Prostate International 14 (2026) 127–131

Contents lists available at ScienceDirect

Prostate International

journal homepage: https://www.journals.elsevier.com/prostate-international

Research Article

Active surveillance could apply to one-quarter of Korean prostate cancer cases: Insights from a 27,075-patient cohort

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ARTICLE INFO

Article history:
Received 15 August 2025
Received in revised form
11 November 2025
Accepted 19 December 2025
Available online 24 December 2025

Keywords:
Active surveillance
Prostate cancer
Prostate-specific antigen

ABSTRACT

Background: The aims of this study were to estimate an upper bound for the proportion of men newly diagnosed with prostate cancer in Korea who could be managed with active surveillance (AS) when favorable intermediate-risk disease is included and to describe variation in AS eligibility by calendar year, administrative district, and residential setting.

Materials and methods: We analyzed biopsy-confirmed prostate cancer diagnosed in 2010, 2012, 2014, 2016, 2018, and 2020 across 51 general hospitals nationwide. Risk was classified using routinely collected clinicopathologic variables (prostate-specific antigen, clinical T stage, Gleason grade group, and biopsy core involvement); AS eligibility was defined as the union of low risk, potentially low risk, and favorable intermediate risk. Group differences in proportions were evaluated using χ^2 tests; temporal trend was assessed using a Cochran–Armitage trend test. Primary analyses used complete cases.

Results: Among 27,075 men (37.9% of nationally reported cases in the indexed years), 1,476 (5.45%) were low risk, 1,082 (4.00%) potentially low risk, 4,028 (14.88%) favorable intermediate risk, 5,880 (21.72%) unfavorable intermediate risk, and 14,609 (53.94%) high risk. Overall, 6,586 (24.3%) were AS-eligible. By year, AS eligibility decreased from 27.6% (2010) to 22.0% (2020) ($p < 0.001$). Across 17 districts, eligibility ranged from 16.9% (Chungbuk) to 29.3% (Gyeonggi) ($p < 0.001$). Urban areas (dong) had higher eligibility than rural areas (eup/myeon): 26.4% versus 20.5% ($p < 0.001$).

Conclusions: Approximately one-quarter of newly diagnosed men in Korea appear potentially eligible for AS under a maximized definition that includes favorable intermediate-risk disease. AS eligibility differed significantly by year, region, and residential setting.

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1. Introduction

Active surveillance (AS) is endorsed by contemporary international guidelines as a standard initial strategy for men with very low– and low-risk prostate cancer (PCa).[1–3] Evidence from randomized trials also informs the boundaries of AS use: the ProtecT and PIVOT trials included substantial numbers of patients beyond low-risk disease, and their long-term results showed no survival advantage for immediate definitive treatment over observation/active monitoring.[4–7] Reflecting these data, recent guidelines cautiously extend AS to selected favorable intermediate-risk disease.[1–3] Concomitantly, advances in risk assessment—widespread use of multiparametric magnetic resonance imaging (mpMRI), emerging genomic classifiers, and increasingly calibrated risk calculators—have improved patient selection and monitoring strategies for conservative management.[2,8] These developments suggest the potential for carefully expanded use of AS beyond traditional low-risk cohorts.

Despite this trajectory, the scale at which AS could be applied in routine practice varies across health systems and remains incompletely defined in Korea. In particular, population-level estimates of the potential AS-eligible pool and how such estimates differ across time, administrative regions, and residential settings are lacking.

Accordingly, we aimed to quantify the potential scope of AS in contemporary Korean practice by estimating an upper-bound proportion of newly diagnosed patients who could be considered

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https://doi.org/10.1016/j.prnil.2025.12.004
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for AS at diagnosis—explicitly including favorable intermediate-risk disease—and by evaluating how this estimate varies across calendar year, administrative district, and residential setting (urban vs. rural). These data are intended to inform service planning, guideline implementation, and patient counseling where AS pathways are evolving.

2. Patients and methods

2.1. Parent cohort and data source

This manuscript reports a secondary analysis of a previously published, multicenter cohort.[9] The parent study assembled biopsy-confirmed PCa cases diagnosed in 2010, 2012, 2014, 2016, 2018, and 2020 across 51 general hospitals (≥200 beds) in South Korea. The present secondary analysis was conducted between June 2022 and February 2025 with support from the National Research Foundation of Korea (MSIT No. 2022R1A2C1009074). Clinical staging and baseline variables (prostate-specific antigen [PSA], clinical T stage, International Society of Urological Pathology [ISUP] grade group, and residential region) were abstracted from medical records; staging typically included computed tomography, mpMRI, and bone scintigraphy as per national insurance coverage. This analysis used deidentified data and was approved by the institutional review board, and informed consent was waived.

In addition to direct information about PCa, the patient's age and place of residence at the time of biopsy, which did not include personal information, were collected to reflect minimal socioeconomic status to the minimum extent possible. Residence area was collected at two levels: information on the current place of residence among the 17 administrative districts nationwide and information on whether the residence was classified as rural or urban (In South Korea, administrative districts are divided into "eup/myeon" areas and "dong" areas, for each). Institutional review board approval has been obtained, and the stipulation for informed consent was waived.

2.2. Criteria for prostate cancer risk stratification

PCa risk classification adhered to the National Comprehensive Cancer Network (NCCN) criteria used during the 2010s. High risk was defined as the presence of any of the following: PSA >20 ng/mL, clinical stage ≥cT3a, or ISUP grade group ≥4; conversely, low risk was defined as PSA <10 ng/mL, clinical stage ≤cT2a, and ISUP grade group 1. In this multicenter dataset, cases with missing values were classified as "potentially low risk" if at least one low-risk criterion was documented.

Intermediate risk was defined as per NCCN as the presence of any one of the following: cT2b–cT2c, ISUP grade group 2–3, or PSA 10–20 ng/mL. Intermediate risk was further subdivided into favorable and unfavorable categories; the latter (unfavorable intermediate risk) was defined as any of the following: ≥2 intermediate-risk factors, ISUP grade group 3, or ≥50% positive biopsy cores. For records with missing values among intermediate-risk variables, the observed variables were analyzed, while the missing ones were handled separately.

2.3. Statistical analysis

Descriptive statistics are reported as counts and percentages. Group comparisons of proportions (AS eligible vs. ineligible) across year (6 levels), administrative district (17 levels), and residence type (urban vs. rural) used χ^2 tests of independence with Cramer's V as an effect size; adjusted standardized residuals were examined to identify cells contributing to significant χ^2 results. The temporal trend across survey years was assessed using the Cochran–Armitage trend test, and primary analyses used complete cases for risk-defining variables, with a sensitivity analysis treating intermediate-risk records with missing defining variables as AS ineligible. Proportions, odds ratios, and risk differences are presented with two-sided 95% confidence intervals; statistical significance was set at $\alpha = 0.001$ to account for the large sample size. Analyses were performed in SPSS Statistics v27 (IBM Corp., Armonk, NY, USA).

3. Results

3.1. Risk distribution at diagnosis

Among 27,075 patients—representing 37.9% of the 71,403 PCa cases recorded in national statistics for the indexed years—1,476 (5.45%) were classified as low risk, 1,082 (4.00 %) as potentially low risk, 4,028 (14.88%) as favorable intermediate risk, 5,880 (21.72%) as unfavorable intermediate risk, and 14,609 (53.94%) as high risk. When AS eligibility was maximized by including low risk, potentially low risk, and favorable intermediate risk, 6,586 patients (24.32%) were considered AS eligible, and 20,489 (75.68%) were non-eligible. Patients within the intermediate-risk stratum who had missing values in risk-defining variables were excluded from the AS-eligibility estimates. Subclassification details for the unfavorable intermediate-risk group are summarized in Table 1.

3.2. Variation in AS eligibility by year, administrative district, and residential setting

Across the six index years (2010–2020), the proportion of AS-eligible patients decreased from 27.6% in 2010 to 22.0% in 2020 (Fig. 1). Across the 17 administrative districts, AS eligibility differed significantly ($\chi^2 = 335.73$, df = 16, $p < 0.001$); district-level percentages are detailed in Fig. 2. AS-eligibility rates ranged from 16.9% in Chungbuk to 29.3% in Gyeonggi. The six regions with the highest AS-eligibility were Gyeonggi (29.3%), Jeonnam (28.9%), Gwangju (28.8%), Incheon (28.4%), Sejong (28.3%), and Seoul (28.3%). By residential setting, AS eligibility was 26.4% in urban

Table 1
Subclassification of the unfavorable intermediate-risk group by the definition of National Comprehensive Cancer Network (NCCN) guidelines.

Subcategory	No. of patients	Percentage of UIR group
1. All three criteria of intermediate-risk cancer	1161	19.7
2. Two-criteria combination of intermediate-risk cancer		
PSA 10–20 ng/mL + ISUP grade group 2	845	14.4
PSA 10–20 ng/mL + clinical stage T2b–T2c	1161	19.7
ISUP grade group 2 + clinical stage T2b–T2c	1931	32.9
3. ISUP grade group ≥3 (Gleason 4 + 3 or higher)	2436	41.4
4. ≥50% positive biopsy cores	1516	25.8

ISUP, International Society of Urological Pathology; PSA, prostate-specific antigen; UIR, unfavorable intermediate risk.

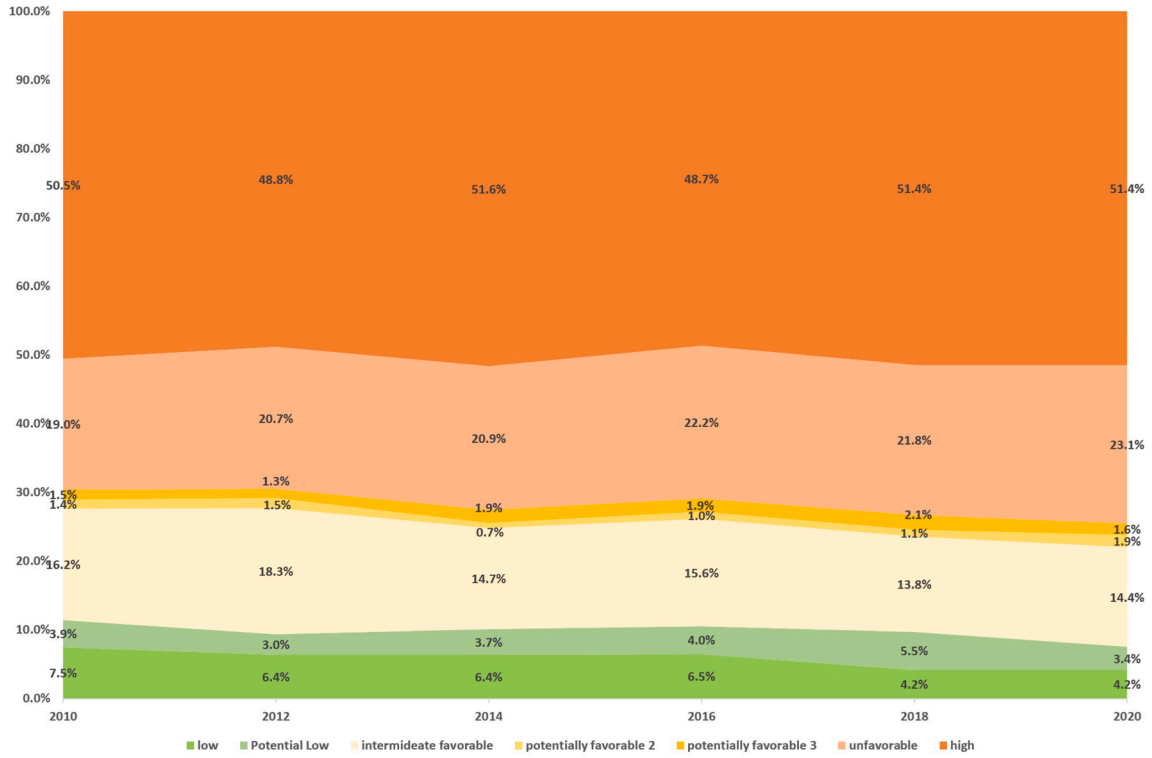


Fig. 1. Classification of prostate cancer risk stratification according to the year of investigation (In order of high risk, favorable intermediate risk, potentially intermediate risk [single missing value], potentially intermediate risk [double missing values], unfavorable intermediate risk, potentially low risk, and low risk.).

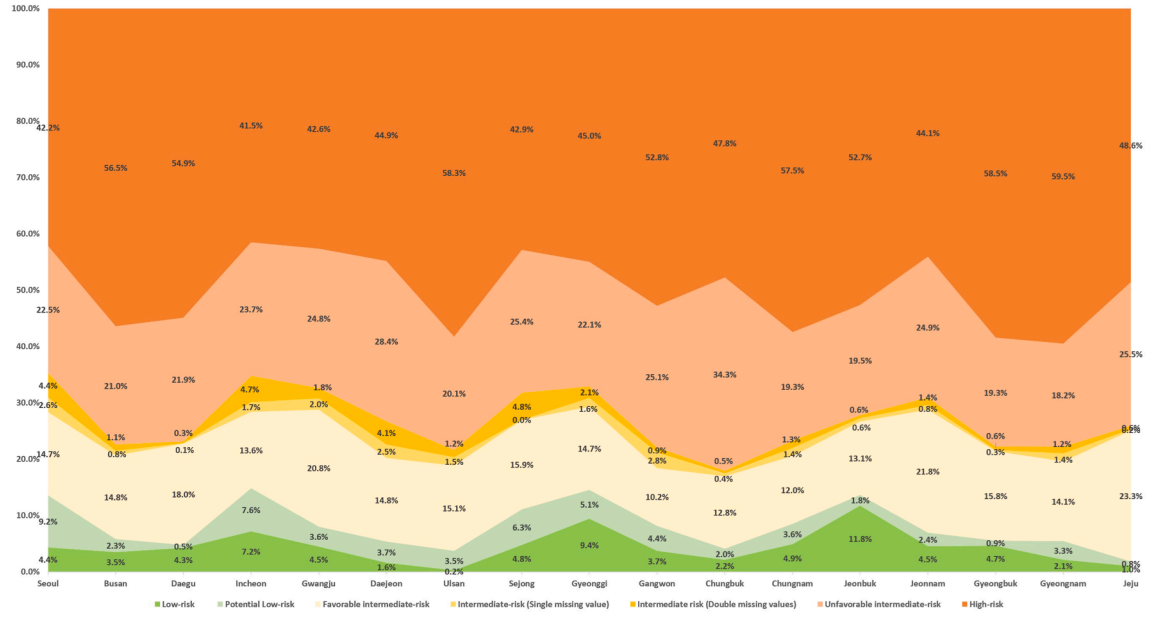


Fig. 2. Classification of prostate cancer risk stratification according to the 17 administrative districts (In order of high risk, favorable intermediate risk, potentially intermediate risk [single missing value], potentially intermediate risk [double missing values], unfavorable intermediate risk, potentially low risk, low risk.).

areas (dong) and 20.5% in rural areas (eup/myeon) ($\chi^2 = 163.32$, df = 1, $p < 0.001$; Fig. 3).

4. Discussion

This nationwide analysis quantified the proportion of Korean men with localized PCa who could be considered eligible for AS, including those with favorable intermediate-risk disease. Across the six index years, the AS-eligible share remained an approximate one-quarter (≈22–28%) estimate of newly diagnosed patients who may be appropriate for conservative management. These results illustrate, within a contemporary Korean context, how guideline-based AS criteria—when extended to favorable intermediate-risk cases—translate into real-world eligibility at the

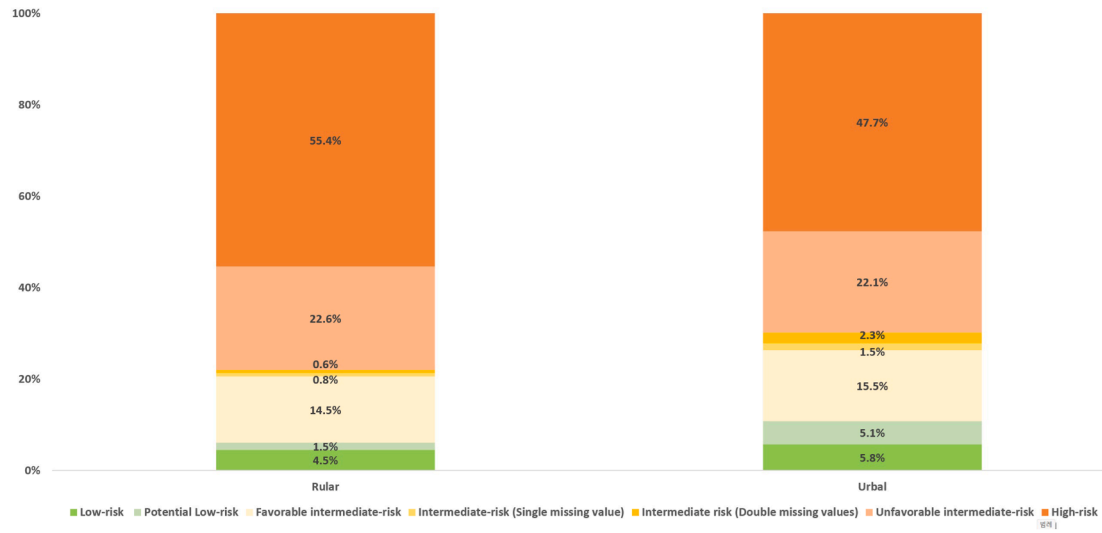


Fig. 3. Classification of prostate cancer risk stratification according to the residential area divided by urban and rural area (In order of high risk, favorable intermediate risk, potentially intermediate risk [single missing value], potentially intermediate risk [double missing values], unfavorable intermediate risk, potentially low risk, low risk.).

population level. This proportion aligns with the rising incidence but gradually stabilizing mortality trends of PCa in Korea reported by recent national projections.[10]

While the present study does not assess oncologic outcomes, its scope aligns with the direction of contemporary international guidelines that endorse AS as a standard option for very low– and low-risk disease and cautiously extend its application to the selected favorable intermediate-risk patients.[1–3] The long-term safety and efficacy of AS have been established in prior phase 3 randomized trials and large prospective cohorts, which demonstrated comparable survival outcomes between immediate radical treatment and structured monitoring.[4–7,11–13] These pivotal data, integrated into recent guideline updates, provide the evidence base that informs the present eligibility-focused estimation. Concurrently, advances in diagnostic and risk-stratification pathways—including mpMRI and validated risk calculators—support more precise patient selection and monitoring.[8,13–16]

Marked heterogeneity in AS eligibility by calendar year, administrative district, and residential setting indicates that system-level conditions, rather than only tumor biology, may substantially influence the size of the candidate pool. In Korea, AS is still not registered as a distinct reimbursable treatment category within the national insurance system, both during the study period (2010–2021) and at present. Consequently, clinicians and patients receive limited institutional or financial support to complete the complex shared decision-making required for AS, and the strategy itself lacks formal recognition and legal protection as a legitimate cancer treatment pathway. These structural limitations likely contribute to regional and temporal variability, reflecting differences in accessibility to PSA testing, mpMRI, and subspecialist counseling, as well as variations in local clinical culture. International experience illustrates how health-system organization affects AS adoption: Sweden has achieved near-universal AS uptake in very-low-risk and dominant use in low-risk disease[16]; Australia/New Zealand registries show high but heterogeneous utilization with jurisdictional and institutional differences[17]; and the United States demonstrates steady growth yet wide practice-level variation, with national AS rates for low-risk disease rising toward 60% in the 2010s to early 2020s.[18–21] These patterns emphasize that expanding AS requires not only appropriate clinical selection but also an enabling health-policy environment that legitimizes and supports AS as an integral component of PCa care. This observation is consistent with recent East Asian reports describing disparities in PCa management related to health-system infrastructure and policy implementation.[22]

These data support a pragmatic implementation agenda tailored to the local context. First, standardized selection and monitoring protocols should be harmonized with international guidance while reflecting domestic resource realities.[1–3] Incorporating calibrated risk calculators, routine use of mpMRI, and, where available, genomic classifiers can refine selection within the intermediate-risk stratum and reduce both undertreatment and overtreatment. Second, reporting of process and outcome indicators—such as time to confirmatory evaluation, trigger-to-treatment rates, and causes of conversion—would enable benchmarking across regions and over time. Third, shared decision-making tools adapted to Korean epidemiology may facilitate patient-centered choice in settings where perceptions of cancer risk and treatment preferences vary.

Strengths of this study include the large, multicenter scope; harmonized risk stratification; and an explicit, reproducible definition of an AS-eligible upper bound. Several limitations warrant cautious interpretation. The cohort represents 37.10% of nationally reported cases in the indexed years and may not fully capture practice patterns in smaller clinics. Missingness in risk-defining variables necessitated the exclusion of some records from eligibility analyses. Because the analysis is cross-sectional, it cannot inform actual AS uptake, adherence, or oncologic outcomes. Finally, regional comparisons were not adjusted for differences in hospital mix or unmeasured socioeconomic factors and thus should be interpreted as descriptive.

Overall, this nationwide analysis quantified the proportion of Korean men with PCa who meet guideline-based criteria for AS, including those with favorable intermediate-risk disease. Approximately one-quarter of newly diagnosed patients were estimated to be AS-eligible, with significant variation across calendar years, administrative districts, and residential settings. These findings underscore that broader implementation of AS in Korea will require institutional and policy support—such as formal insurance recognition, standardized selection and monitoring frameworks, and system-level infrastructure—to enable consistent and equitable application of AS nationwide.

Author contributions

Conceptualization: Y.H.K. Data curation: Y.H.K. Formal analysis: S.W.K. Funding acquisition: Y.H.K. Investigation: Y.U.K. Methodology: Y.H.K. Project administration: Y.H.K. Resources: Y.H.K. Software: S.W.K. Supervision: Y.H.K. Validation: S.W.K., Y.U.K. Visualization: Y.H.K. Writing – original draft: Y.H.K. Writing – review & editing: Y.H.K., S.W.K.

Declaration of generative artificial intelligence and artificial intelligence–assisted technologies in the writing process

During the preparation of this work, the author used ChatGPT (OpenAI Int.) in order to search for and reflect the latest literature and to correct the English text to make it sound more natural. After using this tool/service, the author reviewed and edited the content as needed and takes full responsibility for the content of the publication.

Conflicts of interest

The authors have no conflict of interest in this article.

Acknowledgment

This work was supported by the National Research Foundation of Korea (NRF) grant funded by the Korean government (MSIT) (No.2022R1A2C1009074).

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