DOI:10.31557/APJCC.2026.11.3.353

RESEARCH ARTICLE

Prostate Cancer in Asia: Epidemiology, Association with Human Development Index and Projections to 2040

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Abstract

Introduction: This study aimed to characterize the incidence and mortality of contemporary prostate cancer (PCa) across Asian countries, assess their association with the level of national development, and estimate the future regional burden of PCa by 2040. **Results:** In 2020, Asia accounted for 371,225 of 1,414,259 global incident PCa cases (26.2%) and 120,593 of 375,304 deaths (32.1%). Incidence and death counts were concentrated in China, Japan, and India across 47 Asian countries. The Human Development Index (HDI) showed a positive correlation with the age-standardized incidence rate (ASIR) (r = 0.59, p = 0.000025) and with key components, including life expectancy (r = 0.59), mean years of schooling (r = 0.54), and income per capita (r = 0.46). The age-standardized mortality rate (ASMR) correlated more modestly with HDI (r = 0.30, p = 0.049979) and showed mixed associations with its components. Several countries reported mortality counts that exceeded incident counts, indicating substantial limitations in cancer registration and vital statistics. Under demographic-change assumptions (baseline rates held constant), Asia is projected to contribute the largest absolute global increases by 2040: +349,434 incident cases and +135,911 deaths versus 2020. Ten countries are expected to account for most of the regional rise. **Conclusions:** Asia already contributes more than one-quarter of global PCa cases and one-third of deaths, and is on track for the largest absolute increase in PCa burden by 2040. Clinically, these trends imply a rapid rise in the demand for urologic, radiation, and medical oncology services, particularly in countries projected to shoulder the greatest increases. The strong HDI-ASIR gradient is biologically plausible, reflecting longer life expectancy, westernization of diet and lifestyle, and wider use of prostate-specific antigen testing in more developed settings, while the weaker HDI-ASMR association suggests that early detection and effective treatment are not yet consistently translating into survival gains. From a public health perspective, the findings support tailored regional strategies: scaling risk-adapted early detection and survivorship programs in higher-HDI systems and prioritizing diagnostic capacity, multimodal treatment access, financial protection, and registry strengthening in lower- and middle-HDI countries. Focusing investments on countries expected to experience the largest absolute increases offers a direct route to limiting mortality growth by 2040.

Keywords: Prostate cancer- Asia- Incidence- Mortality- Human Development Index- Forecasting

Asian Pac J Cancer Care, **11 (3)**, 353-361

Submission Date: 12/16/2025 Acceptance Date: 03/04/2026

Introduction

Prostate cancer (PCa) is a major global health challenge. This malignancy is the second most commonly diagnosed malignancy in men and the fifth leading cause of cancer-related mortality. In 2020, an estimated 1.4 million new cases and more than 375,000 deaths were recorded [1]. PCa was the most frequently diagnosed cancer in 112 countries and the leading cause of cancer-related death in 48 countries [2]. The aging population and ongoing economic development are expected to increase the absolute burden. Emerging evidence also links national development indexed by the Human Development Index (HDI) to variation in PCa incidence, stage at presentation,

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and outcomes [3-5].

Asia reflects these global trends, albeit with distinct regional characteristics. Incidence and mortality rates have risen sharply in recent decades [6, 7]. Japan exemplifies this transition: PCa became the most commonly diagnosed cancer in men by 2015, surpassing stomach and lung cancers, a shift plausibly related to lifestyle changes and dietary westernization, despite historically low rates [8]. However, in many Asian settings, limited prostate-specific antigen (PSA) screening and incomplete national cancer registration have constrained epidemiological assessment, impeding accurate trend estimation and policy evaluation [6, 9]. The implementation of organized PSA screening in Japan since 2008 has been associated with lower metastatic presentation and improved survival, underscoring the value of systematic detection and coordinated care pathways [9].

These patterns highlight the urgent need for a clear, comparative characterization of PCa epidemiology across Asia to inform appropriate control strategies. Clinically, a sustained rise in incidence and mortality will translate into heavier demand for diagnostic workup, radical and palliative treatment, and survivorship care across urology, radiation oncology, and medical oncology services [10, 11]. Biologically, the observed gradients in PCa burden are plausible consequences of aging populations, westernization of diet and lifestyle, increasing prevalence of obesity and metabolic disorders, and broader uptake of PSA testing that shifts diagnosis toward earlier stages [12-15]. Understanding how national development and demographic change shape the PCa burden is essential for planning cost-effective screening policies, prioritizing investment in cancer registration and treatment infrastructure, and targeting support to countries at greatest risk of future strain from a public health perspective [1, 2, 11, 16]. This study (i) describes contemporary incidence and mortality across Asian countries, (ii) examines their association with HDI, and (iii) projects country-specific incidence and mortality to 2040 using age-specific rates applied to United Nations population forecasts, decomposing growth into demographic change versus rate change. This study aims to guide decisions on screening policy, diagnostic capacity, and cancer registration strengthening across diverse Asian contexts by aligning epidemiologic profiling with clinical and health system needs.

Materials and Methods

Data sources and data quality

We analyzed country-level PCa incidence, mortality, and age-standardized rates (ASR; per 100,000 person-years, standardized to the World Health Organization (WHO) world standard population) using the International Agency for Research on Cancer (IARC) GLOBOCAN 2020 "Cancer Today" estimates [1,17]. Human Development Index (HDI) values and component indicators (life expectancy, education indices, and gross national income (GNI) per capita in purchasing power parity) were obtained from the United Nations Development Programme Human Development Reports database for 2020 (https://hdr.undp.org/content/human-development-report-2020). Projections to 2040 were obtained from the IARC Cancer Tomorrow framework, which uses population forecasts from the United Nations World Population Prospects 2020 Revision (medium-fertility variant) [17, 18].

GLOBOCAN compiles data from population-based cancer registries, mortality databases, and, where necessary, modeling approaches, applying standardized case definitions (ICD-10), age groups, and world standard population weights to harmonize estimates across countries [17]. However, the underlying data sources and their quality differ between settings, with some countries contributing long-standing, high-quality registry data and others relying more on partial coverage or modeled inputs [16, 17]. As a result, the precision and robustness of estimates are higher in countries with comprehensive registration and complete cause-of-death certification and lower in countries where such systems are still evolving [16, 17]. In countries where population-based cancer registration is partial or absent, GLOBOCAN relies more heavily on modeling and extrapolation; therefore, estimates should be interpreted as the best available approximations rather than exact counts, particularly for low- and middle-HDI settings [1, 17]. Regional totals (Africa, Latin America and the Caribbean, North America, Europe, Oceania, and Asia) were computed by summing country projections; for Asia, analyses included the 47 countries with available data. All inputs were aggregated, publicly available, and de-identified; therefore, ethics approval was not required.

Statistical analysis

Associations between development and PCa burden were assessed ecologically using Pearson correlation coefficients between HDI (continuous) and age-standardized incidence (ASIR) and mortality (ASMR) rates across countries. Pearson correlation was selected because the variables of interest were continuous country-level measures, and initial inspection of scatterplots suggested approximately linear associations without marked outliers. The distributions of ASIR, ASMR, and HDI were examined to assess approximate normality; no extreme skewness was observed that would preclude the use of Pearson's method. Robustness was examined using Spearman's rho as a non-parametric sensitivity analysis (two-sided $\alpha = 0.05$). Correlation coefficients (r) and associated p-values were reported for HDI and each of its components. We did not fit multivariable regression models because of the ecological design, the modest number of countries ($n = 47$), and the high collinearity between HDI and its component indicators, which would increase the risk of unstable estimates and over-interpretation. The correlation analysis was therefore intended as a descriptive summary of broad patterns rather than as a causal model. All data management and statistical analyses were performed using Python 3.10.6 (Pandas, NumPy, SciPy Stats).

Projection model

Future numbers of incident cases and deaths to 2040 were derived from the Cancer Tomorrow application, which implements a demographic projection approach [17,18]. For each country, we applied the 2020 age-specific incidence and mortality rates to the corresponding age- and sex-specific population forecasts from the United Nations World Population Prospects to obtain projected counts for selected years. This approach assumes that age-specific rates remain constant at their 2020 levels and isolates the effects of population growth and aging. We did not fit country-specific age-period-cohort models (e.g. Nordpred or Bayesian age-period-cohort methods) because such models require long, high-quality time series that are not consistently available across Asian countries and may overfit when based on sparse or heterogeneous data [18]. The chosen approach prioritizes transparency and comparability across countries and yields conservative scenario estimates suitable for planning rather than detailed forecasts of complex temporal dynamics [17, 18].

Results

Incidence and mortality of prostate cancer in Asian countries

In 2020, GLOBOCAN reported 1,414,259 PCa cases worldwide. Asia contributed 371,225 incident cases, accounting for 26.2% of the global total (Figure 1a; Table 1S). For mortality, Asia ranked first, with 120,593 deaths (32.1% of 375,304 global deaths; Figure 1b; Table 1S). The number of cases and deaths varied substantially across the 47 Asian countries assessed (Table 1S). China contributed 31.09%, followed by Japan (28.59%) and India (9.30%). The concentration of mortality was similar: China accounted for 42.37% of deaths, India for 13.92%, and Japan for 11.13%.

The country-specific incidence-mortality profiles were markedly heterogeneous (Figure 2). In China, India, Indonesia, Iran, and Thailand, the reported mortality counts exceeded the reported incident counts. In contrast, Japan and the Republic of Republic of Korea recorded a higher incidence than mortality. Age-standardized indicators also differed across settings (Table 1). The highest ASIRs were observed in Japan, Armenia, Turkey,

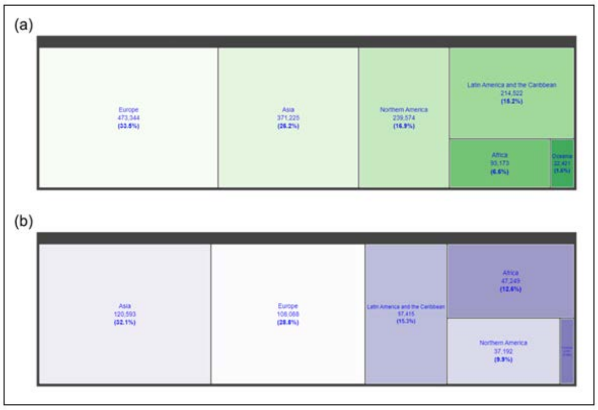

Figure 1. Estimated Number of (a) Incidence and (b) Mortality Cases of Prostate Cancer by Continents

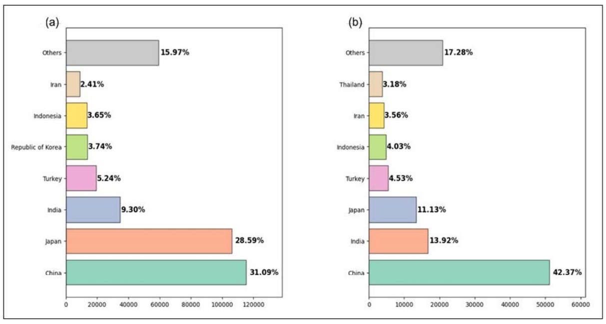

Figure 2. Estimated Number of (a) New Cases and (b) Deaths Due to Prostate Cancer in Asian Countries

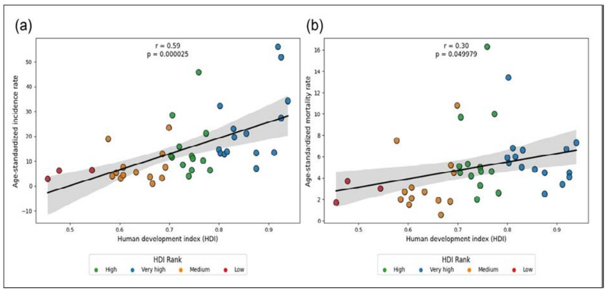

Figure 3. Correlation between (a) Age-standardized Incidence Rate and (b) Age-standardized Mortality Rate of Patients with HDI-treated Prostate Cancer

Lebanon, Singapore, and the Republic of Republic of Korea (Table 2S). The ASMR exceeded the ASIR in the remaining Asian countries. These patterns indicate that the underlying epidemiological descriptions are constrained by data accuracy and completeness and that country-specific incidence and mortality profiles, particularly at the extremes, should be interpreted with caution in light of known limitations in cancer registration and cause-of-death certification.

Correlations between HDI and age-standardized incidence and mortality rates

Across Asian countries, the HDI was positively correlated with the ASIR of PCa ($r = 0.59$; $p = 0.000025$; Figure 3a; Table 3S). The ASIR also showed positive correlations with the following HDI components: life expectancy at birth ($r=0.59$; $p<0.05$; Table 3S; Figure 1S), mean years of schooling ($r=0.54$; $p < 0.05$; Table 3S; Figure 1S), and GNI per capita ($r = 0.46$; $p < 0.05$; Table 3S; Figure 1S). For mortality, the ASMR demonstrated a moderate positive correlation with HDI ($r = 0.30$; $p = 0.049979$; Table 3S; Figure 3b). Component-wise, the ASMR correlated weakly with life expectancy ($r = 0.18$; $p = 0.235358$), moderately with mean years of schooling ($r = 0.38$; $p = 0.011107$; Table 3S; Figure 1S), and weakly with GNI per capita ($r = 0.11$; $p = 0.472542$; Table 3S; Figure 1S). In addition, four settings, namely, Turkey, the Democratic People's Republic of Republic of Korea, the Gaza Strip, and the West Bank, were excluded from these analyses because of missing HDI data or components.

The future burden of prostate cancer in Asia to 2040

The projected PCa burden will rise substantially by 2040 relative to 2020 across six world regions (Africa,

Table 1. Prostate Cancer Mortality in Asian Countries: Deaths, Age-standardized Mortality Rate, and Crude Mortality (sorted from highest to lowest)

Countries	Mortality (male)				
	Case	Rank	ASR	Rank	Crude rate
China	51,094	1	4.6	22	6.9
India	16,783	2	2.7	35	2.3
Japan	13,426	3	4.5	24	21.7
Turkey	5,464	4	11.3	3	13.1
Indonesia	4,863	5	4.5	25	3.5
Iran	4,292	6	10	5	10.1
Thailand	3,837	7	5.9	14	11.3
Philippines	3,164	8	10.8	4	5.7
Viet Nam	2,628	9	5.1	18	5.4
Republic of Korea	2,200	10	4.1	29	8.6
Pakistan	2,188	11	3	34	1.9
Bangladesh	1,289	12	1.9	43	1.5
Malaysia	900	13	5.4	15	5.4
Kazakhstan	532	14	6.8	9	5.8
Israel	531	15	6.7	10	12.3
Georgia	457	16	13.4	2	24
Uzbekistan	456	17	4.2	28	2.7
Syrian Arab Republic	422	18	7.5	7	4.8
Iraq	416	19	5.2	17	2
Singapore	371	20	7.3	8	12.1
Sri Lanka	364	21	2.6	37	3.5
Lebanon	360	22	9.7	6	10.5
Myanmar	347	23	2	40	1.3
Armenia	346	24	16.3	1	24.8
Afghanistan	272	25	3.7	30	1.4
Democratic Republic of Korea	239	26	2	41	1.9
Azerbaijan	218	27	5	19	4.3
Saudi Arabia	204	28	2.5	38	1
Nepal	167	29	1.5	46	1.3
Jordan	142	30	5.3	16	2.7
Cambodia	113	31	2.7	36	1.4
Yemen	104	32	1.7	45	0.69
Kyrgyzstan	78	33	4.5	26	2.4
Oman	73	34	6	12	2.2
Turkmenistan	63	35	3.3	32	2.1
Gaza Strip and the West Bank	63	36	6	13	2.4
Kuwait	52	37	6.6	11	2
United Arab Emirates	47	38	3.4	31	0.69
Tajikistan	43	39	1.8	44	0.89
Lao People's Democratic Republic	41	40	2.1	39	1.1
Qatar	18	41	4.8	21	0.83
Mongolia	17	42	2	42	1.1
Timor-Leste	12	43	3.1	33	1.8
Bahrain	12	44	4.5	27	1.1
Maldives	8	45	4.6	23	2.3
Brunei Darussalam	8	46	5	20	3.5
Bhutan	2	47	0.54	47	0.49

Note: The ASR represents the number of deaths due to PCa reported per 100,000 individuals, with age differences standardized to a standard population. The crude mortality rate represents the total number of deaths due to PCa reported per 100,000 individuals without adjusting for age differences.

Latin America and the Caribbean, Northern America, Europe, Oceania, and Asia). Asia shows the largest absolute increase in incident cases, with +349,434 additional diagnoses by 2040 (Figure 4a; Table 4S). Projected mortality also increases across all regions; Asia again records the greatest absolute rise, with +135,911 additional deaths by 2040 (Figure 4b; Table 4S). Within Asia, analysis of 47 countries identified 10 nations expected to carry the highest absolute burden by 2040 (Figure 5). Population growth and aging are largely responsible for these increases, consistent with age being the dominant risk factor for PCa. These projections represent scenario-based future counts under the assumption that age-specific rates remain at their 2020 levels. Therefore, they should not be interpreted as empirical historical trends but as planning-grade estimates of the likely direction and magnitude of change.

Discussion

Our results indicated that Asia bears a substantial share of the global PCa burden and is projected to contribute the largest absolute increase in incident cases and deaths by 2040. For clinicians, this means that PCa will account for an increasing proportion of male cancer consultations, procedures, and long-term survivorship in many Asian countries, particularly in China, India, and Japan, where the absolute numbers are highest [5, 19, 14]. Therefore, planning for sufficient diagnostic capacity, specialist training, and survivorship services is not only a system-level priority but also a direct determinant of day-to-day clinical practice in the region [14, 11, 20].

The strong, positive correlation between HDI and ASIR indicates that development is accompanied by a higher detected incidence, a pattern that is both epidemiologically and biologically plausible. Countries with higher HDI tend to have longer life expectancy, higher prevalence of westernized diets rich in animal fat and dairy products, and more sedentary lifestyles that contribute to obesity and metabolic disturbances [12, 21, 22]. These factors have been associated with increased risk of PCa and may promote carcinogenesis through hormonal pathways, chronic inflammation, and the insulin-like growth factor axis [12, 23]. In addition, wider diffusion of PSA testing, improved imaging, and easier access to biopsy in higher HDI settings increase detection of low- and intermediate-risk disease that might have remained clinically silent in the absence of screening [15, 24]. Together, these

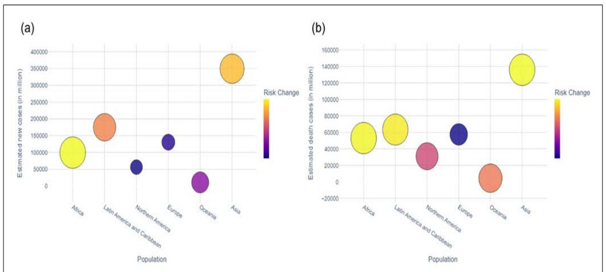

Figure 4. Estimated Number of (a) New Cases and (b) Deaths from Prostate Cancer by 2040

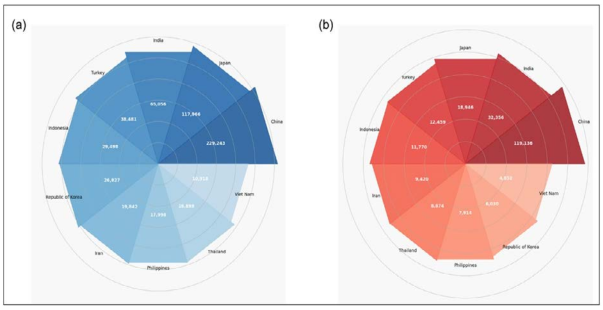

Figure 5. Predicted the Top 10 Asian Countries with the Highest Number of (a) New Cases and (b) Deaths Due to Prostate Cancer by 2040

mechanisms explain why countries with higher HDI show higher ASIR, even when underlying biological risk and diagnostic intensity are both changing.

In contrast, the weaker association between HDI and ASMR highlights that the benefits of earlier detection and treatment are not uniformly translating into survival gains across Asian health systems. Mortality from PCa is more strongly influenced by the stage at diagnosis, timeliness and quality of treatment, availability of radiotherapy and surgery, access to androgen deprivation and newer systemic therapies, and the degree of financial protection that prevents catastrophic health spending [25]. Settings that combine high incidence with comparatively lower mortality likely reflect a mix of earlier detection and guideline-concordant multimodal care access [26]. Conversely, patients may present with more advanced disease, experience longer diagnostic and treatment delays, or face barriers to completing recommended therapy when incidence appears modest but mortality is high [27].

The divergence between incidence and mortality across development levels can be explained by two mechanisms. First, the detection effects of PSA testing, imaging, and biopsy capacity tend to inflate the measured incidence without a proportional rise in mortality when low-risk disease is treated conservatively or with curative intent [15, 24, 28]. This profile aligns with countries with high HDI and structured early detection or opportunistic screening programs. Second, differences in treatment access and quality, including radiotherapy availability, surgical expertise, systemic therapy, and supportive care, shape outcomes more strongly than incidence alone [11, 25, 29]. Fragmented referral pathways, geographic and financial barriers, and limited palliative care can all contribute to excess mortality in lower- and middle-HDI settings, even when the measured incidence remains low [29-31]. Clinically, improving survival in many Asian countries will depend more on shortening diagnostic intervals and ensuring timely access to effective treatment than on increasing detection alone [27, 32].

Known risk factors for PCa include age, family history and inherited susceptibility, ethnicity, and modifiable lifestyle factors [10, 33-35]. Age is the strongest established determinant of risk, and the demographic aging of many Asian populations is therefore a central driver of the rising burden captured in our projections, beyond the more general improvement in life expectancy summarized by HDI [13, 35]. Ethnic and genetic differences also contribute to variation in PCa risk, with historically lower incidence in many Asian populations and evidence from migrant studies that risk increases when Asian men move to higher-incidence settings, consistent with gene-environment interactions [13, 36-38]. Within Asia, ancestry and genetic background heterogeneity may partly underlie differences between subregions and countries [13, 38]. Lifestyle-related factors such as obesity, physical inactivity, and dietary patterns that are higher in animal fat and dairy products and lower in plant-based foods are becoming more prevalent in several Asian countries and are likely to contribute to future increases in risk beyond what is captured by HDI alone [13, 14, 37, 39].

The observation that reported mortality exceeds reported incidence in several countries is implausible in epidemiology and therefore signals measurement limitations rather than true disease dynamics [2, 40]. These inconsistencies are likely driven by under-ascertainment of incident cases in population-based cancer registries, incomplete coverage of private and rural facilities, delays in case consolidation, and more complete capture of deaths through civil registration and vital statistics [16, 40, 41]. Although GLOBOCAN provides a coherent framework for international comparison, the accuracy of the incidence and mortality descriptions is uneven across the region and reflects the strength of underlying information systems [17, 40]. This has two important implications for clinicians and policymakers. First, an obviously low incidence should not be interpreted as low risk when mortality remains high and advanced presentations are observed in clinical services [17, 41, 42]. Second, strengthening registry systems is a prerequisite for monitoring the effect of any clinical or policy intervention. Addressing these issues requires systematic expansion of registry coverage, harmonization of case definitions and coding practices, and routine reconciliation of registry and vital statistics data [16, 40]. These steps are fundamental for assessing credible trends and evaluating the effect of policy changes over time.

The projection approach applies baseline age-specific rates to future population structures, isolating demographic change, population growth, and aging as the principal drivers of rising counts [17, 18]. This yields conservative, planning-grade estimates that can be translated into clinical and public health requirements [11, 18]. Health systems can use these numbers to estimate future needs for urologists, radiation and medical oncologists, radiotherapy machines, pathology and imaging throughput, and access to systemic therapies, including next-generation androgen receptor pathway inhibitors [11]. Because changes in risk factors, PSA testing policies, stage at diagnosis, and treatment uptake are not modeled, these projections should be interpreted as a baseline scenario for strategic planning rather than as forecasts of inevitable outcomes [17, 43]. We report point estimates only because the Cancer Tomorrow framework does not provide country-specific confidence intervals around projected counts, and formal probabilistic uncertainty quantification would require additional assumptions about future trends in incidence and mortality that cannot be robustly supported for all countries [17, 43]. By avoiding more complex age-period-cohort models in settings with limited historical data, the risk of overfitting and spurious precision in the projections is also reduced [43, 44]. Health planners can increase resilience through stress testing programs against plausible higher- and lower-rate alternatives and by integrating PCa into broader national cancer control plans [11, 45]. The results support differentiated policy priorities across health-system contexts. In higher-HDI settings, where the incidence is high but the mortality is relatively low, risk-adapted early detection, informed decision-making around PSA testing, judicious use of active surveillance for low-risk disease, and robust survivorship services are central to maximizing benefit while minimizing overdiagnosis and overtreatment [15, 46, 47]. In practical terms, this implies allocating resources to organized or opportunistic PSA testing in well-informed, higher-risk age groups, strengthening shared decision-making in primary care, and ensuring access to high-quality surgery, radiotherapy, and long-term follow-up for men with localized disease [15, 47]. This includes structured follow-up for men on active surveillance, management of treatment-related toxicities, and attention to quality of life in long-term survivors [46, 47]. Shortening diagnostic intervals, expanding radiotherapy and surgical capacity, establishing multidisciplinary tumor boards, and ensuring affordable access to guideline-concordant systemic therapy are likely to yield the largest mortality reduction in middle-HDI systems with rising incidence and persistent mortality [11, 29, 47]. The 2040 projections can be used to set realistic targets for the number and geographic distribution of radiotherapy units, pathology and imaging services, and oncology teams needed to manage the expected caseload [11]. Initial investments are best directed to registry strengthening, symptom awareness in primary care, and basic diagnostic capacity in lower-HDI settings with low measured incidence but disproportionate mortality, with phased expansion of treatment services aligned to projected volumes [16, 29, 48]. For these countries, our estimates highlight the need to first secure basic diagnostic tools (PSA, biopsy, and pathology) and reliable referral pathways and to protect funding for essential systemic therapies and palliative care, rather than introducing widespread screening [29, 30, 47]. Focusing near-term resources on the countries expected to contribute the greatest absolute increases by 2040 is a pragmatic way to deliver regional impact with limited budgets [11, 14]. Collectively, these differentiated strategies illustrate how the same regional projections can inform tailored approaches to screening policy and resource allocation in very different Asian health-system contexts [11, 14, 29].

These findings also define a practical research agenda that is closely linked to the delivery of services. Stage and treatment pattern surveillance can distinguish detection effects from real shifts in risk using standardized minimum datasets and allow monitoring of stage migration as diagnostic practices change [16, 41, 49]. Care pathway audits, from first presentation to treatment initiation and follow-up, would identify the points of delay that most strongly influence mortality and could be targeted with focused interventions [32, 50]. Coupling these with economic evaluations of scalable strategies, such as radiotherapy expansion, centralized pathology services, and telemedicine-supported follow-up, would support rational priority-setting in the countries projected to shoulder the largest increases in burden [11, 51-53].

This study has several strengths, including standardized inputs across 47 Asian countries, consistent use of a common world standard population for age standardization, and a transparent demographic projection method to 2040 [1, 17, 36]. The ecological design, reliance on modeled estimates where primary data are sparse, missing HDI components for several settings, and the absence of stage- and treatment-specific information are some of the limitations of this study [17, 54]. Because the analysis is based on GLOBOCAN 2020 and Cancer Tomorrow outputs, any under-ascertainment, misclassification, or modeling assumptions in those sources directly affect the accuracy of the incidence, mortality, and projected counts we report, especially in countries with weak or evolving cancer registration [16, 17]. Therefore, numerical differences between countries and the implied mortality and incidence trends should be viewed as approximate, high-level indicators rather than precise measurements of the underlying epidemiology [17, 40]. Correlations cannot be interpreted as causal and may be influenced by unmeasured confounders. Furthermore, we were unable to incorporate individual-level information on age distribution within older age bands, ethnicity, family history, germline mutations, or detailed lifestyle factors such as diet, obesity, and physical activity; HDI functions only as a broad contextual proxy for some of these determinants. Finally, projections to 2040 are based on the assumption of constant age-specific rates and exclude statistical confidence intervals or uncertainty bounds specific to the scenario [10, 54]. Therefore, they should be interpreted as indicative ranges for planning rather than as precise predictions, and they cannot capture potential future changes in diagnostics, treatment, or risk-factor profiles. These constraints reinforce the importance of registry strengthening and pathway measurement to support future analyses and refine clinical and public health strategies for PCa control in Asia [16, 41, 48].

In conclusion, Asia is on course for the largest absolute increase in PCa cases and deaths by 2040, driven predominantly by demographic change and amplified by uneven access to timely diagnosis and effective treatment. Clinically, this will place growing pressure on urology, oncology, and supportive care services and will require deliberate planning of the workforce, infrastructure, and survivorship programs. The incidence-mortality divergence across development levels is biologically plausible and underscores that higher HDI is associated with both greater detection and changing lifestyle-related risk. However, improved survival depends on whether health systems can deliver early, affordable, and guideline-concordant care. From a public health perspective, the findings argue for tailored strategies: risk-adapted early detection and survivorship optimization in higher-HDI systems and accelerated investment in diagnostic capacity, multimodal therapy, financial protection, and registry strengthening in lower- and middle-HDI systems. Concentrating efforts in countries projected to bear the heaviest absolute burden offers the most direct route to bending the mortality curve by 2040 and improving outcomes for men with PCa across Asia. These conclusions are directly grounded in observed 2020 incidence and mortality patterns and in transparent demographic projections to 2040, without assuming unmeasured changes in risk or treatment. Therefore, they provide a pragmatic, data-supported framework for practicing oncologists who must anticipate future caseloads, advocate for appropriate screening policies, and plan services for men with PCa in diverse Asian settings.

Acknowledgments

Statement of Transparency and Principles

- The authors declare no conflict of interest.
- The study was approved by the Research Ethics Committee of the authors' affiliated institution.
- The study data are available upon reasonable request.
- All authors contributed to the implementation of this research.

This research was funded by the University of Medicine and Pharmacy at Ho Chi Minh City under contract number 498/2025/HĐ-ĐHYD, dated 30/09/2025.

Originality Declaration for Figures

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