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ORIGINAL RESEARCH ARTICLE

Expanding treatments for lower urinary tract symptoms, secondary to benign prostatic enlargement. A capacity and budget impact analysis in four Nordic countries

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ABSTRACT

Objectives: This capacity and budget impact analysis considers implications of offering a more diversified benign prostate enlargement (BPE) surgical care offering from a healthcare payer perspective in Sweden, Denmark, Norway and Finland.

Methods: A cohort simulation model compares 4-year treatment costs and capacity impact, including hospital bed-days and operating time, with Transurethral Resection of the Prostate (TURP), Holmium Laser Enucleation of the Prostate (HoLEP) using MOSES™Technology, photoselective vaporisation of the prostate (PVP) and Rezūm™ Water Vapour Therapy (WVTT). Current treatment choice is compared to a hypothetical scenario, where TURP-proportion is reduced to 50% and volumes of HoLEP, PVP and WVTT are increased. Deterministic sensitivity analysis (DSA) and probabilistic sensitivity analysis (PSA) considered uncertainty when varying all model inputs individually and simultaneously.

Results: Reducing the proportion of TURP to 50% and shifting towards a more diversified surgical offering could save 590 bed-days, 2,281 theatre hours and SEK 14,020,153 in Sweden; 343 bed-days, 1,248 theatre hours and DKK 10,493,266 in Denmark; 267 bed-days, 1,032 theatre hours and NOK 9,329,844 in Norway and 576 bed-days, 1,181 theatre hours and 1,059,528€ in Finland per year. WVTT emerged as the lowest-cost procedure in all scenarios. Both DSAs and PSAs demonstrated outcome robustness.

Conclusion: The adoption of a more diversified surgical care offering for patients with BPE in the Nordics may free theatre time and hospital bed-days and create meaningful cost-savings, which off-set higher initial device cost. Economic considerations should not constitute a barrier to the adoption of a patient-centric surgical care offering for BPE patients in the Nordics.

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Introduction

Benign prostatic enlargement (BPE) becomes clinically significant when it causes lower urinary tract symptoms (LUTS). It is a common condition amongst older men, affecting over a third of men over the age of 50 [1]. Nineteen per cent of men in Sweden aged between 45 and 79 years report moderate and 5% report severe symptoms of LUTS secondary to BPE [2] and prevalence higher in older age groups.

Medication is the first line treatment of LUTS secondary to BPE and surgery is recommended when symptoms persist despite pharmacotherapy or in cases of complications due to BPE or as a side-effect of BHE medication [3], for example urinary retention [4, 5]. Transurethral resection of the prostate (TURP) prevails as the gold standard surgical technique. Over the last two decades, an increasingly diversified surgical care armamentarium has been established in many countries, which is compliant with an increasing number of surgical treatment options captured in the European Association of Urology Guidelines, moving from 14 in 2019 to 20 in 2024 were divided into five categories: resection, enucleation, vaporisation and alternative ablative and non-ablative techniques [5, 6]. This may allow physicians to treat BPE patients more adequately, considering the preferred treatment option for individual patients with respect to prostate volume, medication, ability to undergo general anaesthesia, sexual activity and general preferences for treatment [6]. The dominant alternatives to TURP available in Nordic countries include laser techniques, such as Holmium laser enucleation of the prostate (HoLEP) and GreenLight photoselective vaporisation of the prostate (PVP) among others as well as more recent additions including innovative Minimally Invasive Surgical Treatments, such as Rezum, Water Vapour Thermal Therapy (WVTT), Prostatic Urethral Lift (PU Lift), Transurethral Microwave Thermotherapy (TUMT) and temporary implantable nitinol device (iTind) to name a few [7].

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Current trends in BPE surgical management in many European countries, most notably the United Kingdom, France and Germany, indicate a shift away from TURP and towards provision of a diverse array of BPE procedures. Apart from Sweden, Nordic countries appear to still predominantly offer TURP to patients, which accounts for 79% of BPE surgeries in Denmark [8], 79% in Finland [9], 92% in Norway [10], respectively, according to coding-based, publicly accessible procedure data published by the respective healthcare authorities in 2023. Sweden is the exception, estimated to use TURP in 60% of BPE procedures [11].

In light of healthcare systems struggling with surgical capacity and patients facing partly long surgical waiting times, there is a need to understand the economic and resource-related implications of different treatment options to ultimately enhance resource allocation and provide access to care faster for patients with BPE in the Nordics [7].

This study aims to quantify the capacity and budget impact of adopting a more diversified BPE surgical portfolio, including increased volumes of PVP, adoption of HoLEP using MOSES™ technology and WVTT in four Nordic countries.

Method

Analytical methods

A Markov, cohort state transition structure, constructed in Microsoft Excel, was developed to compare costs across four BPE procedures and report the budget and capacity impact of adopting a more diversified surgical BPE treatment portfolio from four Nordic healthcare payer perspectives. The surgical treatments included in the analysis were TURP, HoLEP, PVP and WVTT. TURP reflects a weighted average of 20% Monopolar and 80% Bipolar TURP in Norway and Sweden, informed by discussion with local clinicians. All TURP procedures are assumed to be Bipolar in Denmark and Finland based on feedback that Mono-TURP is rarely used in these settings.

The model structure, illustrated in Figure 1, has a cycle length of 3 months and captures costs in a cohort of men treated over a 4-year time horizon, a time horizon selected to capture the medium-term risk of retreatment. The costs captured in this analysis include equipment, procedure and hospital costs and the risk of short and long-term complications. The focus of this analysis is capacity and budget impact; therefore, treatment effectiveness for functional outcomes as well as quality of life are not considered.

Patients enter the model after their initial procedure and transition to one of two health states, determined by whether they experience incontinence or erectile dysfunction (ED) that persists over the medium term. ED is activated only in a scenario analysis because this attribute is not relevant to all populations accessing these treatments. Costs associated with short-term adverse events associated the procedure are captured in the first model cycle and on transition to retreatment. The probability of retreatment is captured after each 3-month cycle. Retreatment is assumed to be driven by symptom recurrence, rather than short-term complications. Patients with incontinence or ED enter a separate health state, where further surgery is not considered, reflecting clinical opinion and consistent with previous Benign prostatic hyperplasia (BPH) models [12, 13]. The risk of developing incontinence with each therapy is the same irrespective of whether this is a first or second procedure.

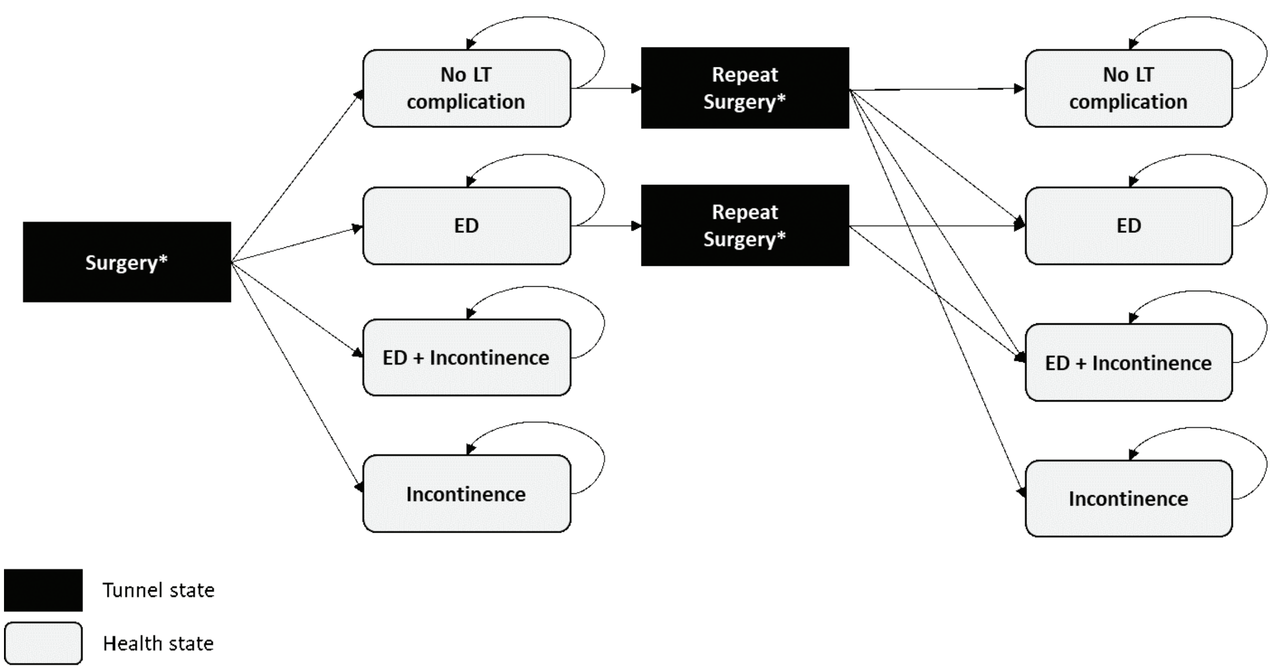

Figure 1. Model diagram.
LT: long-term; ED: erectile dysfunction
*Surgical tunnel states include risk of short-term complications with surgery

Table 1. Population statistics and market distribution assumptions.

Country	Sweden	Denmark	Norway	Finland
Male population over 45 years	2,322,697	1,347,769	1,050,915	1,275,298
Estimated annual referrals for a BPE procedure	14,401	8,354	6,516	7,907
Distribution of procedures	TURP	HoLEP	PVP	WVTT
Current (all countries)	74.9%	5.3%	8.0%	11.8%
Alternative (all countries)	50.0%	15.0%	15.0%	20.0%

HoLEP: Holmium laser enucleation of the prostate; PVP, photoselective vaporisation of the prostate; TURP, transurethral resection of the prostate, WVTT, water vapour thermal therapy; BPE: Benign prostatic enlargement.

Costs reflect local prices in 2024, reported in local currency. Most of the costs are incurred in the first cycle which includes the procedure and the immediate risks of adverse events.

Demographic inputs

Population inputs, reported in Table 1, were sourced from a national database and prevalence rates were assumed to be the same across all settings. Informed by literature [14] and validated by clinical experts, 31% of the male population is assumed to have symptomatic BPE [1] of which 2% are referred for surgery per year. The current proportions of surgical BPE treatments performed in the Nordics were informed by coding-based, publicly accessible procedure data, published by the respective healthcare authorities, applying a weighted average to all Nordic settings. This is compared to a hypothetical scenario with more widespread adoption of new technologies, informed by trends in other Western economies [7].

A pragmatic literature review was conducted to source clinical parameters for each therapeutic option. The clinical parameters selected are reported in Table 2. Retreatment rate with Mono-TURP was obtained from a nationwide analysis, reporting endourological reintervention rates at 8 years compared to reintervention after open prostatectomy [15]. Relative risk of retreatment with Bi-TURP and PVP compared to Mono-TURP was extracted from a systematic literature review [16] and a randomised control study [17] respectively. No retreatment was assumed with HoLEP, informed by clinical studies [18], local experts and consistent with prior modelling [12]. Retreatment data for WVTT were obtained from a5 year follow up of a sham-controlled clinical trial [19]. Where patients were retreated, the second procedure may be a repeat procedure or a TURP. Half of WVTT and PVP procedures were assumed to be retreated with TURP. Adverse events were categorised by two levels of severity defined as non-serious or ≤ Clavien-Dindo grade 2, assumed to be treated in primary care or serious (Clavien-Dindo grade 3+) assumed to be treated in secondary care.

All adverse events for WVTT were sourced from pivotal trials. The systematic literature reviews considered for Mono and Bi-TURP did not report the risk of non-severe adverse events by severity; therefore, these were extracted from the control arm of the GOLIATH study [17]. The risk of severe events was sourced

Table 2. Clinical and procedure related inputs.

Parameter	M-TURP	B-TURP	HoLEP	PVP	WVTT
Probability of retreatment					
Probability of retreatment, timeframe	0.083, 8 years [15]	0.104 8 years [15, 20]	0.0%[a]	0.098 8 years [15, 17]	0.044, 5 years [19]
% retreated with TURP	100[b]	50[b]	0[b]	50[b]	100[b]
Risk of short-term adverse events (90-days)					
Non-acute urinary retention	0.023 [17]	0.023 [17]	0.016 [21]	0.059 [17]	0.026 [22, 23]
Non-acute urinary infection	0.113 [17]	0.113 [17]	0.067 [21]	0.191 [17]	0.021 [22, 23]
Non-acute bleeding	0.083 [17]	0.083 [17]	0%[b]	0.088 [17]	0.138 [22, 23]
Acute urinary retention	0.077 [20]	0.005 [20]	0.016 [21]	0.066 [17]	0.05 [22, 23]
Acute urinary infection	0.073 [19]	0.075 [19]	0.00 [22]	0.00 [17]	0.00 [22, 23]
Stricture	0.068 [20]	0.065 [20]	0.054 [25]	0.044 [17]	0.011 [22, 23]
TUR syndrome	0.021 [20]	0.005 [20]	0.00 [21]	0.00 [17]	0.00 [22, 23]
Acute bleeding/transfusion	0.080 [20]	0.039 [20]	0.00 [21]	0.029 [17]	0.00 [22, 23]
Risk of medium-term adverse event					
Incontinence	0.026 [20]	0.017 [20]	0.028 [20, 26]	0.011 [17]	0.00 [22, 23]
Erectile dysfunction[d]	0.10 [27]	0.10 [27]	0.02 [27]	0.02 [27]	0.00 [22, 23]
% of procedures in an ambulatory setting (%)	0[c]	6.9[c]	67[c]	67[c]	100%[c]
Duration of operation (mins), all settings	68.6 [28]	79.5 [28]	55.5 [25]	49.6 [29]	17.5 [30]
Length of stay after procedure, ambulatory setting (hours), all settings	N/A	6[b]	6[b]	6[b]	4[b]

[a]Retreatment is not applicable after HoLEP.

[b]Assumption, informed by local clinician feedback.

[c]Informed by real world data for the Nordics on-file.

[d]Applied in a sub-group analysis only.

HoLEP: Holmium laser enucleation of the prostate; PVP: photoselective vaporisation of the prostate; TURP: transurethral resection of the prostate; WVTT: water vapour thermal therapy.

from a systematic literature review [20] calculating a weighted rate for Mono-TURP and applying the relative risk with Bi-TURP.

For PVP, the risk of each event was obtained from GOLIATH [17, 29]. Rates for HOLEP were sourced from the most recent studies on MOSES™ technology [21, 25].

Resource use and cost inputs

All cost inputs were country specific, sourced from literature or national databases. Where a local unit cost could not be identified, an alternative Nordic country or UK cost was converted to local currency in 2024 (Table 3). Future costs were discounted at a rate of 3% as recommended by Tandvårds-Läkemedelförmånsverket (TLV) in Sweden [31].

Equipment and consumable costs were sourced for each country from local price lists and previous HTA evaluations. Capital costs were considered for WVTT, HoLEP and PVP, amortized using Excel's PMT formula, applying an interest rate of 3.5% to future costs and assuming the cost was spread evenly over a 7-year lifespan. The cost per patient was estimated assuming that 150 patients are treated per year with WVTT and PVP and 50 patients are treated per year with HoLEP in each hospital they are offered. For TURP, it is assumed that capital equipment would already be available at the facilities,. Procedure times were expected to be the same across all country settings and were sourced from a prior economic analysis [12], where the procedure times were sourced from clinical studies.

The model differentiated between procedures performed in an ambulatory setting where the patient flow is streamlined to facilitate same day discharge, within 4 to 6 h of the procedure. The distribution of procedures across ambulatory and inpatient settings was informed by real world data for the Nordics and assumed 100% of WVTT and 67% of PVP and HoLEP procedures are performed in an ambulatory setting and discharged on the same day. Length of stay for TURP was informed by country-specific clinical studies or procedure data from local healthcare authorities [24yy, 32–34] and validated with local clinicians. The length of stay for all procedures performed in an ambulatory setting was assumed to be 6 h for PVP and HoLEP and 4 h for WVTT, informed by local clinicians. The cost per minute of theatre time was sourced from a Swedish economic analysis [31]. This unit cost was inflated and converted to local currency for the other Nordic countries. The cost per bed-day in Sweden was sourced from Data from Alingsås Clinic and for Norway, Denmark and Finland was sourced from Norwegian Helsedirektoratet 2024, converted for Denmark and Finland.

Non-severe adverse events were assumed to be treated in primary care, sourcing local unit costs for a GP visit and medication. Unit costs for serious adverse events were either costed as hospital events, using local tariff or obtained from the literature. Where a local unit cost could not be identified, an alternative Nordic country or UK cost was converted to local currency in 2024. The resource use and unit costs for treating incontinence were sourced from a prior UK BPE [12] model and converted to local currency.

The pre-operative tests were assumed to be the same for all BPE procedures and included a clinician appointment ultrasound, urodynamic test, flexible cystoscopy. These tests were repeated at post-operative follow-up.

Sensitivity analysis, sub-group and scenario analysis

Uncertainty in the per-patient analysis was assessed through a deterministic sensitivity analysis (DSA), varying all clinical and cost inputs by 20% from the base-case values [8].

The DSA results are displayed in tornado plots for each comparator, ranking the inputs by their impact on the per-patient outcome (Appendix 1). The probabilistic sensitivity analysis (PSA) results are reported in Appendix 2.

A subgroup of sexually active men was considered in a scenario analysis, where ED, with and without incontinence was added as a health state to the model structure. This was considered as a separate subgroup in the model because preservation of sexual function and treatment of ED was expected to be relevant only to a proportion of men referred for BPE surgery.

A further scenario analysis considers the cost impact of performing WVTT in an office setting, where the room and staff costs are considerably lower compared to those in hospital theatre. Here, the fixed and variable costs were sourced from a UK cost analysis of procedures performed in an office under local anaesthesia [36] and inflated and converted to local prices in 2024. Additionally, the acquisition of capital equipment for TURP is considered, applying the capital costs reported for Transurethral Resection in Saline (TURis) in a prior economic analysis [37].

Results

Base-case results

Implementing to a more diversified BPE treatment strategy is predicted to have a positive impact on hospital capacity with respect to bed-days and operating theatre time. Reducing TURP treatments from 74.9% to 50% and assuming these patients opt for an alternative BPE procedure is estimated to free up 590 bed-days and 2,281 theatre hours in Sweden; 343 bed-days and 1,248 theatre hours in Denmark; 267 bed-days and 1,032 theatre hours in Norway and 576 bed-days and 1,181 theatre hours in Finland. The distribution of bed-days and operating hours with each procedure in the current and alternative scenarios is as illustrated in Figure 2 for each country.

The net budget impact of switching 24.9% of those currently treated with TURP to an alternative BPE procedure is predicted to result in net savings to the healthcare system of SEK14,020,153 in Sweden; DKK10,493,266 in Denmark; NOK 9,329,844 in Norway and 1,059,528 Euros in Finland after 4 years (Table 4). The variation in budget impact is attributed to differences in unit costs for equipment, operating room time, length of stay and treatment of adverse events, which vary by country.

Figure 3 shows the cost per patient over 4 years, indicating that WVTT is the least expensive procedure across all settings, with estimated costs of SEK 45,297, DKK 41,660, NOK 32,783 and

Table 3. Resource use and cost inputs.

Parameter	Intervention	Sweden (SEK)	Denmark (DKK)	Norway (NOK)	Finland (EUR)	Source Notes
	Mono-TURP	1,913	Not applicable	2,560	Not applicable	Local price list
	Bi-TURP	4,377	4,079	27,050	265	
	PVP	17,136	12,014	12,308	1,625	
	HoLEP	18,141	12,891	17,861	1,705	
	WVTT	21,519	13,116	17,131	1,644	
Cost per minute of operation time in theatre	All	213[32]	171[32]	243[32]	21[32]	Swedish Economic study [32]
Cost per hospital bed-day	All	8,341[a]	4,199[b]	5,745[b]	525[b]	Sourced from Swedish[a] and Norwegian[b] cost databases, converted to local currency
Length of stay, admitted patients	TURP	1 [33]	1 [34]	1 [35]	2 [24]	Informed by country-specific literature or local healthcare authorities; validated with local clinicians where available
	PVP	1 [33]	1[c] [34]	1 [35]	2 [24]	
	HoLEP	1 [33]	1 [34]	1 [35]	2[c]	
	WVTT	NA	NA	NA	NA	All assumed to be day-case
Cost of recovery bed per hour	All	348[a]	175[b]	239[b]	22[b]	Sourced from Swedish[a] and Norwegian[b] cost databases. Converted to local currency
Unit cost, pre/post- operative Urologist consultation	All	3,200[a]	5,033[d]	2,990[b]	256[b]	Sourced from Swedish[a] and Danish[c] cost databases. Converted to local currency
Combined cost, pre/ post-operative tests	All	4,874[a]	6,190[d]	1,139[a]	98[a]	
Unit cost, non-acute urinary retention	All	3,287[a,d]	545[d]	3,294[a,d]	171[a,d]	Sourced from Swedish[a] and Danish[c] cost databases and applied unit costs from prior UK model to fill data gaps
Unit cost, non-acute bleeding	All	1,999[a,c]	5,033[d]	1,996[a,c]	251[c,d]	
Unit cost, non-acute urinary tract infection	All	2,936[a,d]	432[d,e]	2,940[b,d]	2,373[c,d]	
Unit cost, acute urinary retention	All	27,775[a]	6,632[d]	27,717[a]	2,373[a]	Sourced from Swedish[a] and Danish[c] cost databases. Converted to local currency
Unit cost, of stricture	All	42,637[a]	26,106[d]	42,548[a]	3,642[c]	
Unit cost of acute bleeding / transfusion	All	8,992[c]	6,723[d]	1,568 [32]	138[c]	Sourced from Swedish[a] and Danish[c] cost databases and published economic study. Converted to local currency
Unit cost of transurethral resection syndrome	All	41,878[a,d]	74,454[d]	38,890[b,e]	3,411[b,d]	Sourced from Swedish[a], Danish[c] and Norwegian[a] cost and applied unit costs from prior UK model to fill data gaps
Unit cost, acute urinary tract infection	All	50,678[a]	30,859[d]	50,572[a] [36]	4,329[a]	Sourced from Swedish[a] and Danish[c] cost databases. Converted to local currency
Annual cost of treatment for moderate/ severe incontinence	All	10,800[a,e]	11,430	15,515[a,e]	1,142[a,e]	Sourced from Swedish[a] and Danish[c] cost databases and applied unit costs from prior UK model to fill data gaps
Annual cost of treatment for erectile dysfunction	All	3,714[a,e]	1,679[d,e]	3,850[a,e]	336[b,e]	

[a]Sourced from Västerås Clinic/Swedish cost book.

[b]Sourced from Helsedirektoratet 2024/Norwegian cost book.

[c]Assumed Length of stay with HoLEP and PVP is the same.

[d]Danish cost book/DRG Takster 2024.

[e]Converted from UK Model submitted for Health Technology Assessment, in UK [12].

DKK: Danish kroner; HoLEP: Holmium laser enucleation of the prostate; NOK: Norwegian Krone; PVP: photoselective vaporisation of the prostate; SEK: Swedish krone; TURP: transurethral resection of the prostate; WVTT: water vapour thermal therapy.

3,009 Euros in Sweden, Denmark, Norway and Finland respectively. Cost savings are driven by reduced operation and hospital stay expenses, which outweigh the higher equipment costs. Conversely, while TURP has the lowest equipment costs in all settings, it results in a higher or comparable overall cost per patient due to longer procedures and extended hospital stays. The costs for PVP and HoLEP are comparable in all settings, falling between those of WVTT and TURP.

Sensitivity analysis

The DSA, which compared per-patient costs of each technology to WVTT, repeated for each country, confirmed that the conclusion that WVTT is the lowest-cost procedure, remains robust even with a 20% variation in any input. Tornado plots for each comparator and setting, provided in Appendix 1, rank the model inputs based on the impact of a 20% variation on the relative

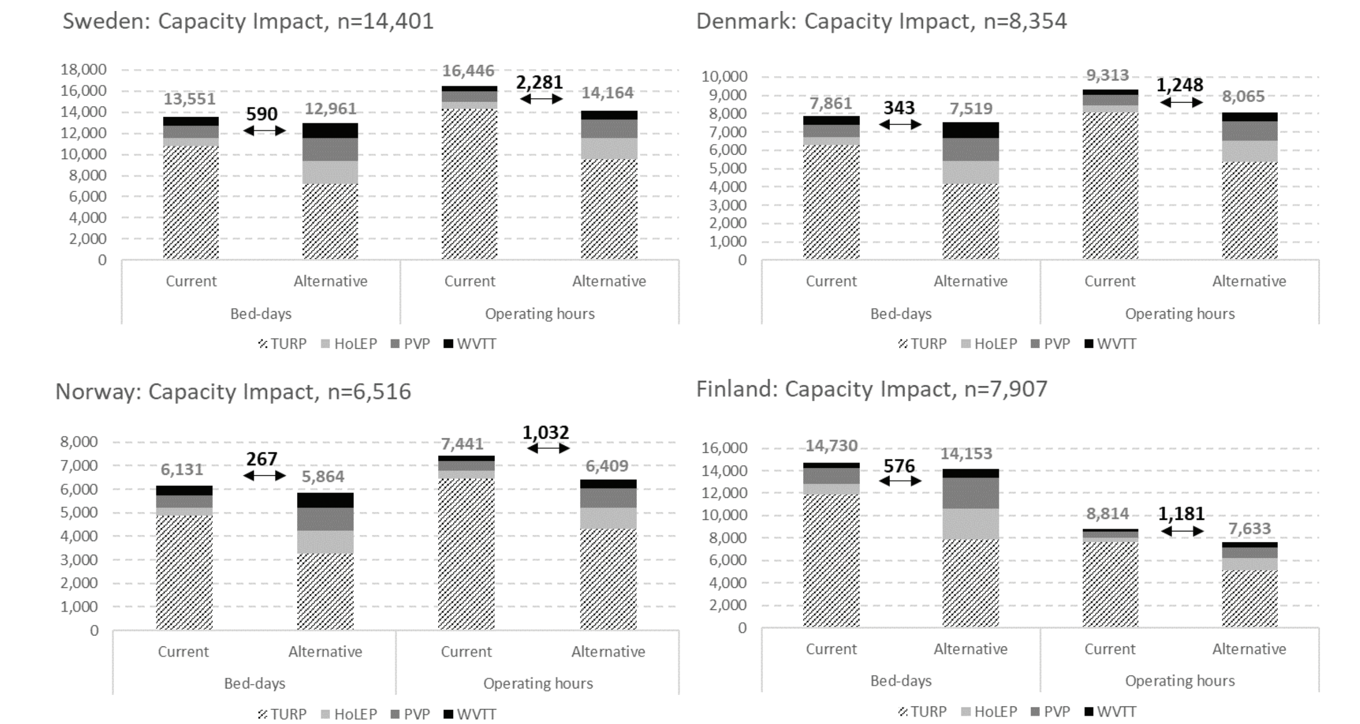

Figure 2. Capacity impact in four Nordic countries.

HoLEP: Holmium laser enucleation of the prostate; PVP: photoselective vaporisation of the prostate; TURP: transurethral resection of the prostate, WVTT: water vapour thermal therapy.

cost difference. The key cost drivers varied depending on the technology and setting, and included unit cost assumptions for operating time, procedure duration, length of stay and bundled equipment costs.

The PSA results comparing the cost per patient treated with WVTT to TURP, PVP, and HoLEP across four settings are summarised in Appendix 2. WVTT demonstrated a high probability of being cost-saving or cost-neutral, ranging from 78% to 100% across all countries and comparators.

Scenario analysis

The per patient cost analysis was repeated, activating the risk of ED to consider the relative cost of BPE procedures amongst sexually activate men with symptomatic LUTS. The results, reported in Table 5 marginally increase the potential cost-savings associated with WVTT, the only procedure assumed to have no associated risk of ED.

The scenario analysis that reported the 4-year cost per patient, assuming that WVTT is performed in an office setting had a more substantial cost impact, lowering the relative cost of WVTT compared to the other BPE procedures performed in theatre, where the cost per minute is higher due to higher room overheads and greater staffing requirements. Reducing the discount rate to 0% did not change the direction of the results.

Discussion

New technologies have expanded the treatment options for symptomatic BPE, both creating efficiencies for healthcare systems and enhancing opportunities for patient-centric care. Laser-based treatments can be routinely conducted as day-case surgery, in contrast with TURP, which usually requires overnight hospital admission. In addition to offering faster recovery, minimally invasive surgical treatments, such as WVTT, substantially

Table 4. Budget impact in four Nordic countries.

		TURP	HoLEP	PVP	WVTT	Total	Difference
Sweden (SEK)	Current	608,162,284	42,316,078	64,170,359	76,978,296	791,627,017	0
	Alternative	405,982,833	119,762,485	120,319,424	130,471,687	776,536,430	15,090,587
Denmark (DKK)	Current	327,039,851	22,110,058	33,398,832	41,068,851	423,617,592	0
	Alternative	218,317,657	62,575,637	62,622,810	69,608,222	413,124,326	10,493,266
Norway (NOK)	Current	231,621,800	16,611,579	22,231,665	25,207,142	295,672,186	0
	Alternative	154,620,694	47,013,904	41,684,371	42,723,969	286,042,938	9,629,247
Finland (Euros)	Current	27,055,689	1,904,767	2,854,962	2,807,219	34,622,636	0
	Alternative	18,061,207	5,390,849	5,353,054	4,757,998	33,563,109	1,059,528

Abbreviations: DKK: Danish kroner; HoLEP, Holmium laser enucleation of the prostate; NOK, Norwegian Krone; PVP, photoselective vaporisation of the prostate; SEK, Swedish krone; TURP, transurethral resection of the prostate, WVTT, water vapour thermal therapy

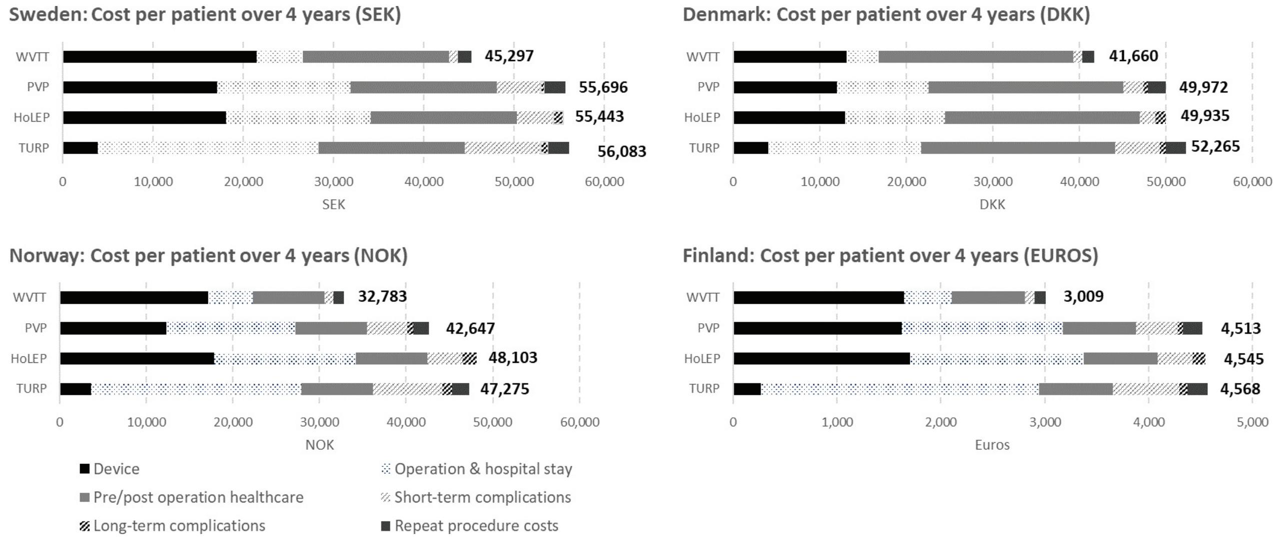

Figure 3. Cost per patient over 4 years in four Nordic countries.
DKK: Danish kroner; HoLEP: Holmium laser enucleation of the prostate; NOK: Norwegian Krone; PVP: photoselective vaporisation of the prostate; SEK: Swedish krone; TURP: transurethral resection of the prostate; WVTT: water vapour thermal therapy.

reduce the operating time and free up theatre space, enabling hospitals to treat more patients. Further efficiency gains may be realised by performing WVTT in an office settings, under local anaesthetic instead of the main hospital theatre, which is standard practice in the United States [38] and also offered in some UK settings [39].

With the exception of Sweden, the adoption of innovative surgical treatments in Nordic countries has been slow compared to other Western healthcare systems. A potential barrier to more widespread uptake is uncertainty surrounding the relative cost and economic benefits, which this analysis aims to address. Despite the higher cost of WVTT consumables, it was predicted to have the lowest cost per patient in all four settings when cost savings from shorter procedure times and hospital stay were accounted for. HoLEP and PVP also had higher equipment costs compared to TURP. However, the cost per patient was comparable or slightly lower compared to that of TURP, when all hospital resources were accounted for.

This analysis highlights the variation in the potential capacity impact associated with implementing a more diverse range of BPE procedures across Nordic countries. The capacity impact, particularly the potential to free up hospital bed-days was greatest in Finland, due to the baseline assumption that the average length of stay with TURP is 2 days, compared to 1 day in Sweden, Denmark and Norway. Notably, in the international comparison, Nordic countries are characterised by particularly short hospital stays, especially in contrast to countries like Germany and France, where BPE patients treated with TURP stayed 5.12 and 3.55 days in hospital in 2023, respectively [40, 41]. Consideration of capacity-related benefits becomes increasingly important for healthcare systems struggling with waiting times. Adoption of innovative treatment options alleviating hospital bed-days and operating theatre time may enable hospitals to increase their procedure throughput and provide access to surgical care to patients faster, potentially reducing waiting times and enhancing the overall quality of surgical care.

This study focuses on capacity and budget impact and does not include treatment effectiveness for functional outcomes, which is an important limitation to acknowledge. However, these outcomes are well-established in the existing clinical literature [5, 20]. Where all options are available, treatment selection may depend on factors such as prostate size, symptom severity, age, sexual activity, anticoagulant use and both patient and clinician preferences alongside economic considerations.

Table 5. Per patient cost of BPH procedures in four Nordic countries (base-case and scenario analysis).

Country	TURP	HoLEP	PVP	WVTT
Base-case, per patient analysis				
Sweden (SEK)	56,083	55,443	55,696	45,297
Denmark (DKK)	52,265	49,935	49,972	41,660
Norway (NOK)	47,275	48,103	42,647	32,783
Finland (Euros)	4,568	4,545	4,513	3,009
Scenario: Activating Erectile Dysfunction				
Sweden (SEK)	57,197	55,831	55,858	45,304
Denmark (DKK)	52,769	50,110	50,046	41,663
Norway (NOK)	48,430	48,506	42,815	32,791
Finland (Euros)	4,669	4,580	4,528	3,009
Scenario: Assuming WVTT is performed in an office setting				
Sweden (SEK)	57,197	55,831	55,858	44,919
Denmark (DKK)	52,265	49,935	49,972	41,207
Norway (NOK)	48,430	48,506	42,815	32,200
Finland (Euros)	4,568	4,545	4,513	2,957
Scenario: per patient analysis, applying a discount rate of 0%				
Sweden (SEK)	56,132	55,460	55,739	45,321
Denmark (DKK)	51,514	49,953	49,997	41,671
Norway (NOK)	47,323	48,128	42,686	32,802
Finland (Euros)	4,573	4,547	4,517	3,011
Scenario: Including Capital cost for TURP				
Sweden (SEK)	56,242	55,443	55,699	45,299
Denmark (DKK)	52,381	49,935	49,975	41,662
Norway (NOK)	47,411	48,103	42,650	32,785
Finland (Euros)	4,583	4,545	4,514	3,009

A further limitation is the assumption that capital costs are spread evenly over 7 years may not hold in practice, where new equipment may not be fully utilized during the initial adoption phase, making the high upfront investment a potential barrier to initial investment. The cost per patient was estimated assuming that 150 patients are treated with PVP/WVTT per year and 50 patients with HoLEP. In practice, the number of patients treated annually is expected to increase as the technology becomes more established. Capital costs for TURP equipment were excluded, which may favour TURP, though the impact of this was considered in a scenario analysis and found to be minimal. Additionally, this analysis also attributes cost savings to shorter procedure times and hospital stays, which are dependent on adjustments to operating room schedules to maximize theatre capacity and updates to hospital discharge protocols to enable same-day discharges. Further limitations to this analysis included data gaps for some unit costs, where a price parity index was applied in the absence of country-specific data. Additionally, heterogeneity in the clinical data as well as a lack of randomised controlled trials comparing the treatment options limit the ability to draw direct comparisons for risk of adverse events and retreatment. However, sensitivity analysis suggests that the cost conclusions are not sensitive to 20% variation in the model inputs.

Conclusion

This analysis suggests that increased procedural volumes of WVTT, HoLEP and PVP for the treatment of LUTS secondary to BPE in the Nordic countries are associated with both capacity and economic benefits to local hospitals and healthcare systems. Offering a more diversified array of BPE surgical treatments provides patients with greater choice, allowing them to select treatments in consultation with their physicians that best meet their needs.

Higher initial device cost should not prevent the adoption of a patient-centric surgical care offering, as these are mitigated by the consideration of hospital resource utilisation for operating time, hospital bed days and care for treatment-related complications.

Disclosure statements

D. Blissett is the managing director for MedTech Economics, a consultancy commissioned by Boston Scientific for health economic consultancy services.

L. Bruno and A. Spies are employees at Boston Scientific.

E. Kvan is a paid advisor to Boston Scientific.

D. Pogodin-Hannolainen is a paid advisor to Janssen and Boston Scientific.

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