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SYSTEMATIC REVIEW

A Systematic Review of the Economic Burden of Prostate Cancer: Direct and Indirect Cost Perspectives

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Abstract

Introduction Prostate cancer (PC) is the second most common cancer in men. Although many studies have assessed its economic burden, no recent reviews have focused on studies conducted under current clinical guidelines. This study systematically reviews recent cost-of-illness studies evaluating direct and indirect costs associated with PC.

Methods A systematic search was conducted using the PICOS framework and a combination of free-text and MeSH terms in PubMed and the Cochrane Library, and only free-text terms in EconLit. The search included articles published between January 2015 and October 2025. Data on total, direct, and indirect costs were extracted and synthesized. All costs were converted to 2025 USD, and quality of studies was assessed with a simplified version of the CHEERS checklist.

Results Ninety-five studies met the inclusion criteria. Direct medical costs for non-metastatic prostate cancer (nmPC) varied widely by disease stage, treatment, and country, ranging from approximately US$1200 to US$280,000 per patient-year, with higher costs observed in advanced stages and in patients experiencing treatment-related adverse events (AEs). Progression to metastatic disease was associated with a marked cost escalation, with annual costs largely driven by systemic therapies and skeletal-related events. Indirect costs ranged from US$666 to US$12,900 per patient-year and accounted for up to 30% of total PC-related costs, primarily due to productivity losses from premature mortality.

Conclusions PC imposes a substantial economic burden on healthcare systems and society, particularly in advanced stages. Policy promoting early detection, risk-adapted treatment, and equitable therapy access may help contain costs. Further research should address the economic impact of emerging diagnostics and minimally invasive interventions.

Key Points for Decision Makers

Prostate cancer leads to high healthcare costs, especially in advanced stages.

Active surveillance is the least expensive option for low-risk patients.

Early detection and tailored treatment can reduce long-term costs and improve outcomes.

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1 Introduction

Prostate cancer (PC) is the fourth most common cancer worldwide and the second most common in men, with an estimated 1,467,854 new cases and 397,439 deaths recorded in 2022 [1]. It is projected that approximately one in eight men will be diagnosed with PC during their lifetime [2]. Major risk factors include age, family history, and genetic predisposition, while lifestyle factors such as smoking, diet, lack of physical activity, medication use, and occupational exposures may also contribute to increased incidence [3]. The highest PC incidence rates are reported in North and South America, Europe, Australia, and the Caribbean, with particularly high rates observed among Black and African American populations. In recent years, incidence and mortality rates have either stabilized or declined across most regions [4]. However, trends in incidence remain closely

linked to the adoption of prostate-specific antigen (PSA) screening, especially in high-income countries [5, 6].

PC displays highly heterogeneous biological behaviour, ranging from indolent tumours that never metastasize to highly aggressive forms, posing significant challenges for screening, diagnosis, and treatment [7]. To assess how aggressive PC is, several tests and procedures are performed to determine its clinical stage. Stage I indicates that the tumour is small, confined to the prostate, and highly likely to be curable. As the cancer grows, the stage increases. Stage IV indicates that the cancer has metastasized to the lymph nodes or other parts of the body, making it much more difficult to cure [8]. National and international clinical guidelines offer valuable and updated frameworks to guide healthcare providers in delivering standardized, personalized, and multidisciplinary PC care (Supplementary Table 1, see electronic supplementary material [ESM]) [9–20]. These guidelines broadly endorse a risk-adapted approach, although some differences exist in specific recommendations.

In recent years, advances in precision medicine have significantly improved the management of PC. Prostate-specific membrane antigen (PSMA)-targeted approaches have matured, supporting the development of more effective radioligand and immunologic treatments. For castration-resistant prostate cancer (CRPC), next-generation androgen receptor (AR) pathway inhibitors and degraders have expanded therapeutic options. Alongside these innovations, combination therapies are required to optimize PC treatment due to the complexity of tumour heterogeneity [21].

As one of the most common malignancies, PC has been the focus of extensive health economic research. Between 2015 and 2022, numerous publications reviewed various aspects of PC healthcare economics [22–27]. However, none of these reviews fully addressed cost-of-illness data within the context of recent advances in clinical management. A recent systematic review examined PC cost analyses published between 2022 and 2025; however, this limited time frame may have excluded relevant earlier studies and prevented a comprehensive assessment of long-term evidence [28]. Consequently, there is a need for an assessment that incorporates an updated and complete picture of the global economic burden and cost structure of PC care.

The objective of this review is to systematically search, analyse, and summarize recent cost-of-illness (COI) studies evaluating PC direct and indirect costs within the context of the latest clinical guidelines and evolving management strategies. This study provides a comprehensive estimate of the resource demands associated with PC, informing policy decisions, resource allocation, and priority setting within healthcare systems.

2 Methodology

This systematic literature review was designed and reported following the PRISMA 2020 (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure methodological transparency and reproducibility.

2.1 Data Sources and Search Strategy

Relevant studies were identified through systematic searches of PubMed, Cochrane Library, and EconLit, chosen for their comprehensive coverage of biomedical and economic journals across all aspects of PC research. The inclusion and exclusion criteria were defined according to the PICOS framework (Population, Intervention, Comparator, Outcomes, Study design), as summarized in Table 1.

Eligible publications were full-length, open-access articles in English, published between January 2015 and October 2025. This timeframe was selected because the 2010 European Association of Urology (EAU) PC guidelines introduced major changes expected to influence diagnostic, treatment, and follow-up resource utilization and related costs. These included the promotion of active surveillance for low-risk patients, the recommendation to repeat PSA testing before biopsy, and the restriction of CT/MRI imaging to intermediate- or high-risk cases [29]. It was anticipated that such clinical practice changes would be reflected in economic evaluations published from 2015 onward, given that cost analyses rely on data collected in the preceding years.

The search strategy applied full-text, and combined controlled vocabulary and free-text terms, designed according to the following inclusion and exclusion criteria:

- For PubMed and the Cochrane Library: (("prostate cancer" OR "prostatic neoplasm" OR "prostatic neoplasms"[MeSH]) AND ((((("cost analysis" OR "health care costs" OR "economic burden" OR "cost of illness"[MeSH]) NOT "cost-benefit analysis"[MeSH]) NOT "cost-effectiveness analysis"[MeSH]) NOT "financial stress"[MeSH])).
- For EconLit: (("prostate cancer" OR "prostatic neoplasm") AND ("cost analysis" OR "health care costs" OR "economic burden")).

The searches were conducted in October 2025, and the complete search strings are presented in Supplementary Table 2 (ESM).

2.2 Study Selection and Eligibility Criteria

All identified records in both databases were manually screened, with duplicates being removed. Two reviewers

Table 1 Inclusion and exclusion criteria according to the PICOS scheme

	Inclusion criteria	Exclusion criteria
Population	Patients with prostate cancer (any stage)	
Intervention	Costs	
Comparator	Any or none	
Outcomes	Direct costs Indirect costs Monetary terms	Clinical outcomes without cost data Out-of-pocket costs in financial toxicity studies
Studies	COI	Cost-effectiveness Cost-utility Cost-benefit Budget impact Review Systematic review Editorial Commentary Letter Abstract
Other	Full-length studies in English published between January 2015 and October 2025	Non-free access

COI cost of illness

(AR and MA) independently screened titles and abstracts for relevance, followed by a full-text review against the predefined inclusion and exclusion criteria (Table 1). Complementary searches were also performed, including citations of specific studies, reference lists of included studies and grey literature reports. Discrepancies were resolved through discussion, with the involvement of a third reviewer (JD) until consensus was reached.

2.3 Data Extraction and Quality Appraisal

Data on study setting, population, disease stage, treatment type, and cost outcomes including both direct and indirect costs related to PC were manually extracted into a structured template by AR and MA.

To ensure the reliability of studies, each article was assessed using a simplified version of the CHEERS (Consolidated Health Economic Evaluation Reporting Standards) checklist, adapted for COI studies. Key appraisal domains included clarity of study perspective, description of cost components, data sources, and reporting of assumptions. Studies retrieved were not excluded based on quality, but findings were interpreted in light of their methodological rigor, based on the CHEERS checklist.

2.4 Cost Standardization

Cost data was extracted in the original currency and reference year as reported in each study. For consistency across sources, all monetary values were subsequently standardized to 2025 US dollars (USD) following a two-step procedure.

First, values were inflated to 2025 using the country-specific annual inflation rates derived from the International Monetary Fund (IMF) database [30]. Second, for studies reporting costs in currencies other than USD, these were converted using 2025 exchange rates obtained from exchange-rates.org [31]. If the reference year for reported costs was not indicated, the study year was assumed as the base year for cost estimation and adjustment. To enable comparison of time and patient-dependent cost data, expenditures reported over different timeframes (e.g., costs for 6 months per patient or per patient-month) were normalized on a per-patient-year basis, representing the annual cost incurred per individual. When studies presented aggregate or population-level costs (e.g., total national or regional expenditures related to PC), the original reporting format was retained to preserve the contextual interpretation of the results.

3 Results

3.1 Study Selection and Characteristics

A total of 316 records were retrieved and screened. After removing one duplicate, 315 unique records remained for initial evaluation. The review included COI studies that reported all-cause and PC-related costs. During the title and abstract screening, 200 records could not meet the inclusion and exclusion criteria (Table 1) or were behind a paywall and were excluded. Of the remaining publications, two could not be retrieved, leaving 113 full-text articles assessed

for eligibility. Following full-text review, 46 studies were excluded because they were not COI analyses, five focused solely on financial toxicity (out-of-pocket costs), four did not provide cost data specific to PC, and three were only abstracts. An additional 48 studies were identified through other sources, including citation searching, reference screening of included articles, and from the UK National Institute for Health and Care Excellence (NICE), in the prostate cancer guidance. After eligibility assessment, four of these were excluded. In total, 95 studies met all inclusion criteria and were included in the final review (Fig. 1).

Publication volume increased over time, peaking in 2022 ($n = 14$) [47, 49, 50, 59, 63, 67, 79, 103–105, 114, 117, 120, 123], while 2017 had the fewest full-year publications ($n = 5$) [56, 74, 85–87]. The review included studies from 28 countries, each focusing on a single national context. The United States accounted for the largest share (38 studies, 40%), followed by Canada, Japan, and Iran.

3.1.1 Study Perspective

Most studies adopted a healthcare system perspective ($n = 46$), followed by unspecified payer ($n = 17$) and societal ($n = 16$) perspectives. Four analyses were conducted from a United States Medicare perspective [89, 96, 107, 119], three from a patient perspective [55, 103, 105], and seven from other limited viewpoints [41, 48, 87, 91, 99, 110, 115], while eight did not specify the perspective [51, 117, 118, 120–125].

Regarding methodology, 84 studies were retrospective analyses using databases or registries, six were prospective studies, four applied modelling approaches, and one used a mixed method combining expert interviews and modelling. Sample sizes ranged from 90 participants [47] to national-level estimates exceeding 200,000 in Brazil [32] and 590,000 in Egypt [46].

3.1.2 Disease Stage

Patient classification varied widely across studies, including categories by metastatic or hormonal status (e.g., nmCRPC, mCRPC), tumour stage (I–IV), risk stratification, or treatment type (active surveillance, radical prostatectomy or surgery, brachytherapy, external radiotherapy or androgen deprivation therapy). Several prevalence-based studies and cost analyses did not specify disease stage, particularly those estimating national expenditures or focusing on specific cost components (e.g., follow-up, medication, or physician services). This heterogeneity limits comparability across studies; therefore, patient status was harmonized according to categories described in Sect. 3.2.

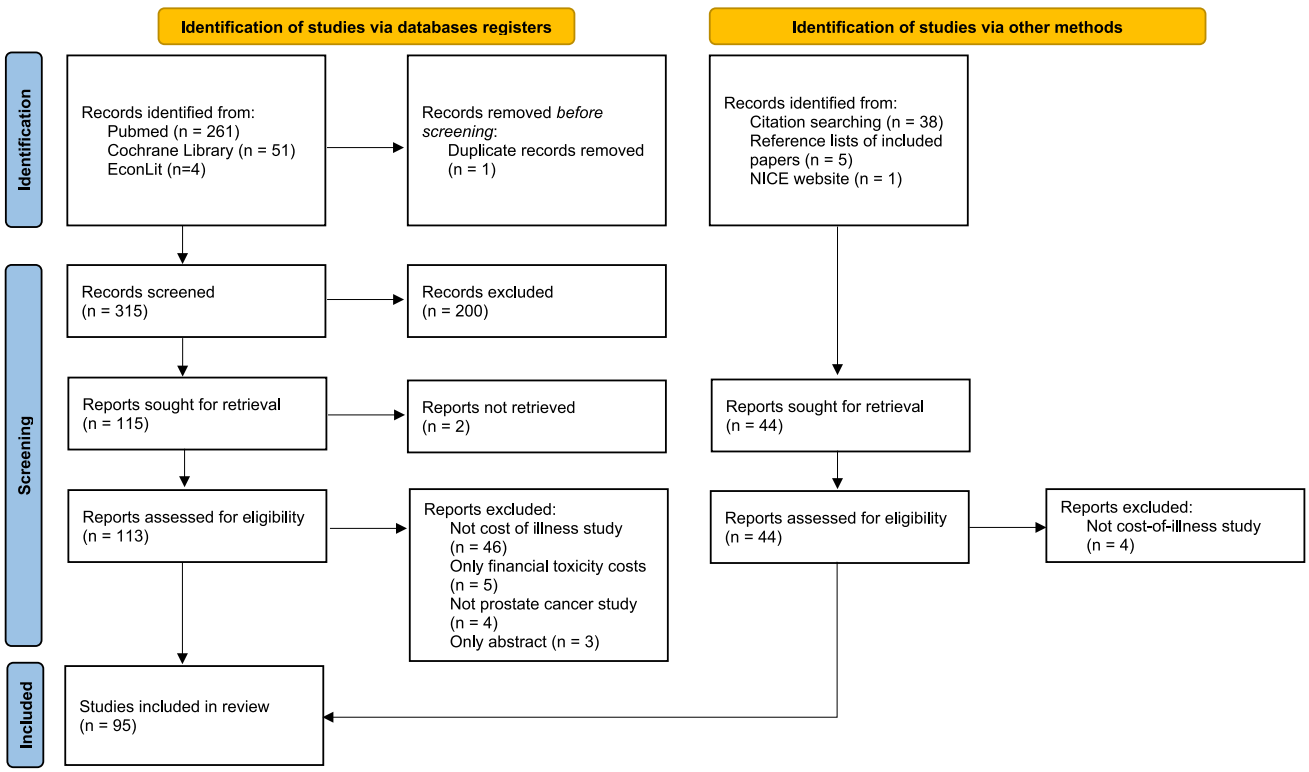

Fig. 1 PRISMA flow chart

3.2 Direct Costs of Prostate Cancer

A total of 93 articles reporting direct medical costs associated with PC were identified and included in the review (Tables 2, 3, 4). Most studies employed retrospective analyses of patient cohorts using national, institutional, or insurance claims databases. Direct costs were reported across 28 countries, encompassing high-, middle-, and low-income nations. However, significant variation in healthcare systems, cost accounting methods, treatment pathways, and study designs limited direct comparability.

To better reflect differences in economic burden by disease stage, the results are categorized as follows:

- Studies estimating total direct costs for unspecified or mixed PC subtype cohorts, including national-level COI studies (Table 2).
- Studies estimating total direct costs for early stage, localized, or non-metastatic PC (nmPC) (Table 3).
- Studies estimating total direct costs for advanced, terminal or metastatic PC (mPC) (Table 4).
- Studies were grouped by geographical context (continent and country) and by methodology used to extract and calculate the costs.

3.2.1 Direct Medical Costs in Unspecified Prostate Cancer Phases

Some studies reported direct medical costs for PC without stratifying patients by metastatic status (Table 2). Average total healthcare costs per patient-year ranged from US$2280 in Sweden [70] to US$117,337 in Antigua and Barbuda [112], where treatment accounted for 86% of the total annual expenditure.

Within this overall burden, treatment choice emerged as a major cost driver [69]. Several studies examined costs associated with specific treatment modalities, including medication, surgery, radiotherapy, androgen deprivation therapy (ADT), and active surveillance. Stratification by treatment type revealed substantial cost differences. In the United States, two studies reported total treatment-related costs [92, 96], consistently identifying active surveillance as the least costly approach, followed by ADT. Brachytherapy and radical prostatectomy were associated with comparable costs, while external beam radiotherapy represented the most expensive treatment option [96, 99]. The use of corticosteroids with chemotherapy in patients with CRPC substantially increased costs from US$41,657 per patient-year (no corticosteroids) to US$123,217 per patient-year (high-dose corticosteroids) [92].

Patient characteristics also influenced costs [68]. Age-related differences were observed in both the United Kingdom and the United States, with higher annual costs among patients aged 65 years or older compared with younger patients [78, 80].

3.2.2 Direct Cost in Early, Localized or Regionalized Prostate Cancer

More studies evaluated direct medical costs for patients diagnosed with early stage PC (Table 3), providing insight into the economic burden across disease severity. Mean total costs varied substantially depending on the clinical stage and the type of treatment received. Reported costs ranged widely, from US$1213 per patient-year for low-risk PC in a modelling study in Canada [35], up to US$282,839 per patient-year for patients with central nervous system (CNS)-related adverse events (AEs) in the United States [110].

Disease stage emerged as a key determinant of costs, with more advanced stages generally associated with higher treatment-related expenditures. Patients diagnosed at stage I consistently incurred the lowest costs, reflecting less intensive treatment and more conservative management. Costs increased at stage II due to the use of more aggressive therapeutic approaches, while most studies identified stage III as the costliest disease stage. For example, Reddy et al. reported that stage III patients incurred up to 3-fold higher costs than those diagnosed at stage I [104]. However, absolute cost estimates varied substantially across countries, from US$3380 per patient-year in Iran [54] to US$150,831 per patient-year in Antigua and Barbuda [112], underscoring the influence of healthcare system context.

Beyond disease stage, the choice of treatment significantly affects total direct medical costs. Treatments vary significantly in cost depending on the patient's risk classification, disease progression, and country-specific healthcare costs.

- Active surveillance emerged as the least costly treatment strategy. Estimated costs ranged from US$1213 per patient-year for low-risk patients in Canada [35] to US$13,021 per patient-year in the United States [87].
- Brachytherapy was considered the most affordable radiotherapy option. Low-dose brachytherapy costs US$2494 per patient-year while high-dose brachytherapy costs US$3180 per patient-year in the United States [83]. In Canada, costs were higher, with US$8583 per patient-year for low-risk patients [35].
- ADT was considered another affordable option, with costs ranging from US$4822 per patient-year in the United States [99] to US$32,997 per patient-year in Canada [34]. A Swedish study reported that patients receiving ADT who progressed to nmCRPC incurred significantly higher costs—approximately 1.9 times more—than those with non-metastatic hormone-sensitive prostate cancer (nmHSPC), underscoring the critical role of tumour hormone sensitivity in determining the economic burden of PC [71].

Table 2 Summary of studies evaluating direct costs for unknown or unspecified prostate cancer subtype

Study	Continent	Country	Methodology		Perspective	Patient population	Total mean direct costs per patient-year (in 2025 US$)	
Ngcamphalala et al. (2022) [47]	Africa	Eswatini	Population-based	Retrospective prevalence-based	Societal	90		86,410
Lana et al. (2020) [32]	America	Brazil		Retrospective	Healthcare system	212,445		12,912
Perrault et al. (2015) [33]		Canada		Retrospective	Healthcare system	1671		18,428
Zheng et al. (2016) [80]		United States		Retrospective patient-level	Societal	1170	Age group 18–64 years Age group ≥ 65 years	9030 16,607
Schultz et al. (2019) [92]				Retrospective	Healthcare system	9425	No corticosteroid LD corticosteroid MD corticosteroid HD corticosteroid	41,452 59,332 85,167 122,612
Tang et al. (2020) [96]				Retrospective	Healthcare payer	24,843	SBRT RP LD brachytherapy HD brachytherapy AS	36,899 32,422 35,697 27,059 13,290
Zaorsky et al. (2021) [101]				Retrospective	Healthcare payer	56,775		18,892
Shih et al. (2022) [103]				Retrospective	Healthcare payer and patient	59,197		68,962
Lin et al. (2023) [118]				Retrospective	ND	958		24,342
Bai et al. (2020) [44]	Asia	China		Retrospective	Healthcare system	3936	All cohort Outpatients Inpatients	3652 442 3931
Matsumoto et al. (2022) [59]		Japan		Retrospective	Societal	91,215		23,472
Lee et al. (2015) [65]		South Korea		Prospective prevalence-based	Societal	36,105		10,940
Huang et al. (2020) [72]		Taiwan		Retrospective	Societal	35,086		4246
Inotai et al. (2015) [51]	Europe	Hungary		Retrospective	ND	56,382	All-cause PC-related	5902 3295
Hao et al. (2020) [70]		Sweden		Retrospective prevalence-based	Societal	1772		2280
Laudicella et al. (2016) [78]		United Kingdom		Retrospective	Healthcare system	286,426	Age group 18–64 years Age group ≥65 years	32,509 112,874

Table 2 (continued)

Study	Continent	Country	Methodology		Perspective	Patient population	Total mean direct costs per patient-year (in 2025 US$)	
Blakely et al. (2015) [62]	Oceania	New Zealand		Retrospective	Healthcare system	National level		11,198
Merollini et al. (2022) [114]		Australia		Retrospective	Healthcare system	40,988		11,069
Pantoja et al. (2025) [75]	America	Trinidad and Tobago	Facility-based	Cross-sectional prospective	Healthcare system	250		8510
Bovell et al. (2024) [112]		Antigua and Barbuda		Retrospective prevalence-based	Healthcare provider	109		117,337
Alinezhad et al. (2023) [53]	Asia	Iran		Retrospective prevalence-based	Patient	297		51,966
Hall et al. (2015) [77]	Europe	United Kingdom		Observational retrospective	Healthcare system	104		5634
Gustavsen et al. (2020) [99]	America	United States	Modelling-based	Deterministic, decision-analytic	Commercial payer	Hypothetical cohort	AS RP RT ADT RT+ADT	1717 17,086 54,971 4822 57,382

ADT androgen deprivation therapy, *AS* active surveillance, *HD* high-dose, *LD* low-dose, *MD* medium-dose, *ND* not defined, *PC* prostate cancer, *RP* radical prostatectomy, *RT* radiotherapy, *SBRT* stereotactic body radiation therapy

- Radical prostatectomy showed moderate costs in some settings and relatively high costs in others. In the United States, surgery had costs of US$2719 per patient-year in favourable-risk PC [102]. In other settings, cost increased up to US$35,937 per patient-year in Switzerland for localized PC [126].
- External radiotherapy was considered more expensive than brachytherapy. In the United States, stereotactic body radiation therapy amounted to US$3239 per patient-year and intensity-modulated radiotherapy to US$6544 per patient-year [83]. Another study estimated higher costs for radiotherapy: US$54,971 per patient-year [99].
- Treatment combination strategies, typically used in aggressive or high-risk diseases, reflect the highest treatment-related expenditure. Costs amounted to US$14,579 per patient-year for radiotherapy + brachytherapy and US$14,468 per patient-year for radiotherapy + ADT per patient-year in intermediate-risk patients [35]. In Switzerland, radical prostatectomy with radiotherapy cost US$56,172 per patient-year [126].
- Chemotherapy was considered a cost amplifier, increasing direct costs when added, with cost of care for patients with localized PC increasing from US$21,241 to US$37,666 per patient-year in the United States [81].

Finally, clinical characteristics further shaped the economic burden. Faster PSA doubling time, a marker of aggressive disease, was strongly associated with higher costs, ranging from US$18,751 per patient-year for PSA doubling times > 12 months to US$64,985 per patient-year for doubling times of 2 months or less [41]. Treatment-related AEs, particularly CNS-related complications, also substantially increased costs, raising annual expenditures by > 50% among patients receiving secondary hormonal therapies [97].

3.2.3 Direct Cost Estimations for Advanced, Metastatic Prostate Cancer Subtype

Direct medical costs associated with mPC increase substantially with disease progression and treatment complexity, reflecting intensified healthcare resource utilization. Evidence across countries consistently shows that the transition from non-metastatic to metastatic disease marks a major escalation in costs, even prior to formal metastatic diagnosis. A large cohort study by Li et al. reported that patients who developed metastases incurred US$44,255 per patient-year preceding diagnosis, rising sharply to US$78,939 per patient-year in the year of metastatic diagnosis [86]. Similar patterns of post-diagnosis cost escalation have been observed in other analyses [107, 111].

Within metastatic disease, tumour hormone sensitivity emerged as a key cost determinant. Two studies highlighted

Table 3 Summary of studies evaluating direct costs for early stage, non-metastatic or low-risk prostate cancer

Study	Continent	Country	Methodology		Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Elsisi et al. (2023) [46]	Africa	Egypt	Population-based	Retrospective prevalence-based	Societal	nmHSPC	215,207		93,555
Krahn et al. (2016) [34]	America	Canada		Retrospective	Healthcare system	nmPC	21,818	ADT	14,629–32,997
Garbens et al. (2019) [38]				Retrospective	Healthcare system	Localized PC	28,849	RP RT	9044 9849
Freedland et al. (2023) [41]				Retrospective	Healthcare system	nmCRPC	281	PSA ≤ 2 months	
								All-cause	64,985
								PC-related	44,802
								PSA > 12 months	
								All-cause	18,751
								PC-related	7369
Zhang et al. (2023) [42]				Retrospective	Healthcare system	Early-stage PC	66,841	Aged 18–64 years by treatment	
								RP	16,335
								RT	13,248
								ADT/chemotherapy	7572
								No treatment	3899
								Aged ≥ 65 years by treatment	
								RP	13,661
								RT	10,977
								ADT/chemotherapy	7416
								No treatment	2396
Mallow et al. (2016) [81]		United States		Retrospective	Healthcare system	Localized PC	1237	Without chemotherapy	21,241
								With chemotherapy	37,666
Li et al. (2017) [86]				Retrospective	Healthcare system	nmPC	25,709		46,462
Kariburyo et al. (2017) [87]				Retrospective	Provider	Favourable risk PC	352	AS (PC-related) Treatment (PC-related)	13,021 27,361
Chen AB et al. (2018) [88]				Retrospective	Healthcare payer	Stage I–III	67,733	Stage I/II Stage III	35,514 36,069
Chen CT et al. (2018) [89]				Retrospective	Medicare payer	Stage I–III	74,480	Stage I/II	
								Year of diagnosis	35,403
								Year of death	86,462
								Stage III	
								Year of diagnosis	36,262
								Year of death	91,333

Table 3 (continued)

Study	Continent	Country	Methodology	Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Trogdon et al. (2019) [94]			Nationwide, retrospective	Healthcare payer	nmPC	49,692	Median	6690
Appukkuttan et al. (2020) [95]			Pre- and post-retrospective	Health plan	nmCRPC	261	All-cause	48,159
Shah et al. (2020) [97]			Retrospective	Healthcare payer	nmPC	532	No CNS-related AEs	42,812
							With CNS-related AEs	67,142
							No AEs	44,343
							With AEs	59,753
Wu et al. (2020) [98]			Retrospective	Healthcare payer	nmCRPC	1622	Medical insurance	39,188
							Medicare	36,982
Reddy et al. (2022) [104]			Retrospective cross-sectional	Healthcare payer	Stage I–III	124,058	Stage I	10,256
							Stage II	29,517
							Stage III	33,958
Trinh et al. (2022) [105]			Retrospective, observational	Healthcare payer and patient	nmCSPC	3854	Medical insurance	33,938
							Medicare	27,781
Appukkuttan et al. (2024) [110]			Retrospective observational	Commercial payer	nmCRPC	605	With non-CNS-related AEs	
							All-cause	263,985
							PC-related	197,197
							No non-CNS-related AEs	
							All-cause	235,497
							PC-related	203,944
							CNS-related AEs	
							All-cause	282,839
							PC-related	196,801
							No CNS-related AEs	
							All-cause	236,501
							PC-related	201,829
McGarvey et al. (2022) [120]			Retrospective	ND	Stage I–III	2079	Stage I	75,217
							Stage II	96,200
							Stage III	102,781
Wang et al. (2024) [45]	Asia	China	Retrospective, observational	Healthcare system	nmCRPC	679		29,318

Table 3 (continued)

Study	Continent	Country	Methodology		Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Ibarrondo et al. (2022) [67]	Europe	Spain		Retrospective observational	Healthcare system	Stage I–III	4289	Stage I Stage II Stage III	11,533 12,472 12,684
Laudicella et al. (2016) [78]		United Kingdom		Retrospective	Healthcare system	Initial and continuum phase	286,426	18–64 years age group Initial phase Continuum phase ≥ 65 years age group Initial phase Continuum phase	 109,626 25,463 241,636 80,196
Murtola et al. (2025) [122]		Finland		Retrospective, noninterventional	ND	Localized PC	16,212	AS RT RT+ADT RP	5501 12,010 13,885 15,677
Stucki et al. (2024) [126]		Switzerland		Retrospective	Healthcare system	Localized PC	5591	RP RP+RT RT	35,937 56,172 21,543
Goldsbury et al. (2018) [113]	Oceania	Australia		Retrospective	Healthcare system	Initial and continuum phase	1944	Initial phase (PC-related) Continuing phase (PC-related)	15,407 1376
Pantoja et al. (2025) [75]	America	Trinidad and Tobago	Facility-based	Cross-sectional prospective	Healthcare system	nmPC	195		4866
Magnani et al. (2021) [102]		United States		Retrospective	Healthcare system	nmPC	3433	Favourable risk AS Surgery RT Unfavourable risk Surgery RT	 1424 2719 4478 3437 7834
Bovell et al. (2024) [112]		Antigua and Barbuda		Retrospective prevalence-based	Healthcare provider	Stage I–III	93	Stage I Stage II Stage III	102,748 148,945 150,831
Mojahedian et al. (2019) [52]	Asia	Iran		Prospective, cross-sectional	Societal	Low-risk, local and local regionalized	263	Low risk Localized Local regionalized	3311 46,900 41,960
Darvishi Teli et al. (2024) [54]				Prospective, cross-sectional	Societal	Stage I–III	254	Stage I Stage II Stage III	6809 2632 3379
Svensson et al. (2021) [71]	Europe	Sweden		Retrospective, non-interventional	Healthcare system	nmHSPC nmCRPC	1034 356	ADT nmHSPC nmCRPC	 5212 9730

Table 3 (continued)

Study	Continent	Country	Methodology		Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Sanyal et al. (2016) [35]	America	Canada	Modelling-based	Markov chain Monte Carlo model	Healthcare system	Low and intermediate risk	14,160	Low risk	
								AS	1213
								RP	7619
								Brachytherapy	8583
								IMRT	12,308
								Intermediate risk	
								RP	7699
								IMRT	12,463
								IMRT+ADT	14,468
								IMRT+ Brachytherapy	14,579
Laviana et al. (2016) [83]		United States		Process maps model	Healthcare system	Localized, low risk		AS	2027
								LD brachytherapy	2494
								HD brachytherapy	3180
								SBRT	3239
								Cryotherapy	3114
								RALP	4706
								IMRT	6544
Gustavsen et al. (2020) [99]				Deterministic, decision-analytic model	Commercial payer	Low-, intermediate-, and high-risk localized PC		Low risk	
								AS	1717
								RP	17,086
								RT	54,971
								ADT	4822
								Intermediate risk	
								AS	1717
								RP	17,086
								RT	54,971
								ADT	4822
								RT+ADT	57,382
Borsoi et al. (2023) [57]	Europe	Italy	Mixed	Mixed	Healthcare system	nmCRPC		ADT	5469

ADT androgen deprivation therapy, *AE* adverse event, *AS* active surveillance, *CNS* central nervous system, *HD* high-dose, *IMRT* intensity modulation radiotherapy, *LD* low-dose, *ND* not defined, *nmCRPC* non-metastatic castration-resistant prostate cancer, *nmCSPC* non-metastatic castration-sensitive prostate cancer, *nmHSPC* non-metastatic hormone-sensitive prostate cancer, *nmPC* non-metastatic prostate cancer, *PC* prostate cancer, *PSA* prostate-specific antigen, *RALP* robotic-assisted laparoscopic prostatectomy, *RP* radical prostatectomy, *RT* radiotherapy, *SBRT* stereotactic body radiation therapy

that the economic burden increased substantially, with healthcare costs rising approximately 3-fold for mCRPC compared with mHSPC [71, 109].

Treatment choice was a major driver of the economic burden in mPC. In Italy, systemic therapies accounted for >77% of total costs among patients with mCRPC, with annual expenditures of US$30,400 per patient-year for first-line and US$26,932 per patient-year for second-line treatment [56]. In Greece, first-line therapy similarly accounted for 72% of total costs, while second- and third-line therapies were associated with lower expenditures [116]. Marked cost differences between regimens were also reported in Germany, where costs ranged from US$16,718 per patient-year for best supportive care to US$88,543 per patient-year for

Table 4 Summary of studies evaluating direct costs for stage IV, metastatic, high-risk or terminal prostate cancer

Study	Continent	Country	Methodology		Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Elsisi et al. (2023) [46]	Africa	Egypt	Population-based	Retrospective prevalence-based	Societal	mHSPC	263,032		151,368
						mCRPC	116,732		
Ngcamphalala et al. (2022) [47]		Eswatini		Retrospective prevalence-based	Societal	Stage IV	90		69,413
Perrault et al. (2015) [33]	America	Canada		Retrospective	Healthcare system	MBD	626	All-cause	29,883
								MBD-related	8984
Krahn et al. (2016) [34]				Retrospective	Healthcare system	mPC with ADT	3445		25,066–32,997
Zhang et al. (2023) [42]				Retrospective	Healthcare system	Advanced PC	66,841	18–64-years age group	
								RP	17,567
								RT	24,727
								ADT/chemotherapy	11,290
								No treatment	6942
								≥ 65-year age group	
								RP	16,919
								RT	23,437
								ADT/chemotherapy	12,126
								No treatment	4837
Mallow et al. (2016) [81]		United States		Retrospective	Healthcare system	mPC	60		42,889
McDougall et al. (2016) [82]				Retrospective	Healthcare system	mPC with MBD	3297	With SREs	63,536
								Without SREs	44,953
Dinan et al. (2016) [84]				Retrospective	Healthcare system	Terminal phase	8215		66,658
Li et al. (2017) [86]				Retrospective	Healthcare system	mPC	7482	12 months before diagnosis	44,255
								1 month before diagnosis	80,458
								Month of diagnosis	224,328
								12 months after diagnosis	78,939
Chen AB et al. (2018) [88]				Retrospective	Healthcare payer	Stage IV	67,733		37,237
Chen CT et al. (2018) [89]				Retrospective	Medicare payer	Stage IV	74,480	Year of diagnosis	51,779
								Year of death	86,276

Table 4 (continued)

Study	Continent	Country	Methodology	Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Zhong et al. (2018) [90]			Retrospective	Healthcare payer	With SREs	787	With SREs	104,411
					Without SREs	787	Without SREs	73,779
Wen et al. (2019) [93]			Retrospective, observational	Healthcare payer	mCRPC with MBD	1518	MarketScan database	
							Before treatment initiation (median)	43,513
							After treatment initiation (median)	190,943
							PharMetrics database	
							Before treatment initiation (median)	45,143
							After treatment initiation (median)	190,992
Appukkuttan et al. (2020) [95]			Pre- and post-retrospective	Health plan	mCRPC	261	All-cause	214,710
Wu et al. (2020) [98]			Retrospective	Healthcare payer	mCRPC	1622	Medical insurance (all-cause)	244,530
							Medicare (all-cause)	187,733
Ryan et al. (2021) [100]			Retrospective observational	Healthcare payer	mCSPC	19,841	Medical insurance	137,320
							Medicare	87,920
Reddy et al. (2022) [104]			Retrospective cross-sectional	Healthcare payer	Stage IV	124,058	PC-related	78,911
Trinh et al. (2022) [105]			Retrospective, observational	Healthcare payer and patient	mCSPC	3854	Medicare	
							Progressors (nmPC to mPC)	99,879
							De novo (without previous diagnosis)	131,110
							Medical insurance	
							Progressors (nmPC to mPC)	100,451
							De novo (without previous diagnosis)	149,997
Horný et al. (2023) [106]			Retrospective, observational	Healthcare payer	mPC	26,910	Medical insurance (PC-related)	70,637
							Medicare (PC-related)	55,149
Freedland et al. (2023) [41]			Non-interventional, retrospective	Healthcare payer	mCRPC	14,780	All-cause	157,031
							PC-related	66,420
Kaye et al. (2024) [108]			Retrospective	Healthcare payer	mCRPC	459	All-cause	153,496
							PC-related	124,044

Table 4 (continued)

Study	Continent	Country	Methodology	Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Kaye et al. (2024) [109]			Retrospective	Healthcare payer	mCSPC to mCRPC	296	mCSPC	
							All-cause	57,729
							PC-related	37,307
							mCRPC	
							All-cause	126,798
							PC-related	104,549
Kaye et al. (2024) [111]			Retrospective	Healthcare payer	mCSPC	871	Pre-treatment (all-cause)	91,069
							Pre-treatment (PC-related)	49,913
							Follow-up (all-cause)	77,642
							Follow-up (PC-related)	56,933
							Advanced therapy	
							Pre-treatment (all-cause)	90,978
							Pre-treatment (PC-related)	57,011
							Follow-up (all-cause)	115,210
							Follow-up (PC-related)	94,371
Ko et al. (2022) [117]			Retrospective	ND	nmHSPC	3,729	mHSPC incremental costs vs nmHSPC	141,594
					mHSPC	600		
McGarvey et al. (2022) [120]			Retrospective	ND	Stage IV	2079		182,893
Ramaswamy et al. (2020) [124]			Retrospective	ND	mCRPC	2320	Enzalutamide (all-cause)	125,062
							Enzalutamide (PC-related)	97,775
							Abiraterone acetate (all-cause)	140,638
							Abiraterone acetate (PC-related)	112,610
Schultz et al. (2018) [125]			Retrospective	ND	mCRPC	2865	Enzalutamide (all-cause)	235,393
							Enzalutamide (PC-related)	182,811
							Abiraterone acetate (all-cause)	231,563
							Abiraterone acetate (PC-related)	172,991
Zhuo et al. (2019) [43]	Asia	China	Retrospective cross-sectional observational	Healthcare system	mPC with MBD	737	All cohort	21,218
							Outpatients	7978
							Inpatients	16,572
Wang et al. (2024) [45]			Retrospective, observational		mHSPC	1086		24,731
Kimura et al. (2024) [61]		Japan	Retrospective	Healthcare system	mCSPC	7665		9435

Table 4 (continued)

Study	Continent	Country	Methodology	Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Ha et al. (2021) [66]		South Korea	Retrospective	Statutory health insurance	Terminal	18,419	Treatment	
							All cohort	17,605
							Surgery	18,099
							Surgery+ADT	17,232
							Surgery+RT	21,498
							Surgery+ADT+RT	21,828
							RT	20,007
							ADT	14,361
							ADT+RT	20,553
Liu et al. (2025) [73]		Taiwan	Retrospective	Healthcare system	Stage IV	9849	20–64-y age group	11,149
							65–74-y age group	9793
							75–89-y age group	5154
Kreis et al. (2021) [48]	Europe	Germany	Retrospective	ND	mCRPC	3944	Treatment	
							Cabazitaxel (all-cause)	133,032
							Cabazitaxel (PC-related)	110,578
							Abiratezone (all-cause)	41,700
							Abiratezone (PC-related)	27,544
							Enzalutamide (all-cause)	91,106
							Enzalutamide (PC-related)	79,826
							Docetaxel (all-cause)	88,543
							Docetaxel (PC-related)	76,985
							Best supportive care (all-cause)	16,718
							Best supportive care (PC-related)	7636
Restelli et al. (2017) [56]		Italy	Prevalence-based	ND	mCRPC	9700	All treatment	29,254
							First-line	30,400
							Second-line	26,932
Bjørnelv et al. (2022) [63]		Norway	Retrospective	Healthcare system	Terminal	4658		105,270
Ibarrondo et al. (2022) [67]		Spain	Retrospective observational	Healthcare payer	Stage IV	513		10,427
Laudicella et al. (2016) [78]		United Kingdom	Retrospective	Medicare payer	Terminal phase	286,426	18–64-y age group	18,610
							≥65-y age group	162,861
Murtola et al. (2025) [122]		Finland	Retrospective, noninterventional	Healthcare payer	mPC	16,212	No immediate treatment	49,842
							RT	52,378
							RT+ADT	53,316
							RP	50,320

Table 4 (continued)

Study	Continent	Country	Methodology		Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Stucki et al. (2024) [126]		Switzerland		Retrospective	Healthcare payer	mPC	5591	OS-improving medication	49,976
Merollini et al. (2022) [114]	Oceania	Australia		Retrospective, bottom-up	Healthcare system	Terminal phase	1944	PC-related	36,040
Saad et al. (2019) [37]	America	Canada	Facility-based	Retrospective	Healthcare system	mCRPC with MBD	393	Palliative treatment	
								Without symptomatic SREs	3622
								With symptomatic SREs	8383
Pantoja et al. (2025) [75]		Trinidad and Tobago		Cross-sectional prospective	Healthcare system	mPC	42		11,241
Bovell et al. (2024) [112]		Antigua and Barbuda	Facility-based	Retrospective prevalence-based	Healthcare provider	Stage IV	16		109,301
Mojahedian et al. (2019) [52]	Asia	Iran	Facility-based	Prospective, cross-sectional	Societal	mPC	263	mHSPC	184,928
								mCRPC	28,704
Darvishi Teli et al. (2024) [54]			Facility-based	Prospective, cross-sectional	Societal	Stage IV	26		6123
Satoh et al. (2018) [60]		Japan	Facility-based	Retrospective observational	Healthcare system	mCRPC	4001	With SREs	8272
								No SREs	5071
Svensson et al. (2021) [71]	Europe	Sweden	Facility-based	Retrospective, non-interventional	Healthcare system	mHSPC mCRPC	884 1172	ADT	
								mHSPC	10,289
								mCRPC	36,582
Ter Heine et al. (2017) [74]		Netherlands	Facility-based	Retrospective	Healthcare system	Terminal with MBD	136		3937
Rana et al. (2022) [79]		United Kingdom	Facility-based	Retrospective	Healthcare system	mCRPC	261	Abiraterone	74,238
								Before chemotherapy	76,236
								After chemotherapy	73,526
								Enzalutamide	76,783
								Before chemotherapy	79,619
								After chemotherapy	75,721
Bournakis et al. (2025) [116]		Greece	Facility-based	Non-interventional, retrospective	Payer	mCRPC	119	All treatment	42,749
								First line	30,800
								Second line	14,330
								Third line	16,286
Sanyal et al. (2016) [35]	America	Canada	Modelling-based	Markov chain Monte Carlo model	Healthcare system	High-risk	14,160	RP	8685
								IMRT+ADT	17,727
								IMRT+ADT+brachytherapy	19,015

Table 4 (continued)

Study	Continent	Country	Methodology		Perspective	Patient population		Total mean direct costs per patient-year (in 2025 US$)	
Gustavsen et al. (2020) [99]		United States	Modelling-based	Retrospective observational	Healthcare payer	High-risk	ND	RP	17,086
								RT	54,971
								ADT	4822
								RT+ADT	57,382
Round et al. (2015) [76]	Europe	United Kingdom	Modelling-based	Monte Carlo simulations	Societal	Terminal	9698		27,094

ADT androgen deprivation therapy, *IMRT* intensity-modulated radiotherapy, *MBD* metastatic bone disease, *mCRPC* metastatic castration-resistant prostate cancer, *mCSPC* metastatic castration-sensitive prostate cancer, *mHSPC* metastatic hormone-sensitive prostate cancer, *mPC* metastatic prostate cancer, *ND* not defined, *nmHSPC* non-metastatic hormone-sensitive prostate cancer, *nmPC* non-metastatic prostate cancer, *OS* overall survival, *PC* prostate cancer, *RP* radical prostatectomy, *RT* radiotherapy, *SRE* skeletal-related event

docetaxel and US$133,032 per patient-year for cabazitaxel [48]. In the United States, all-cause annual costs for mCRPC exceeded US$230,000 for patients treated with enzalutamide or abiraterone acetate [125].

Finally, complications further amplified costs. Patients experiencing skeletal-related events (SREs) incurred substantially higher expenditures, with costs increasing from US$3622 to US$8383 per patient-year in Canada [37] and from US$44,953 to US$63,536 per patient-year in the United States [82], while another study estimated an additional US$35,000 per patient-year attributable to SREs [90].

3.2.3.1 Cost Comparisons Between Prostate Cancer Clinical Stages Studies consistently show that the direct medical costs of PC rise significantly with disease progression. Across international settings, mPC was associated with increases in healthcare costs ranging from 1.1-fold to 35-fold compared with non-metastatic cases [46, 47, 52, 54, 67, 71, 75, 122, 126]. This trend was strongly echoed in the United States, where multiple studies demonstrated substantial cost escalation. Increases ranged from approximately 2-fold to over 5-fold [81, 86, 88, 89, 91, 95, 98, 104, 117]. The most dramatic increases were observed at the point of metastasis and during later-stage therapies.

Though these findings demonstrate that direct medical costs of PC increase consistently with disease progression, some trends and exceptions were observed in other studies. In Antigua and Barbuda, treatment costs for patients diagnosed at stages II and III were found to be higher than those at stage IV, ranging from US$102,748 to US$150,831 per patient-year for non-metastatic stages, compared with US$109,301 per patient-year for metastatic cases, and attributed to the intensive use of surgery and systemic therapies at earlier stages, though the patient population was very small ($n = 109$) [112].

Additionally, Murtola et al. compared costs for patients before and after metastasis subdivided by treatment followed, obtaining 3.1-fold to 4.1-fold increases for metastatic disease [122].

3.3 Indirect Costs of Prostate Cancer

Fifteen studies were identified that evaluated indirect costs related to PC, and 12 have been reported in patient-years [46, 47, 51–54, 59, 70, 72, 76, 80, 118]. Most studies focused on productivity losses, while a smaller number also incorporated informal care (Table 5). Evidence from diverse economic settings indicates that indirect costs constitute a substantial component of the overall economic burden of PC, accounting for approximately 30% of total costs in several analyses [54, 70].

Across countries, annual indirect costs of PC ranged from US$666 per patient-year for non-metastatic patients in Egypt [46] to US$12,895 per patient-year in Iran [53].

Four studies compared morbidity-related and mortality-related productivity losses, consistently demonstrating that the largest share of indirect costs was associated with premature mortality. These mortality-related costs were reported to be 4-fold to 20-fold higher than those morbidity-related losses [47, 58, 59, 72].

Informal care emerged as a significant cost component where assessed, with annual estimates ranging from approximately US$1039 per patient-year in Sweden to nearly US$8866 per patient-year in the United Kingdom [70, 76]. However, the data for the United Kingdom was extracted from patients receiving end-of-life care, likely increasing losses [76].

A study from the United States comparing PC patients with a cancer-free control group estimated that productivity

losses ranged from US$4023 per patient-year for individuals aged 18–64 years, to US$7094 per patient-year for those aged 65 years and older [80]. Another study estimated that productivity losses due to absenteeism were US$1753 per patient-year [118].

4 Discussion

This review provides a comprehensive and updated synthesis of the economic burden associated with PC across a broad range of global settings and clinical stages, revealing consistent patterns. PC generates one of the highest total national-level healthcare costs among malignancies, though per-patient cost is relatively moderate compared with

Table 5 Summary of studies evaluating indirect costs for prostate cancer

Authors (year)	Continent	Country	Perspective	Methodology	Patient population	Mean indirect costs per patient-year (in 2025 US$)	
Elsisi et al. (2023) [46]	Africa	Egypt	Societal	Retrospective, population-based	478,239	nmPC	666
						mPC	6997
Ngcamphalala et al. (2022) [47]		Eswatini	Societal	Retrospective, population-based	90	Productivity losses	3475
						Morbidity (sick leave)	122
						Premature mortality	3353
Zheng et al. (2016) [80]	America	United States	Societal	Retrospective, population-based	1170	Productivity losses	
						Age group 18–64 years	4023
						Age group ≥ 65 years	7094
Lin et al. (2023) [118]			ND	Retrospective, population-based	958	Productivity losses	1753
Mojahedian et al. (2019) [52]	Asia	Iran	Societal	Prospective, facility-based	263	Productivity losses	
						Low risk	371
						Local	1300
						Local regionalized	1856
						mHSPC	3713
						mCRPC	5569
Alinezhad et al. (2023) [53]			Patient	Prospective, facility-based	297	Productivity losses	12,895
Darvishi Teli et al. (2024) [54]			Societal	Prospective, facility-based	285	Productivity losses	
						Stage I	2063
						Stage II	1028
						Stage III	1616
						Stage IV	1739
Matsumoto et al. (2022) [59]		Japan	Societal	Retrospective, population-based	91,215	Productivity losses	9335
						Morbidity (sick leave)	1570
						Premature mortality	7765
Huang et al. (2020) [72]		Taiwan	Societal	Retrospective, population-based	35,086	Indirect costs	1221
						Morbidity (sick-leave)	70
						Productivity losses	1152
Inotai et al. (2015) [51]	Europe	Hungary	ND	Retrospective population-based analysis	56,382	Sick allowance	60
Hao et al. (2020) [70]		Sweden	Societal	Retrospective, population-based	1772	Indirect costs	1419
						Informal care	1039
						Productivity losses	380
Round et al. (2015) [76]		United Kingdom	Societal	Modelling-based (Monte Carlo simulations)	9698	Informal care	8866

mCRPC metastatic castration-resistant prostate cancer, *mHSPC* metastatic hormone-sensitive prostate cancer, *mPC* metastatic prostate cancer, *ND* not defined, *nmPC* non-metastatic prostate cancer

cancers that require prolonged systemic therapies. Nonetheless, the economic burden of PC increases substantially with disease progression, emphasizing the value of early detection, timely intervention, integrated care pathways and palliative care planning to optimize resource use during high-cost periods, particularly the initial treatment phase and end-of-life care. Overall, the results described collectively support the design of cost-conscious, patient-centred cancer control policies that balance clinical benefit, equity, and economic sustainability, valuable for health system planners and decision-makers.

PC has been associated with high national healthcare expenditures. Some studies included in the review compared the costs of PC with other cancers. In Australia, one study identified PC as the costliest cancer type, while in the United States, it ranked as the second most expensive cancer [101, 114]. However, on a per-patient basis, PC tends to be less costly than cancers such as breast or colorectal [72, 77]. Mittmann et al. reported that medication costs for PC were relatively low when compared with those for breast, colorectal, and lung cancers, while radiation therapy costs were comparatively higher. This was especially evident at stage I, where only 32% of patients used medication [40]. These findings are consistent with clinical guidelines that favour active surveillance for low-risk patients to avoid overtreatment and associated costs [7, 8, 10, 15, 18–21]. Consequently, the highest treatment-related costs are typically linked to more advanced stages of the disease.

This review examined the cost estimates reported across different clinical stages, confirming a general trend of increasing expenditures as the disease advances. While some exceptions exist, most studies indicate that costs are lowest at early stages and progressively increase through stages II and III. These stages often involve definitive treatments including surgery and radiotherapy—either alone or in combination with ADT and chemotherapy—which significantly elevate overall treatment costs. Freedland et al. further highlighted a relationship between PSA doubling time and treatment costs in patients with nmCRPC, finding that faster PSA doubling time was associated with significantly higher expenditures [41].

The cost implications of various treatment options for nmPC were also analysed. The evidence available identified active surveillance as the least expensive strategy [35, 83, 96, 99, 102]. Among definitive therapies, brachytherapy emerged as the less costly option, followed by radical prostatectomy, while radiotherapy was most expensive [35, 74, 83, 96, 102]. Furthermore, the addition of ADT or chemotherapy substantially increased overall treatment costs, acting as cost amplifiers due to intensified healthcare resource utilization [79, 81].

Costs associated with mPC (stage IV) were found to be considerably higher compared with non-metastatic cases. Multiple factors contribute to the elevated costs observed in mPC. The widespread use of systemic therapies, including hormonal therapies, chemotherapy, and radiopharmaceuticals, introduces a high burden of AEs, which significantly escalate healthcare costs, particularly for SREs and CNS-related AEs [56, 60, 74, 82, 90, 110]. Thus, a substantial proportion of PC treatment costs can be attributed to managing these therapy-associated AEs.

Another important driver of costs is tumour resistance to hormonal therapy. Two studies demonstrated that costs substantially increased when cancer progressed from hormone-sensitive to castration-resistant states [71, 109]. This escalation is likely due to the necessity for more aggressive and systemic treatments, as well as the higher incidence of AEs. Kaye et al., for example, reported notable increases in pharmacy and outpatient service costs for patients with castration-resistant disease [109].

Several studies also quantified the indirect costs associated with PC from a societal perspective. Although PC predominantly affects an older population, the indirect economic burden—particularly in advanced stages—was considered substantial [46, 52, 54].

The types of indirect costs included across studies were highly heterogeneous. Most analyses focused on productivity losses, either related to morbidity (e.g., sick leave or absenteeism) [47, 52–54, 58, 59, 64, 70, 72, 80, 115, 118] and/or premature mortality [47, 52, 53, 58, 59, 70, 72, 123], while several also examined the economic burden of informal caregiving [52, 70, 76]. Among studies comparing productivity losses from morbidity versus mortality, mortality-related losses consistently accounted for the greater share [47, 58, 59]. In Sweden, the costs associated with informal care were estimated to be 2.7 times higher than productivity losses [70], and in the United Kingdom, a considerable portion of the total costs was attributed to informal care needs [76]. These results indicate that indirect costs are often driven more by premature mortality and informal caregiving than by short-term productivity losses from sick leave or absenteeism. Consequently, studies that only consider absenteeism likely underestimate the total indirect burden of PC.

Most studies included in this review were retrospective analyses, while only six were conducted using a prospective design. In addition, studies were further distinguished according to the source and method of cost data collection, including national administrative databases, hospital-specific electronic health records, patient-level data obtained through personal interviews in selected centres, simulation or modelling approaches, and other mixed methods. Comparing cost estimates between these methodological approaches is challenging, as they differ substantially in scope, population coverage, and types of costs captured.

For instance, analyses based on national databases typically reflect broader populations but may lack clinical granularity, whereas hospital- or centre-specific data may provide more detailed cost components at the expense of generalizability. Similarly, prospective studies and interview-based data collection are often limited by smaller sample sizes and narrower care settings, while model-based studies depend heavily on underlying assumptions. The observed variation in cost estimates across studies therefore likely reflects methodological and contextual differences, rather than true differences in resource use. These discrepancies highlight the importance of standardizing costing methodologies and ensuring transparency in study design.

Additionally, it is important to recognize that country-specific healthcare structures significantly influence cost patterns. In the United States, several studies distinguished between patients insured through commercial health plans and those covered by Medicare, consistently finding that Medicare cohorts incurred lower healthcare costs [98, 100, 106, 107]. In smaller countries such as Antigua and Barbuda and Eswatini, cross-border procurement of therapies further exacerbated the economic burden [47, 112]. Additionally, these two studies had a small sample population: 90 for Eswatini and 109 for Antigua and Barbuda. These examples underline the necessity for studies to carefully contextualize cost data within the framework of local healthcare systems, as significant variability in economic burden can arise based on healthcare infrastructure, access, and policy differences.

This review is subject to several limitations. Only free, full-length research articles published in English were included, which may have excluded relevant findings presented in abstracts, non–open-access publications, or studies published in other languages. Additionally, studies focused on cost-effectiveness, cost-utility, or cost-saving analyses were excluded, despite their potential relevance to the economic landscape of PC.

Significant variability was observed across countries and even among studies conducted within the same country. These discrepancies—stemming from differences in methodology, study populations, original currency and healthcare system characteristics—make direct comparisons challenging. Furthermore, there is a marked geographic bias; more than half of the included studies were conducted in North America, with 32 from the United States [80–111] and 10 from Canada [33–42]. Consequently, while the burden of PC is well characterized for these countries, the findings may not fully represent the economic impact in other healthcare settings.

5 Conclusion

This systematic review provides several policy-relevant insights for health systems and payers. First, prostate cancer imposes a substantial and highly variable economic burden across countries, disease stages, and treatment pathways, reflecting differences in clinical practice, pricing, and health system organization. These variations highlight opportunities for efficiency gains through more consistent adoption of evidence-based care pathways and improved coordination across settings of care. Second, costs increased markedly with disease progression and advanced therapies, underscoring the importance of early detection, timely intervention, and optimized treatment sequencing from a health system perspective. Third, the limited and heterogeneous evidence on indirect costs suggests that the societal burden of prostate cancer remains underestimated in many jurisdictions, potentially biasing resource allocation decisions that rely solely on direct medical costs. Finally, the substantial methodological heterogeneity observed across COI studies limits cross-country comparability and policy transferability. This review emphasizes the need for greater methodological standardization and transparency in cost studies to support robust health technology assessment, budget impact analyses, and value-based pricing decisions in prostate cancer care.

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Declarations

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