. The lowest estimates were found in Thailand and China, with a difference of 0.37 (Fig. 5). Taiwan had the highest ICER (63,802.35), while Canada had the lowest (\$10,055.5) (Fig. 8).

Economic evaluation (model)	Perspective	Time horizon	Discount rate (%)	Sensitivity analysis	Willingness to pay
CUA (Markov model)	Medicare payer perspective	Lifetime	3	1-way sensitivity, multiway sensitivity, threshol, and PSA	\$50,000 per QALY and \$150,000 per QALY
CEA and CUA (Markov model)	Australian health system	20-year and lifetime	5	One-way sensitivity analyses and PSA	Australian dollar (AUD) 50,000 per life year gained or per QALY
CEA (DENERHTN) trial	French healthcare perspective (compulsory health insurance, complementary health insurance and patient co-payments)	6 months	Not applicable	PSA	Threshold of e1 540/ mmHg reduction
CUA and CEA (Markov model)	Payer perspective	Lifetime	Costs: 4.0% LYs and QALYs: 1.5%	Scenario analysis, one-way sensitivity analysis and PSA	E10,000-80,000/QALY
CEA and CUA (Markov model)	Healthcare payer	Lifetime	3.5	DSA and PSA	£20,000 per QALY
CEA and CUA (Markov model)	Payer's perspective	Lifetime	3	One-way and PSA	E35 000/QALY
CUA (Markov model)	Societal perspective	10-year and lifetime	3	DSA and PSA	\$50,000 per QALY

FINDINGS OF COST-EFFECTIVENESS OF RDN IN PATIENTS WITH RESISTANT HYPERTENSION

Taylor et al examined the cost-effectiveness of ultrasound RDN (uRDN) plus standard care compared with standard care from a US health system perspective using a Markov model. The effectiveness inputs for this study were derived from the RADIANCE-HTN TRIO trial. Based on the results of this study, uRDN reduced systolic blood pressure by 5.8 mmHg compared to standard care alone. On average, patients who received

uRDN gained 15 years of life and 12.01 QALYs. On the other hand, patients receiving standard care gained 14.29 years of life and 11.42 QALYs. The uRDN intervention, however, was associated with higher lifetime costs than standard care alone (\$110,476 vs. \$102,875 per patient, ICER=\$129,000 per QALY) [14]. According to the results of the study by Weber et al in the US, the Vessix system for RDN is cost-effective compared with pharmacotherapy. There was an ICER of \$18,819 per life year gained, which is below the US WTP [44].

Tab. II. The characteristics of conference abstracts included in the present study.

First author (Year of publication)	Country	Population	Compared interventions	Type of economic evaluation (Model)	Perspective	Time horizon	Willingness to pay	Main findings (US\$2024)
Schmieder, R. E. (2025)	UK, Spain, Netherlands, Belgium, Sweden, and the Czech Republic	Uncontrolled hypertension	RF RDN as an adjunct treatment option	CUA (Markov model)	NC	Lifetime	£20,000, €25,000, €20,000, €40,000, SEK 500,000, and 1,200,000 Kc per QALY gained in the UK, Spain, Netherlands, Belgium, Sweden, and Czech Republic settings, respectively	For Group 1, incremental costs, QALYs, and resulting ICERs with RF RDN were: UK: £1,451 (\$2,113.41), 0.82 QALYs, £1,760 (\$2,563.47) per QALY gained. Spain: €2,338 (\$3,825.44), 0.82 QALYs, €2,849 (\$4,661.54) per QALY gained. Netherlands: -€3,447 (\$4,344.29), 1.33 QALYs, dominant. Belgium: €686 (\$941.40), 1.23 QALYs, €556 (\$763.00) per QALY gained. Sweden: SEK 24,791 (\$2,901.98), 1.03 QALYs, SEK 24,134 (\$2,825.07) per QALY gained. Czech Republic: 154,604 Kc (\$11,601.76), 1.01 QALYs, 152,604 Kc (\$11,451.68)
Eusse, C. A. (2025)	Colombia	Resistant hypertension	RF RDN	CUA (Markov model)	Healthcare system	Lifetime	Three times the Colombian gross domestic product (GDP) per capita per QALY gained	Compared to a sham control and over a patient's lifetime, RF RDN led to a 0.37 QALY gain at an incremental cost of \$4,100 (\$3,986.90), yielding an ICER of \$11,017 (\$10,713.10) per QALY gained, below the WTP threshold of \$23,750 (\$23,094.87) per QALY
Ryschon, A. M. (2024)	Belgium	Uncontrolled hypertension	RF RDN	CUA (Markov model)	Healthcare payer	10 years and lifetime	€40,000 per QALY gained	Compared to sham therapy, RF RDN led to an incremental QALY gain of 0.57 at an incremental cost of €5,218 (\$6465.92), yielding an ICER of €9,089 (\$11262.70) per QALY gained, substantially below willingness-to-pay thresholds referenced for Belgium
Pietzsch, J. B. (2024)	Netherlands	Uncontrolled hypertension	RF RDN	CUA (Markov model)	NC	10 years and lifetime	€20,000 per QALY gained	Over a lifetime horizon, the therapy added 0.61 QALYs with an incremental cost of €3,828 (\$4857.87), yielding an ICER of €6,277 (\$7965.74) per QALY gained, below the willingness-to-pay threshold of €20,000 per QALY gained
Lobo, M. D. (2024)	UK	Uncontrolled hypertension	RDN	CUA (Decision-analytic model)	NHS healthcare system (payer)	10 years and lifetime	£20-30,000 per QALY gained	RDN resulted in an increase in health benefit over a patient's lifetime, adding 0.35 QALYs (0.44 based on ON MED OUS data) at a concurrent cost increase of £4779 (\$6886.17), resulting in an ICER of £13,629 (\$19638.33) per QALY gained
Kahan, T. (2023)	Sweden	Uncontrolled hypertension	RF-RDN	CUA (Markov model)	Swedish healthcare perspective	10 years and lifetime	SEK 500,000 per QALY gained	RDN resulted added 0.43 QALYs at a concurrent cost increase of SEK61,791 (\$7271.23) over lifetime, resulting in an ICER of SEK143,887 (\$16931.84) per QALY gained
Feldman, R. (2023)	Canada	Uncontrolled hypertension	RF-RDN	CUA (Markov model)	Payer perspective	10 years and lifetime	\$50,000 per quality-adjusted life year (QALY) gained	RF RDN added 0.38 QALYs (13.69 vs. 13.31) at a concurrent cost increase of \$8,935 (\$7608.25) (\$63,708 (\$54248.09) vs. \$54,772 (\$46638.98)), resulting in an ICER of \$23,442 (\$19961.13) per QALY gained

Tab. II (follows). The characteristics of conference abstracts included in the present study.

First author (Year of publication)	Country	Population	Compared interventions	Type of economic evaluation (Model)	Perspective	Time horizon	Willingness to pay	Main findings (US\$2024)
Sharp, A. S. P. (2022)	UK	Uncontrolled hypertension	RDN	CUA (Decision- analytic model)	NHS healthcare system (payer)	Lifetime	£20-30,000 per QALY gained	RDN resulted in an increase in health benefit over a patient's lifetime, adding 0.48 QALYs (0.52 based on 3-year data) at a concurrent cost increase of £3,428 (\$5409.36), resulting in an ICER of £7,169 (\$11312.62) per QALY gained (for 6 months, base-case analysis)
Kirtane, Ajay (2022)	UK	Resistant hypertension	Paradise Ultrasound RDN System compared with standard of care (SoC)	CUA (State- transition model)	NC	NC	£20,000 to £30,000 (\$27,346 to \$41,019)	A mean reduction in Office SBP of 8.5 mmHg with ultrasound RDN resulted in an average improvement in both absolute life years (LYs) and quality-adjusted life years (QALYs) gained compared with SoC (15.82 vs. 15.41 LYs and 12.68 vs. 12.34 QALYs). The overall cost per QALY gained with ultrasound RDN is estimated at £14,798 (\$23351.12)
Arbel, Yaron (2022)	Israel	Resistant hypertension	RDN compared to a usual care	CUA (Markov model)	HMO perspective	Lifetime	NC	Patients that underwent RDN had reduced event rates and that lead to an increased median survival of 18.2 years compared to 17.0 years for usual care. The discounted lifetime incremental cost-effectiveness ratio was \$16,119 (\$17090.27) per QALY
Pietzsch, J. B. (2018)	Germany	Uncontrolled hypertension	Catheter-based renal denervation (RDN)	CUA (Decision- analytic model)	NC	Lifetime	€100,000/QALY	In the base case, RDN had a lifetime additional clinical benefit of 0.31 QALYs (17.3 vs. 17.0 yrs). Concurrent discounted costs were €5,347 (\$8498.64) higher for RDN (€25,876 (\$41127.87) vs. 20,529 (\$32629.23)), resulting in a lifetime ICER of €33,741 (\$53628.66) per QALY gained
Pietzsch, J. B. (2016)	US	Uncontrolled hypertension	DN plus best medical therapy versus best medical therapy alone	CUA (Decision- analytic model)	NC	Lifetime	\$100k/QALY gained	Projected ICERs: \$13,326 (\$16999.66) per QALY
Weber, M (2014)	US	Resistant Hypertension	Vessix System for renal denervation (RDN) compared to best medical therapy (BMT)	CEA (Markov model)	NC	10 years and lifetime	NC	Incremental cost per life years gained: 10 years: \$18,819 (\$24490.08). Lifetime: \$2,637 (\$3431.66)
Tilden, D. (2014)	Australia	Resistant Hypertension	RDN plus standard of care (SOC) vs SOC alone	CUA (Markov model)	Payer	Lifetime	NC	RDN was associated with higher incremental costs \$5,951.04 (\$5297.69) and additional QALYs (0.4296) resulting in an incremental cost per QALY of \$13,852 (\$12331.23)
Sapoval, M. (2014)	Germany	Resistant hypertension	Vessix System for renal denervation (RDN)	CUA (Markov model)	NC	Lifetime (10 years)	35,000€/QALY	The incremental cost per life year gained (LYG) was €5,899 and per QALY gained was €7,986 (\$13564.41)
Kang, H. Y. (2014)	South Korea	Resistant Hypertension	standard of care (SOC) alone with 'SOC plus RDN.	CUA (Markov model)	National Health Insurance	Lifetime	Per-capita GDP in Korea in 2012 26 million KRW	The incremental cost-utility ratio (ICUR) was 19.69 million (\$27592.94) KRW per QALY gained

Tab. II (follows). The characteristics of conference abstracts included in the present study.

First author (Year of publication)	Country	Population	Compared interventions	Type of economic evaluation (Model)	Perspective	Time horizon	Willingness to pay	Main findings (US\$2024)
Henry, T. (2014)	Netherlands	Resistant Hypertension	RDN was compared with standard of care (SoC)	CUA (Markov model)	Health care payer	NC	€10,000-80,000 per QALY	RDN resulted in an increase in QALYs of 0.89 at an incremental cost of €1,315 (\$2082.40) per patient resulting in an ICER of just €1,474 (\$2334.18). RDN therapy was cost effective
Valencia, J. E. (2013)	Colombia	Resistant arterial hypertension	RDN compared with standard of care (SC)	CUA (Markov model)	Payer perspective	Lifetime	NC	RDN achieved higher QALY's (10.27 vs. 9.72) at a higher cost during their lifetime [COP\$91406.781 (\$116.13) vs. COP\$80799.285 (\$102.65)]. ICER of COP\$19301.843 (\$24.52)
Sadri, H. (2013)	Canada	Resistant hypertension	RDN compared to optimal pharmacotherapy (OPT)	CUA (Markov model)	Health care system	Lifetime	\$25,000 and \$50,000/QALY	RDN increased QALYs by 0.60 and LYs by 0.65 compared to OPT. ICERs for RDN were \$5,648 (\$6098.01)/QALY and \$5,171(\$5583.01)/LY
Jugrin, A. V. (2013)	Belgium	Resistant hypertension	RDN as compared to current standard of care (SoC)	CUA (Markov model)	Payer perspective	Lifetime	20,000€ /QALY	Incremental cost-utility ratio (ICUR) of €3,020 (\$4878.94)/QALY. Catheter-based RDN procedure could be a cost-effective strategy
Ceballos, R. M. (2013)	Mexico	Resistant Hypertension	RDN compared to standard of care (SoC)	CEA (Markov model)	Public payer perspective	Lifetime	One GDP/capita of MXN\$ 139,900 (US\$ 10,630) per additional life year	Lifetime ICER was estimated at US\$ 14,750 (\$19553.89 per LY gained, and had an incremental cost of MXN \$117,916 (\$156319.73) compared to SoC
Pietzsch, J. B. (2012)	UK	Resistant hypertension	Catheter-based renal denervation (RDN)	CUA (Markov model)	UK National Health Service perspective (payer)	Lifetime	NC	ICER: £4,870/QALY (\$2869.08). RDN reduces and delays cardiovascular events and is a cost-effective therapy
Pietzsch, J.B. (2012)	US	Resistant hypertension	RDN	CUA (Markov model)	NC	Lifetime	\$50-100K/QALY	ICERs were well below commonly accepted willingness-to-pay thresholds (\$50-100K/QALY)

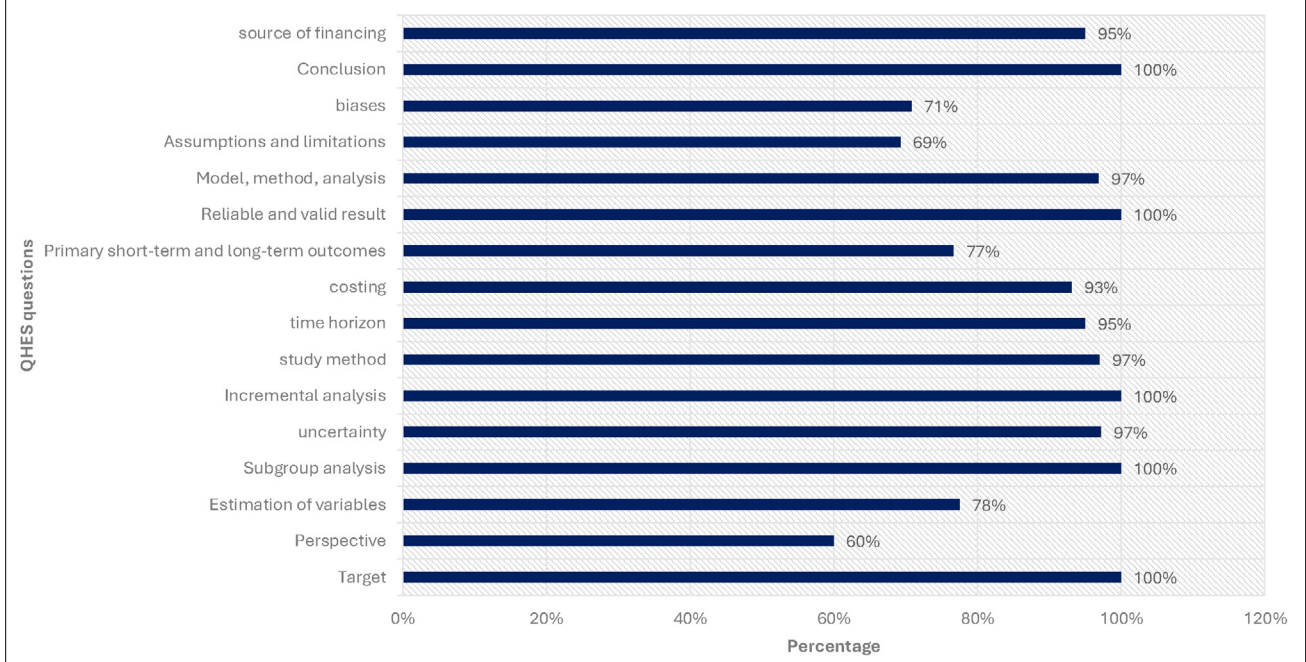
PSA: Probabilistic sensitivity analysis; CEA: cost-effectiveness analysis; CUA: cost-utility analysis; NC: No clear; QALY: Quality-adjusted life years; RDN: radiofrequency renal denervation.

According to Henry et al., RDN was found to be cost-effective from a payer's perspective in the Netherlands. As compared to standard care, RDN generated 0.89 additional QALYs and cost €2,600 (\$4,356.98) more. In terms of QALYs, the ICER was €2,914 (\$4,883.17) [28]. Another cost-effectiveness study conducted in the Netherlands showed that URDN resulted in an incremental cost of €1,594 (\$2,108.31) when compared with SOC, and the difference in life years and QALYs was estimated to be 1.21 and 1.0, respectively. The ICER per life year gained was €1,321 (\$1,747.23) and the ICER per QALY gained was €1,654 (\$2,187.67) [15].

In Germany, Dorenkamp et al evaluated the cost-effectiveness of RDN for men and women with resistant hypertension at different ages. A payer perspective was used in this study. This study found that the cost-effectiveness ratio increased with age, indicating that RDN was more cost-effective in the younger age groups. In addition, RDN's cost-effectiveness was most

affected by its effectiveness in reducing systolic blood pressure, the number of non-responders to treatment, and the procedure's cost [30]. In addition, Taylor et al. in the UK found that RDN improved mean life years and QALY compared with standard care alone (0.63), with an ICER of £5,600 (\$5,937.43) per QALY [21]. The results of another UK study showed that uRDN generated 12.68 QALYs, while standard care generated 12.34. This study reported an ICER of £14,798 (\$23,351.12) [40]. In France, URDN in patients with resistant hypertension resulted in an improvement in life years by 1.18 and QALY by 0.9. ICER was €6,261 (\$7,248.75) per QALY and €4,996 (\$6,582.13) per life year gained. In Belgium, URDN improved life years by 1.22 and QALYs by 0.97 (ICER per QALY=€4,426 (\$5,674.46) [15].

Patients with resistant hypertension in Uzbekistan had a different cost pattern than those in other countries, with standard care costing \$1,700 more than RDN. In contrast, RDNs cost more than standard care in

Fig. 2. Results of quality assessment of the methodology of studies using QHES checklist.

the UK and other countries (for example, in the UK the difference was reported to be \$5,856). Among the countries, the United States had the highest cost level, with \$117,132 for RDN and \$109,073 for standard care (Fig. 4). The Netherlands and Belgium had the highest QALY gains, while Uzbekistan had the lowest, with a difference of 0.4 between the two treatment strategies (Fig. 6). The Netherlands had the lowest ICER (\$2,187.5) and Australia had the highest (\$39,613) in patients with resistant hypertension (Fig. 7).

Discussion

The purpose of this systematic review was to examine the evidence on the cost-effectiveness of RDN in treating patients with RH and UH. RDN appears to be a cost-effective treatment option in many countries based on the results of the studies. In spite of the higher initial cost of RDN compared to standard medical treatment, the reduction in blood pressure and, consequently, the reduction in cardiovascular events can lead to increased QALYs. In particular, this treatment advantage can be seen in the prevention of heart failure (a 28% reduction in risk; relative risk [RR]=0.72) and stroke (a 20% reduction; RR=0.80), among other clinical outcomes. In addition, other clinical outcomes demonstrated consistent downward trends, including coronary artery disease and angina (an 11% reduction; RR=0.89), myocardial infarction (a 12% reduction; RR=0.88), and advanced renal disease (a 4% reduction; RR=0.96), suggesting that RDN may have a preventive and long-term impact on the management of high-risk patients [16, 18, 20, 22, 23,

25]. In addition, RDN treatment reduced cardiovascular mortality by 30% and all-cause mortality by 15%, emphasizing its clinical superiority for improving patient survival [31].

To simulate clinical and economic outcomes over a lifetime horizon, most of the studies included in this review used Markov decision models. The economic analysis of the studies was based on the assumption that the reduction in systolic blood pressure caused by RDN leads to a reduction in the risk of clinical events in the long term, as demonstrated by available epidemiological studies, due to the lack of clinical trials that directly assessed the impact of RDN on serious clinical outcomes, including death, stroke, or major cardiovascular events. In spite of these general results, different studies have reported varying cost-effectiveness rates. It is likely that these differences are caused by differences in intervention costs and demographic characteristics among patients across countries. However, most of these studies reported ICERs below WTP. The heterogeneity of study results may also be caused by differences in model assumptions, risk prediction equations, and cost sources. According to the reviewed studies, patient characteristics have a significant impact on RDN's economic outcomes. It was found that younger patients benefit the most economically from this intervention in a German study [30]. In younger patients, due to a longer life expectancy, lower blood pressure can prevent a greater number of cardiovascular events, increasing QALYs. As preventing costly events such as stroke and myocardial infarction results in significant savings in healthcare costs, targeting patients with

Tab. III. Findings of methodology quality assessment with QHES checklist.

Study (year of publication)	Target	Perspective	Estimation of variables	Subgroup analysis	Uncertainty	Incremental analysis	Study method	Time horizon
Ribichini (2026)	7	4	6	1	9	6	5	7
Xursandov, I. (2025)	7	0	8	1	9	6	2	3
Taylor, R. S. (2025)	7	2	6	1	9	6	5	6
S. Taylor (2025)	7	2	6	1	9	6	5	7
McFarlane, P. A. (2025)	7	2	6	1	9	6	5	7
Lian, D. (2025)	7	2	6	1	9	6	5	7
Kahan, T. (2025)	7	2	6	1	9	6	5	7
Huang, H. C. (2025)	7	2	6	1	9	6	5	7
Daemen, J. (2025)	7	4	6	1	9	6	5	7
Taylor, R. S. (2024)	7	4	6	1	9	6	5	7
Sharp, A. S. P. (2024)	7	4	6	1	9	6	5	7
Rodríguez-Leor, Oriol (2024)	7	2	6	1	9	6	5	7
Kario, K. (2024)	7	4	6	1	9	6	5	7
Kandzari, D. E. (2024)	7	2	6	1	9	6	5	7
Chowdhury, E. K. (2018)	7	2	6	1	9	6	5	7
Bulsei, J. (2018)	7	2	8	1	4	6	5	7
Henry, T. L. (2015)	7	2	6	1	9	6	5	7
Gladwell, D. (2014)	7	2	6	1	9	6	5	7
Dorenkamp, Marc (2013)	7	2	6	1	9	6	5	6
Geisler, B. P. (2012)	7	2	6	1	9	6	5	6

higher cardiovascular risk can also increase the cost-effectiveness of RDN.

RDN’s cost-effectiveness may be affected by assumptions about baseline cardiovascular risk, according to economic modeling studies. As an example, in a study by Chowdhury et al., it was reported that this intervention was only cost-effective when the 10-year risk of cardiovascular disease exceeded a certain threshold (approximately 13.2%) [26].

Many studies have shown that the cost-effectiveness of RDN varies greatly based on certain variables. An important factor is the magnitude and persistence of the reduction in systolic blood pressure following intervention [26, 30, 31]. In addition, the proportion of patients who do not respond to treatment [30], the cost of RDN treatment [17, 19,

20, 22-26, 28-30, 55], and the degree of reduction in the risk of cardiovascular events have been reported as other determinants of economic outcomes [15, 16, 19-22, 24, 25, 55]. As a result of these findings, appropriate patient selection, along with reduced costs associated with RDN, may increase RDN’s economic value.

Despite the promising results, some limitations should be considered when interpreting the findings of this review. The majority of available studies are based on economic modeling, and long-term real-world data on RDN’s effectiveness and sustainability are still limited. As well, many models have extrapolated results from short-follow-up clinical trials to a lifelong time horizon, which may introduce uncertainty. Cost-effectiveness estimates may be affected if real-world treatment effects decline over

Costing	Primary short-term and long-term outcomes	Reliable and valid result	Model, method, analysis	Assumptions and limitations	Biases	Conclusion	Source of financing	Total
8	5	7	8	5	4	8	3	93
4	2	7	8	0	0	8	0	65
8	5	7	8	6	6	8	3	93
8	5	7	8	5	4	8	3	91
8	5	7	8	6	5	8	3	93
8	5	7	8	4	4	8	3	90
8	5	7	8	5	4	8	3	91
8	5	7	8	5	6	8	3	93
8	5	7	8	6	5	8	3	95
8	5	7	8	6	5	8	3	95
8	5	7	8	6	6	8	3	96
8	5	7	8	5	3	8	3	90
8	5	7	8	6	4	8	3	94
8	5	7	8	6	6	8	3	94
6	3	7	8	6	5	8	3	89
3	2	7	3	2	2	8	3	70
8	5	7	8	5	4	8	3	91
8	5	7	8	2	2	8	3	86
8	5	7	8	5	4	8	3	90
8	5	7	8	6	6	8	3	93

time. The lack of rigorous monitoring or assessment of patient compliance with antihypertensive drug therapy is an important limitation of the studies included in this review. The effectiveness of RDN compared to standard medicine could be affected by nonadherence to drug regimens in treatment-resistant hypertension. It is assumed in many economic models that patients in the intervention and comparison groups take their medications similarly. In real-world settings, adherence may vary. In the absence of accounting for this variable, the cost-effectiveness ratio can be overestimated or underestimated, with consequent changes in the clinical effects. According to the available evidence, RDN could be a potentially cost-effective treatment option for patients with resistant or uncontrolled hypertension, particularly when used in

patients with higher cardiovascular risk. It is, however, important to conduct studies based on real-world data and long-term follow-up to better assess the sustained clinical and economic effects of this intervention at the health policy level.

Conclusion

Based on the studies included in this systematic review, RDN has been reported as a cost-effective intervention in most cost-effectiveness models. To more accurately determine the economic value of RDN, further economic studies with long-term clinical data and in different health system settings are necessary.

Tab. IV. Intervention cost and output results.

ICER (US \$2,024)	Mean of LYG/QALY		Total cost (US \$2,024)	Comparators		First author (Year of publication)
	QALY	LYG				
Reference group	14.13	-	€33.900 (\$54,666.47)	SOC		Ribichini, Flavio L. (2026)
Incremental Cost per QALY: €8.282 (\$13,355.39)	14.54	-	€37.318 (\$60,178.26)	RF RDN		
Incremental Cost per QALY: \$4,150 (\$4035.52)	6.85	-	\$12,500 (\$12,155.20)	RDN Group		Xursandov, I. (2025)
	6.45	-	\$14,200 (\$13,808.30)	Pharmacotherapy Group		
Incremental Cost per QALY: \$129,900 (\$13,677.30) Incremental Cost per LYG: \$10,645 (\$11,286.42)	12.01	15	\$110,476 (\$117,132.83)	Ultrasound RDN plus SoC		Taylor, R. S. (2025)
	11.42	14.29	\$102,875 (\$109,073.83)	SoC alone		
Incremental Cost per QALY: €4.426 (\$5,674.46) Incremental Cost per LYG: €3.528 (\$4,523.16)	14.17	17.94	€44.087 (\$56,522.80)	Soc alone	Belgium	S. Taylor (2025)
	Reference group	15.14	19.15	€48.378 (\$62,024.18)		
Incremental Cost per QALY: €6.261 (\$7,248.75) Incremental Cost per LYG: €4.996 (\$6,582.13)	13.77	17.43	€48.795 (\$64,286.48)	Soc alone	France	
	Reference group	14.71	18.61	€54.692 (\$72,055.67)		
Incremental Cost per QALY: €1.654 (\$2,187.67) Incremental Cost per LYG: €1.321 (\$1,747.23)	14.18	17.94	€55.478 (\$73,378.28)	Soc alone	The Netherlands	
	Reference group	15.15	19.15	€57.072 (\$75,486.59)		
Reference group	15.30		\$67,940 (\$57,851.69)	Soc		McFarlane, P. A. (2025)
Incremental Cost per QALY: \$11,809 (\$10,055.50)	15.81		\$73,971 (\$62,987.15)	RDN		
Incremental Cost per QALY: \$19,049 (\$19,480.52) Incremental Cost per LYG: \$22,046 (\$22,545.4)	13.27	14.27	\$17,260 (\$17,650.99)	RDN group	Mainland China	Lian, D. (2025)
	Reference group	12.90	13.95	\$10,170 (\$10,400.38)		
Incremental Cost per QALY: \$15,821 (\$16,179.40) Incremental Cost per LYG: \$18,310 (\$18,724.78)	13.27	14.27	\$34,592 (\$35,375.62)	RDN group	Japan	
	Reference group	12.90	13.95	\$28,703 (\$29,353.22)		
Incremental Cost per QALY: \$18,525 (\$18944.65) Incremental Cost per LYG: \$21,410 (\$21,895.01)	13.27	14.27	\$10,994 (\$11,243.05)	RDN group	Thailand	
	Reference group	12.90	13.95	\$4,099 (\$4,191.86)		
Incremental Cost per QALY: \$139,280 (\$15,764.57)	14.34	-	\$43,4362 (\$49,163.78)	Soc		Kahan, T. (2025)
Reference group	14.79	-	\$49,7498 (\$56,309.90)	RDN		

Tab. IV (follows). Intervention cost and output results.

ICER (US \$2,024)	Mean of LYG/QALY		Total cost (US \$2,024)	Comparators	First author (Year of publication)
	QALY	LYG			
Incremental Cost per QALY: \$85,0932 (\$63,802.35)	14.90	-	\$41,3050 (\$30,970.23)	Soc	Huang, H. C. (2025)
Reference group	15.15	-	\$62,9432 (\$47,194.42)	RDN	
Incremental Cost per QALY: €6.784 (\$8,609.14)	17.49	-	€46.769 (\$59,351.52)	Soc	Daemen, J. (2025)
Reference group	16.88	-	€42.632 (\$54,101.52)	RDN	
Incremental Cost per QALY: £5,600 (\$5,937.43)	11.49	14.37	£31,261 (\$33,144.16)	uRDN+ Soc	Taylor, R. S. (2024)
Incremental Cost per LYG: £4,578 (\$4,853.85)	12.12	15.14	£34,784 (\$36,879.94)	SoC alone	
Reference group	13.40	-	£19,223 (\$31,122.73)	Soc	Sharp, A. S. P. (2024)
Incremental Cost per QALY: £13,482 (\$21,274.49)	13.76	-	£24,484 (\$38,638.71)	Rf RDN	
Reference group	13.63	15.8	€21.045 (\$36,052.07)	Soc	Rodríguez-Leor, Oriol (2024)
Incremental Cost per QALY: €15.057 (\$25,794.06)	13.99	16.08	€26.381 (\$45,193.14)	Rf RDN	
Reference group	17.98	-	¥6,886,843 (\$81,308.25)	Soc	Kario, K. (2024)
Incremental Cost per QALY: ¥2,565,236 (\$30,285.99)	18.34	-	¥7,810,566 (\$92,214.02)	Rf RDN	
Incremental Cost per QALY: \$32,732	12.83	-	\$96,416	Rf RDN	Kandzari, D. E. (2024)
Reference group	12.49	-	\$85,141	Soc	
Reference group	11216.9	11630.8	\$26,273,976 (\$22,083,806.05)	Soc	Chowdhury, E. K. (2018)
Incremental Cost per QALY: \$47,130 (\$39,613.71) Incremental Cost per LYG: \$49,519 (\$41,621.72)	11401.5	11806.4	34,970,545 (\$29,393,447.47)	RDN	
ICER: €1.450 (\$2,186.94) / mmHg reduction in SBP	Difference reduction daytime in SBP: 5.9 mm Hg			RDN	Bulsei, J. (2018)
				Soc	
Reference group	15.13	16.87	€20.861 (\$34958.04)	Soc	Henry, T. L. (2015)
Incremental Cost per QALY: €2.914 (\$4,883.17) Incremental Cost per LYG: €3.335 (\$5,588.66)	16.02	17.65	€23.461 (\$39,315.02)	RDN	
Reference group	12.16	13.59	[quale valuta?] 17,432.15	Soc	Gladwell, D. (2014)
Incremental Cost per QALY: £4,805 (\$9,507.55) Incremental Cost per LYG: £5887 (\$11648.47)	12.77	14.09	[quale valuta?] 23,289.03	RDN	



Tab. IV. Intervention cost and output results.

ICER (US \$2,024)	Mean of LYG/QALY		Total cost (US \$2,024)	Comparators		First author (Year of publication)
	QALY	LYG				
Reference group	13.28	14.50	€30.474 (\$53,764.62)	BMT	Men, 50	Dorenkamp, Marc (2013)
Incremental Cost per LYG: €1.576 (\$2,780.50) Incremental Cost per QALY: €1.512 (\$2,667.59)	14.52	15.69	€32.349 (\$57,072.65)	RDN		
Reference group	10.93	12	€27.149 (\$47,898)	BMT	Men, 60	
Incremental Cost per LYG: €2.615 (\$4,613.59) Incremental Cost per QALY: €2.642 (\$4,661.22)	11.91	12.99	€29,738 (\$52,466)	RDN		
Reference group	8.18	9.04	€22.601 (\$39,874.46)	BMT	Men, 70	
Incremental Cost per LYG: €4.166 (\$7,349.98) Incremental Cost per QALY: €4.292 (\$7,572.28)	8.84	9.72	€25.434 (\$44,872.66)	RDN		
Reference group	15.75	16.84	€29.593 (\$52,210.29)	BMT	Women, 50	
Incremental Cost per LYG: €1.619 (\$2,856.37) Incremental Cost per QALY: €1.560 (\$2,752.27)	16.86	17.91	€31.325 (\$55,266.02)	RDN		
Reference group	13.24	14.25	€26.961 (\$47,566.7)	BMT	Women, 60	
Incremental Cost per LYG: €2.349 (\$4,144.29) Incremental Cost per QALY: €2.323 (\$4,098.42)	14.12	15.12	€29.005 (\$51,172.90)	RDN		
Reference group	10.18	10.98	€39.013,49 (\$39,013.49)	BMT	Women, 70	
Incremental Cost per LYG: €4.118 (\$7,265.30) Incremental Cost per QALY: €4.260 (\$7,515.83)	10.76	11.58	€24.584 (\$43,373.02)	RDN		
Dominated	12.07	17.07	\$110,349 (\$154,784.19)	Soc		Geisler, B. P. (2012)
-	13.17	18.37	\$108,580 (\$152,392.85)	RDN		
QALY: Quality-adjusted life years; LYG: Life years gained; ICER: incremental cost-effectiveness ratio; SOC: Standard of care; RDN: Renal denervation; BMT: best medical therapy; Rf RDN: Radiofrequency Renal Denervation; uRDN: Ultrasound Renal Denervation.						

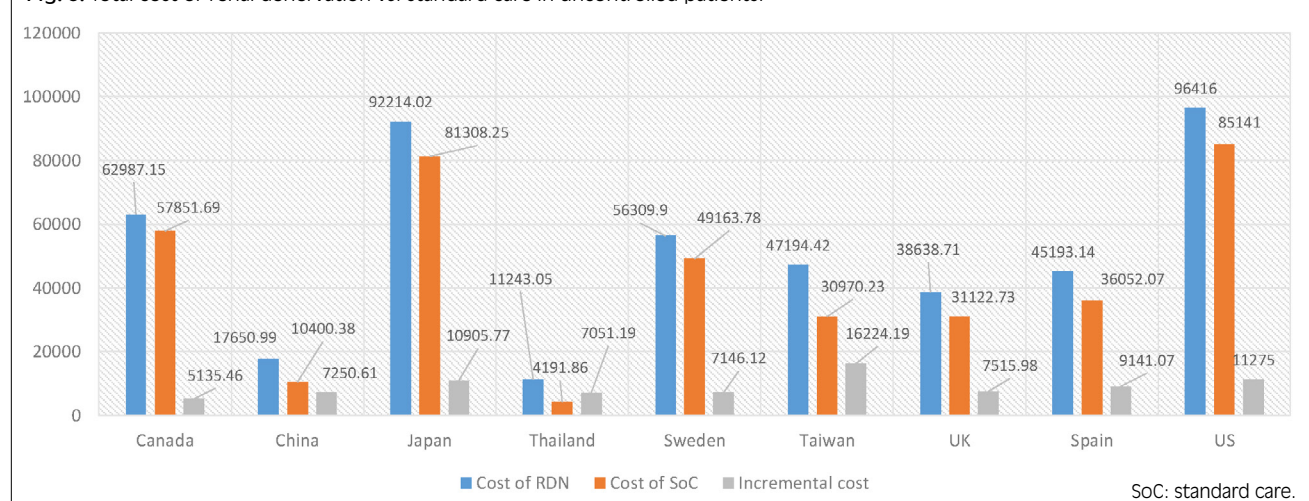
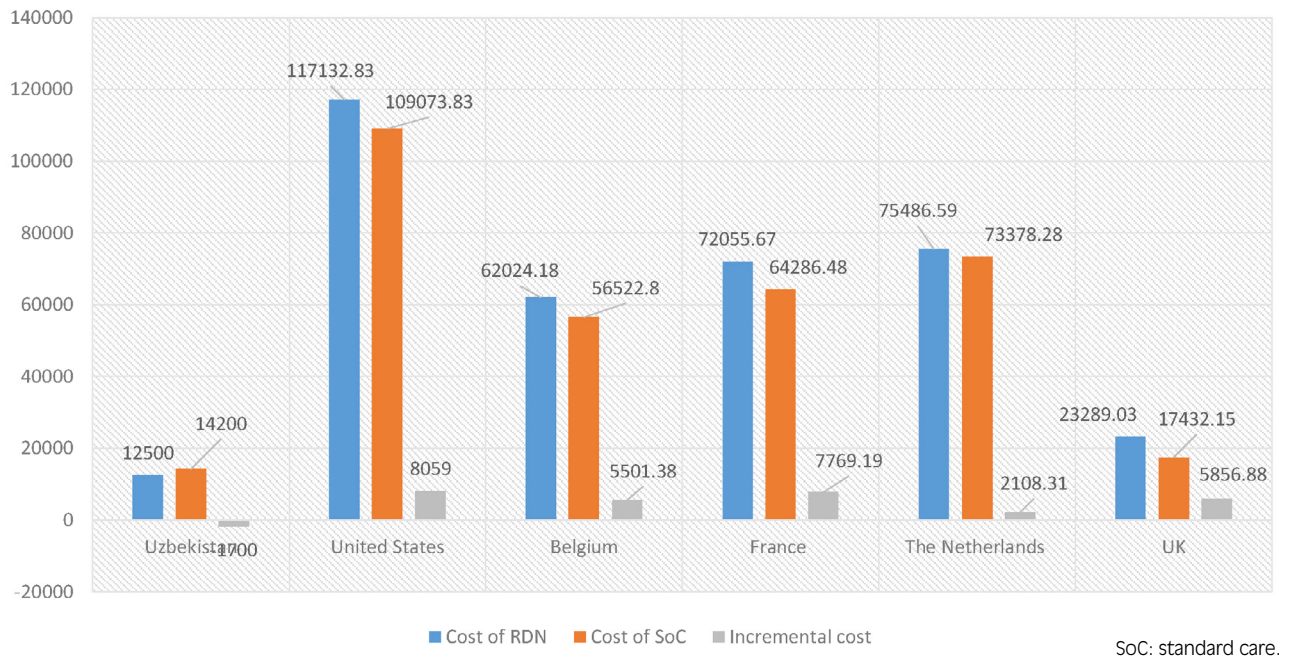
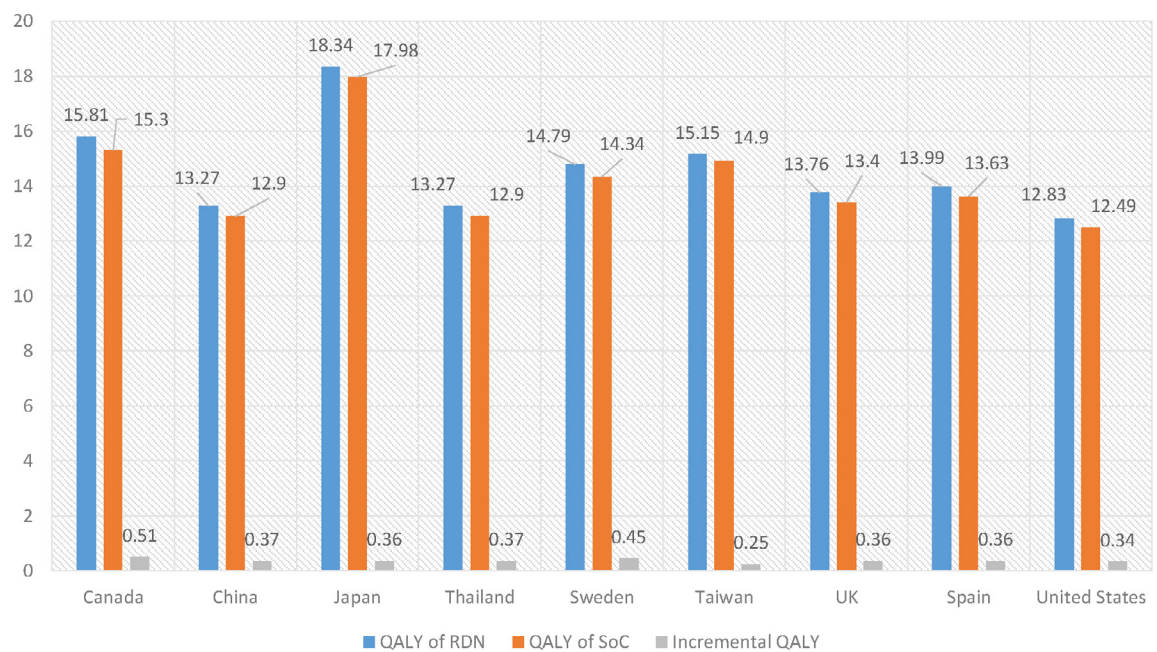
Fig. 3. Total cost of renal denervation vs. standard care in uncontrolled patients.

Fig. 4. Total cost of renal denervation vs. standard care in resistant patients.**Fig. 5.** QALYs of renal denervation vs. standard care in uncontrolled hypertension patients.

QALYs: quality-adjusted life-years; SoC: standard care.

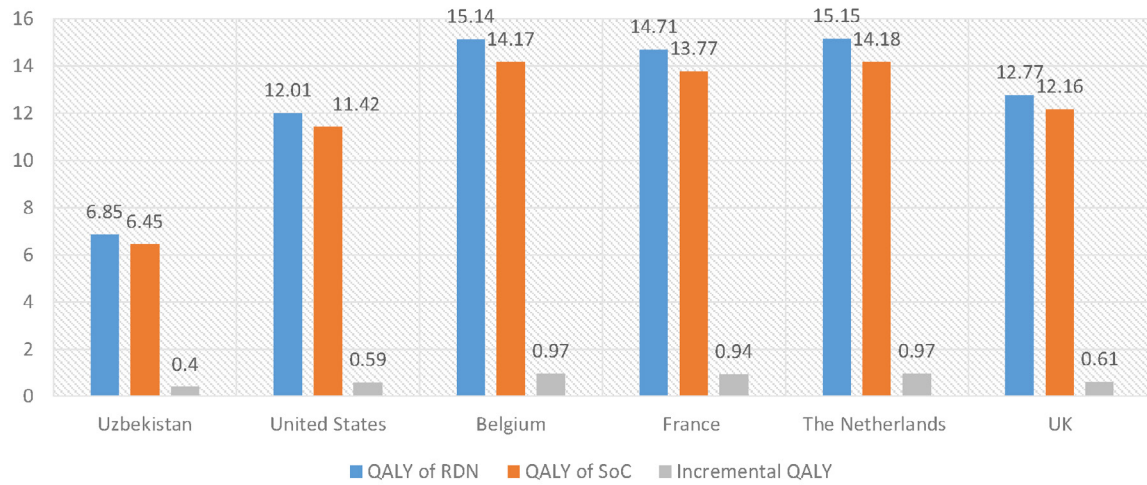
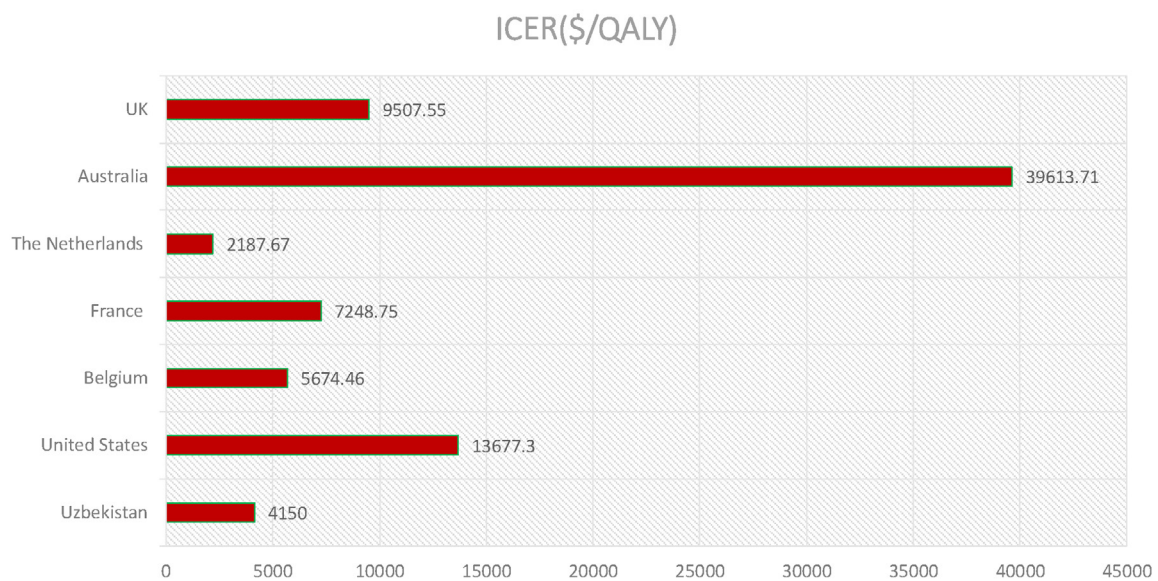
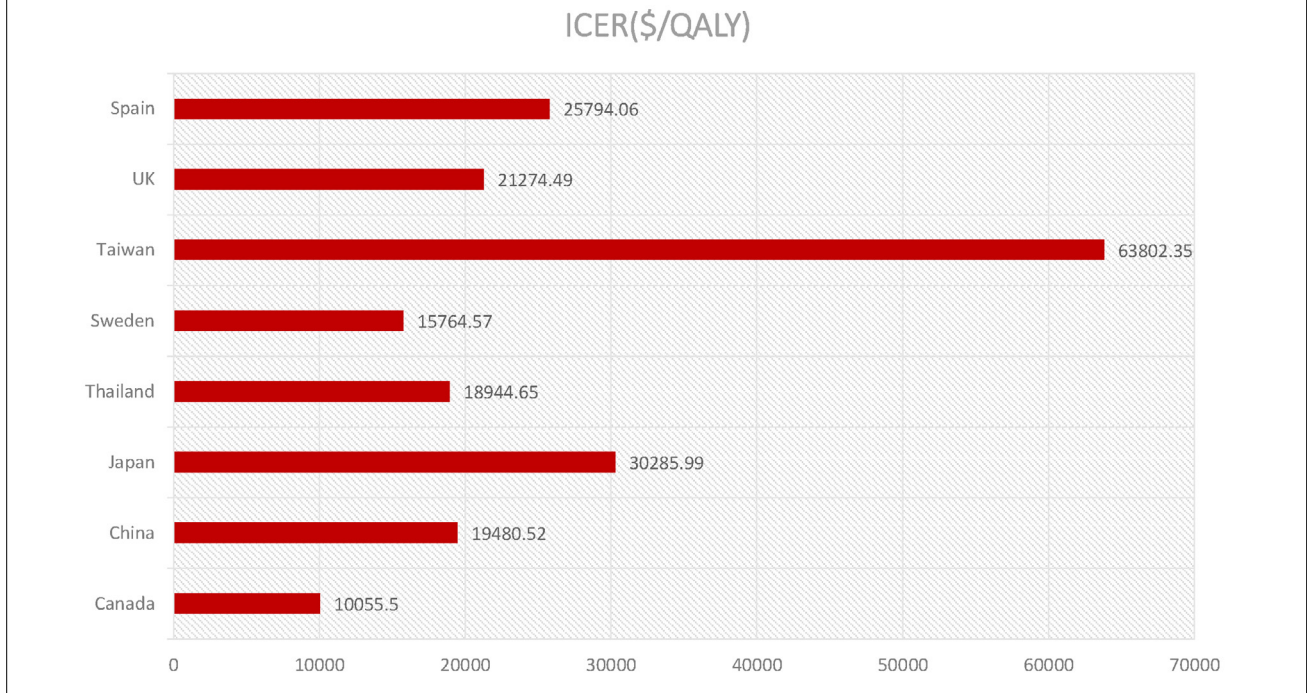
Fig. 6. QALYs of renal denervation vs. standard care in resistant patients.**Fig. 7.** Incremental cost per QALY of renal denervation vs. standard care resistant patients.

Fig. 8. Incremental cost per QALY of renal denervation vs. standard care in uncontrolled patients.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

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Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Conflict of interest statement

The authors declare that they have no conflict of interest.

Authors' contributions

AS and HO contributed to the conception and design

of the study. AS and AKH independently screened the articles, while HO served as the third reviewer to resolve disagreements. AS, MT, HO, and AKH contributed to data interpretation. AS, MT, HO, and AKH drafted the manuscript and critically revised it for important intellectual content. All authors approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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